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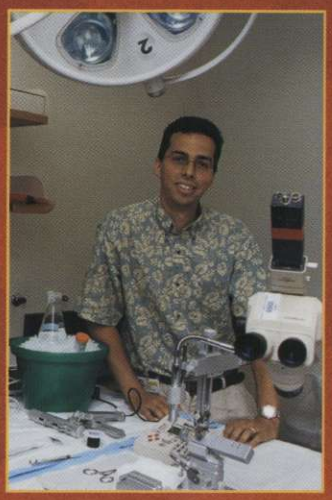

Tomorrow's Education TODAY

2001–2002 GRADUATE BULLETIN

Rochester Institute of Technology
2001-2002 Institute Calendar

FALL QUARTER (20011)

April 23-September 13
Fall Registration. Use telephone, Student Information System, walk-in or mail-in options. Students will be billed.*

September 5
Evening classes begin

September 6
Day classes begin

September 8
Saturday classes begin

September 13
Last date to drop/add courses

October 19
Last date to withdraw with a "W" grade

November 14
Last day class

November 17
Last Saturday class

November 15,16,17,19
Final exams—day classes

November 20
Last evening class

November 21-December 2
Fall/Winter break

WINTER QUARTER (20012)

October 22-December 10
Winter Registration. Use telephone, Student Information System, walk-in or mail-in options. Students will be billed.*

December 3
Day and evening classes begin

December 8
Saturday classes begin

December 10
Last date to drop/add courses

December 22
Last day of classes before break

January 5
Saturday classes resume

January 7
Day and evening classes resume

January 25
Last date to withdraw with a "W" grade

February 22
Last day class

February 23
Last Saturday class

February 23, 25, 26, 27
Final exams—day classes

March 1
Last evening class

March 2-March 10
Winter/Spring break

SPRING QUARTER (20013)

January 28-March 18
Spring Registration. Use telephone, Student Information System, walk-in or mail-in options. Students will be billed.*

March 11
Day and evening classes begin

March 16
Saturday classes begin

March 18
Last date to drop/add courses

April 19
Last date to withdraw with a "W" grade

May 17
Last day class

May 18
Last Saturday class

May 18, 20, 21, 22
Final exams—day classes

May 24
Last evening class

May 25
Commencement

May 26-June 2
Spring/Summer break

SUMMER QUARTER (20014)

April 22-June 10
Summer Registration. Use telephone, Student Information System, walk-in or mail-in options. Students will be billed.*

June 3
Day and evening classes begin

June 8
Saturday classes begin

June 10
Last date to drop/add summer quarter courses

filly 4
Holiday (classes will be held)

July 12
Last date to withdraw with a "W" grade

August 9
Last day class

August 12,13,14
Final exams—day classes

August 16
Last evening class

August 17
Last Saturday class

** Refer to quarterly schedule of courses for specific registration dates and times.*

RIT
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Rochester Institute of Technology

Graduate Bulletin

2001–2002

Rochester Institute of Technology

About This Bulletin—

This Graduate Bulletin does not constitute a contract between the Institute and its students on either a collective or individual basis. It represents RIT's best academic, social and financial planning at the time the Graduate Bulletin was published. Course and curriculum changes, modifications of tuition, fee, dormitory, meal and other charges, plus unforeseen changes in other aspects of RIT life sometimes occur after the Graduate Bulletin has been printed but before the changes can be incorporated in a later edition of the same publication. Because of this, Rochester Institute of Technology does not assume a contractual obligation with its students for the contents of this Graduate Bulletin.

RIT will admit and hire men and women; veterans; persons with disabilities; and individuals of any race, creed, religion, color, national or ethnic origin, sexual orientation, age or marital status in compliance with all appropriate legislation, including the Age Discrimination Act and Title VI of the Civil Rights Act of 1964 (P.L. 88-352).

Rochester Institute of Technology
Office of Graduate Enrollment Services
58 Lomb Memorial Drive
Rochester, NY 14623-5604
716-475-2229
GRADINFO@rit.edu

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Graduate Bulletin 2001-2002
Produced by the Office of University Publications

Graduate Education at RIT

Katherine Mayberry, *associate provost for academic programs*

The graduate learning experience at RIT is *focused.* RIT graduate programs focus on the conceptual structure and organization of knowledge in the chosen subject—an understanding that is essential to both accept and lead technological change in the professions. They also build an educational base for additional learning and offer access to, and mobility within, one or more professional areas.

The programs themselves are centered in fields that combine both theoretical knowledge and practical applications, especially those with a proven need in the marketplace. Thesis topics often relate directly to situational concerns, rather than theoretical discourse. Programs that do not require a thesis or project encourage other avenues for professional experience, such as optional or required cooperative education or an internship.

Students often use employers as primary sources for research and special projects. This application approach attracts faculty who value problem-solving skills in students. Whether a thesis, project or professional portfolio is required, our students are encouraged to incorporate both independent study and experimental learning into their programs. Graduate students also may assist in undergraduate education, such as in laboratories.

A philosophy supported by campus resources. RIT's international reputation as an applied technological university gives graduate students the advantage of working with the sophisticated technology and laboratories found both on and off campus. Students in microelectronics manufacturing have access to clean-room facilities that meet industry standards. Computer graphics design students access digital media using a variety of systems and software, including Macintosh, IBM, Silicon Graphics and Media 100 digital video editing. In the Center for Integrated Manufacturing Studies, graduate students are incorporating robotic laser systems into a model assembly line. Our telecommunications technology workstations were donated by an industry eager to hire students experienced with equipment used in their own laboratories. Students in travel management test software on the industry-standard SABRE computer systems.

Technology also has brought together students in design, photography and printing. In RIT's Electronic Still Photography Laboratory, the three disciplines have merged through electronics.

Regardless of the program, RIT encourages and promotes technological innovation in all areas.

Specialized and Diverse Programs

While technology is integral to all graduate programs, the essence of RIT graduate education is found in the diversity of programs, course offerings and learning options.

Our reputation as a technologically advanced university is matched by our commitment to offer programs designed to meet specialized needs of employers. A dozen international corporations—including Eastman Kodak Company, Konica, Agfa Gevaert, Xerox and Fuji—have sponsored the building of laboratories in the Chester F. Carlson Center for Imaging Science, which houses the nation's most comprehensive imaging science programs. Enriched by the perspective provided by the National Technical Institute for the Deaf, one of RIT's colleges, we offer full access to deaf and hard-of-hearing students seeking graduate-level academic programs.

Across campus, graduate students mix exciting research and stimulating dialogues with faculty and such distinguished visitors as George Bush, Joe Torre, Jesse Jackson, John Hockenberry and Maya Angelou, Annie Leibovitz, Jerry Uelsmann and Greg Heisler. The College of Business draws prominent figures from the business world—including U.S. Steel CEO Thomas Usher and Robert Bartley, editor and vice president of *The Wall Street Journal*—through the William D. Gasser Distinguished Lectureship in Business.

The Institute continues to receive international recognition for the quality of its academic programs. In *U.S. News & World Report's* annual ranking of America's best graduate schools, RIT's School of Photographic Arts and Sciences has been ranked number one in its field for five consecutive years. This publication has also consistently ranked RIT in the top 20 in its master of fine arts category. Recognition also has been awarded by industry: RIT's colleges of Business and Engineering were winners in the Motorola University Challenge—an award presented to just nine universities nationwide. These two colleges also won the IBM Total Quality Management Competition and received more than $1.2 million to integrate quality themes into their courses and laboratories.

Convenient and Flexible Programs

RIT's diversity also extends to the manner in which courses and programs are scheduled. Half of our graduate programs are available on a part-time, evening basis and are designed for working professionals. Examples of programs offered through online learning include software development and management; information technology; environmental, health and safety management; and health systems administration. These programs allow students access to an RIT education without attending classes on campus.

In addition, RIT's executive MBA offers professionals an opportunity to earn a master's degree by studying on campus Friday and Saturday, every other week. Professionals from California to England visit RIT every summer for executive leader master's degree programs, which combine four-week on-campus residencies with classes using distance-learning technology.

Graduate Programs of Study

Academic Area	RIT College	HECIS Code	Page
Business and Management			
• Accounting	Business	0502	30
• Business Administration (MBA, Executive MBA)t MBA program concentrations on page 30	Business	0506	28,30
• Finance (MS)	Business	0504	33
• Health Systems Administration (MS)*	Applied Science & Technology	1202	13
• Hospitality-Tourism Management (MS)t	Applied Science & Technology	0510.1	8
• Human Resource Development (MS)t	Applied Science & Technology	0515.00	11
• Instructional Technology (MS)t	Applied Science & Technology	0699	12
• Manufacturing Management and Leadership (MS)	Business/Engineering	0599	34
• Product Development (MS)	Business / Engineering	0599	68
• Service Management (MS)t	Applied Science & Technology	0599	9
Computer Science and Information Technology			
• Computer Engineering (MS)	Engineering	0999	57
• Computer Science (MS)	Computing & Information Sciences	0701	42
• Information Technology (MS)*	Computing & Information Sciences	0699	45
• Interactive Multimedia Development (Advanced Certificate)	Computing & Information Sciences	0699	15
• Software Development and Management (MS)*	Computing & Information Sciences	0799	44
Cross-Disciplinary Studies (Individualized Program)			
• Cross-Disciplinary Professional Studies (MS)*	Applied Science & Technology	4999	14
Education and Liberal Arts			
• Art Education (MST)	Imaging Arts & Sciences	0831	84
• Communication and Media Technologies (MS)	Liberal Arts	0605.00	105
• Human Resource Development (MS)t	Applied Science & Technology	0826	11
• Instructional Technology (MS)t	Applied Science & Technology	0699	12
• Public Policy (MS)	Liberal Arts	2102.00	107
• School Psychology (MS, Advanced Certificate)	Liberal Arts	0826.02	108
• School Psychology and Deafness (Advanced Certificate)	Liberal Arts	0826.02	109
• Secondary Education of Students Who Are Deaf or Hard of Hearing (MS)	NTID	0803	137
• Technical Information Design (Advanced Certificate)*	Applied Science & Technology	0605	15
Engineering and Technology			
• Applied Statistics (MS)*	Engineering	1702	66
• Computer Engineering (MS)	Engineering	0999	57
• Computer Integrated Manufacturing (MS)	Applied Science & Technology	0913	6
• Electrical Engineering (MS)	Engineering	0909	57
• Engineering Management (ME)	Engineering	0913	61
• Environmental Health and Safety Management (MS)*	Applied Science & Technology	0420	5
• Industrial Engineering (ME)	Engineering	0913	60
• Industrial and Manufacturing Engineering (MS)	Engineering	0913	60
• Manufacturing Engineering (ME)	Engineering	0913	60
• Manufacturing Management and Leadership (MS)	Business / Engineering	0599	34
• Materials Science and Engineering (MS)	Engineering/Science	0915	119
• Mechanical Engineering (MS, ME)	Engineering	0910	63
• Microelectronics Manufacturing Engineering (ME, MS)*	Engineering	0999	64
• Packaging Science (MS)	Applied Science & Technology	4999	7
• Product Development (MS)	Business / Engineering	0599	68
• Statistical Quality (Advanced Certificate)*	Engineering	1702	66
• Systems Engineering (ME)	Engineering	0913	60
• Vibrations (Advanced Certificate)	Engineering	0910	
Photography, Fine Art, and Graphic Communication			
• Art Education (MST)	Imaging Arts & Sciences	0831	84
• Ceramics and Ceramic Sculpture (MFA, MST)	Imaging Arts & Sciences	1009	87
• Computer Graphics Design (MFA)	Imaging Arts & Sciences	1009	86
• Fine Arts Studio (MFA, MST)	Imaging Arts & Sciences	1002	84
• Glass and Glass Sculpture (MFA, MST)	Imaging Arts & Sciences	1009	88
• Graphic Arts Publishing (MS)	Imaging Arts & Sciences	0699	89
• Graphic Arts Systems (MS)	Imaging Arts & Sciences	0699	89
• Graphic Design (MFA, MST)	Imaging Arts & Sciences	1009	86
• Imaging Arts/Computer Animation (MFA)	Imaging Arts & Sciences	1011	91
• Imaging Arts/Film (MFA)	Imaging Arts & Sciences	1011	91
• Imaging Arts/Photography (MFA)	Imaging Arts & Sciences	1011	93
• Industrial and Interior Design (MFA, MST)	Imaging Arts & Sciences	1009	86
• Medical Illustration (MFA, MST)	Imaging Arts & Sciences	1299	84
• Metalcrafts and Jewelry (MFA, MST)	Imaging Arts & Sciences	1009	88
• Printing Technology (MS)	Imaging Arts & Sciences	0699	90
• Weaving and Textile Design (MFA, MST	Imaging Arts & Sciences	1009	100
• Woodworking and Furniture Design (MFA, MST)	Imaging Arts & Sciences	1009	88
Science, Mathematics, and Imaging Science			
• Applied Statistics (MS)*	Engineering	1702	66
• Chemistry (MS)	Science	1905	116
• Clinical Chemistry (MS)	Science	1223	118
• Color Science (MS)	Science	1099	121
• Environmental Science (MS)	Science	0420	
• Imaging Science (MS and Ph.D.)*	Science	1011	122,123
• Industrial and Applied Mathematics (MS)	Science	1799	118
• Materials Science and Engineering (MS)	Engineering/Science	0915	119
• Statistical Quality (Advanced Certificate)*	Engineering	1702	66

**These programs include opportunities for degree completion through distance learning, †These programs include degree completion through Executive Education option.*

The RIT Philosophy and Mission

RIT's mission is the education of men and women for work and life in a democratic, technological and global society. It is integral to the Institute's mission to be a dynamic center of higher education—one in which technology, the arts and sciences and other dimensions of human knowledge and civilization are valued, cultivated and applied.

Throughout its history, the Institute has been at the forefront of career education in preparing students for technological and professional careers. RIT structures itself as an educational resource for all who seek to be competent and enthusiastic lifelong learners, whether they are young adults or professionals seeking to upgrade their skills by studying for an advanced degree. Our goal is that all graduates will understand the ethical, technological, humanitarian and aesthetic challenges of a diverse work place and an international community.

The Institute's educational philosophy emphasizes not only theory—the natural foundation of knowledge—but also the practical work place applications of theories. This dual emphasis is prized by employers and offers graduates upward career mobility and the flexibility for changes in career direction.

Another asset of an RIT education is cooperative education, which offers undergraduate and graduate students in selected programs the opportunity for paid, professional work experience while they are completing their degrees.

RIT, founded in 1829, is a privately endowed university in suburban Rochester, N.Y. Its eight colleges include: Applied Science and Technology, Business, Computing and Information Sciences, Engineering, Imaging Arts and Sciences, Liberal Arts, Science and the National Technical Institute for the Deaf.

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www.rit.edu/GRAD

Access to practical technology draws graduate students to RIT.

History of Graduate Education

Starting in 1955 with the master of fine arts degree, RIT has continually created new graduate programs to meet employers' and students' requests for education in particular functional areas. When surveys in the 1960s indicated the need for sophisticated statistical knowledge, a master of science degree in applied and mathematical statistics was created. More recently, RIT's Center for Microelectronic and Computer Engineering began a master's degree in microelectronics manufacturing engineering. Other graduate programs have taken similar routes, and all seven RIT colleges exhibit continuous concern for the emerging needs of the business, industrial and scholarly communities.

A recent example of RIT's continuing endeavor to provide education in emerging career fields is the Ph.D. in imaging science, which was also the first degree of its kind in the United States. The Ph.D. is one of more than 50 graduate degrees now offered by the Institute.

Sponsored Research

Sponsored research is a vital, integral component of several RIT programs. Faculty undertake research for a variety of important reasons—the advancement of knowledge, professional development, the strengthening of academic programs and growing partnerships with industry.

Under regulations established by the Institute, sponsored research, programs and projects are encouraged. These projects increase student participation in research and in working more closely with faculty. Often, thesis topics emanate from research projects.

External funding for research—such as for CIMS, the Center for Integrated Manufacturing Studies—comes from federal and state agencies, private foundations and corporate sponsors. Our most active sponsors include The National Science Foundation, The National Institutes of Health, The Department of Education, The Central Intelligence Agency, The Department of Defense, National Aeronautics and Space Administration, IBM, Eastman Kodak Company and the Society of Manufacturing Engineers.

Accreditation

RIT is chartered by the legislature of the State of New York and accredited by:

The Commission of Higher Education
Middle States Association of Colleges and Schools
3624 Market Street
Philadelphia, PA 19104-2680
215-662-5606

and

The New York State Education Department
Office of Higher Education and the Professions
Cultural Education Center, Room 5B28
Albany, N.Y. 12230
518-474-5851

In addition to institutional accreditation, curricula in the colleges are accredited by appropriate professional accreditation bodies. Where applicable, specific mention of these is included in the college descriptions. Students wishing to review documents describing accreditation should contact the Office of the Associate Provost for Academic Programs.

w~

College of Applied Science and Technology

Wiley R. McKinzie, Dean

PROGRAMS

MASTER OF SCIENCE DEGREES IN:

Computer Integrated Manufacturing
Hospitality-Tourism Management
Service Management
Human Resource Development
Instructional Technology
Environmental, Health and Safety Management
Packaging Science
Health Systems Administration
Cross-disciplinary Professional Studies

ADVANCED CERTIFICATES AVAILABLE IN:

Interactive Multimedia Development
Integrated Health Systems
Health Systems Finance
Technical Information Design

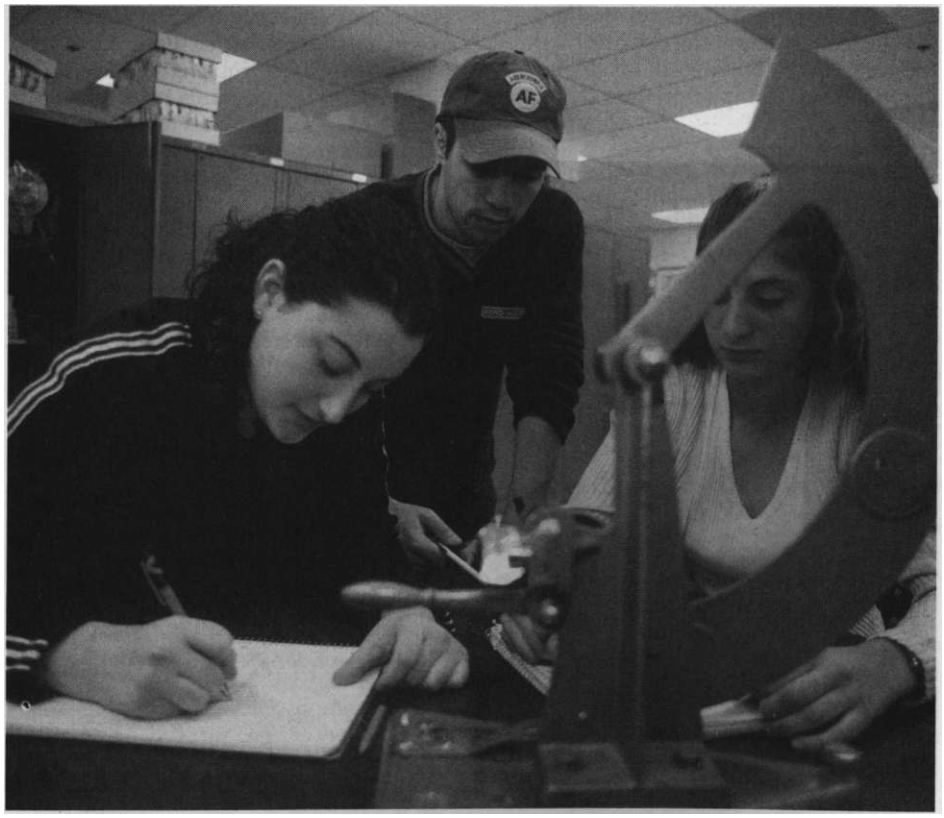
EXECUTIVE LEADER:

A nontraditional delivery of graduate education encompassing two summers for degrees in hospitality-tourism management, service management, career and human resource development, instructional technology and packaging science

Graduate education in any discipline requires commitment of both the student and the institution involved. The diverse, graduate-level academic areas within the College of Applied Science and Technology represent RIT's commitment to curricular innovation, program flexibility and academic rigor. In fact, several degrees, including software development and management and information technology, are not only unique in their content but in the way many classes are offered through distance learning—a benefit for working professionals who want to continue their education while employed.

We are also committed to advancing the state of our education through the latest technology, management theories and educational philosophies. In fall 1999, the college opened a new building containing state-of-the-art laboratories. The new facilities support courses that address current and future applications in the areas of electrical-computer-telecommunications engineering technology, manufacturing and mechanical engineering technology, and packaging science. In addition to laboratories in computer networking, telecommunications, a circuits "studio," mechanics and materials, the new building includes student study space and departmental and faculty offices. RIT's $22 million Center for Integrated Manufacturing Studies gives graduate students the opportunity to test new technologies for actual companies seeking solutions to real problems. Continual computer laboratory upgrades mean that we have technology that is considered the industry standard.

Most importantly, all the programs are recognized as being academic leaders in the state, national and international education communities. In addition, our close ties to business and industry mean that our course content is relevant and practical for tomorrow's managers, whether they oversee computer integrated manufacturing or a resort hotel. Graduates are eagerly sought out by employers, with a high placement rate that assures graduates can pick the best positions for their personal and professional development.



Master of Science in Environmental, Health and Safety Management

Maureen Valentine, *Department Chair*
Joseph Rosenbeck, *Graduate Program Coordinator*

The last decade has seen significant changes in how organizations view and manage environmental, health and safety (EHS) issues. Increasingly, companies are capitalizing on the synergies among these three areas by managing them together—necessitating that EHS professionals be cross trained in all three functions. The emergence of voluntary standards and codes of conduct, including international standards, coupled with the need to manage costs has resulted in a trend to go beyond regulatory compliance through the use of EHS management systems and integration of EHS into key business processes.

The program

Established in 1997, RIT's master of science degree program in environmental, health and safety management is offered by the department of civil engineering technology, environmental management and safety. Developed by experienced EHS professionals from the department's Advisory Committee and faculty, the MS program is designed to provide graduates with a solid grounding in both technical and managerial aspects of leading practices in EHS management. The program is designed for early- to mid-career professionals and other professionals planning a career move into this field.

RIT's program in environmental, health and safety management utilizes an integrated systems focus to ensure that graduates can:

- Identify and leverage the regulatory, voluntary and business drivers for EHS programs.
- Design and implement effective EHS management systems and programs.
- Design and implement performance measurement processes to verify EHS effectiveness.
- Demonstrate how an effective EHS program adds value to the organization.

The program is designed to be completed in 15 months by full-time students or in two years of part-time study while working full time. Students can tailor an individual program of study by complementing core and foundation courses with professional electives that match their academic and career interests.

Admission requirements

Admission to the MS degree program in environmental, health, and safety management requires:

- A bachelor's degree from an accredited university or college
- A minimum undergraduate grade-point average of 3.0 (B) over the junior and senior level years
- At least 20 quarter credit hours (or 15 semester credit hours) of college-level science and math course work, with at least 4 credit hours (or 3 semester credit hours) in each of the following three categories: 1) general chemistry or organic chemistry; 2) biology, microbiology, ecology or biochemistry; and 3) physics, geology, hydrology or geochemistry
- At least one college-level course in statistics
- At least one college-level course or equivalent experience in computer science

Graduate Record Examination (GRE) scores are not normally required. Applicants who do not meet the above requirements, however, may be required to submit GRE scores to support their candidacy.

International students are required to have achieved a minimum score of 570 on the Test of English as a Second Language (TOEFL).

In addition to the RIT graduate application, applicants to this program must submit:

- Two writing samples to demonstrate written communication skills
- A current resume or CV with sufficient detail to identify specific tasks and levels of responsibilities

Generally, applicants are expected to have formal academic training or documented experience in the areas of environmental management (air, water, solid and hazardous waste), occupational health, and occupational safety. Academic and experiential gaps in these areas may be addressed through program foundation courses and electives.

The program was designed for EHS professionals with some work experience. Applicants with less than one year of relevant work experience may be expected to complete one or more graduate co-op quarters during their program of study.

Potential applicants are strongly encouraged to contact the graduate program coordinator (716-475-6469) for informal advising and additional information about the program.

Transfer credit

Up to 12 quarter credits of graduate course work may be accepted into the program if appropriate and approved by the student's major professor or the admissions committee. The maximum number of transfer credits may be reduced in order to ensure that transfer credits and foundation course work do not exceed 20 quarter credits.

Financial aid

Applicants seeking graduate scholarships or assistantships should identify this in the graduate application. A limited number of scholarships and assistantships are available on a competitive basis. Applicants seeking scholarships or assistantships should apply by April 1. Information about student loans may be obtained from the RIT Financial Aid Office (716-475-2186).

The curriculum

The master of science degree program in environmental, health and safety management consists of 48 credit hours of graduate study. The program is available in both classroom and distance-learning formats. Some courses are taught only in distance-learning format. The curriculum consists of a sequence of core courses (24 credits), professional electives chosen from the program or other departments (18 credits), and a graduate thesis or project (6 credits).

Foundation courses are intensive survey courses that allow each student to fill gaps in academic preparation and/or work experience related to the environmental, health and safety fields. Necessary foundation course work will be determined at the time of admission to the program. Up to 12 credits of foundation course work may be counted toward the degree as elective course work.

Core courses include:

0630-720	Environmental, Health & Safety Management
0102-740	Organizational Behavior & Leadership
0630-725	EHS Accounting & Finance
0630-740	EHS Management System Design
0630-760	Integrating EHS into Business Management
0630-790	EHS Internal Auditing

A 6-credit graduate thesis or graduate project is required for graduation. Thesis and project topics should complement the student's interests and program of study. A thesis will be most appropriate for students with interests in conducting original research or in topics requiring substantial theoretical analysis. A graduate project will be most appropriate for students interested in applied problem solving.

Department of Manufacturing and Mechanical Engineering Technology/Packaging Science

John A. Stratton, *Chair*

The department offers an MS program in computer integrated manufacturing (CIM) and an MS in packaging science. The MS in CIM is jointly sponsored by the colleges of Business and Engineering and is available for full- and part-time students. The MS in packaging science is available for full- and part-time students and in an executive leader format.

The department's 14 laboratories in the CAST and CIMS buildings are available to and used by graduate students.

Master of Science in Computer Integrated Manufacturing

S. Manian Ramkumar, *Program Adviser*

The master of science in computer integrated manufacturing is a multidisciplinary degree offered by the department of manufacturing and mechanical engineering technology in collaboration with the colleges of Business and Engineering. The program is designed for individuals who wish to achieve competence in the effective integration of the computing, manufacturing, design, and maintenance processes found in any manufacturing enterprise. Students take a set of common core courses and then elect a concentration in design, manufacturing, software, electronics packaging, management, or quality.

Entrance requirements

Applicants should have completed a baccalaureate or equivalent degree from an accredited academic institution in the field of engineering, engineering technology, computing, or business with a minimum grade point average of 3.0 on a 4.0 scale. Students with degrees in other disciplines will be considered on an individual basis. Calculus, computer programming, and statistics are required backgrounds.

Applicants should submit two professional recommendations and transcripts from previous college attendance, along with the graduate application form.

A minimum TOEFL score of 550 (for paper-based exam) or 213 (computer-based) is required for international applicants seeking admission from non-English-speaking countries. Applicants with a lower TOEFL score may be admitted conditionally and will take a prescribed English language program, along with a reduced MS-CIM program course load. GRE exams are not required, but students may choose to submit these scores as additional information, if they desire, or in some cases may be required to do so.

Curriculum

The graduate program of study consists of 52 credits composed of the core, concentration, elective, and a capstone management course or thesis. Students may be required to take additional prerequisite courses, depending on their background and elected concentration. Courses in the prerequisite group may be waived from graduation requirements, depending on the students' academic and employment background, after approval of the program chair. Full-time students are eligible for two co-op blocks (three months for each block), after completing three quarters (nine months) of study at RIT.

Core courses (20 credits)

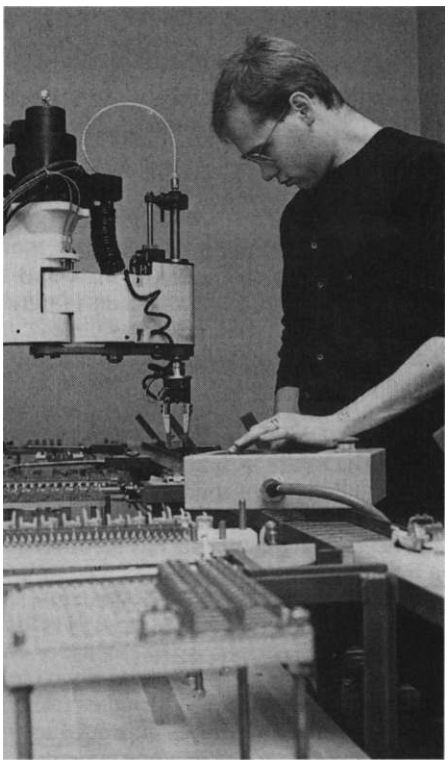
0617-850 Flexible Manufacturing & Assembly Systems
0617-730 Data Management & Communication
0101-794 Cost Accounting in the Manufacturing Environment
0102-740 Organizational Behavior & Leadership
0303-750 Management of Quality Systems
or
0307-782 Quality Engineering

Concentration options (20 credits)

Design Concentration
0304-618 Computer Aided Engineering
0304-801 Design for Manufacture
0304-865 Computer Implementation
0610-820 Concept Design & Critical Parameter Management
0610-870 Robust Design & Production Systems

Manufacturing Concentration
0617-870 Manufacturing Automation Controls
0304-615 Robotics
0303-630 Computer-Aided Manufacturing II
0303-710 Systems Simulation
0303-749 Manufacturing Strategy & Tactics

Management Concentration
0102-742 Introduction to Technology Management
0106-743 Operations Management & Process Improvement
0307-781 Quality Management
0106-749 Manufacturing Strategy & Tactics
0101-703 Financial Accounting Systems



An automated assembly lab is available to students of computer integrated manufacturing.

Software Concentration
Prerequisites: Algorithms and Data Structures and any high-level programming language
0617-870 Manufacturing Automation Controls
0602-717 Information Integration
0602-710 Object Technologies
0602-720 Data Object Development
0602-750 Distributed Systems

Electronics Packaging Concentration
0617-855 Electronics Packaging Fundamentals
0617-856 Advanced Concepts in Electronics Packaging
0307-801 Design of Experiments I
0303-757 Reliability
0106-743 Operations Management & Process Improvement

Quality Concentration
Prerequisites: Statistics (equivalent to 0307-711, 712
0307-721 Statistical Process Control
0307-731 Statistical Acceptance Control
0307-781 Quality Management
0307-732 Quality Engineering
0307-801 Design of Experiments I
0307-802 Statistical Quality Control II

Elective (8 credits)

Each student must take two graduate-level elective courses according to his or her concentration as follows:

1. Any course from another concentration
2. Any course from another graduate program, if approved by the

program adviser and faculty member teaching the course
3. Any independent study course if approved by the student's academic adviser

Capstone (4 credits)

0617-896 Project Management in CIM
or
0106-744 Project Management
or
0617-897 Thesis
0617-999 Cooperative Education (0 credits)

Financial aid

Limited scholarships and graduate assistantships are available in the department of manufacturing and mechanical engineering technology. Information may be obtained from:

Prof. S. Manian Ramkumar,
Program Chair
78 Lomb Memorial Drive
Rochester, N.Y. 14623-5604
E-mail: smrmet@rit.edu

Master of Science in Packaging Science

Deanna Jacobs, *Program Coordinator*

The master of science degree program in packaging science is designed to accommodate a wide range of needs of people in differing circumstances. It is flexible enough to meet the needs of professionals who have been working in the field for a number of years, and it is suitable for those students who wish to pursue a graduate program immediately upon receiving the BS degree.

In addition, although an undergraduate curriculum in packaging science is preferred as preparation for the MS program, graduates from certain other disciplines can successfully pursue this program if certain basic packaging science courses are coupled with appropriate work experience.

Admission requirements

Students entering the program will have a graduate academic adviser appointed and will develop their programs of study in consultation with their adviser. They may utilize the model curriculum to complete their degree requirements, or may propose alternative course work. All programs must be consistent with the general outline of the model curriculum, and have advisory approval. In instances where the student has insufficient academic or practical preparation to study packaging at the graduate level, he or she will work out an appropriate program to correct such deficiency, generally by completing the following undergraduate courses: Packaging Principles, Materials I, Materials II, Rigid Containers, Flexible Containers, Production Systems, Packaging for Distribution, Packaging for Marketing, and/or Shock and Vibra-tion. These courses may not be used for credit toward the MS degree.

Further, a basic competence in statistics and basic computer literacy will be assumed. Applicants for graduate study may satisfy these requirements by having completed the equivalent of 0307-711 and having completed a course in computer applications. Lacking this background, applicants will be required to take 0307-711 and/or 0607-341, or equivalent course work to remedy a background deficiency.

Application for admission for graduate study in packaging will be made through the Office of Graduate Enrollment Services. Final acceptance of the candidate for graduate study will be determined by the department of packaging science. All applicants must have earned a B (3.0) average grade in their final two years of undergraduate degree work, submit transcripts of undergraduate work to the RIT Office of Graduate Enrollment Services and submit two letters of recommendation to the department of packaging science. Normally, completion of the last two years of the undergraduate degree program with a B average will serve to satisfy entrance requirements. In those cases where there may be some question of the capability of the applicant to complete this program of graduate study, he or she may be required to submit his or her scores on the Graduate Record Examination to support the candidacy.

Environmental concerns present new challenges and have increased job opportunities for packaging science graduates.

Executive leader MS program

This intensive program consists of four two-week summer sessions and a research project. It is conducted over two consecutive summers. Candidates should be practicing packaging professionals with a minimum of five years' work experience beyond the baccalaureate degree. Admission to the executive leader MS program also requires endorsements from senior management or administrative personnel.

The structure of the program provides individuals an opportunity to obtain their advanced degree without disrupting their employment. Graduate credit is granted for life and professional experiences.

The program concentrates on the application of packaging technology to the integrated task of making and selling the company's product. Candidates are encouraged to align research project goals with current job responsibilities.

More information can be found in the executive leader brochure for packaging science.

The curriculum

The curriculum is composed of three components: packaging core courses, research, and elective credit. The MS degree program requires completion of 48 credits of graduate-level course work, as follows:

Packaging core course work
Completion of a minimum of 20 credits in graduate-level packaging courses, including 0607-701, Research Methods, and any four of the following:

0607-721 Packaging Administration
0607-731 Advanced Packaging Economics
0607-742 Distribution Systems
0607-750 Graduate Seminar
0607-752 The Legal Environment
0607-763 Packaging for End-Use
0607-770 Advanced Computer Applications
0607-783 Packaging Dynamics
0607-799 Advanced Packaging Design

Research
Students in the master's program will be required to prepare and defend a 12-credit Graduate Thesis (0607-890) completed under the supervision of their adviser. The type of research done and the area of study will be agreed upon by the student and the adviser before the student enrolls for graduate thesis credits.

Students may also elect to take up to eight credits of Independent Study (0607-798), but this may NOT be used as credit toward the 20 credits of packaging core course work.

Elective credit

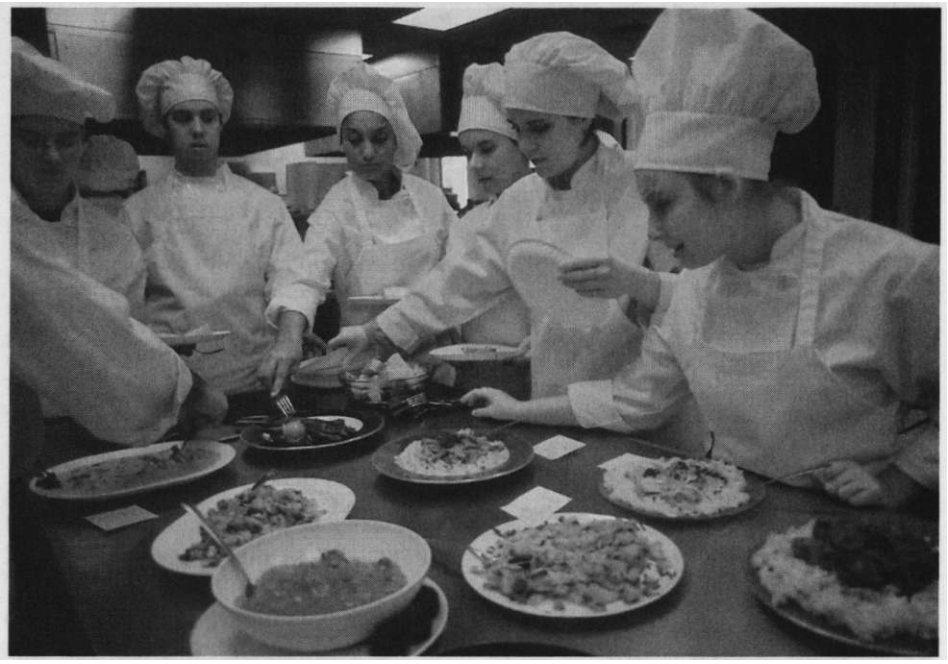
In addition to packaging core (20 credits, including Research Methods) and thesis (12 credits), each student will complete a minimum of 16 elective credits selected in consultation with the adviser to complete the degree requirement.

In general, graduate-level course work will be selected to meet degree requirements, but, in limited circumstances, where individual need indicates that it would be appropriate, a limited number of 500-level undergraduate courses (not to exceed 12 credits, in total) may be used to fulfill elective credit.

Financial aid

Scholarships and graduate assistantships are available in the department of packaging science. Information may be obtained from:

Karen L. Proctor,
Program Chair
MET/Packaging Science Dept.
Rochester Institute of Technology
78 Lomb Memorial Drive
Rochester, N.Y. 14623-5604



Hospitality and Service Management

Francis M. Domoy, *Chair*
James Jacobs, *Program Chair*

Master of Science in Hospitality–Tourism Management

The MS in hospitality-tourism management graduates professionals who can step into numerous mid-level service management and training director positions. The program is focused on service-quality training and supervision functions within the corporate setting and at postsecondary academic institutions.

The hospitality-tourism management major may be taken as a full- or part-time master's degree program. The length of time required to earn a degree varies according to the student's undergraduate preparation and the number of graduate courses taken per quarter. All students must earn a minimum of 48 quarter hours of graduate credit (36 of which must be registered through RIT) to earn the master of science degree. For full-time students, the program will require a minimum of four quarters of study at the graduate level. Part-time students generally will require seven or eight quarters of study at the graduate level.

The curriculum

The curriculum is a combination of a required core in service-quality management plus required concentration courses. It also contains elective courses appropriate for the candidate's background and interests and either a research thesis or a graduate project. Course offerings are generally scheduled in the evening as well as during the summer months to facilitate part-time students.

Program requirements

The MS in hospitality-tourism management program shares several of the same core courses used in the MS in service management. These courses introduce the major concepts associated with all aspects of service management, whether they are applied specifically to the hospitality-tourism industries or to the wider service amalgam. This commonality becomes even more evident when the nature of the concepts is depicted. Among the general concepts investigated are *service strategy formulation and delivery* (building customer loyalty, customer complaints and recovery, managing for productivity gains, managing variable supply and demand), *customer-focused research* (determining customer requirements, developing reliable customer satisfaction instruments) and *human resource issues* (selection, training, recognition and rewards, teamwork and assessing corporate culture).

The core courses facilitate the paradigm shift from manufacturing to service and move the focus from traditional organizational structures to an organization where employees must provide several functions, sometimes simultaneously This multifunctional approach provides a new avenue by which to examine service organizations and to explore such issues as empowerment, teamwork, horizontal management and corporate cultures.

0625-750 Elements of Service Management: A Systems Approach
0625-760 Research Methods & Applications in Service Management: Measuring Customer Satisfaction
0624-770 Service Leadership: Examining & Implementing Change
0625-790 Introduction to Graduate Research: Thesis/Project Option
0624-825 Strategic Process of Service Firms

Each course not only introduces the service philosophy but also examines the real differences in hospitality-service management outcomes necessitated by the adoption of the new paradigm. In so doing, these courses set the stage for the professional "cluster" courses.

The Introduction to Graduate Research core course provides a logical path for the student who is developing a research proposal. Among the elements discussed are problem statement, purpose and significance, hypothesis and assumptions, scope and limitations, methodology and the nature of research, procedures (sampling, developing research instruments, analysis) and literature review. These concepts are applicable to both hospitality-tourism and service management.

Each of the 10 professional "cluster" courses focuses on specific industry issues and applications:

0624-823 Strategic Environment of the Hospitality-Tourism Industry
0624-826 Tourism Policy Analysis
0624-827 Technology Transfer in Hospitality-Tourism Industries

0624-828	Meeting Planning Management
0624-833	Policy Analysis: Food & Nutrition Issues
0624-835	Planning & Marketing of Health Care Related Services
0625-844	Breakthrough Thinking
0625-846	Service Management Futures
0624-848	Convention & Exhibition Management
0624-867	Tourism Planning & Development
0624-868	Legal Issues & Evaluation of Events

Elective courses provide students with an opportunity to individualize their graduate programs in line with their career and professional interests. Students are allowed a wide selection of courses from food, hotel and travel management; the College of Business; and the department of information technology. However, students are cautioned to observe course prerequisites in their selections.

Of the eight to 12 hours of electives, students are relatively free to select courses that they feel best meet their needs. The only limitations are that:

- all courses must be graduate level
- a maximum of 12 graduate quarter hours may be transferred from another university
- a maximum of eight graduate quarter hours may be taken in independent study or practicum courses

Master's thesis/project

A thesis or project is required of all candidates. Thesis topics should complement the candidate's undergraduate training, career experiences and graduate interests. The thesis is by nature a formal research document that reflects the candidate's professional preparation. The graduate faculty, in addition to the director of the program, can aid the candidate in selecting a relevant thesis topic.

Projects are, by nature of an applied research genre, a reflection of the student's ability to utilize professional modeling and forecasting techniques to explain decision making within the hospitality-tourism industry. When the project option is selected, the candidate must complete a minimum of six additional hours of electives.

Admission requirements

Prior to admission to the master of science degree program, applicants must illustrate to the chairman of the program that their previous training, ability, practical experience and education indicate a reasonable chance of success. Applicants may be admitted who hold a baccalaureate degree from an accredited institution. They must have undergraduate GPAs of 3.0 or higher. The complete admission requirements are:

- graduate application
- earned baccalaureate degree
- official undergraduate transcript(s)
- two professional recommendations
- an on-campus interview (when possible)
- undergraduate GPA of 3.0 or higher (a GPA of 2.75 will be considered if applicant has superior recommendations; length of time since the candidate's college graduation also will be considered)
- foundation course work that is 3.0 or higher (if required)
- Test of English as a Foreign Language (TOEFL) of 550 paper based or 213 computer based (international students)

Students who already are qualified for one or more required courses may substitute other course work with the permission of the chair of the program. Students whose prior undergraduate work was in areas other than hospitality-tourism may be required to complete additional courses, after a review of their work by the chair of the program. The student may choose elective courses with the approval of the chair of the program.

Financial aid

Scholarships and graduate assistantships are available in hospitality and service management. Information may be obtained from:

Graduate Programs
Hospitality and Service Management
Rochester Institute of Technology
14 Lomb Memorial Drive
Rochester, N.Y. 14623-5604
716-475-5062

Accelerated Program

Executive leader MS program

This is an intensive program consisting of four two-week summer sessions conducted over the span of two summers and an independent research project conducted over the span of two summers. It emphasizes the strategic dimensions of service quality, policy analysis and executive performance within the context of the service economy. It is designed to enhance the continued lifelong learning and career development of executives and mid-level hospitality professionals without disruption of employment. Graduate credit is granted for life and management experiences.

The executive leader MS program is offered to service management practitioners who have a minimum of five years' experience beyond the baccalaureate. Certification through various professional associations (such as CFE, CFP, CCM, CCTE, CHA, CTC, CTP, CMP) is accepted as documentation of professional commitment. Endorsements from senior management and administrators are preferred.

Master of Science in Service Management

This program fills an emerging need in the many service businesses and industries that focus on customer satisfaction. Such businesses will find this program in tune with their educational and training investments. Attention is focused on the management interface between the customer and the service provider. Problems in such areas as measuring customer satisfaction, empowering front-line employees, developing a teamwork environment, benchmarking, etc., require the employee to be skilled in different analytical techniques. This program gives individual students access to the interdisciplinary expertise of a technological university.

The program is flexible: five core courses (18 credit hours) are required. The choice of professional electives from a wide array of disciplines (computer science-information technology, quality and applied statistics, business and others) responds to individual student needs.

Both full- and part-time study are allowed. Courses are offered in the evening. Full-time students may complete the MS program within one calendar year (four academic quarters). The program also is offered in the executive leader format (four two-week sessions delivered over two summers).

This is a broad-based and cross-disciplinary program. Careful selection

Graduate students in service management learn management, customer satisfaction and quality skills as they pertain to the rapidly growing service industry.

of courses can provide unique educational preparation for individuals in varying service industries. An individualized professional concentration might include courses from human performance development and training, human resource development, computer science, information technology and the College of Business's MBA program, or the student may choose to earn a graduate certificate in statistical quality through the Center for Quality and Applied Statistics in the College of Engineering.

The "research capstone" of the program may be guided under the mentorship of faculty in the various disciplines represented in the professional concentration.

Most individuals working in service-based industries will find no need to take "bridge" courses, regardless of their undergraduate preparation.

Curriculum requirements

The service management program includes a minimum of 48 quarter credit hours of graduate credit (36 of which must be registered through RIT) and can be completed in four full-time quarters or in seven to eight part-time quarters. The basic curriculum is a combination of required core, professional concentration and elective courses that will satisfy the student's individual needs. Students who already are qualified for one or more required courses may substitute other course work with the permission of the program chair. Students whose prior undergraduate work was not in the service industries field may be required to complete additional courses and/or a cooperative educational experience. This will be determined after a review of their work by the program chair. A thesis or final project is also required for all students.

The student may choose elective courses with the approval of the program chair. Electives may be selected from within hospitality and service management, from RIT's College of Business, the department of human performance development and training, human resource development, and information technology. Of the possible six to 12 hours of electives, students are relatively free to select courses they feel best meet their needs. The only limitations are:

- all courses must be graduate level
- all course prerequisites must be met
- a maximum of 12 graduate quarter credit hours may be transferred from outside RIT
- a maximum of eight graduate quarter credit hours may be taken in independent study or practicum courses

Note: Students matriculated in RIT's MBA program may use service management courses offered through hospitality/tourism management and service management programs as a concentration within their degree program.

Required core courses (18 credits)

		Credits
0625-750	Elements of Service Management: A Systems Approach	4
0625- 760	Research Methods & Applications in Service Management: Measuring Customer Satisfaction	4
0624-770	Service Leadership: Examining & Implementing Change	4
0624-825	Strategic Process of Service Firms	4
0625-790	Introduction to Graduate Research: Thesis/Project Options	2

Professional concentration (16-18 credits)

Hospitality and Service Management

		Credits
0625-841	Benchmarking & the Process of Continuous Improvement	4
0625-843	Empowered Teams: Self-Directed Work Groups	4
0625-845	Relationship Management in Service Firms	4
0625-847	Reengineering Service Environments	4
0625-849	Service Quality Self-Assessment Processes	4

Instructional Technology

0627-735	Theories of Adult Learning	4
0627-755	Criterion Reference Instruction I	4
0627-756	Criterion Reference Instruction II	4

Human Resource Management

0626-710	Theories of Organizational Development	4
0626-720	Theories of Career Development	4
0626-730	Theories of Human Resource Development	4

Information Technology

0602-718	Current Themes in Information Technology	4
0602-733	Fundamentals of Telecommunications	4
0602-741	Fundamentals of Web-Based Multimedia	4
0602-745	Theories of Interactive Computing	4

College of Business

		Credits
0102-763	Behavioral Skills in Total Quality	4
0106-745	Quality Control & Improvement	4

(Prerequisites or approval of the associate dean of Graduate Studies, College of Business, may be required.)

College of Engineering—Center for Quality and Applied Statistics

Graduate Certificate in Statistical Quality

		Credits
0307-721	Statistical Quality Control I	3
0307-731	Statistical Quality Control II	3
0307-781	Quality Management	3
0307-782	Quality Engineering	3
0307-801	Design of Experiments I	3
0307-802	Design of Experiments II	3

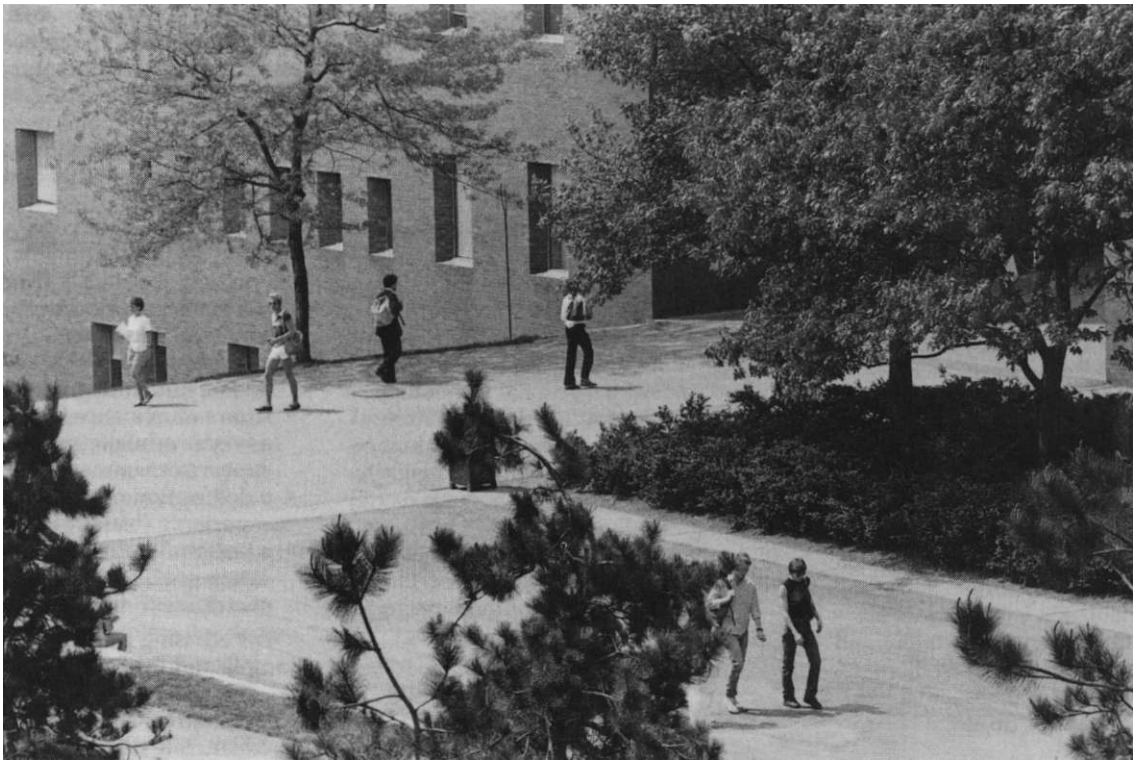
Facilities and equipment

- Computers: dedicated access to 17 advanced American Airlines SABRE reservation terminals; 20 dedicated Dell computers tied to both LAN and RIT's VAX system.
- Applied software packages: business application software such as MS Office, WordPerfect; database programs such as MSAcces and FoxPro, spreadsheet programs such as Lotus 1-2-3 and Excel; graphics programs, including Harvard Graphics, FreeLance, WordPerfect Presentation, and PowerPoint; as well as service research application packages such as SurveyPro, Survey Tracker (including the Customer Service, Strategic Planning, Market Strength, Malcolm Baldrige, Food Services, and Lodging Resort modules); and AllClear and ABC Flow-Chart programs. RIT also maintains X-SPSS, Minitab and SAS on its VAX cluster.

Admission requirements

Prior to being admitted to the master of science degree program, applicants must illustrate the program chairperson that their previous training, ability, practical experience and education indicate a reasonable chance of success. The complete list of admission requirements includes:

- graduate application
- baccalaureate degree or equivalent from an accredited institution
- Graduate Record Examination or Miller Analogies Test
- official undergraduate transcript(s)
- two professional recommendations
- an on-campus interview (when possible)
- undergraduate GPA of 3.0 or higher (a GPA of 2.75 will be considered, given superior recommendations, GRE or MAT scores and length of time since the candidate's college graduation)
- foundation course work with grades of 3.0 or higher (if required)
- Test of English as a Foreign Language (TOEFL) score of at least 550 paper based or 213 computer based for international students.



You don't need to race across campus for your next class: at RIT, most of the academic buildings are in very close proximity.

Faculty

All faculty in the master's degree program are experienced at preparing individuals for current career opportunities. They are accessible to students for individual guidance, and their ongoing participation as professional consultants and researchers allows them to integrate the latest technical innovations into their classes.

Master of Science in Human Resource Development

Dianne Mau, *Program Chair*

Human resource development today

The mission of this program is to provide education, training, research and consultation for human resource development.

Primary activities center on the MS-HRD program, which is characterized by a philosophy of pragmatism, theoretical foundations in the social sciences and mastery of relevant technologies and human productivity methodologies.

Human resource development is the integrated use of training and development, organization development and career development to improve individual, group and organizational productivity and effectiveness.

The program

The human resource development program is a 48-quarter-credit-hour program with four major curriculum components: career development, organization development, human resource development and human resource management. Students have the option of concentrating in a specific area or developing a program that best meets their interests or needs.

The HRD internship is designed to assist students in accomplishing three objectives: to gain on-the-job professional experience in the HR field; to become acquainted with the daily HR work challenges and strategies used to resolve these; and to develop professional contacts and build experience-based credentials, which will enable the student to find professional employment upon graduation.

Classes are offered in the evenings, on Saturdays and online.

Executive leader option

This option, designed for HRD professionals with at least five years' experience, differs from the traditional program in the following ways:

- a portfolio is required and evaluated for up to 12 hours of credit
- classes are offered in an accelerated format using two-week blocks each summer

Admission requirements

Admission requirements for the master of science degree include:

- successful completion of the baccalaureate degree at an accredited college or university
- a cumulative grade point average of 3.0 or above or evidence of relevant professional performance
- two letters of reference
- the writing samplet
- TOEFL 570 (paper); 230 (computer)
- an oral presentationt
- an interview with program faculty

tNot required for executive leader

Required for executive leader option:

- a portfolio
- five years of professional experience in HRD or related field

All credentials must be submitted and reviewed by the faculty prior to the completion of 12 quarter credit hours of graduate work in the program.

Application forms are available from the Office of Graduate Enrollment Services, or call 716-475-5062 for further information.

Financial aid

In addition to the assistance available through the Financial Aid Office (716-475-2186), the department awards scholarships. For more information, contact the HRD department (716-475-5062). Only matriculated students are eligible for scholarships.

Degree requirements

The degree requires completion of a minimum of 48 quarter credit hours at the graduate level. The degree can usually be completed in four consecutive quarters. However, the majority of students attend part time and take from two to four years to complete the degree work. Executive leaders who have 12 credits for their portfolios can complete the degree in five quarters. Students must maintain a B average and complete the degree within seven years of the first course counted toward the degree.

Students choose the electives they feel best meet their needs. The only restrictions are that all courses must be graduate level or approved for graduate credit, and a maximum of 12 quarter credit hours (not counted toward another degree) may be transferred from another college or university.

Upon matriculation each student is assigned an adviser, and the student and adviser develop a plan of study. For specific questions about courses and a plan of study, the adviser or program chair should be consulted.

Required Core Courses
Empirical Methods in HRD*
Applied Data Analysis in HRD
Internship

*Choose three of six:**
Theories of Organizational Development
Theories of Career Development
Theories of Human Resource Development
Human Resource Management I
Human Resource Management II
Human Resource Management III

•Required by traditional program, not executive leader option

Elective/Technique Courses
Planning & Evaluation in Organizational Dev.
Practice of Consultation in Organizational Dev.
Career Counseling Techniques
Group Leadership Skills
Design & Delivery of Training
Needs Assessment & Proposal Dev.
Organizational Wellness
Assessment & Measurements
HR in Total Quality Cultures
Human Resource Planning
Training Management
Global Human Resources

Note: 48 credit hours for MS degree; courses may be taken in other graduate-level programs at RIT and other institutions with permission of adviser.

Instructional Technology

Master of Science in Instructional Technology

C.J. Wallington, *Program Chair*

The RIT instructional technology program focuses on instructional design—creating courses that other people teach or that need no teacher. The program also encompasses performance technology—improving work performance through ways other than training. For three decades instructional technology graduates have found employment in the design, development, and evaluation of training and instruction. The majority of graduates hold jobs in medium or large organizations, usually in business and industry. There they work in teams on ways to improve employee performance. Some examples of the linkage between the instructional technology program and business and industry are:

- continuous feedback from training and performance technology professionals
- Mager Associates' courses in Criterion Referenced Instruction, Instructional Module Development, Training the Training Manager, and Instructor-Led Training
- participation in the RIT executive leader program (for experienced professionals)
- continuing communication with program graduates to keep abreast of best practices in training and performance technology

Instructional technology means an orientation toward training and performance improvement through highly structured, carefully designed and tested materials and performance support tools. Human performance development and training differs from information technology and computer tools by *focusing on the individual and the group rather than on computers.*

The instructional technology program *does* offer courses in computer-assisted instruction, computer-based performance improvement systems and presentation design, but the emphasis is still on the individual rather than on media—an approach that contributes to our graduates' employability. To broaden their experience with delivery systems, instructional technology students experience a range of courses from completely modular and individual to working in highly interactive groups.

In short, the program prepares its graduates to develop ways for working adults to improve their job performance—especially through training in technical, professional and managerial work.

The instructional design option is for graduates planning to enter the training field either in the private sector (business and industry) or larger public sector organizations (social or governmental agencies). An option is not required, however, and students may choose other approved electives that best meet their career needs.

Admission requirements

Admission decisions for the human performance development and training program are based on:

- a review of the baccalaureate degree and any other degrees or course work
- letters of reference from academic advisers or major professors and from supervisors or managers
- a description of previous work experience (usually a resume)
- a personal statement of work or career goals and how the degree can contribute to those goals.

For advising purposes, a writing sample and the Miller Analogies Test are also required.

Nonmatriculated students who have a baccalaureate degree may, with prior permission, take two courses from a selected list. Successful completion of any course work does not change the requirements for admission nor are those courses necessarily counted toward the degree.

If a prospective student has questions about the program, job prospects or relation of the degree to any personal goals, he or she should contact the human performance development and training program chair for additional information and possibly an interview—either in person or by telephone. Graduate application forms are available from the Office of Graduate Enrollment Services or hospitality and service management department, College of Applied Science and Technology.

Prerequisite skills

Two sets of skills are required of every graduate—basic computer skills and basic statistical skills. Basic computer skills include using basic software tools (word processors, spreadsheets, databases). Students may show proof of these skills through previous courses or through work experience.

Skill requirements in basic (descriptive) statistics can be met through previous courses or through experience. RIT offers several graduate courses that will meet the requirement and can be counted toward the degree.

Financial aid

Financial assistance is available through the following sources:

- RIT Financial Aid Office: 716-475-2186
- Human performance development and training program: 716-475-2893

Each has a different form of assistance and source of funding. For more information, contact *each* source above. For a general overview of financial assistance, write to:

Instructional Technology Program
Rochester Institute of Technology
14 Lomb Memorial Drive
Rochester, NY 14623-5604.

Degree requirements

The degree requires a minimum of 48 quarter credit hours at the graduate level. Twenty-six of the 48 hours are seven core courses required for *all* students. In addition, every student must complete an instructional development project that can serve as part of a portfolio for prospective employers. The degree can be completed in three or four consecutive quarters *if* the student starts in the fall quarter. The majority of students attend part time and take from two to four years to complete the degree work. The degree must be completed within seven years of the first course counted toward the degree. All courses are offered in the evening—and occasionally on Saturdays—so that students may work in the daytime as they take courses.

Of the 22 elective hours, students are relatively free to choose those they feel best meet their needs. Restrictions are:

- all courses must be graduate level
- a maximum of nine quarter credit hours (not counted toward another degree) may be transferred from another college or university
- a maximum of 16 hours may be taken outside the instructional technology program
- a maximum of eight hours may be taken in special projects, independent study or internship courses
- a student may take a *maximum* of 16 hours in any combination of the above.

Each student is assigned an adviser with whom a course plan should be developed to best suit the student's career and graduation requirements.

While the student has some liberty to choose course sequence, careful attention should be given to course prerequisites. A good rule-of-thumb is to take 0627-735, 755 and 756 within the first 20 hours of course work in order to prepare for 0627-771, 772 and 773 (the instructional development sequence). For answers to specific questions, the student should contact his or her adviser.

Required core courses

(26 credits)		**Credits**
0627-721	Evaluation of Training	4
0627-735	Theories of Adult Learning	4
0627-755	Criterion-Referenced Instruction 1	3
0627-756	Criterion-Referenced Instruction 2	3
0627-771	Instructional Development 1	4
0627-772	Instructional Development 2	4
0627-773	Instructional Development 3	4

Instructional design option
Four of the electives below

0627-706	Instructor-Led Training	4
0627-712	Computer-Assisted Instruction I	4
0627-721	Evaluation of Training & Instruction	4
0627-757	Techniques of Work Analysis	3
0627-762	Developing Instructional Modules	3
0627-797	Gathering & Maintaining Voice of the Customer	4

Option total: 13 to 15 credits, depending on courses chosen (additional elective credits needed to total the 48 credits required for graduation)

No option is currently required. The option allows a student to develop a special area of emphasis or to have a set of special skills to show an employer.

Master of Science in Health Systems Administration

William Walence, *Program Chair*

The health systems administration program is designed to meet the needs and demands of professionals desiring a degree specific to the health care field. It is designed for working health care administrators, clinicians and support personnel in health care organizations, and anyone desiring a career move into the health care environment.

One of the program's advantages is that it can be pursued while working full time. In addition, thesis and internship options allow a wide range of personal choice in designing a program to fit specific academic and career needs. Employing a leading-edge, systems approach to health care administration, the program capitalizes on RIT's experience and skill in delivering creative academic offerings through advanced technological means to distance learners.

As a focal point in the debate over health care costs and provision, Rochester has gained a national reputation for affordable, high-quality health care services. The Rochester community possesses an enviable array of talented health care administrators and care givers—many of whom are also faculty in the program and whose expertise is invaluable.

The program meets students' needs by taking a value-added, continuous improvement approach to program development and maintenance. Its guiding principles operate in the context of a socially conscious world view:

- it is responsive to evolving trends in health care and management
- it provides an integrated systems approach to health care
- it possesses a balance of quantitative and qualitative content
- it teaches useful skills
- it employs and imparts innovative technology
- it fosters lifelong learning.

The program

Health systems administration is a 57-quarter-credit-hour distance learning program. It requires 18 months of study.

Each fall, four courses (Integrated Health Systems, HS Administration, HS Operations and Finance, Statistical Concepts) meet one day each for on-campus sessions. These sessions provide students and instructors an opportunity to meet one another as well as familiarize themselves with RIT.

Attendance at the fall sessions is not required for MS students. Those who choose not to attend will be provided all of the materials and tapes from the one-day sessions. Students should feel free to attend if their schedules permit.

The schedule for the 2001 optional sessions can be found at our program Web site: www.rit.edu/-hsawww.

Teaching methodologies include computer networking, video lectures and seminars, audio-taped lectures and discussions, and teleconferences.

Year 1			
Summer Quarter	**Fall Quarter** Statistical Concepts Integrated HS	**Winter Quarter** Quality Mgmt. for HS Preventive Epidemiology	**Spring Quarter** Info. Systems for Health Administrators HS Policy and Law
Year 2			
Elective	HS Admin. Finance for Operations	HS Economics & Finance HS Seminar	HS Issues HS Strategic Planning

Admission requirements

Admission requirements for the master of science degree include:

- successful completion of the baccalaureate degree at a regionally accredited college or university
- A cumulative grade point average of 3.0 or above on a 4.0 scale or superior endorsement and more than three years' management work experience
- letters of reference from two individuals who have recently functioned as the applicant's supervisors
- official undergraduate and, if applicable, graduate transcripts
- three or more years' experience in a health care or health-related organization or business environment as either a clinician or manager. (An internship in a health care organization is required for those who lack such experience.)
- telephone interview with health systems administration faculty member

All credentials must be submitted and reviewed by the faculty prior to the completion of 12 quarter credit hours of graduate work in the program. Go to www.rit.edu/healthsystems for further information.

Financial assistance

Assistance may be available through the RIT Financial Aid Office (716-475-2186).

Degree requirements

The degree requires completion of a minimum of 57 quarter credit hours at the graduate level. The program can usually be completed in 21 months, and program requirements must be met within seven years of the date of the oldest course counted toward the student's program. Students must maintain a 3.0 (B) average and must complete a thesis or other appropriate research or comparable professional achievement.

Upon matriculation each student is assigned an adviser, and together they develop a plan of study. For specific questions about courses and a plan of study, the adviser or department chair should be consulted. Call William Walence at 716-475-7359.

Curriculum

The following themes link courses and pervade the curriculum: ethics and social responsibility, systems perspective, communication skills, managing change, quality and computer literacy.

Required courses

Statistical Concepts or Introduction to Statistics
Integrated Health Care Systems
Preventive Epidemiology
Information Systems for Health Administrators
Health Systems Quality
Health Systems Policy & Law
Health Systems Seminar
Health Systems Operations & Finance
Health Systems Economics & Finance
Health Systems Planning
Health Systems Administration
Health Systems Issues

Electives

Reengineering Health Care
Culture & Leadership
Medicare/Medicaid
Managed Care

Additional credit options

(8 credit hours required from elective courses, thesis or internship)

Advanced Certificates in Health Administration

RIT now offers two new advanced certificates in health systems administration. Each consists of four graduate courses and can be taken via distance learning (computer networking, videos, audios). Students do not need to come to campus to take these courses.

The courses for these certificates are the same as those in the master of science degree in health systems administration. The faculty and resources for these courses are the same as those for the MS degree. The courses can be applied to the MS degree at a later date if desired.

Advanced certificate in integrated health systems

	Credits
Integrated Health Systems	4
Health Systems Administration	4
Quality Mgmt. for Health Systems	4
Elective	4
Advanced Certificate Total	**16**

Advanced certificate in health systems finance

	Credits
Finance for Operations	4
Health Systems Economics & Finance	4
Managed Care	4
Elective	4
Advanced Certificate Total	**16**

Admission requirements

Admission requirements for an advanced certificate program are the same as those for the MS in health systems administration:

- BS or BA degree from an accredited college or university, in health care or business
- a 3.0 grade point average (GPA) on a 4.0 scale
- three years of work experience. If you do not have health care work experience, you may be required to take an additional course, Survey of Health Systems, to gain foundation knowledge.

The Center for Multidisciplinary Studies

James Myers, *Director*

Master of Science in Cross-Disciplinary Professional Studies

The cross-disciplinary professional studies program is specifically designed to enable the mature learner to fashion a customized plan of graduate study tailored to his or her personal and professional goals. This degree offers an opportunity to draw on more than 50 RIT graduate programs—for example, interactive media design, human resource development, graphic design, information technology and health systems administration—in order to gain the advanced knowledge and skills necessary to respond successfully to new and emerging career opportunities. The degree is completed with a practical, hands-on project directly related to the student's individualized plan of study. The cross-disciplinary professional studies master's degree with certain concentrations can also be pursued through distance learning.

The program

The master of science in cross-disciplinary professional studies requires completion of 48 quarter credit hours as specified in an individualized plan of study consisting of two or three professional concentrations. Each concentration consists of three to four courses drawn from an existing RIT graduate program. Graduate credits earned in other programs can be used in completing a concentration. Certain concentrations can be completed with distance delivered courses, including:

- applied statistics
- organizational development
- environmental management
- health systems administration
- information technology
- product and production systems design
- other distance-delivered concentrations as they become available.

Besides course work in two or three concentrations, there are two required courses. Credit hours not required in a student's concentrations can be used for electives. For further information or advising, call Dr. Richard Morales at 716-475-2234.

Required courses

Context and Trends (4 credits)

This course introduces students to interdisciplinary thinking, problem solving and research techniques using electronic information resources.

The Capstone Project (4 credits)

This course is a supervised, hands-on experience in which students apply the skills and knowledge developed through their individualized plans of study and conclude with oral and written presentations.

The following examples are illustrations of the cross-disciplinary professional studies format. Many other combinations are possible.

Examples: Cross-Disciplinary Professional Studies

Plan of Study Example 2: Cross-Disciplinary Professional Studies with Two Professional Concentrations

		Credits
0699	Context & Trends	4
	CONCENTRATION A: MANAGEMENT	
0102	Organizational Behavior & Leadership	4
0102	Leading a Quality Organization	4
0102	Business & Society	4
0102	International Management	4
	CONCENTRATION B: ORGANIZATIONAL DEVELOPMENT	
0626	Needs Assessment	3
0626	Theory of Organizational Development	3
0626	Planning & Evaluation in Organizational Development	3
0626	Organization Restructuring	3
	ELECTIVES	
0307	Quality Management	4
0625	Elements of Service Management	4
0625	Organizational Strategies of Service Firms	4
0699	Capstone Project	
	Total	**48**

Example 2: Cross Disciplinary Professional Studies with Three Professional Concentrations

		Credits
0699	Context & Trends	4
	CONCENTRATION A: INTERACTIVE MULTIMEDIA DEVELOPMENT	
0604	Fundamentals of Interactive Multimedia Development	4
0604	Interactive Multimedia Development	4
0604	Programming for Interactive Multimedia	4
0604	Interactive Multimedia Project	4
	CONCENTRATION B: GRAPHIC ARTS TECHNOLOGY	
2081	Trends in Printing Technology	4
2081	Computer-Aided Printing Design & Copy	4
2081	Markets for Electronic Publishing	4
	CONCENTRATION C: MANAGEMENT OF TECHNOLOGY	
0102	Introduction to Technology Management	4
0102	Strategic & Global Factors in the Management of Technology	4
0102	Managing a High-Tech Organization	4
	Electives	0
0699	Capstone Project	4
	Total	48

Admission requirements

The program is especially suitable for individuals with career experience who can define the skills and knowledge they wish to obtain through graduate study. Admission requirements include:

- successful completion of a baccalaureate degree at a regionally accredited college or university
- an undergraduate cumulative grade point average of 3.0 or better on a 4.0 scale or superior endorsements and more than three years of management experience
- three to five years full-time work experience
- letters of reference from two individuals who have served recently as either the applicant's supervisors or instructors
- a statement of career objectives and description of the skills and knowledge sought through graduate study
- an approved plan of study developed with the program chair.

International students must submit the results of the Test of English as a Foreign Language (minimum score of 550) as part of the application process. The TOEFL requirement is waived for native speakers of English or those submitting educational transcripts and diplomas from American colleges and universities.

All applicants are urged to discuss their plans with the cross-disciplinary professional studies program adviser before making formal application.

Financial assistance

Assistance may be available through the RIT Financial Aid Office (716-475-2186) and the Office of Graduate Enrollment Services. Financial Aid reviews eligibility for loans, and the Office of Graduate Enrollment Services offers scholarships.

Advanced Certificate in Technical Information Design

Admission requirements

Certificate applicants should have a baccalaureate or equivalent degree from an accredited institution and a minimum cumulative grade point average of 3.0 (B). Students with lower grade point averages may take courses on a nonmatriculated basis and be admitted after successful completion of two or more courses and permission of the program chairperson. Two professional recommendations also must be submitted.

Applicants whose native language is other than English must take the TOEFL examination. A score of at least 550 is required. Students with a lower score may be admitted conditionally and will take a prescribed program in English along with a reduced program course load.

Students entering this program are also expected to have basic skills in technical writing and editing and technical document design.

The curriculum

Technical information design is a growing multidisciplinary communication field that requires understanding and skills in the development and use of text, graphic design, multimedia, and other techniques to enhance contemporary technical communication. Success in this field demands that the practitioner have superior writing skills, adeptness at selecting and using available and emerging media, and the ability to recognize excellence

in the visual aspects of communication design. This program focuses on the information designer's use of technology to create documentation and to deliver information to the intended audience.

Required courses

0604-741	Fundamentals of Web-Based Multimedia	4
0688-711	Technical Information Design	4
0688-731	Technical Procedures	4
0688-741	Usability Design & Testing	4

In addition, students are required to complete a minimum of seven elective credits chosen with the approval of their program adviser.

Elective courses

0604-730	Interactive Media Implementation	4
0604-745	Theories in Interactive Computing	4
0688-721	Creating Technical Proposals	4
0688-732	Managing Technical & Scientific Communication	3
2081-723	Contemporary Publishing	4
2081-742	Document Processing Languages	4
2081-743	Markets for Electronic Publishing	4
2081-744	Introduction to Multimedia Publishing	4

Graduate Faculty College of Applied Science and Technology

Wiley R. McKinzie, MS, State University of New York at Buffalo—Dean, Professor
Linda A. Tolan, BS, State University of New York College at Geneseo; MS, Rochester Institute of Technology—Associate Dean, Associate Professor

Department of Civil Engineering Technology, Environmental Management and Safety

Abi Aghayere, BS, University of Lagos; MS, Massachusetts Institute of Technology; Ph.D., University of Alberta; PE—Assistant Professor
G. Todd Dunn, BS, Dartmouth College; MSCE, University of California; PE—Associate Professor
Robert H. Easton, BS, U.S. Military Academy; MSCE, Iowa State University; PE—Professor
Joshua Goldowitz, BS, State University of New York at Binghamton; MS, University of Arizona—Associate Professor
William C. **Larsen,** BS, MSCE, Dartmouth College; PE—Associate Professor
Robert E. McGrath Jr., BCE, Rensselaer Polytechnic Institute; MSCE, Syracuse University; PE—Professor Emeritus
John Morelli, BS, Syracuse University; MS, Ph.D., State University of New York College of Environmental Science and Forestry—Associate Professor
Mark Piterman, MCE, Odessa Marine Engineers Institute—Professor Emeritus
Joseph M. Rosenbeck, BS, MS, Central Missouri State University—Program Coordinator; Associate Professor
Maureen S. **Valentine,** BSCE, Tufts University; MCE, Virginia Polytechnic Institute; PE—Chairman, Civil Engineering Technology, Environmental Management and Safety; Associate Professor
Jennifer Wadhams, BS, Roberts Wesleyan College; MS, University of Rochester—Assistant Professor

Scott B. Wolcott, AAS, State University of New York, Canton; BS, MS, State University of New York, Buffalo; PE—Assistant Professor

Adjunct Faculty—Environmental Management and Technology

Michael Chambers, BS, Clarkson University
Maria Csutora, Ph.D., Budapest University of Economic Sciences
Twyla Cummings, Ph.D., The Union Institute
Libby Ford, MS, University of Notre Dame
Jacqueline Fox, MS, University of Rochester
Deborah Gordon, MS, University of Rochester
Wayne Loomis, MS, University of Rochester
Jean McCreary, JD, University of Florida School of Law
Edward Mullen, BS, Clarkson University
David Richardson, MPH, University of Michigan
George Thomas, MS, Johns Hopkins University

Department of Manufacturing and Mechanical Engineering Technology/Packaging Science

Ronald F. Amberger, BME, Rensselaer Polytechnic Institute; ME, Pennsylvania State University; PE—Professor
A. Ray Chapman, BS, Michigan State University; MBA, Rochester Institute of Technology—Professor
Charles L. DeRoller, BS, ME, Rochester Institute of Technology—Associate Professor
Louis B. Gennaro, BS, U.S. Military Academy; MS, Northeastern University—Professor
Daniel L. Goodwin, BS, MS, Ph.D., Michigan State University—Chairman, Professor
Martin Gordon, BSME, MSME, MBA, State University of New York Buffalo—Assistant Professor
Deanna M. Jacobs, BS, State University of New York College at Plattsburgh; MA, State University of New York College at Geneseo; MS, Rochester Institute of Technology—Associate Professor
Guy Johnson, BS, Pennsylvania State; MS, Syracuse University—Professor
Seung Kim, BS, Hanyang University; MS, Ph.D., University of Illinois
Ti-Lin Liu, MS, Tsinghua University—Associate Professor
Carl A. Lundgren, BS, Rensselaer Polytechnic Institute; MBA, University of Rochester—Professor
Robert A. Merrill, BS, Clarkson College; MS, Northeastern University; PE—Professor
Karen L. Proctor, BS, Michigan State University; MBA, Rochester Institute of Technology—Associate Professor
S. Manian Ramkumar, BE, PSG, College of Technology-Bharathiar; ME, Rochester Institute of Technology—Associate Professor; Graduate Program Adviser
Elizabeth A. Scholle, BSE, University of Pittsburgh; MS, Ph.D., University of Illinois; EIT Professional Certification—Assistant Professor
James F. Scudder, BME, Cornell University; PE—Assistant Professor
John A. Stratton, MS, Rensselaer Polytechnic Institute—Department Chair; Professor
Fritz J. Yambrach, BS, Michigan State University, BS, MBA, Utah State University—Associate Professor

Hospitality and Service Management

Francis M. Domoy, BS, MA, State University of New York at Buffalo; Ph.D., Michigan State University—Chair, Professor
Stanley Bissell, BA, Ohio Wesleyan University; MA, University of Auckland, New Zealand; MLS, State University of New York College at Geneseo— Associate Professor
David Crumb, BS, Florida State University; MBA, Michigan State University—Assistant Professor
Barbara Cerio Iocca, RD, BS, M.Ed., State University of New York at Buffalo—Associate Professor
James Jacobs, MS, Troy State University; Ph.D., State University of New York at Buffalo—Graduate Chair; Associate Professor

Elizabeth Kmiecinski, RD, BS, Ohio State University; MS, University of Kentucky—Assistant Professor
Dianne C. Mau, BS, Rochester Institute of Technology; MS, State University of New York College at Brockport—Graduate Program Chair
Thomas McCaffery, BS, University of Scranton; MHA, University of Michigan; JD, Boston College Law School—Associate Professor
Warren Sackler, BA, Michigan State University; MA, New York University—Associate Professor
Edward Steffens, BS, MBA, Rochester Institute of Technology—Assistant Professor
Edward B. Stockham, AB, Ph.D., University of Pennsylvania—Associate Professor
William W. Walence, BA, MA, Kent State University; Ph.D., Ohio State University—Program Chair, Health Systems Administration, Deaf Studies; Associate Professor
C. J. Wallington, BS, University of Missouri at Kansas City; Ph.D., University of Southern California—Graduate Program Chair, Professor
Carol Whitlock, RD, BS, MS, Pennsylvania State University; Ph.D., University of Massachusetts—Professor

Adjunct Faculty—Hospitality and Service Management

Judy Christiansen, BA, University of Hartford; MS, New England Conservatory of Music
Richard Cowen, MBA—Health Care Management Consultant, Rochester
Christopher Davis, M.D.—Physician, Rochester
Deborah DeMay, MS, Rochester Institute of Technology
Donna A. Dickson, BA, State University of New York College at Buffalo; MS, Rochester Institute of Technology
Karin Edinger, BS, State University of New York at Brockport, MS, Rochester Institute of Technology
James Fatula, Ph.D.—Consultant, Health Care Management, Rochester, New York
Rebecca Ferraro, BS, State University of New York College at Brockport; MS, Rochester Institute of Technology
Arnold S. **Gissin,** MPH—Administrator, Jewish Home of Rochester
Katherine Hiltunen, MBA, BSN—Director, QM/UM Analysis, Blue Cross and Blue Shield of Rochester
Patricia Houghton, RN, MHA, CPHQ
Ed Keyes, BS, University of Massachusetts; MS, Rochester Institute of Technology
Joseph M. LaLopa, MS, Rochester Institute of Technology; Ph.D., Michigan State University
Marcia Marriott, BS, MA, State University of New York at Brockport; Ph.D., Southwest University
Richard Morano, BS, Rochester Institute of Technology; MS, University of Rochester; Ed.D., University of Rochester-
James Myers, BS, MS, Rochester Institute of Technology; Ph.D., Michigan State University
Michael O'Connor, MS—Executive Director, Rochester Community Individual Practice Association
A. Holly Olsen, BS, University of Montana; MS, Rochester Institute of Technology
James M. Papero, BS, Ed.M., University of Rochester
Damon Revelas, BS, MS, Rochester Institute of Technology; Ph.D., State University of New York at Buffalo
Annette Rummel, BBA, Northwood University, MS, Rochester Institute of Technology
Patricia Seischab, MS, Rochester Institute of Technology
Theresa Seil, BS, State University of New York at Brockport; MBA, Syracuse University
Christine Sevilla, BA, University of Southern California at Santa Barbara; MPA, State University of New York at Brockport; MS, Rochester Institute of Technology
Dan L. Sirmans, BBA, Georgia State University; MS, Rochester Institute of Technology
J. Wixson Smith, BS, State University of New York College at Geneseo; MS, Rochester Institute of Technology
Michael Tarcinale, Ph.D., RN—Vice President, Randamax, Inc., Rochester, New York
Arthur G. **Tweet,** Ph.D.—Consultant, CQI Associates, Rochester, New York
Beverly Voos, MS, President and Chief Executive Officer, Rochester Healthcare Information Group, Rochester, New York
Albro C. **Wilson,** MS, Rochester Institute of Technology
Carl Winkelbauer, Ed.D., University of Rochester

Center for Multidisciplinary Studies

Janet Graham, BS, MS, Rochester Institute of Technology—Assistant Professor; Associate Director
James Myers, BS, MS, Rochester Institute of Technology; Ph.D., University of Michigan—Director, Associate Professor
Richard Morales, BA, Michigan State University; MA, State University of New York at Brockport; MSW, Ph.D., Syracuse University—Visiting Associate Professor
Thomas F. Moran, BSME, California Polytechnic State College; MSME, California State College at Long Beach—Program Chair, Communications; Associate Professor
Linda A. Tolan, BS, State University of New York College at Geneseo; MS, Rochester Institute of Technology—Associate Dean, Associate Professor

The Student Alumni Union, a popular gathering spot, contains many student activities and services offices, the cafeteria and Ritskeller, Ingle Auditorium and the RTTreat.

Packaging Science

0607-701 Research Methods in Packaging
Discussion of procedures, methods and requirements for carrying out the research project. Students pursue advanced study and research in the following areas: distribution packaging, package systems development, product and/or package damage in the physical distribution environment, materials, quality preservation, production and mechanical properties of packaging materials and systems. Credit 4

0607-721 Packaging Administration
Study of the role of packaging operations in the corporate enterprise. Positioning of the packaging function in the corporation, managerial practice, interpersonal relationships and control techniques are considered. Individualized instruction, case analysis and/or research papers supplement classroom instruction. **Credit 4**

0607-731 Advanced Packaging Economics
An advanced study of the firm's economic behavior in relationship to activities within the packaging function. Included are packaging costs, production theory and case studies demonstrating general trends in the packaging industry. Individual instruction, case study and/or research paper required, as appropriate to the student's level or interest. **Credit 4**

0607-742 Distribution Systems
Study of the shipping and handling environment encountered by goods in packages during distribution to the product user. Materials handling, warehousing and the impact of the distribution environment on shipping container design and development are considered. Case study or individual research appropriate to student's interest. Credit 4

0607-750 Graduate Seminar
Course concentrates on topic of current interest, depending on instructor, quarter offered and mix of students. Content to be announced before registration dates. Credit 4

0607-752 The Legal Environment
An intensive study of federal, state and local regulation that affects packaging. Individualized study and research on an interest basis. **Credit 4**

0607-763 Packaging for End Use
An intensive study of package design requirements specific to use of a product at specified end points. Individual design and development of a package system and its specifications, appropriate to the needs of the product and the consumer/user. Credit 4

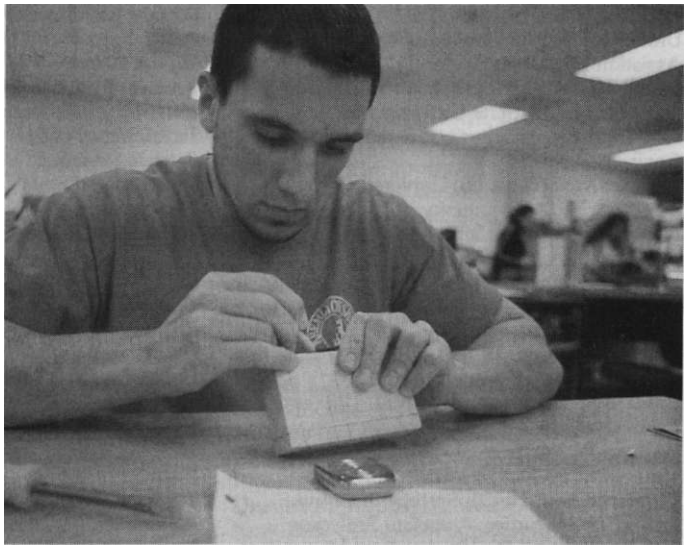
0607-770 Advanced Computer Application
Study of the application of computer techniques and data processing for packaging applications: specification development, test simulation, optimum sizing of package systems, process control and similar applications will be presented. Computer program development and individual research on an interest basis. **Credit 4**

0607-783 Packaging Dynamics
The study of instrumentation systems for analysis, evaluation and application of shock and vibration test methods and data to package system design and development for specific products. Individualized instruction appropriate to student's interests. Credit 4

0607-798 Independent Study
Student-initiated study in an area of specialized interest, not leading to a thesis. A comprehensive written report of the investigation is required. Cannot be used to fulfill core requirements. Credit **1-8**

0607-799 Advanced Packaging Design
Advanced package design projects selected in consultation with the instructor. Individual study appropriate to area of interest and background of student. (Consent of department) **Credit 1-4**

0607-890 Graduate Thesis
An independent research project to be completed by the student in consultation with the major professor. A written thesis and an oral defense of the thesis are required. (Consent of department) Credit **1-12**



Manufacturing & Mechanical Engineering Technology

0610-630 Tolerance Design
This is a comprehensive course on the topics of analytical and experimental development of design and production tolerances. The course covers worst case and statistical tolerance analysis, 6 Sigma methods for tolerancing, Monte Carlo simulation sensitivity analysis of systems, and Taguchi's approach to tolerance design. Special emphasis will be given to developing tolerances for complex aggregations of technologies. System tolerance and cost balancing are covered in detail. The use of tolerance design in critical parameter management will be covered. Students will conduct a project in computer-aided tolerance analysis. Credit 4

0610-710 Product Development & Integration
This course covers a broad set of topics, processes, and best practices related to the disciplined development of products and production systems. The course takes two major views of product development: total quality development and system engineering as applied to the earliest phases of new product development. A thorough review of product and technology development processes and best practices will be covered in the context of reducing time to market. Skills will be developed to enable the student to construct and actively participate in a modern, concurrent new product development process. The student will be introduced to critical parameter management to aid in fulfilling voice of the customer requirements. System integration for total product life cycle performance is a major focus. Studies and reading in diverse product and system development topics are required. Credit 4

0610-820 Concept Design & Critical Parameter Management
This course focuses on gathering the voice of the customer, translating it into technical requirements, defining functions to fulfill the requirements, generating concepts to physically fulfill the functions and the evaluation and selection of superior product and subsystem concepts that are safe to take to commercialization. Team labs will be conducted in QFD, functional analysis and decomposition, concept generation and Pugh's concept selection process. Critical parameter management techniques will be covered in detail. Credit 4

0610-830 Instrumentation & Computer Aided Data Acquisition
This course integrates modern methods of acquiring, processing, and analyzing data. The goal is to generate value-added information to the critical parameter management process during new product development. The course focus is on the measurement of product- or process-critical functional responses that are direct indicators of the true physical functions that control product quality. Students will acquire a strong set of skills in hands-on development, design, construction, and operation of manual and computer-aided data acquisition systems. Topics include applications for data base management and application for empirical model building, robust design, tolerance design, and statistical process control. Students will be introduced to Lab View for data acquisition and control. Credit 4

0610-870 Robust Design & Production Systems
This is an advanced course in Taguchi's dynamic methods of robust design. Students learn to optimize design parameter nominal set points to promote insensitivity to sources of variation in the manufacturing and customer use environments. Development of robust and tunable systems and their manufacturing processes is a major focus. Engineering methods for designing for additivity are used to promote rapid system integration. The role of robust design in critical parameter management will be demonstrated. Team labs in robust design projects will be required. Credit 4

Gateway to Technology

0617-730 Data Management & Communication
This is a course in communication and data management. The first part of this course will focus on data communication. Fundamental concepts of computer systems will be explored. This information will be a precursor to such topics as parallel and serial communication, synchronous and asynchronous communication, point-to-point, and broadcast networks. Additional discussion will include application of network applications in CIM such as EDI. The second part of this course will discuss elementary data management topics such as data storage and retrieval, the use of commercial DBMS's and the relational model. It will also discuss data representation in CIM; the melding of representation schemes used by CAD systems and CNC/DNC machine tools. (0602-710) Credit 4

0617-842 Data Management in CIM
Introduction to data management for manufacturing applications. Topics include conceptual, implementation and physical design of databases as well as data representation used in manufacturing processes. Geometric modeling of 3D objects for analysis and display is included. Laboratory work required. (0602-710,0602-730) Credit 4

0617-845 Distributed Systems
This is a course in writing distributed applications, as distinguished from distributed operating systems. As such, it focuses on two principal issues: types of implementation platforms and interprocess communication mechanisms. The first issue involves a discussion of different types of environments in which the programmer may find himself or herself, including traditional timesharing systems, event-driven systems and uniprogramming systems. The pros and cons of each are discussed as a basis for implementing distributed systems. The second issue is concerned with how processes, or tasks, communicate with one another, whether this is different when the processes are on a single processor or different processors and how they can synchronize their accesses to shared resources. (0602-710,0602-730) Credit 4

0617-850 Flexible Manufacturing & Assembly Systems
This course provides in-depth knowledge of automated manufacturing and assembly systems, their design, operation, and implementation. Topics include system hardware, software, controls, programming, and integration. Emphasis is on providing a thorough understanding of computer controlled machines, tooling, tool management, part feeding, part orientation, part holding, material handling systems, robots, AGVS, coordinate measuring machines, sensors, system controls, general- and special-purpose assembly systems, and management issues. Concepts pertaining to design of products for automated manufacturing, handling, and assembly will also be discussed. (0617-220 or equivalent) Class 4, Credit 4

0617-855 Electronics Packaging Fundamentals
This course will provide a thorough understanding of the technology, components, equipment, design, and manufacturing process for surface mount electronics manufacturing. As an introductory course, it will provide the students with the strong foundation needed for advanced work in surface mount technology (SMT). The laboratory demonstrations will orient and familiarize students with the manufacturing equipment and process for printed circuit board assembly. Class 4, Credit 4

0617-856 Advanced Concepts in Electronics Packaging
This course provides an in-depth study of materials, analytical procedures, and manufacturing processes related to surface mount electronics manufacturing. The lecture topics will include design and manufacturing standards, stencil printing, component placement, soldering, cleaning, testing, inspection, real-time process control, and CAD/CAM integration. The laboratory projects for this course will include analytical analysis of raw materials, solder joint reliability, substrate inspection, and a detailed process study of stencil printing, component placement, soldering, post solder inspection, and rework and repair. (0617-855) Class 4, Credit 4

0617-870 Manufacturing Automation Controls
This is a course dealing with the principles and application of programmable logic controllers (PLC). Topics include PLC hardware, programming, and application in a computer integrated manufacturing (CIM) environment. Students will also be exposed to human machine interface (HMI) and PLC networks. (Graduate standing) Class **3, Lab 2,** Credit **4**

0617-896 Project Management in CIM
Interdisciplinary course covering project management in CIM. Students will study real-world problems that are related to manufacturing hardware or manufacturing processes and propose solutions to problems requiring an integrated approach. Topics include the identification and definition of the goal; strategy development; project planning; required resource estimation; project organization; proposal development; project approval; project staffing; team building; implementation of the project managing scope, performance, schedule and resources; and project termination. (Completion of required courses in CIM curriculum) **Credit 4**

0617-897 MS Thesis
Interdisciplinary thesis on CIM research area to be monitored and advised by committee of three faculty. This thesis work may serve as the capstone course of the CIM degree. (Defense of thesis requires completion of all required courses.) Credit **0-4**

0617-898 Graduate Seminar
Special offering of advanced graduate-level topics. These topics are developed and taught on a special offering basis and will vary from year to year. **Credit 1-4**

0617-899 Independent Study
Faculty-directed study of appropriate topics on a tutorial basis. This course is generally used to allow an individual to pursue topics in depth under faculty sponsorship. Credit **1-4**

0617-999 Manufacturing Grad Co-op
Work experience in manufacturing position appropriate to selected major in graduate program. Position to be obtained through interviewing process with the assistance of the Office of Cooperative Education and Career Services. Credit **0**

Bike patrols are one way that Campus Safety provides security to the RIT community.

Hospitality and Service Management

Hospitality–Tourism Management

0624-770 Service Leadership: Examining & Implementing Change
An overview and examination of various personnel leadership functions as applied to the delivery of service excellence. Current literature is used to explore the interrelationships of various conceptual paradigms. The goal is to enhance each individual's understanding and to augment his/her ability to interact in the service environment and to critically understand strategies founded in continuous learning. Concepts discussed include: teamwork, empowerment, relationship management, corporate culture and "moments of truth" management. Credit 4

0624-825 Strategic Processes of Service Firms
An analysis of the organizational structure, operational procedures, corporate policies, financial growth and related factors of service firms. The course traces the evolution of various companies to reveal individual growth strategies. Credit 4

0624-826 Tourism Policy Analysis
An analysis of the goals and objectives for tourism development in geographic areas of different size. Topics include employment, income redistribution, cultural impact, labor supply and tourism resource base. Specific policies for touristic regions are compared for effectiveness and overall cost benefits. Credit 4

0624-827 Technical Transfer in Hotel Industry
Survey of computer information systems for planning and control in hospitality and tourism operations. Various software and hardware packages are examined in relation to planning and control functions. Credit 4

0624-828 Meeting Planning Development
An examination of the role of professional meeting planners as they function in the corporate, association and educational environments. Both corporate and independent meeting planners will be assessed. Methods of planning and programming for meeting will be surveyed and evaluated. A review of the economic impact of conferencing and support service functions will be undertaken. Negotiation skills are examined. Credit 4

0624-840 Service Quality Management
Total quality management (TQM) philosophy is applied to the hospitality-tourism industry. Underlying principles, TQM tools and techniques and case studies are used to bridge the gap between theory and practical application. Credit 4

0624-843 Resort Development: An Instructional Approach
Market segmentation; methods in marketing research; creating a menu, an environment, a theme for a defined market; improving the market share through quality control, innovation, promotions, public relations, menu engineering and community involvement; premarketing, creating a new image; marketing to increase profitability. Case studies and project. Credit 4

0624-844 Hospitality Resource Management
This course is designed to analyze the inputs associated with the development of hospitality firms. Labor markets, financial instruments, tourism infrastructures, real estate markets and educational support systems will be assessed in order to determine the development of hospitality firms. Credit 4

0624-846 Travel Marketing Systems
Includes the identification of markets, product pricing strategies and mixes of communication as they relate to the tourism distribution system. The efficiencies of various channel configurations and their resultant organizational patterns are evaluated. Credit 4

0624-848 Convention & Exhibition Management
The organization and operation of exhibit/convention space is examined from the meeting planner's perspective. Emphasis is given to use of exhibits to enhance both program and attendance. A detailed review of the factors necessary for successful exhibits and exhibitor relations is conducted with emphasis on the various methods employed to encourage participation. Budget controls and financial reporting systems are analyzed. The decision-making process on use of the exhibit as an income producing segment of conferencing is stressed. Credit 4

0624-867 Tourism Planning & Development
Tourism planning defines the frames of reference used in making choices concerning the development of tourism facilities and use of space. Topics include: tourism income and expenditure; pricing policy; taxing authorities; ownership patterns; financing and leakage potentials of the various tourism infrastructures. This course focuses on the planning and development of tourism as it is "packaged" through its distribution channels. Credit 4

0624-868 Legal Issues & Evaluation
An examination of the instruments used to confirm meeting arrangements. Focus is on informal instruments (letter of agreement) and formal documentation (contract). A survey of legal decisions impacting the liability of the planner and their impact on the meeting function is conducted. The performance of meeting planners and their interrelationships and interdependencies with external support staffs are assessed. Credit 4

0624-880 Seminar: Current Issues
A small-group examination of contemporary issues and topics chosen by the students and faculty member. Research, oral presentations and class discussions of all issues selected. Credit 4

0624-890 Practicum in Hotel Training
An opportunity for the student to apply skills learned in previous courses in a work or laboratory setting. A proposal must be approved by the director of the program, before enrolling in the course. Credit 1-6

0624-896 Graduate Project
This course number is used to fulfill the graduate paper requirement under the non-thesis option for the MS degree in hospitality/tourism management. The candidate must obtain the approval of the director of the program and, if necessary, an appropriate faculty member to supervise the paper before registering for this course. A formal written paper and an oral presentation of the project results are required. Credit 1-3

0624-898 Thesis
Thesis based on experimental evidence obtained by the candidate in an appropriate topic demonstrating the reduction of theory into practice. A formal written thesis and oral defense are required. The candidate must obtain the approval of the director of the program and, if necessary, an appropriate faculty member to guide the thesis before registering for the thesis. Credit 2-9

0624-899 Independent Study
An opportunity for the advanced student to undertake independent investigation in a special area under the guidance of a faculty member. A written proposal is to be forwarded to the sponsoring faculty member and approved by the director of the program before registering for this course. The independent study must seek to answer questions outside the scope of regular course work. Credit 1-6

Service Management

0625-750 Elements of Service Management: A Systems Approach
General Systems Theory is used to examine the major components of the service industry. The interactions and interdependencies of these components are discussed within the framework of developing a service management strategy to insure service quality. Credit 4

0625-760 Research Methods & Application in Service Industry
This course surveys the various assessment issues related to questionnaire development and evaluation, particularly as they relate to measuring customer satisfaction. Two methods of determining important service quality characteristics are examined: 1) the quality dimension development process and 2) the critical incident technique. Guidelines for developing questionnaires are discussed, with emphasis on issues of reliability and validity. The role and mechanisms associated with focus groups are addressed. The use of customer satisfaction data for service quality benchmarking is examined. Credit 4

0625-790 Introduction to Graduate Research: Options
This course is designed to introduce the general nature of applied research and evaluation applicable to service industries and to contemporary trends in the field. The course focuses on the nature, types, procedures and applications of research specifically those attributes needed to prepare a graduate research proposal: problem definition, review of literature, methodology, analysis of findings and recommendations. A graduate research proposal is required at the completion of the course. Credit 2

0625-841 Benchmark & Continuous Process Improvement
This course examines the benchmarking process as a means of achieving continuous service improvement. Among the topics discussed are proactive management, measuring performance, out-of-the-box thinking, internal, competitive, industry, and best-in-class benchmarking. The critical success factors at each stage of benchmarking in service industries are investigated. Credit 4

0625-843 Empowered Teams
This course focuses on the service organization's internal customers—the employee and middle management. It examines the prerequisites, transformations, and assumptions needed to decentralize the service firm and implement self-directed, empowered teams. Among the issues examined are accepting more responsibility for the service performance, assuming accountability for customer satisfaction, and planning with the "customer-in" decision-making framework. Credit 4

0625-844 Breakthrough Thinking, Creativity & Innovation
Learning to solve problems, create profound decisions, and continuously change our organizations has always been a function of leadership. Today's fast-paced global business environment requires that we utilize equally insightful, aggressive, and distinctly new processes to change. This course examines the global phenomena and builds in the learner new methods to achieve leadership in an age of change—breakthrough thinking, creativity, and innovation. The learner will become adept at true value innovation in a knowledge/service economy. Credit 4

0625-845 Relationship Management in Service Firms
This course examines the nature of managing the on-going relationships that characterize the service process. Relationships both internal and external to the organization are considered. Organizational implications of developing service recovery systems are also investigated. Credit 4

0625-846 Service Leadership Futures
This course changes each year as it evolves from students' interpretations of what the course should entail. In general, students will gain the capacity to examine both the current status and future route(s) that service industries will evolve. It is the first in a series of courses that will prepare career-minded individuals to function in our rapidly changing environment and, more important, in the future. The goal is to create leaders for tomorrow's service organizations and society. Credit 4

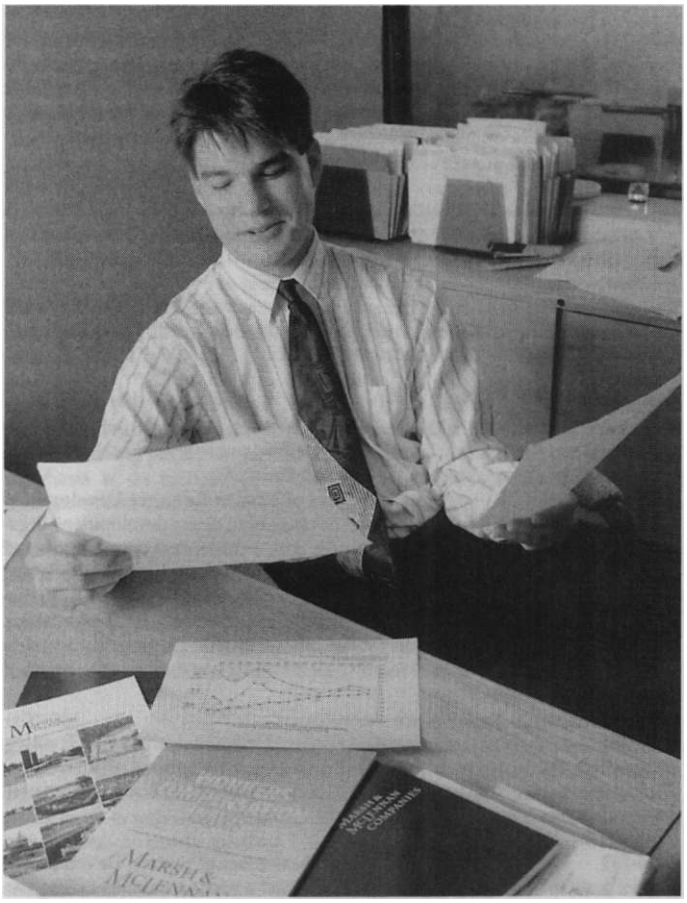
0625-847 Reengineering Service Environment
This course focuses on the process orientation of concentrating on and rethinking end-to-end service activities that create value for customers. It challenges traditional organizational viewpoints and reexamines the assumptions underlying the appropriateness of rigid divisions of labor, elaborate control systems and managerial hierarchy within service firms. Credit 4

0625-849 Service Quality Self-Assessment Processes
This course examines the various self-assessment processes associated with improving service quality. The seven Malcolm Baldrige National Quality Award categories, the eight President's Award for Quality and Productivity categories (Federal Quality Institute), and the ISO 9000 categories are examined. These guidelines are oriented towards systems and are used to probe relationships that reach across departments and disciplines, with the goal of achieving and maintaining total quality service management. Credit 4

0625-880 Current Issues Seminar
A small-group examination of contemporary issues and topics chosen by the students and faculty member. Research, oral presentations, and class discussions of all issues selected. Credit 4

0625-890 Practicum in Service Management
An opportunity for the student to apply skills learned in previous courses in a work or laboratory setting. Proposal must be approved by the director of the program before enrolling in the course. Credit 1-6

0625-896 Graduate Project
The course number is used to fulfill the graduate paper requirement under the non-thesis option for the MS degree in service management. The candidate must obtain the approval of the graduate coordinator and, if necessary, an appropriate faculty member to supervise the paper before registering for this course. A formal written paper and an oral presentation of the project results are required. Credit 1-3



0625-898 Research Thesis
Thesis based on experimental evidence obtained by the candidate in an appropriate topic demonstrating the reduction of theory into practice. The candidate must obtain the approval of the graduate coordinator and if necessary, an appropriate faculty member to supervise the paper before registering for this course. A formal written paper and an oral presentation of the project results are required. Credit 1-6

0625-899 Independent Study
An opportunity for the advanced student to undertake independent investigation in a special area under the guidance of a faculty member. A written proposal is to be forwarded to the sponsoring faculty member and approved by the Graduate Coordinator before registering for this course. The independent study must seek to answer questions outside the scope of regular coursework. Credit 1-6

Human Resource Development

0626-707 Applied Data Analysis to Career & Human Resource Development
Explores statistical concepts and procedures as applied to typical human resource, training and career counseling situations. Participants apply a computer program to the analysis of data. This course is offered in the classroom and online. Credit 3

0626-710 Theory of Organizational Development
This course introduces the student to organization development theories and their application in an organizational setting. Consideration is given to the psychological, sociological, and historical constructs upon which the field is based. Students will become familiar with the philosophical foundations for the key theories as well as the practical work of key theorists. This course will also examine how theories of organization development are being applied in organizations to foster change, innovation, and the revitalization of the organization. Credit 4

0626-712 Planning & Evaluating Organizational Development
Introduces participants to a strategic planning model, which they then use to develop a strategic plan for an organization. (0626-710) Credit 4

0626-713 Practices of Consulting Organizational Development
Explores the role and skills of the consultant. Participants engage in an assessment of an organization's needs, write a proposal, and, from the assessment data, make recommendations for interventions. They also explore their interests and aptitudes as consultants. (0626-710) Credit 4

0626-715 Empirical Methods
Acquaints participants with the tools for doing assessments and other data gathering activities. Practice includes survey development, interviewing and conducting focus groups. Credit 4

0626-720 Theories of Career Development
Examines theories of career development as applied to the process an individual uses in making career decisions. Credit 4

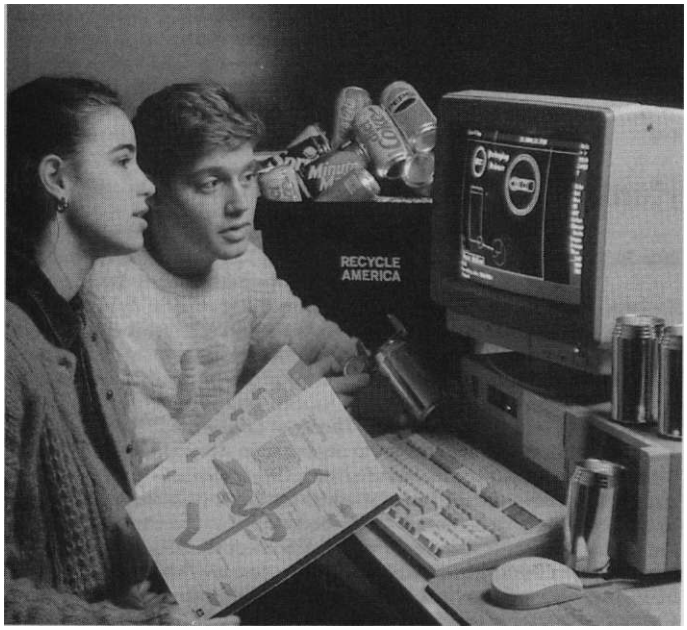
0626-721 Career Counseling Techniques
Introduces participants to theories and techniques used in individual career counseling situations. Participants plan, practice, and analyze nonclinical techniques used in career counseling. (0626-720) Credit 4

0626-730 Theories of Human Resource Development
Professionals in the HR fields of employee education, career development, organization development and training require both a conceptual understanding of human learning and performance and systematic procedures for inducing learning and performance. This course presents recent investigations, both theoretical and empirical, into human learning, motivation and performance. Through readings and group activities, students will increase their understanding of theories of human resource development as the basis for practical applications. Credit 4

0626-732 Design & Delivery of Training
Emphasizes the techniques used for design and development of instruction. During the course, participants design a training module, deliver a portion of it, and evaluate its success. (0626-730) Credit 4

0626-733 Needs Assessment/Proposal Development
Shows participants how to develop and conduct a needs assessment,design an evaluation and write a proposal to do a needs analysis or evaluation. Credit 4

0626-740 Group Leadership
Group leadership combines theory and practice to give participants the skills needed to use interactive techniques for training, to facilitate meetings and to take leadership responsibility as a participant. Credit 4



0626-780 Human Resource Management I
Suitable for managers as well as human resource staff, this course examines the formal systems in an organization that ensure the effective and efficient use of human talent to accomplish organizational goals. Major topics include job analysis, job descriptions, employee recruitment, employee selection, and performance management. Credit 4

0626-781 Human Resource Management II
The bottom-line business of human resources must be the delivery and or development of human capital that enable the enterprise to become more competitive, to operate for maximum effectiveness, and to execute its business strategies effectively. HR embodies organizational programs and processes that can enhance individual competencies and organizational capabilities. This course will prepare individuals to evaluate HR programs/processes and redesign these to meet the changing needs of the organization. Credit 4

0626-782 Human Resource Management III
The bottom-line business of human resources must be the delivery and/or development of human capital that enables the enterprise to become more competitive, to operate for maximum effectiveness, and to execute its business strategies effectively. The course will analyze the strategic needs of businesses in various stages in their life cycle, look at culture and leadership and their impact, and devise HR strategies to achieve the desired results (0626-780,0626-781) Credit 4

0626-877 Internship
The internship is required of all students. This course consists of four parts: at least 200 hours of professional accomplishments in an appropriate setting, attendance at a seminar, an oral presentation and formal summary report. Students will work with their advisers to complete all necessary arrangements. Students should plan to meet with their advisers at least two months before planning to take the internship. Proposals for the internship must be approved and on file before registration. Credit 1-6

0626-890 Independent Study
Provides for independent study or research activity in subject matter areas not included in any existing course in the degree program, but having specialized value to students. Proposals approved by a supervising faculty member and the department director are required before registration. This course may be taken more than once but for no more than a total of 6 credit hours. Credit 1-6

0626-891,892,893 Selected Topics
Selected Topics are innovative courses not reflected in the curriculum. Titles will appear in the course listing each quarter (see below). The course may be taken more than once as topics change but for no more than a total of 6 credit hours. Credit 1-4

Course topics include:
Global Aspects of HR: Global demographics and economies have fundamentally changed the scope of human resource management and the composition of the workforce. Organizations must accept these changes and pursue the most effective human resource practices and policies to recruit, manage, develop, and retain a competitive workforce. Topics will include global labor markets; legal, social, and governmental aspects of employment; expatriates and inpatriates; and cultural attitudes affecting employee selection.

Human Resource Information Systems: The basic premise of this course is that human resource information systems (HRIS) are in their infancy in most organizations where they exist at all but that they can and probably will become the central business technology of successful organizations in this century.

Human Resource Planning: The course is designed to provide students with an understanding of the human resources strategic planning process and how it should be an integral part of any organization's business planning process, whether it is a stable environment, a growth situation, or in a condition of downsizing. Emphasis is given to predicting and matching the demand for individuals in an organization with the available supply of competent and skilled human resources from both internal and external sources. This course covers techniques for forecasting the demand for skilled employees, including managers, within a firm and identifies ways to ensure that the ever-changing requirements are met.

Assessment and Measurement: This course introduces the fundamentals of tests and measurements, which include the theory of standardized test development, the criteria for administration of tests, validity, reliability, and how to evaluate tests and instruments for use in career, HRD, and OD projects and interventions. Various HRD and OD instruments will be studied and administered. This course will be evidence to test publishers that the professional is ethically responsible to administer level A and B tests under the American Psychological Association Standards (after graduate degree has been completed).

Organizational Wellness: This course will bring into focus unique ways of helping and counseling employees (as well as family members) with various problems; address ways of helping supervisors identify the troubled employee while encouraging employees to self-identify through respect for confidentiality; and to identify the best employee resources for workplace wellness programs. Topics will include identifying employees' special mental and physical health needs and developing the programs to meet these needs. Program developers will be able to recognize short- and long-term benefits of a wellness-in-the-workplace program while measuring and conveying the benefits to management.

0626-899 Executive Leader Portfolio Assessment
Credit 1-12

Instructional Technology

0627-706 Instructor-Led Training
An overview of the process of designing and giving training presentations. Included are principles of presentation design, selection and production of presentation media, basic research on presentation design and presentation media. Mager certificate available. Credit 4

0627-709 Training the Training Manager
A service course explaining the management of the training process, instructional design and development, and performance technology. Includes principles of needs assessment and evaluating the worth of training as well as trends in instructional design and training delivery systems. Not for instructional technology majors except those in the training manager option. Offered in Executive Leader Program. Credit 4

0627-710 Managing Criterion-Referenced Instruction
A special version of Training the Training Manager (0627-709) *only* for those who have *either* the criterion-referenced instruction (Mager CRI) certificate *or* have completed 0627-755, 756 (Criterion-Referenced Instruction and Technical Training 1, 2) *and* have student-developed course materials from one of these courses. (0627-755,756 or CRI materials; permission of department) **Credit** 2

0627-711 Computer-Based Performance Improvement
Students study characteristics of computer-based tools and systems designed to improve employee performance and productivity. These tools and systems include electronic performance support systems, just-in-time training, on-line job aids, audio conference and video-conferencing and computer-based training. The course emphasizes principles of system design and effectiveness rather than authoring procedures. Credit 4

0627-712 Computer-Assisted Instruction I (CAI1)
Students learn the use of the computer for instruction (computer-assisted instruction) and then produce their own computer-assisted instruction programs. Students review and research various hardware and software configurations, programming languages and sources of previously developed computer-assisted courses. Covers some methods of course and lessons development. Project required. (0627-755 or permission of department) Credit 4

0627-713 Computer-Assisted Instruction 2 (CAI 2)
The student develops more complex and sophisticated instructional sequences that incorporate advanced CAI programming techniques; enters the sequence on the computer, tests and debugs the sequences; and using the computer, gathers the student response information necessary to validate the sequences. The student also explains and demonstrates CAI and writes proposals for CAI courses and lessons. Two projects required. (0627-712) Credit 4

0627-721 Evaluation of Training & Instruction
A course to train students in the development and application of testing methods and used to measure performance, principally cognitive and psychomotor skills, as well as methods to determine overall course effectiveness. Covers methods for both formative and summative evaluation and the means of validating instructional materials and instructional systems. (Basic descriptive statistics) Credit 4

0627-735 Theories of Adult Learning
Relates various theories of learning to actual teaching and training. Students review learning principles and apply them to practical instructional situations. Emphasis is on both behavioral and cognitive approaches to developing instruction and training. Required for graduation. Credit 4

0627-755 Criterion-Referenced Instruction (CRI 1)
A two course sequence (0627-755 and 756) that applies the principles of instructional development specifically to those areas of training in which performance criteria can be precisely stated and accurately measured. Such training usually tends to be in technical skill areas where procedures or product are predetermined or can be clearly specified. Credit 3

0627-756 Criterion-Referenced Instruction 2 (CRI 2)
A two course sequence (0627-755 and 756) that applies the principles of instructional development specifically to those areas of training in which performance criteria can be precisely stated and accurately measured. Such training usually tends to be in technical skill areas where procedures or product are predetermined or can be clearly specified. Mager certificate available. (0627-755) Credit 3

0627-757 Techniques of Work Analysis
Students learn a variety of job analysis and task analysis techniques based on functional job analysis. Data gathered from analyses are cast into various formats for job restructuring, writing job descriptions, establishing task and job hierarchies, and developing training programs. Credit 3

0627-762 Instructional Module Development 1 (IMD1)
This course is designed to follow 0627-755 and 756 to give the student practice in the development, evaluation, and revision of self- instructional materials. The course, largely self-instructional and project oriented, emphasizes structuring the module, actual module writing, and tryout and revisions procedures. Students must have already selected a content area and developed objectives, a course plan, and criterion tests. (0627-755,756) Credit 3

0627-763 Instructional Module Development 2 (IMD 2)
In this extension of Instructional Module Development 1 (0627-762),the student completes an additional course module and develops course control documents for both the course manager and the student. Mager certificate available. (0627-755,756,762) Credit 3

0627-767 Performance Technology
The course provides an introduction to performance technology and its application, the areas of instructional technology and instructional design. The course includes the assessment of work-related performance deficiencies and techniques that an instructional designer can use to remedy performance deficiencies. (0627-755,756) Credit 4

0627-771 Instructional Development I
First of a required three-course sequence (0627-771,772,773). Covers the concepts and principles underlying the developing of instructional programs and materials. Instructional development is the systematic solution of instruction and learning problems involving needs assessment, task analysis, specification of objectives, analysis and synthesis of instructional strategies and methods of evaluation. An instructional development project is part of the sequence. Required for graduation and must be taken before completing 24 hours of program. (0627-735,755,756) Credit 4

0627-772 **Instructional Development 2**
Second of a required three-course sequence (0627-771, 772, 773). The instructional development principles are applied in an actual project selected by the student. Includes more sophisticated means of development as well as module and test development. Required for graduation. (0627-735,755,756,771) **Credit 4**

0627-773 **Instructional Development 3**
Last in a required three-course sequence (0627-771,772,773). Covers the differences in human resource development, instructional program development, and performance technology as well as the instructional developer's role in these processes. Covers development of evaluation plans and the development and revision of course modules. Also covers trends in selected areas of instructional design and development. Required for graduation. (0627-735, 755, 756, 771,772) Credit 4

0627-777 **Internship**
Special opportunities may occur for students to obtain work experience in a job or environment similar or coincident with their career objectives. A proposal (guidelines available from the department) must be approved by the department before registering for this course.(0627-755,756,771 plus 20 hours of course work) **Credit** 1-3

0627-797 **Finding & Maintaining Voice of the Customer**
This course shows students how business and industry use the quality function deployment (QFD) process to identify the voice of the customer, to identify customer requirements, and to follow those requirements through houses of quality. Includes customer interviewing, Kano analysis, competitive assessment, affinity diagramming, preplanning matrix, substitute quality characteristics, houses of quality. Emphasizes QFD in the service sector. Project required. Some statistics required. **Credit 4**

0627-890 **Independent Study**
An opportunity for a student to explore, with a faculty adviser, an area of interest to the student. A proposal (guidelines available from the department) must be approved by the department before registering for this course. (0627-755,756,771 plus 20 hours of course work) **Credit** 1-3

Health Systems Administration

0635-710 **Integrated Health Systems**
Examination of the history and evolution of the continuum of health care delivery in the United States and trends toward integrated health care systems. Review of general systems approach and the various elements of the health care continuum, including a study of alternate delivery systems and managed care. Analysis of emerging and evolving health care systems, their management and social issues impacting integration of health care deliver. Includes research methodologies in health administration. **Credit 4**

0635-715 **Information Systems in Health Administration**
Theory and use of computers and information systems in health care delivery and administration is covered in depth. The information needs of clinical and administrative personnel are examined with an emphasis on developing and evaluating comprehensive information systems for health care organizations. **Credit 4**

0635-720 **Preventive Epidemiology**
Examination and use of the statistical processes employed in the evaluation and assessment of disease, morbidity and mortality of populations served by health systems in the United States. Compares and contrasts health systems status within the United States and with other industrialized countries. Appraisal of health systems research from a managerial perspective with emphasis on prevention, access, distribution, cost, efficiency and effectiveness of health care. (Statistical Concepts or Introduction to Statistics) Credit **4**

0635-730 **Quality Management for Health Systems**
Course explores past and current definitions of quality and competing concepts of quality; reviews total quality movement in health care environments, reviews existing quality requirements of accrediting organizations, federal and state agencies, and third party payers; describes and explains quality improvement systems developed by health care accrediting agencies, health care regulators and researchers; application of quality tools. **Credit 4**

0635-740 **Health Systems Seminar**
Special interdisciplinary seminar course, team-taught by professionals and faculty from health care and business. Focuses on evolving trends in the areas of management decision-making tools, management science, human resource management, and technology assessment and acquisition. (Permission of program chair) **Credit 4**

0635-777 Health Systems Administration Internship
This is a health systems administration internship. Consists of a professional placement in an appropriate health care organization of at least 240 hours. Required for students without health care work experience. Can be taken in place of electives. Students will arrange with their program chair or assigned adviser, negotiate any arrangement necessary for on-site supervision and develop a written proposal. Students will present an oral evaluation of their experiences at the final course seminar.

0635-798 Special Topics
Experimental courses are offered under this number; titles appear each quarter's course listing. Credit 1-5

0635-810 Health Systems Administration
The development, structure and current forces transforming the health care system will be considered. Topics will include the status of the national and regional populations; manpower issues; hospital services; ambulatory care and alternative delivery systems; and mental health; long-term care. Administration in health care facilities including roles, functions, and responsibilities; organizational design and structures; problem solving; motivation; communication; leadership; change; human resources; and health care practices focusing on patient care and education (0635-730) Credit 4

0635-815 Finance for Operation
This introductory course examines the responsibilities of the finance function in health care entities and their relations to the operating responsibility centers (or departments). Subject matter is broad enough to include both not-for-profit and for-profit organizations in the allied health field. While this is an online course, students are invited to participate in the first two on-campus lectures (attendance is optional, and those not attending will receive a videotape of the campus sessions). Topics in the course include: terminology and measurements; cost finding and allocation; budgeting and the budgeting process; reports; reimbursement; interpretation of financial statements; and facilities and materials management. (Matriculated student in the health systems master's program or permission of department chairperson). Credit 4

0635-820 Health Systems Economics & Finance
Investigation of the efficiency, effectiveness and equity of the economics of health care and a conceptual and practical knowledge of health care finance. Reviews sources of funding, the accounting and reporting process, and the influence of third-party payers on the provision of health care through applied exercises. Provides an integrated overview of managerial economics, financial management, and product management for distinct health care organizations composing the overall health care system. (Accounting Concepts for Managers) Credit 4

0635-830 Health Systems Planning
A review of the methodology of planning effectively for health care systems. The use of data systems, forecasting, and identifying and analyzing problems is explored, along with the process of strategic planning, setting priorities, developing projects, and allocating resources. Students will prepare actual business plans and applications for new health care programs to regulatory agencies. (Permission of program chair) Credit 4

0635-840 Health Systems Policy & Law
An examination of the roles and responsibilities of policy makers on the health care system. Compares and contrasts the regulatory functions of varying levels of government and the political process as it relates to health care systems. Examination of control issues and regulatory dynamics, the legislative process, and regulatory trends in the United States. Assessment of health systems' strategies and responses to regulatory oversight. An overview of legislation as it applies to health facilities and administrative law using case studies. Credit 5

0635-876 Health Systems Issues
This is the health systems administration research project capstone course, required for all graduate majors. Students will research and discuss contemporary issues of health care delivery and management. Course work from the program will be integrated by the instructor in order to reinforce a systems approach to health care administration. An original research project, which utilizes a systems approach to health care delivery or administration and culminates in a written report, is required. (Permission of program chair) Credit 4

0635-881 Managed Care
An in-depth look at characteristics of successful managed care plans. The course will familiarize the student with all essential elements of managed care, using the tools needed to model and compare various managed care structures. Credit 4

0635-882 Bioethics
An overview of what ethics means, the principal ethical theories, and their application to specific bioethical issues. The course will familiarize students with ethics and ethical principles, the role of ethics in professional life, what is bioethics and an appreciation of ethical issues and arguments surrounding contemporary bioethical issues such as death, rationing health care and managed care. Credit 4

0635-890 Health Systems Administration Independent Study
Provides for independent study or research activity in subject areas not included in any existing course in the degree program, but having special value to students. Proposals approved by a supervising faculty member and the program chair are required prior to registration. This course may be taken more than once.

0635-896 Health Systems Administration Thesis
An independent research project on a specific health system administration topic or problem, developed by the student with input from a faculty thesis adviser. The research must culminate in a formal written thesis and oral defense. Approval by the program chair and a faculty thesis adviser is required for this course.

Environmental, Health & Safety Management

0630-610 Survey of Occupational Health
An intensive foundation course for students who have completed the appropriate science and mathematics prerequisites, but lack academic preparation or practical experience in environmental/industrial health. Introduces principles, strategies, technologies and regulations for environmental/industrial health. Provides a comprehensive examination of methods of minimizing employee exposure to chemical, biological and physical hazards in the workplace. Credit 2

0630-611 Survey of Occupational Safety
An intensive foundation course for students who have completed the appropriate science and mathematics prerequisites, but lack academic preparation or practical experience in safety management and engineering. Introduces principles, strategies, technologies and regulations for workplace and construction safety management. Credit 2

0630-620 Survey of Solid & Hazardous Waste Management
An intensive foundation course for students who have completed the appropriate science and mathematics prerequisites, but lack academic preparation or practical experience in solid and hazardous waste management. Introduces principles, strategies, technologies, and regulations for reducing, recycling, handling, treating, storing, and disposing of solid and hazardous waste. Credit 2

0630-621 Survey of Industrial Wastewater Management
An intensive foundation course for students who have completed the appropriate science and mathematics prerequisites, but lack academic preparation or practical experience in wastewater management. Identifies and characterizes the sources of industrial wastewater and examines the related environmental impacts, regulatory implications, and technical and cost considerations of treatment and disposal methodologies. Credit 2

0630-622 Survey of Air Emissions Management
An intensive foundation course for students who have completed the appropriate science and mathematics prerequisites, but lack academic preparation or practical experience in air emissions management. Identifies and categorizes industrial air pollutants and their sources addresses applicable state and federal laws and regulations, reduction strategies, control technologies, testing, monitoring and reporting requirements. Credit 2

0630-710 Special Topics
Permits students to pursue certain advanced undergraduate coursework at a graduate level. Examples include: Contaminant Hydrology, Wetland Delineation and Remedial Investigation/Corrective Action. Credit 1-4

0630-720 Environmental Health & Safety Management
This course presents an overview of environmental, health and safety management, and provides students with an introduction to management systems for EHS operations. Explores the motivations and strategies for environmental, health and safety management, identifies EHS management components and presents the fundamentals of developing EHS visions and policies. This course includes an on-campus Executive Leader session. Credit 4

0630-725 EHS Accounting & Finance
Pollution and accidents impose costs—not just remedial costs, but also time, lost opportunities, long-term liabilities and even company image. These costs are often overlooked by current accounting practices. This course will train students to make good business decisions when all the EHS costs of economic decision, as well as the economic costs of EHS decisions, are taken into consideration. The course will focus on decisions made at the company level. Methods will be taught to identify and quantify the full costs of projects and activities. A more accurate approach to EHS accounting will result in a safer environment and increased competitiveness. Credit 4

0630-735 Resource Reduction
This course will focus on strategies for reducing the use of materials, energy and environmental resources. It builds upon courses for controlling air emissions, wastewater and solid and hazardous waste and moves upstream into the production process to reduce or eliminate waste by not producing it in the first place. Students learn how to conduct resource reduction assessments and identify opportunities to reduce or conserve resources. This course will take you beyond end-of-pipe controls and look at life-cycle assessment as an environmental management tool. Credit 4

0630-799 Independent Study
Students will have the opportunity to pursue relevant environmental, health and safety topics related to their work or professional interests at an advanced level. Students will gain added depth and/or specialized skill in a specific EHS area. **Credit** 1-4

0630-810 Special Topics
This course discusses new and developing EHS topics in selected areas, such as Workers Compensation, environmental economics, incident management, design for the environment, international environmental management, life-cycle assessment, industrial hygiene monitoring and measurement, regulatory strategy and compliance alternatives. Credit 1-4

0630-888 Graduate Co-op
Students will have the opportunity to gain appropriate work experience and applied knowledge of the profession working in one or more EHS areas. The graduate committee determines whether enrollment for one or more co-op quarters will be required. Credit 0

0630-890 **Graduate Project/Thesis Planning**
This is the first of a two-course sequence in which each EHS management graduate student will design and conduct graduate thesis research or a graduate project. In this course graduate students will rigorously develop their research or graduate project ideas, conduct literature reviews, prepare bibliographies, identify and plan methodologies, identify deliverables, prepare schedules, become familiar with report formats and the proper use of literary guides, and gain a clear understanding of the expectations of the faculty and the discipline. Each student will be required to prepare a complete thesis research or graduate project proposal as a final requirement of this course. Credit 2

0630-891 **Graduate Project**
Graduate projects are an applied research project, reflecting the student's ability to utilize professional skills to design, develop, and/or evaluate an environmental, health and safety project and/or management decision. A formal written paper and oral presentation are required. (0630-890) Credit 1-4

0630-899 **Graduate Thesis**
The graduate thesis is a formal research document that empirically relates theory with practice. A formal written thesis and oral defense are required. (0630-890) Credit 1-4

0633-712 **Fire Protection**
Introduces fundamental concepts in protection of industrial workers and property from fire and explosion. Fire chemistry, control of ignition sources in industry, and properties of combustible materials are discussed. A major facility review project is completed. Fire detection and extinguishment are covered along with building construction for fire prevention, life safety, fire codes and related topics. (EHS graduate students or engineering technology, industrial engineering graduate students only) Credit 4

0633-726 **Occupational Health II and Laboratory**
A lecture/laboratory course that provides a basic understanding of techniques used in measuring and evaluating the magnitude of health hazards in industry. Laboratory sessions provide experience in air sampling, noise measurements, heat measurement, particle size analysis, chemical analysis and evaluation of industrial ventilation. Several sampling projects are completed by students during the course. (0630-450 or 0630-610) Credit 4

0633-730 Mechanical & Electrical Controls & Standards
Discussion of OSHA standards relating design and analysis for safety, including electrical circuit controls and mechanical guarding. Particular attention will be paid to OSHA, ANSI and NEC standards as they relate to wood, metal, films and automation. A portion of the course will change regularly to reflect emerging issues in industry. A project reviewing actual equipment and installations will be completed. (EHS graduate students or Engineering technology, industrial engineering graduate students only.) **Credit 4**

Technical Information Design

0688-711 Technical Information Design
Intensive practice in the creation of content for online and multimedia documents with emphasis on the presentation of technical and scientific concepts, products, and processes. A survey of graphic methods for the display of complex technical relationships and ideas. Students will also explore contemporary topics (international technical communication, the future of online documentation, ethical considerations in technical information design, etc.) and applications (legal, medical, electronics, environmental, etc.) in technical information design. (0688-333 or permission of instructor) **Credit 4**

0688-721 Creating Technical Proposals
The elements of proposal writing, including responsiveness, establishing credibility, and technical clarity. The proposal process as practiced in government and industry, including an understanding of RFPs, RFIs, and the decision process. Specialized proposals including NDAs, online and multimedia proposals and technical marketing presentations. (0688-333 or equivalent or permission of instructor). **Credit 4**

0688-731 Technical Procedures
The development of task-oriented and process documentation. Procedures for complex physical and mental tasks including time-constrained activities, emergencies, diagnostics and troubleshooting, and multiple-path processes. Formats for print, electronic, and multi-media instructions. An introduction to applications used for the creation of online help, including Web-delivered and online help. (0688-333 or permission of instructor) **Credit 4**

0688-732 Managing Technical & Scientific Communications
The management of technical and scientific communication projects and organizations. Managerial roles, practices, and responsibilities. Technological factors in the production and distribution of technical documentation. Management strategies for content and audience evolution. Management of parallel (print and online) projects, single-sourcing, and documentation localization. (0688-333 **or** equivalent or permission of instructor) **Credit 4**

0688-741 Usability Design & Testing
The elements of successful electronic and print document design. The use of design concepts and tools to increase usability. Introduction to information mapping. Design and usability test considerations for multimedia and user-centered media. (0688-333 or equivalent or permission of instructor) **Credit 4**

Cross–Disciplinary Professional Studies

0699-705 Context & Trends
This course introduces students to interdisciplinary thinking, problem solving and research techniques and also print and electronic information resources appropriate to the students plan-of-study. **Credit 4**

0699-775 Capstone Project
This course is a supervised hands-on experience in which the students apply the skills and knowledge developed through their individual plans-of-study and concludes with oral presentations. **Credit 4**

College of Business

Thomas D. Hopkins, Dean

Success in the 21st century business environment will require leadership and management attuned to rapid changes in technology and increasingly vigorous and global competition. Astute problem preventers and solvers who have gained a systems perspective will be able to convert product development and management challenges into competitive advantages. The College of Business offers a benchmarked portfolio of comprehensive, rigorous programs of study. Our innovative, multidisciplinary curriculum —embedding an international perspective, current technology and quality principles throughout—produces graduates able to convert managerial learning into pragmatic business applications. Our faculty combine teaching excellence and personalized attention to student needs with applied research. Our setting in a technological university embarked on creative business partnering, and entailing joint programs across colleges and countries, opens unique opportunities for all partners—including industry leaders, faculty and students.

PROGRAMS

MASTER OF BUSINESS ADMINISTRATION

EXECUTIVE MASTER OF BUSINESS ADMINISTRATION

MASTER OF SCIENCE DEGREES IN:

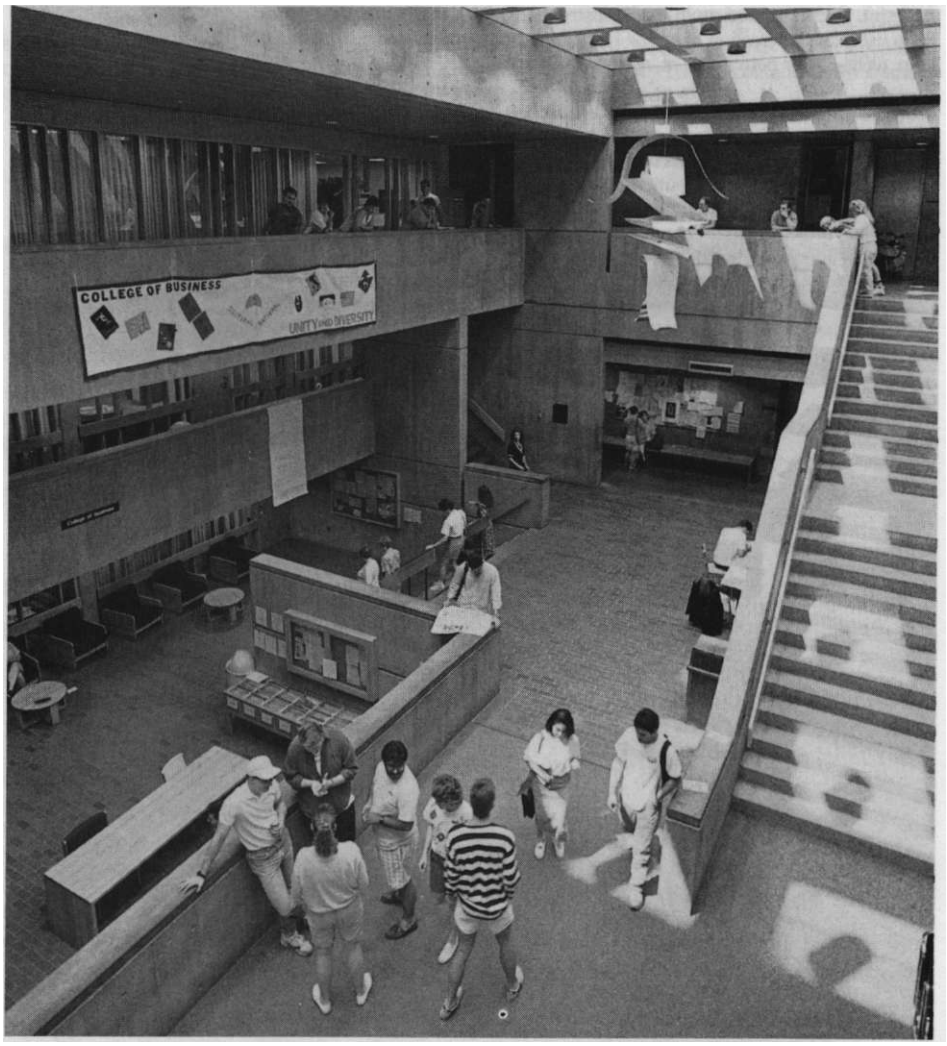
- Finance
- Manufacturing Management and Leadership
- Product Development

Master of Business Administration

Donald O. Wilson, Ph.D., *Director*

The master of business administration (MBA) degree program provides students with the capabilities for strategic and critical thinking needed for effective leadership in a global economy where creative management of both people and technology is vital. The curriculum begins with a solid, mainstream grounding in the functional areas of business and combines that foundation with the flexibility that allows students to specialize in one or two areas of expertise. In the classroom, students learn the latest theories and concepts and how they can be immediately applied to solve problems in the work place. The program is built on the foundations of technology, quality and a global perspective.

The MBA program requires 72 quarter credit hours and consists of 18 courses, eight of which are devoted to core functional areas and 10 available for concentration areas and electives. All College of Business courses carry 4 credit hours. Students create a concentration field(s) of study by selecting a four-course sequence in a particular area of specialization. Traditional business concentrations include CPA and corporate accounting, e-business marketing, finance, health systems administration, international business, management and leadership, marketing and sales management, marketing research and quality and organizational improvement. Technical concentrations include



The lobby of the Max Lowenthal Building, home of the College of Business

management information systems, manufacturing management, quality and applied statistics and technology management.

The College of Business also offers specialized MBA options in quality management, management of technology, and international business, as well as an Executive MBA. RIT also awards MBA degrees to students attending the U.S. Business School in Prague.

Accredited by the International Association for Management Education (AACSB) the College of Business has earned a reputation as a leader in the area of quality education.

Admission

Applications are accepted for all four academic quarters. However, most full-time students begin their program of study in the fall. Prerequisites for admission include a baccalaureate degree from an accredited institution and a working knowledge of algebra and statistics. All entering students are required to successfully complete math review courses in algebra and statistics during their first quarter of study This requirement is waived for students who pass a math diagnostic exam administered during orientation.

Completed applications for admission should be on file in the Office of Admissions five weeks prior to registration for the upcoming academic quarter. Transcripts from all previous undergraduate and graduate work, a Graduate Management Admission Test (GMAT) score, relevant professional experience and a personal statement or resume are evaluated by the Graduate Admissions Committee. International applicants must submit the results of the Test of English as a Foreign Language (TOEFL, minimum paper-based score 570 or minimum computer-based score 230) as part of the application. The TOEFL requirement is waived for native speakers of English and for those submitting transcripts and diplomas from American undergraduate schools.

Accepted students can defer enrollment for up to one year. If beyond one year, a new application must be submitted and will be evaluated on then-current admission standards.

Nonmatriculated status

Students with strong undergraduate records are permitted to take two graduate courses on a nonmatriculated basis. To become a matriculated student, and admitted formally to the MBA program, the regular admissions process should be followed. Credits earned while a nonmatriculated student may be applied to the student's degree program.

Academic standards

Credit hour requirements for the MBA are normally 72 quarter credit hours. In certain cases total credit hours may be reduced by the use of waiver or transfer credit. Students have the responsibility of applying for these credits.

Students must maintain a grade of "B" or better for all courses taken at the College of Business. Grades of all repeated MBA courses will be counted in the GPA computation. The policy on probation and suspension is explained in the section "The Steps Toward Earning Your Degree" in this bulletin.

Program completion requirement

Institute policy requires that graduate programs be completed within seven years of the student's initial registration for courses in the program. A grade point average of 3.0 must be maintained.

Orientation

All new students are required to attend an orientation session prior to enrolling in courses. They will take the math waiver exam, and course selection, career planning, program planning, and academic advising are also discussed at this time.

Waiver policy/transfer credit

Students can waive up to six MBA foundation courses if prior academic preparation is equivalent to these graduate courses and occurred within the last five years. Courses may be either waived outright or through an examination.

A maximum of 12 credit hours may be awarded as transfer credit from other graduate programs. The courses must have been taken at an accredited institution and the student must have earned a grade of "B" or better. The courses must be relevant to the student's MBA program of study.

Credits from waiver, transfer or undergraduate courses are not counted in the GPA computation. Students must apply for transfer and/or waiver credit.

Placement

Preparation for professional placement begins early in the graduate student's program with workshop participation on self-assessment, resume preparation, interviewing techniques, job search strategies and career opportunities in various industries. The Office of Cooperative Education and Career Services offers individualized career counseling, provides critical job leads, and coordinates employers' annual campus recruiting visits.

Cooperative education

Optional cooperative education affords graduate students the opportunity to hold a paid position for three to six months. No academic credit is granted, but formal recording of the co-op experience is made on the student's transcript. Graduate faculty evaluate the student's written report analyzing the company and experience. Students in good academic standing are eligible for co-op after completing the foundation courses and a substantial portion of their concentration courses. RIT does not guarantee that all students will be placed.

Facilities

RIT is a national leader in incorporating computer and network technology into the classroom. Students have access to extensive computer resources within the College of Business and throughout campus, along with the latest business and productivity software and computer support. The Wallace Library computer system provides students with access to numerous external databases. Remote access from residence halls and the College of Business computer labs is available as well.

Financial aid

Financial assistance is awarded for outstanding scholarship and professional promise without consideration of financial need. Matriculated full- and part-time students are eligible for scholarships and/or assistantships. Students awarded assistantships are assigned to work for College of Business faculty or staff. All applicants are automatically reviewed for these awards.

Several alternative loan programs and federal and state programs are also available. Please contact the Office of Financial Aid (716-475-2186) for further information.

U.S. Business School in Prague

The College of Business offers an opportunity for MBA students with strong academic backgrounds and work experience to complete part of their coursework in the Czech Republic through the U.S. Business School in Prague.

Course offerings

Since it is sometimes necessary to make changes in course schedules or instructors, up-to-date information about courses to be offered in a given quarter is available in the College of Business Student Services Office. RIT makes no guarantee that every catalog course will be offered in any given year or that courses will be offered in a particular quarter or sequence.

All MBA students take the following nine core courses:

		Credits
*0103-705	Economics for Managers	4
*0101-703	Financial Accounting Systems	4
*0104-721	Financial Analysis for Managers	4
*0105-761	Marketing Concepts	4
"0106-743	Operations Management	4
*0102-740	Organizational Behavior & Leadership	4
*0106-782	Statistical Analysis for Decision Making	4
*0112-710	Management Information Systems Concepts	4
0102-759	Competitive Strategy	4

• *Up to six of these courses can be waived, thus reducing the number of courses required to graduate.*

Students with one concentration area take:
- 9 core courses
- 4 courses in a business concentration area
- 5 electives, outside above concentration area. No more than 4 of these can be taken in any one discipline.

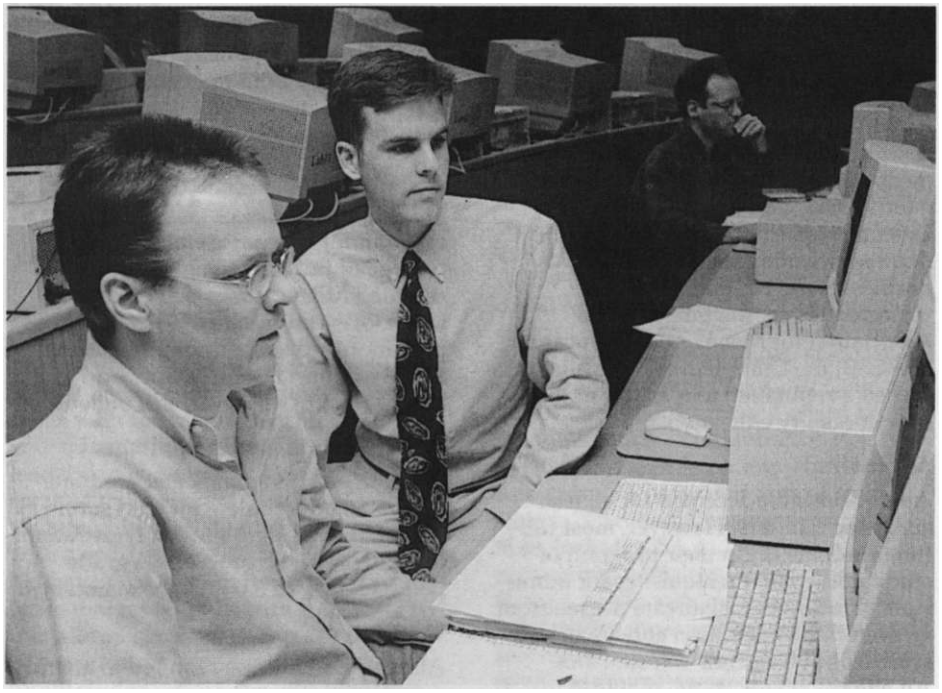
Students with two concentration areas take:
- 9 core courses
- 4 courses in a business concentration area
- 4 courses in a second business or technical area
- 1 elective, outside above concentration areas

Notes:
- Students cannot complete more than two concentration areas.
- No course can be counted in more than one concentration.
- No more than four electives can be completed in any one discipline.
- Students taking two concentration areas need to meet with an adviser.

Business Concentrations

Corporate Accounting		**Credits**
0101-704	Accounting Theory I	4
0101-705	Accounting Theory II	4
0101-706	Cost Accounting	4
Choose one from the following:		
0101-708	Auditing	4
0101-709	Basic Taxation	4
0101-707	Advanced Accounting & Theory	4

If students wish to take the Certified Management Accountant (CMA) examination offered by the Institute of Management Accountants (IMA), the corporate accounting concentration qualifies them to do so.



CPA Accounting

Students wishing to take the CPA examination in New York State upon graduation from the MBA program must take 23 graduate courses rather than 18. (Note: Up to 11 courses may be waived.) The State of New York requires that a graduate degree for CPA candidates who do not have an undergraduate degree in accounting must include at least 60 semester hours (i.e., 90 quarter hours) of course work. Furthermore, the curriculum must include a specified number of hours in accounting, economics, finance, law and business electives. For the CPA option, students take the following 14 courses in addition to the nine MBA core courses:

		Credits
0101-704	Accounting Theory I	4
0101 705	Accounting Theory II	4
0101-706	Cost Accounting	4
0101-707	Advanced Accounting & Theory	4
0101-708	Auditing	4
0101-709	Basic Taxation	4
0101-710	Advanced Taxation	4
0101-730	Business Law I	4
0101-731	Business Law II	4
Finance elective		4
Economics elective		4
Business electives		12

CPA candidates should meet with an adviser in the College of Business no later than the start of their second quarter in the MBA program to carefully plan their remaining course work and to learn about New York CPA licensure requirements. Some courses in this program are offered only once a year.

Finance*		**Credits**
0104-722	Financial Management II	4
0104-725	Securities & Investment Analysis	4
One advanced economics course		4
Choose two courses from the following:		
0104-724	Problems in Corporate Finance	4
0104-730	Financial Institutions & Markets	4
0104-734	Working Capital Management	4
0104-732	Portfolio Theory	4
0104-729	Seminar in Finance	4
0104-731	Problems in Investments	4
0104-760	International Finance	4
0104-740	Futures & Options	4

• 5 *course concentration*

Marketing and Sales Management		**Credits**
0105-764	Channel Management	4
0105-762	Advanced Marketing Management	4
Choose two from the following:		
0105-767	Marketing Communications	4
0105-765	Sales Management	4
0105-758	Seminar in Marketing: various topics	4
0105-771	Customer Satisfaction Research Methods	4
0105-770	Professional Selling	4
0105-766	International Marketing	4
0105-772	Marketing on the Internet	4
0105-773	Database Marketing	4

Marketing Research		Credits
0105-771	Customer Satisfaction Research Methods	4
0307-801	Design of Experiments I	4*
Choose two from the following:		
0105-762	Advanced Marketing Management	4
0307-802	Design of Experiments II	4*
0105-772	Marketing on the Internet	4
0307-831	Multivariate Analysis Applications	4*
0307-841	Regression Analysis	4*
0105-773	Database Marketing	4

** Student should register for the 4-credit-hour option of these courses.*

International Business		Credits
0102-780	Multinational Business Operations & Environment	4
0102-782	Seminar in International Business	4
Choose two from the following:		
0102-760	International Management	4
0104-760	International Finance	4
0105-766	International Marketing	4

Management and Leadership		Credits
0102-741	Leading Change in a Quality Organization	4
0102-745	Social and Political Environment of Business	4
Choose any two management electives		8

Entrepreneurship		Credits
0102-758	Seminar in Management: Entrepreneurship	4
0102-753	Field Experience in Business Consulting	4
Choose two from the following:		
0101-709	Basic Taxation	4
0101-730	Business Law I	4
0105-763	Buyer Behavior	4
0104-722	Financial Management II	4
0102-762	Managing New Process & Product Development	4
0105-772	Marketing on the Internet	4
	Other management courses*	

** Must be approved by a graduate adviser*

Note: This concentration has certain restrictions. Please see a graduate adviser for details.

Technology Concentrations

Technology Management		Credits
0102-742	Introduction to Technology Management	4
0102-762	Managing New Product & Process Development	4
Choose any two of the following:		
0106-744	Project Management	4
0102-741	Leading Change in a Quality Organization	4
0106-749	Manufacturing Strategy & Tactics	4
0102-761	Managing Research & Innovation	4
0102-745	Social & Political Environment of Business	4

Management Information Systems		Credits
0112-720	Systems Analysis & Design I	4
0112-755	Information Systems Management	4
Programming Course (if needed)*		
Choose two from the following:		
0112-700	Information Technology Hardware & Software	4
0112-735	Network Technology	4
0106-744	Project Management	4
0112-725	Systems Analysis & Design II	4
0112-760	Integrated Business Systems	
0112-761	Business Process Design & Workflow	
Other MIS courses*		

** Must be approved by a graduate/faculty adviser*

Note: Prerequisite for this concentration is a course in a programming language

E-Business Marketing		
0105-772	Marketing on the Internet	4
0105-758	Seminar in Marketing: Business to Business E-Commerce	4
0105-773	Database Marketing	4
One Marketing Elective		4

Quality and Organizational Improvement		Credits
0102-741	Leading Change in a Quality Organization	4
0106-745	Quality Control & Improvement	4
Choose two from the following:		
0105-771	Customer Satisfaction Research Methods	4
0307-782	Quality Engineering	4*
0307-721	Statistical Process Control	4*
0307-731	Statistical Acceptance Control	4*
0625-841	Benchmarking & the Process of Continuous Improvement	4

** Student should register for the 4-credit-hour option of these courses.*

Manufacturing Management		Credits
0106-744	Project Management	4
0106-745	Quality Control & Improvement	4
0106-749	Manufacturing Strategy	4
Choose one from the following:		
0102-742	Introduction to Technology Management	4
0102-760	International Management	4
0101-794	Cost Accounting in the Manufacturing Environment	4
0102-741	Leading Change in a Quality Organization	4
0307-781	Quality Management	4*
0307-782	Quality Engineering	4*
0307-721	Statistical Process Control	4*
0307-731	Statistical Acceptance Control	4*
0303-690	Seminar in Computer Integrated Manufacturing	4

• Student should register for the 4-credit-hour option of these courses.

Quality and Applied Statistics		Credits
Choose any four of the following:		
0106-745	Quality Control & Improvement	4
0307-782	Quality Engineering	4*
0307-721	Statistical Process Control	4*
0307-731	Statistical Acceptance Control	4*
0307-801	Design of Experiments I	4*
0307-802	Design of Experiments II	4*

• Student should register for the 4-credit-hour option of these courses.

Other technical options include:

- Computer-Integrated Technology
- Engineering Management
- Health Systems Administration
- Software Project Management
- Telecommunications
- Printing Management

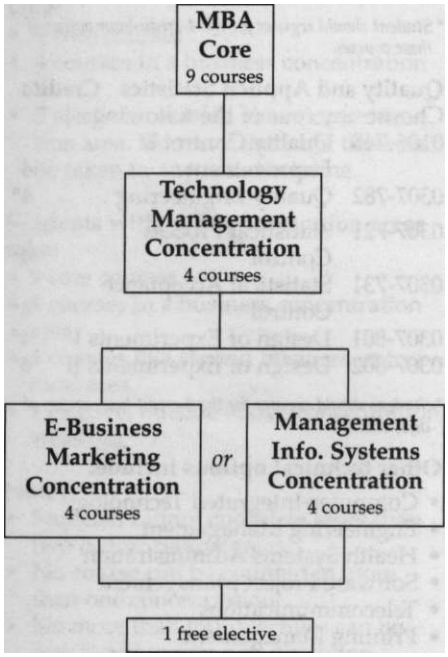
See a graduate adviser for more information.

Specialized MBA Tracks

Students should carefully select their two concentrations so that these areas of study are congruent with their career goals. Two related concentrations may be joined to create a specialized MBA track. Examples of these tracks are described below.

Management of technology MBA track

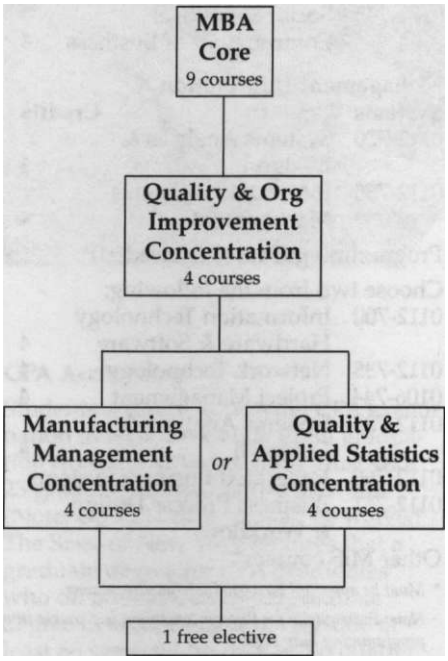
This track is designed to provide students with the analytical tools and skills needed to successfully manage technology intensive organizations. This is an attractive option for students interested in careers with organizations that either produce or utilize technology.



Students in the management of technology MBA track complete the nine-course core, the four-course technology management concentration and either the four-course e-business marketing concentration or the management information systems concentration. One free elective is to be chosen from courses outside the above concentrations.

Quantity management MBA track*

Increased competition in the global marketplace means that firms must now provide quality products and services that attract and delight customers. The quality management track is designed to provide students with the analytical tools and mathematical models needed to successfully manage quality systems in organizations. Statistical quality control is emphasized along with the application of the fundamental concepts of TQM to production and operations management.

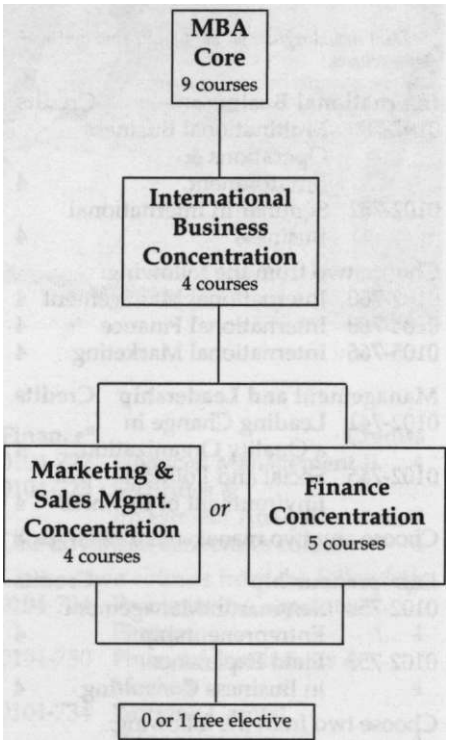


Students in the quality management MBA track complete the nine-course core, the four-course quality and organizational improvement concentration followed by either the manufacturing management concentration or the quality and applied statistics concentration. Students pursuing the quality and applied statistics concentration will enroll in courses in the Center for Quality and Applied Statistics of RIT's College of Engineering. One free elective must be selected from courses outside the above concentrations.

** This MBA track has certain restrictions. Interested students should see a graduate adviser.*

International business MBA track

This track is designed to prepare students for the growing demand for global managers who understand the international business environment. The interdisciplinary curriculum combines international business theory and practice in addition to stressing the interrelationships among business functions such as marketing, management and finance in a worldwide economic environment.



In addition to the nine-course core, students in the international business MBA track complete a four course international business concentration that includes courses in international marketing, international finance and international management. Students then complete a four-course concentration in marketing and sales management or finance. The free elective should be in an area outside these concentrations. To provide students with an international experience, the free elective can be taken at the U.S. Business School in Prague. Students wishing to pursue careers in international business should be proficient in a foreign language. This requirement may be satisfied by previous course work or by examination.

Executive MBA

Ann C. T. Young, Ph.D., *Director*

Marge McConnell, *Coordinator*

The executive MBA is an integrated, two-year cohort-based program designed to develop future leaders and general managers in organizations serious about improving customer satisfaction, product quality, and organizational success.

A team of RIT faculty and executives from all sectors of business and industry designed the executive MBA for professionals with substantial career experience. Using practical approaches to improving business results and increasing personal productivity, participants in the program:

- Strengthen their leadership and interactive skills by collaborating with teams of professional peers and faculty.
- Develop strategic perspectives consistent with the needs of customers, stockholders, employees, the community, and other organizational stakeholders.
- Apply cross-functional approaches to enhance their analytical and decision-making capabilities.
- Utilize the principles of quality and quality-based tools to accomplish organizational goals.
- Obtain a solid foundation in the functional areas of business.

Executive MBA and traditional MBA: the differences

Executive MBA students must have a minimum of eight years of professional experience. Courses are conducted all day Friday and Saturday on alternative weekends during the academic year. Participants work in teams, studying a curriculum that focuses on developing general management skills.

The executive MBA program is structured in an interactive fashion, and the emphasis is on cross-functional integration. The topics covered are those taught in the traditional MBA program.

Admission

In order to be considered for admission to the executive MBA program, a candidate must:

1. have a minimum of eight years of professional experience and hold advanced technical, managerial, or executive responsibilities;
2. have earned a bachelor's degree;
3. be interviewed by a representative of the executive MBA team; and
4. submit a completed admissions package.

Sponsorship

Employer sponsorship includes several dimensions:

- The sponsor must agree to permit the candidate to attend scheduled Friday/Saturday classes and the two required summer weeks.
- The sponsor pays all or a major portion of the tuition, which includes course books and a laptop computer.
- Business owners or individuals may sponsor themselves

Program structure and content

The executive MBA program consists of two summer weeks plus six weekends per quarter, for a total of 36 weekends over the program's 21 months.

The first-year curriculum focuses on core business concepts and provides fundamental skills, knowledge, and perspectives in accounting, statistics, leadership, finance, and economics. The second year extends that foundation and develops cross-functional analysis skills with an emphasis on strategy, marketing, technology, and international business. Interdisciplinary examples, case analyses, and an applied orientation are key components of the program.

The EMBA program also includes practical experience obtained through capstone consulting projects; ongoing support for career-oriented skills such as career development planning, communications, and team building; the application of a cross-functional business simulation model; and an optional week-long business trip to Prague.

Curriculum

FIRST YEAR, SUMMER
Five-Day Orientation

QUARTER ONE, FALL
Accounting & Organizational Goals
Managerial Accounting
Microeconomics
Leadership

QUARTER TWO, WINTER
Data Analysis
Statistics for Decision Making
Macroeconomics
Human Resources Management

QUARTER THREE, SPRING
Valuation & Capital Budgeting
Financial Analysis & Planning
Total Quality for Managers
Business, Government & Society

SECOND YEAR, SUMMER
Five-day Introduction to
Cross-Functional Thinking

QUARTER FOUR, FALL
Strategic Thinking
Organizational Design & Change
Marketing Strategy
Technology Management

QUARTER FIVE, WINTER
Capstone Projects
Internet Marketing
Electronic Commerce & Information Management
Manufacturing Management

QUARTER SIX, SPRING
Capstone Projects
Entrepreneurship /Intrapreneurship
International Business
International Marketing

Information and Application

All correspondence for executive MBA admission information and for the submission of required documents should be sent to:

Executive MBA Program
College of Business
Rochester Institute of Technology
107 Lomb Memorial Drive
Rochester, NY 14623-5608
716-475-7435
716-475-6441 (fax)
emba@rit.edu

Master of Science in Finance

The master of science in finance program is designed to prepare students for managerial careers in corporate finance, investment analysis and portfolio management, financial consulting and financial institutions. Courses that clearly parallel the Chartered Financial Analyst Program will prepare students who plan to take this exam.

Full-time students who begin studies in the fall can complete the program in as little as 12 months; part-time students in 18 to 24 months.

Admission requirements

Applicants should have baccalaureate degrees from accredited programs. To be considered for admission it is necessary to file an application, submit official transcripts of all previous undergraduate and graduate work, results of the Graduate Management Admissions Test and provide an up-to-date resume. International applicants must submit the results of the Test of English as a Foreign Language (TOEFL, minimum paper-based score 570 or minimum computer-based score 230) as part of the application. The TOEFL requirement is waived for native speakers of English and for those submitting transcripts and diplomas from American undergraduate schools.

Curriculum

The graduate program of study consists of 12 courses and a comprehensive exam. The courses are:

0104-721 Financial Analysis for Managers
0104-722 Financial Management II
0104-725 Securities & Investment Analysis
0101-703 Financial Accounting Systems
0106-782 Statistical Analysis for Decision Making
0103-711 Microeconomics
0103-712 Macroeconomics
Three finance electives
Two breadth electives

Breadth elective courses may be chosen from the graduate business courses in accounting, management, marketing, management information systems, technology management or international business.

The candidate must successfully complete a comprehensive field exam based on the finance courses completed by the student.

Master of Science in Manufacturing Management and Leadership

Daniel P. Johnson, *Director*

Joint Program: Colleges of Business and Engineering

The MS in manufacturing management and leadership was developed jointly by the Colleges of Business and Engineering to meet the needs of working professionals in manufacturing, operations and supply chain management positions. The integrated curriculum is designed to develop the technical and business skills necessary to successfully lead manufacturing teams, product/process improvement projects and supply chain initiatives. Many tools and techniques involved in "black belt" improvement training are integral to the program. The program involves business and engineering courses with a strong emphasis on integration. Unifying themes are: leadership and teaming; total quality; manufacturing engineering; total cost; and manufacturing strategy. A required seminar series is an integral part of the program. This program is designed to accommodate part-time students and may be completed in two academic years. A required capstone project will be oriented to the solution of manufacturing management problems.

Admission requirements

Applicants should have a baccalaureate or equivalent degree from an accredited institution and a minimum cumulative grade point average of 3.0 **(B).** Applicants must submit Graduate Management Admission Test (GMAT) scores. The Graduate Record Exam (GRE) is acceptable as a substitute if completed during the previous five years. Applicants should also submit two professional recommendations.

Applicants should have two or more years experience in a manufacturing-related organization or related business environment. A resume and an interview with program faculty and admission staff are also required.

Applicants whose native language is other than English must take the TOEFL examination; a score of at least 570 paper-based or 230 computer-based is required.

Prerequisite knowledge

Admitted students must possess or acquire focused knowledge and skills at the introductory course level in:

- Probability and statistics
- Engineering economy or basic finance
- Differential calculus
- Computer literacy
- Comprehension of engineering drawings
- Basic properties of materials
- Manufacturing processes

The focused requirements are specified in a preassessment package that students may use to determine their individual needs. Areas that may need strengthening can be addressed by guided reading, formal course work, independent study, seminars or other suitable means. Students should complete the preassessment process at least one quarter before enrollment.

The curriculum

The graduate program of study consists of 48 credits of engineering and business courses and an integrative capstone project. The courses are:

0102-763 Behavioral Skills for Managers
0303-625 Concepts in Manufacturing Engineering
0106-744 Project Management
0303-766 Manufacturing Systems
0102-747 Managing Manufacturing Resources
0303-748 Management of Quality Systems
0101-794 Cost Accounting in the Manufacturing Environment
0303-760 Product/Process Development & Design
0303-720 Production Control
0303-762 Manufacturing Systems Modeling & Performance Analysis
0303-723 Facilities Planning
0102-891 Capstone Integrative Project*

Seminar topics are selected to meet the interests of students and to discuss emerging issues. Topics might include ergonomics, safety, environment; demand forecasting; change process system management; and design of experiments or Taguchi Robust Design.

Program of study

The master of science program in manufacturing management and leadership is formatted to be completed in two academic years. Each class is admitted and scheduled as a cohort group in the fall quarter. Within a cohort, teams of four to six students are created for various purposes such as study groups and project teams.

• *Students must receive a grade of B or better in their capstone project to graduate from the program.*

Master of Science in Product Development

See page 68 for description of this program.

Graduate Faculty College of Business

Accounting Faculty

Francis E. Kearns, AB, Cornell University; BD, Harvard University; MBA, Ph.D., SUNY at Buffalo—Assistant Professor
Khondkar E. Karim, BC, MC, University of Dhaka; MS, Eastern Michigan University; DBA Mississippi State University—Associate Professor
Michael J. Lacina, BBA, Western Michigan University; MBA, Michigan State University; Ph.D., Purdue University—Assistant Professor
Wayne J. Morse, BBA, Siena College; MBA, Cornell University; Ph.D. Michigan State University—Associate Dean
Bruce L Oliver, BBA, MBA, University of Cincinnati; Ph.D., University of Washington—Professor
Daniel D. Tessoni, BSBA, St. John Fisher College; MS, Clarkson University; Ph.D., Syracuse University—Assistant Professor
Robert J. Warth, BS, Rochester Institute of Technology; MBA, University of Rochester—Assistant Professor

Decision Science Faculty

John E. Ettlie, BS, MS, Ph.D., Northwestern University—Professor
George A. Johnson, BS, University of Rochester; MBA, DBA, Indiana University—Professor
A. Erhan Mergen, BS, Middle East Technical University, Turkey; MS, Ph.D., Union College—Professor
Thomas F. **Pray,** BS, MS, Clarkson University; Ph.D., Rensselaer Polytechnic Institute—Professor
William J. Stevenson, BSIE, MBA, Ph.D., Syracuse University—Associate Professor
Thomas A. Williams, BS, Clarkson College of Technology; MS, Ph.D., Rensselaer Polytechnic Institute—Professor

Finance and Economics Faculty

Steven C. Gold, BA, BS, Rutgers University; MA, Ph.D., SUNY Binghamton—Professor
Chun-Keung (Stan) Hoi, BS, MS, University of North Texas; Ph.D., Arizona State University—Assistant Professor
Jeffrey P. Lessard, BSBA, University of New Hampshire, MBA, Plymouth State College; MA, Ph.D., University of Arkansas—Professor
Ashok J. Robin, MBA, Ph.D., SUNY Buffalo-Associate Professor
Thomas D. Hopkins, BA, Oberlin College; MA, Ph.D., Yale University—Professor; Dean

Management Faculty

David C. Baldridge, BS, MBA, University of Michigan; Ph.D., University of Connecticut—Assistant Professor
Robert J. Barbato, BA, LeMoyne College; Ph.D., Michigan State University—Associate Professor
Richard DeMartino, BA, Roanoke College, MPA, Ph.D., University of Virginia—Assistant Professor
Andrew J. DuBrin, AB, Hunter College; MS, Purdue University; Ph.D., Michigan State University—Professor
David McHardy Reid, BS, University of Salford; MS, University of Manchester; Ph.D., University of Edinburgh—Professor
Sandra L. Rothenberg, BS, Syracuse University; MS, Ph.D., Massachusetts Institute of Technology—Assistant Professor
Donald O. Wilson, BS, Oklahoma State University; MS, MPA, University of Southern California; Ph.D., University of California at Irvine—Assistant Professor

Management Information Systems Faculty

Jack S. Cook, BS, MA, MBA, University of South Dakota; MS, Ph.D., Washington State University—Associate Professor
Carlos Ferran-Urdaneta, BS, MS, Universidad Metropolitana, DBA, Boston University—Assistant Professor
Daniel A. Joseph, BS, Niagara University; MA, SUNY Albany; MBA, Ph.D., SUNY Buffalo—Associate Professor
Victor J. Perotti, BS, MS, MA, Ph.D., Ohio State University—Assistant Professor
Quiang (John) Tu, BS, MS, Xian Jiaotong University; Ph.D., University of Toledo—Assistant Professor
Stelios C. Zyglidopoulos, MS, Pitchion, Graduate School of Industrial Studies MBA, Ph.D., McGill University—Assistant Professor

Marketing Faculty

Deborah Colton, BA State University of New York at Buffalo; MBA, RIT; Ph.D., University of South Carolina—Assistant Professor
Eugene H. Fram, BS, ML, University of Pittsburgh; Ed.D., SUNY Buffalo—Professor
Wen Gong, BS, Beijing University; MBA, University of Business and Economics; Ph.D., George Washington University—Assistant Professor
Patricia A. Sorce, BS, Kent State University; MS, Ph.D., University of Massachusetts—Associate Professor
Philip R. Tyler, BS, Rochester Institute of Technology; MBA, DBA, Michigan State University—Associate Professor
Stanley M Widrick, BS, Clarkson College of Technology; MBA, SUNY Buffalo; Ph.D., Syracuse University—Professor

Special Appointments

Albert J. Simone, Ph.D., Massachusetts Institute of Technology—President, Rochester Institute of Technology; Professor
Kay Whitmore, former Chairman, President and CEO, Eastman Kodak Company—Distinguished Lecturer in Management

Accounting

0101-703 Financial Accounting Systems
An introduction to accounting as an information system used by business entities to report their financial performance to interested outside parties. The course will focus on financial statements that are generated under Generally Accepted Accounting Principles. Issues will include income determination, valuation of assets and liabilities, revenue and expense recognition, and financial statement analysis. Credit 4

0101-704 Accounting Theory I
A comprehensive exposure at an intermediate level to accounting theory and practice. Emphasis is placed on applying underlying accounting theory to complex accounting measurement problems. The effects of alternative methods are considered throughout the entire course. (0101-703) Credit 4

0101-705 Accounting Theory II
Continuation of Accounting Theory I with emphasis on equity and special measurement and reporting problems. Topics include the statement of cash flows, pension, leases, revenue recognition, and investments. (0101-704) Credit 4

0101-706 Cost Accounting
A thorough study of the principles and techniques used to accumulate costs for inventory valuation and managerial decision making. Includes problems and procedures relating to job order, process and standard costs systems, with particular attention to the problems of overhead allocation, activity-based costing, measuring the costs of quality and control. (0101-703) Credit 4

0101-707 Advanced Accounting And Theory
Analysis and evaluation of current accounting thought relating to the nature, measurement and reporting of business income and financial position; concepts of income in relation to the reporting entity; attention to special areas relating to consolidated statements, foreign currency statement translation, governmental and not-for-profit accounting. (0101-705) Credit 4

0101-708 Auditing
The theory and practice of auditing examined; critical study of auditing procedures and standards in the light of current practice; measurement and reliance of internal control, covered by case studies; modern auditing techniques by statistical sampling and electronic data processing applications; audit reports and the legal liability exposure of auditors. (0101-705) Credit 4

0101-709 Basic Taxation
Study of federal income taxation, emphasizing tax planning for individuals and unincorporated businesses. Topics covered include income measurement and the deductibility of personal and business expenses. (0101-703) Credit 4

0101-710 Advanced Taxation
A continuation of Basic Taxation. Emphasis is on the tax treatment of property transactions and the taxation of business entities. This course also covers the use of technology to prepare complex returns and to research tax issues. (0101-709) Credit 4

0101-730 Business Law I
An introduction to law and ethical considerations in the areas of contracts, creditors' rights, agency, partnership, corporations, bailments, and international law in a global economy. Credit 4

0101-731 Business Law II
Topics of business law with ethical considerations intended to help prepare students for the CPA exam. Topics from the Uniform Commercial Code include: sales, commercial paper and secured transactions, and personal and real property. Regulation of the securities market, liability of accountants, and international law also are discussed. (0101-730) Credit 4

0101-794 Cost Accounting for Manufacturing Environment
A first course in accounting for students specializing in computer integrated manufacturing systems (CIMS) or Manufacturing Management and Leadership (MM&L). The course will introduce the routine internal accounting systems and accounting processes used by manufacturing firms, specialized techniques used to evaluate efficiency and effectiveness of manufacturing operations, form and content of manufacturing financial statements and additional topics relevant to manufacturing firms. The course should not be taken by those with a program concentration in accounting. Credit 4

Management

0102-740 Organizational Behavior & Leadership
This is a first course in management. Students will explore models for managing behavior of individuals and teams in organizations. Topics include motivation, team building, conflict resolution, leadership, organizational change and managing organizational cultures. Teaching techniques include class discussion, case studies, team exercises and team presentations. Credit 4

0102-741 Leading Change in a Quality Organization
Total quality has become a catalyst for change, and astute leadership recognizes the need to embrace change in order to remain competitive. In order to meet today's competitive challenges, many successful organizations are introducing innovative approaches to building and sustaining a culture committed to quality and the principles of continuous improvement. This course examines the various theories and approaches currently used by behavioral science practitioners to assist organizations in achieving planned change. Topics include methods of managing the change process in organizations devoted to quality, overcoming resistance to change, the role of the change agent, organizational restructuring, and business process re-engineering. (0102-740) Credit 4

0102-745 Social & Political Environment of Business
The course illuminates the role of ethics, social ideology and government policy and regulation in guiding business decisions and in providing the conditions for successful competitive activity. Special attention is given to the role of business in assessing technological opportunity and risk, managing product liability and victim compensation, directing the corporation in a manner consistent with the public policy on the natural environment and developing policies that assure fair treatment of the diverse individuals in the workplace. Credit 4

0102-746 Management & Career Development
Study and application of current methods of developing managers, with a primary emphasis on career development of both managerial personnel in general and the person taking this course. Implications of current technological developments for training, replacement, and advancement of managerial personnel are discussed. Insight is also provided into the organizational function of management development. (0102-740) Credit 4

0102-750 Human Resource Management
This course focuses on the importance of managing human resources with an awareness of the needs of the business and of the legal and regulatory environment. Attention is given to the increasing organizational need to have greater cooperation among top management HR managers, line managers and employees. Students will become familiar with the functions of staffing, appraising and compensating employee performance, training and organizational development and establishing and maintaining effective work relationships. (0102-740) Credit 4

0102-753 Field Experience in Business Consulting
Students nearing the completion of their program work in consulting teams to assist local small firms and entrepreneurs. Problems are isolated and solutions then developed. A team consultant's report is prepared for the firms/entrepreneurs. (0101-703,0104-721,0105-761) Credit 4

0102-756 Power And Influence
Power and influence processes are pervasive and an important part of organizational life. This course has as its objectives enhancing the understanding of these processes and increasing the student's skills in using them. Topics covered include the conditions under which power and politics are more likely to dominate decision processes, assessing the relative power of various actors, understanding the basis for their positions on issues, the sources of both individual and departmental power, power and influence strategies and tactics, and some functional and dysfunctional aspects of organizational politics for both individuals and the organizations involved. (0102-740) Credit 4

0102-757 Management & Leadership
Interpersonal aspects of managerial work, managing key individual work relationships (bosses, peers and subordinates), use of communication and leadership skills as a key aspect of effective management. The course deals with individual, interpersonal, group and organizational aspects of leadership. (0102-740) Credit 4

0102-758 **Seminar in Management**
A presentation of current specialty topics within the broad field of management. Seminar topics have included organizational power and politics, improving individual and managerial effectiveness, managerial control systems, employee and labor relations, organization development, macro and micro aspects of technology management, business ethics and Total Quality Management. The course topic for a specific quarter will be announced prior to the course offering. (0102-740, or consent of instructor) Credit 4

0102-759 Competitive Strategy
Strategic management decisions involve cross-functional integration of different management disciplines. As a capstone course, this course integrates and encourages use of what was learned in previous business courses. The objective is to gain insights into developing strategies for sustained competitive advantage. Topics include analysis of mission and visioning, general environmental trends, industry attractiveness, value-chain analysis, core competencies, business and corporate-level strategies, etc. The case method will be used to identify effective business and corporate-level strategies for firms and industries under dynamic competitive conditions. The workload in this capstone course tends to be considerably heavier than average. (All other required core courses) Credit 4

0102-760 **International Management**
An analysis of business behavior and organization in the European Community, Eastern bloc countries, the Pacific Basin, and the U.S. with particular emphasis on values, authority, individual and group relations, labor-management ties, risk tolerance, and motivational techniques. The course will prepare students to recognize different values and cultural factors in the global business community and how these shape and determine appropriate management behavior. The problems and opportunities of transferring management practices from one culture to another will also be examined. (0102-740) Credit 4

0102-763 **Behavioral Skills for Managers & Professionals**
The course provides the opportunity to develop individual and interpersonal skills that enhance managerial performance in today's high-performance organization. Each participant is given the opportunity to perform in each of the major skill dimensions, given evaluative feedback and given the opportunity to incorporate the implications of that feedback into additional performance opportunities. Course participants are also provided with the opportunity to assess their career work preferences and to compare them with the performance expectations of managerial positions. The administrative styles of each participant are also assessed, and the impact of the behaviors that flow from each style on the perceptions and performance of others in the organization is clarified. Credit 4

0102-775 Business Ethics
Ethical issues involved in individual and corporate conduct will be examined. Topics include ethical hazards in modern organizations; creating an ethical climate in an organization; honesty; whistle blowing; environmental ethics; ethics in advertising and sales, financial management and personnel management; and the role of character and virtues in effective leadership. Special attention is also given to the ethical assumptions of major corporate strategic decisions. Credit 4

0102-799 **Independent Study**
A supervised investigation and report within a business area of professional interest. The exact content should be contained in a proposal for review, acceptance, and assignment to an appropriate faculty member, who will provide supervision and evaluation. Appropriateness to written objectives and ability of faculty will be included in the review and consideration for acceptance. (Permission of instructor and graduate department) Credit **4**

Technology Management

0102-742 **Introduction to Technology Management**
This course is an introduction to the technological process in organizations and the factors, both internal and external, that influence the rate, timing and success of industrial innovations. The interrelationship between science and technology and the importance of these two disciplines on the process of technological innovation is examined. Also discussed is the process of R&D management, the strategic management of technology, the dynamics of technology life cycles and organizational influences on engineering and manufacturing processes. (0102-740 for business majors; permission of instructor for students in other colleges) **Credit 4**

0102-761 **Managing Research & Innovation**
This course deals with the responsibilities of, and operating problems faced by managers responsible for the research function within high- technology firms. Topics will include: internal technology assessments, the acquisition of technology, domestic and international technology transfer, and the selection and management of R&D projects. Particular attention will be given to motivating and managing creative individuals, organizational alternatives for R&D, and techniques for overcoming barriers to innovation. (0102-742 recommended for business majors, permission of instructor for students in other colleges.) Credit 4

0102-762 **Managing New Process and Product Development**
The course deals with the internal organizational challenges faced by managers of technology-intensive companies. Particular attention is given to management techniques for successfully developing and introducing into the marketplace new products and services. Also discussed is the management of technical groups and project teams, cross-functional integration, organizational support of innovation and creativity and organizational alternatives such as matrix management and skunk works. (0106-743 recommended for business majors; permission of instructor for students in other colleges) Credit 4

International Business

0102-780 **Multinational Business Operation & Environment**
The course focuses on issues related to business political economy and the complexity of international business. Topics include trade theory; evolving political, regulatory, and economic environments; the multinational corporation; host country relations; direct foreign investment; and managing across national boundaries. (0103-705) **Credit 4**

0102-782 **Seminar in International Business**
This capstone course will focus on either contemporary issues and problems in international business or regional studies analysis (e.g., Europe, Eastern Bloc, Pacific Basin). It will emphasize faculty-directed student research projects. (0102-780) **Credit 4**

0102-760 **International Management**
An analysis of business behavior and organization in the European Community, Eastern bloc countries, the Pacific Basin, and the U.S. with particular emphasis on values, authority, individual and group relations, labor-management ties, risk tolerance, and motivational techniques. The course will prepare students to recognize different values and cultural factors in the global business community and how these shape and determine appropriate management behavior. The problems and opportunities of transferring management practices from one culture to another will also be examined. (0102-740) Credit 4

0104-760 **International Finance**
This course has a specific focus on international business problems that are financial in nature. Topics include an examination of the international environment the firm operates in, international investment, exchange rates and the management of risks arising from shifting exchange rates, and the problems of short and long term asset and liability management. (0104-721) **Credit** 4

0105-766 **International Marketing**
This course has a specific focus on the international marketing challenges facing firms operating in developing and developed country markets. Topics will include an examination of the international environment and its impact on marketing decisions, international pricing and promotion, product-market entry and penetration strategies, and how to organize international marketing operations for maximum effectiveness. (0105-761) Credit 4

Economics

0103-705 **Economics For Managers**
This course focuses on the fundamental economic theories most useful for the management of the firm. Applications drawn from current economic events are utilized to better understand the internal and external environments of the firm and to help managers formulate effective business strategies and policies. Although no prior knowledge of economics is required, this is more than just a survey or principles course. Some important intermediate level economics tools of analysis (both microeconomic and macroeconomic) are introduced to provide managers with the skills necessary to apply economics in a meaningful way to business decision making. (0106-066 algebra or equivalent) Credit 4

0103-711 **Microeconomics**
This is an intermediate microeconomic theory course with applications. The fundamentals of consumer behavior theory, market demand, and the theory of the firm are stressed with applications. Also, resource allocation and product distribution as fundamentals to management and to understanding the role of a firm in an economy. Credit 4

0103-712 **Macroeconomics**
This is an intermediate macroeconomic theory course with applications. A basic framework of product and money market equilibrium is explored with applications in fiscal and monetary policy. An understanding of major aggregate economic relationships is developed, as well as economic policy. Credit 4

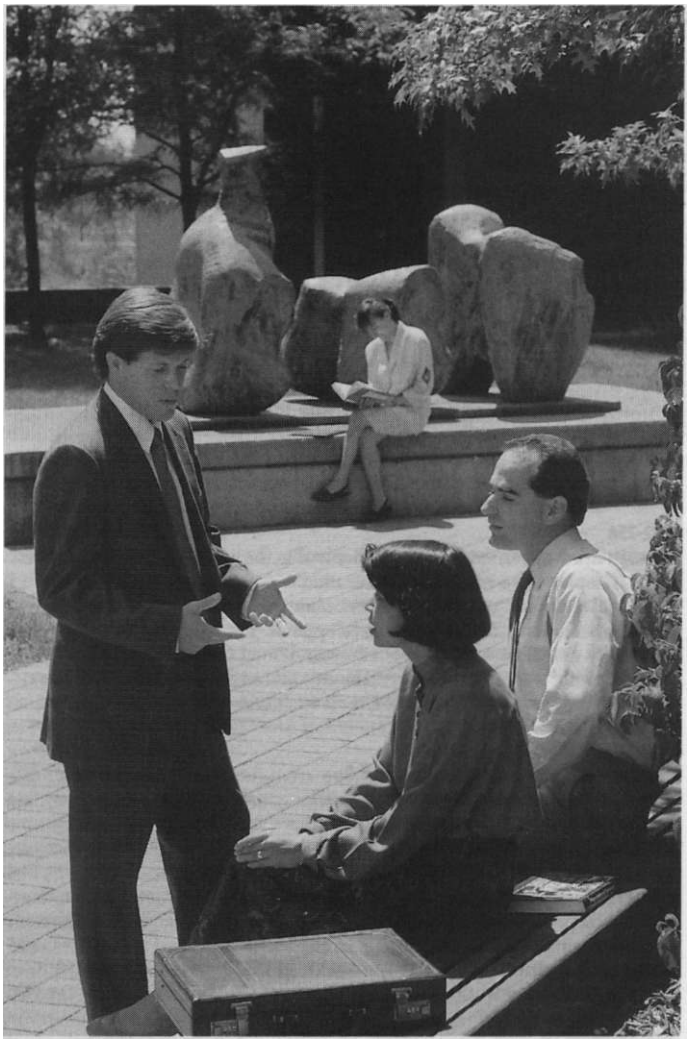
Finance

0104-721 **Financial Analysis for Managers**
An examination of basic financial theories, techniques, and practices relating to the valuation, pricing, and selection of capital/financial assets and the definition, evaluation, and management of corporate risk. Topics include: time value of money, valuation, capital asset pricing, risk and diversification, cost of capital, capital budgeting techniques. (0101-703 prerequisite, 0103-705 or 0103-711 and 0106-782 as pre or corequisite) Credit 4

0104-722 **Financial Management II**
This course emphasizes the theories, techniques, and practices associated with capital structure decisions, equity and debt restructuring, dividend policy, financial forecasting, working capital management, financial analysis, financial control, and leasing. (0104-721) Credit 4

0104-724 **Problems In Corporate Finance**
This course is designed to give the student greater in-depth understanding of contemporary problems in finance. The focus will be on state-of-the-art techniques of corporate financial management from both a theoretical and practical perspective. Examples of specific topics include: working capital management, capital asset acquisition, capital structure, financial analysis, dividend policy, financial strategy and special topics. The case approach will be the primary method of instruction. The emphasis will be on the analytical and decision making techniques used to develop acceptable solutions. (0104-721,722) Credit 4

0104-725 Securities And Investments
Study of securities and other investment media and their markets. Analysis of investment values based on fundamental analytic procedures, technical analytic procedures, and the impact that modern portfolio theory has on the value of financial assets. Topics include return, growth, risk, accounting procedures, tax considerations and the impact of various institutional arrangements on value determination. (0104-721) Credit 4



0104-730 **Financial Institutions & Markets**
An examination of the role of financial intermediation in the economy. The existence of regulations and the expanding level of competition among intermediaries are discussed. The importance of interest rate risk and hedging such risk is extensively covered. Topics include regulatory laws, gap analysis, hedging duration gap exposure, bank performance, pension funds, insurance companies and mutual funds. (0104-721) Credit 4

0104-732 **Portfolio Theory**
This course extends the knowledge of risk and return in a portfolio context to active portfolio management. The measurement and evaluation of portfolio performance are analyzed. The importance of asset allocations, international diversification and pension fund management and the use of a wide range of derivative securities to manage risk are explored. (0104-721) Credit 4

0104-734 **Working Capital Management**
This course is an examination of the management of current assets and current liabilities. Emphasis is placed upon cash and marketable securities management, cash budgeting, inventory control, accounts receivable management, and short-term and intermediate-term financing. (0104-721) Credit 4.

0104-740 **Futures & Options**
This course focuses on financial derivative securities. Their role in financial management is becoming increasingly important, especially in portfolio management. This course covers valuation of various options and futures as well as their use in risk management. Specific topics include option and futures pricing models, option strategies and contemporary topics such as index arbitraging. (0104-721) Credit 4

0104-760 International Finance
This course has a specific focus on international business problems that are financial in nature. Topics include an examination of the international environment the firm operates in, international investment, exchange rates and the management of risks arising from shifting exchange rates, and the problems of short and long term asset and liability management. (0104-721) Credit 4

Marketing

0105-758 Seminar in Marketing
Topics to vary. For example: Business to Business E-Commerce
This seminar focuses on assessing the extent to which business to business e-commerce tools (e.g., internet, extranet, EDI) have changed the ways in which marketing channels function. Major strategic channel issues covered include auctions, exchanges, marketing communications, pricing, inside selling, sales force automation, branding and partnerships. (0105-761) Credit 4

0105-761 Marketing Concepts
An introduction to the field of marketing stressing its role in providing customer satisfaction. Emphasis will be on determining customer needs and wants and how the marketer can satisfy those through the controllable marketing variables of product, price, promotion, and distribution. Credit 4

0105-762 Advanced Marketing Management
A course designed to give the student an in-depth knowledge of middle- and upper-level marketing problems and processes. Topics include the tools used by marketing managers and the role of total quality management in the development, implementation, and control of marketing plans. (0105-761) Credit 4

0105-763 Buyer Behavior
A study of the determinants of consumer and business buying behavior. (0105-761) Credit 4

0105-764 Channel Management
This course involves a study of the elements and management of marketing channels. A marketing channel is viewed as an interorganizational system involved with the task of making goods, services and concepts available for consumption by enhancing their time, place and possession utilities. The course focuses on how institutions can effectively and efficiently transmit things of value from points of conception, extraction and/or production to points of value consumption. (0105-761) Credit 4

0105-765 Sales Management
A course centered around the role, activities, and tools employed by sales force managers. The importance of continuous improvement and of defining and meeting the requirements of both internal and external customers is presented as the foundation of effective sales management. (0105-761) Credit 4

0105-766 International Marketing
This course has a specific focus on the international marketing challenges facing firms operating in developing and developed country markets. Topics will include an examination of the international environment and its impact on marketing decisions, international pricing and promotion, product-market entry and penetration strategies, and how to organize international marketing operations for maximum effectiveness. (0105-761) Credit 4

0105-767 Marketing Communications
This course presents an in-depth view of the promotional tools of advertising, sales promotion, and public relations. Students will develop a comprehensive promotion plan, beginning with the marketing strategy and ending with implementation and evaluation. (0105-761) Credit 4

0105-770 Professional Selling
A critical examination of the challenges and opportunities provided by professional selling. Selling concepts, tools, strategies and tactics will be discussed, observed and practiced. Students are exposed to and experience some of the problems faced and rewards earned by those in professional sales. (0105-761) Credit 4

0105-771 Customer Satisfaction Research Methods
This course provides an overview of customer satisfaction theory and practice, with particular emphasis on how customer satisfaction is measured and used in organizational decision making. The student will learn about the processes of conducting a customer satisfaction survey that includes the following: determining customer requirements, questionnaire design, sampling plan design and data analysis. (0105-761,0106-782 or equivalent) Credit 4

0105-772 Marketing on the Internet
This course is designed to expose students to the many ways in which marketing concepts and strategic marketing issues can be enhanced through effective use of the Internet and related technologies. The course focuses on both business to consumer and business to business environments. Specific attention is given to the understanding and implementation of on-line competitive advantage through successful brand management, effective competitive intelligence and the pursuit of a customer focused digital marketing mix. The course emphasizes practical application in the form of research papers and real world domestic and international consultancy assignments. (0105-761) Credit **4**

0105-773 Database Marketing
This course provides the student with the application of database management to the challenges of relationship marketing. The students will be taught Microsoft ACCESS software program, after which they will apply the information from an analysis of a database to design a relationship marketing plan. (0105-761,0106-782) Credit **4**

Production & Operations Management

0106-743 Operations Management
Study of the management of production/operations and improvement of processes. Encompasses both manufacturing and services. Topics include operations strategy, quality planning, control and improvement, project management, planning for and control of job, batch and high volume operations (forecasting, capacity and materials planning, scheduling, inventory management, JIT, supply chain management), international operations, and current issues. (0106-782 or equivalent, pre- or co- requisites) **Credit** 4

0106-744 Project Management
A study in the principles of project management. This course focuses on the leadership role of the project manager, roles and responsibilities of the project management team members, and various tools and techniques for project planning and control. Considerable emphasis is placed on Statements of Work and Work Breakdown Structures. This material is presented using a combination of lecture/discussion, group exercises, and case studies. Credit **4**

0106-745 Quality Control & Improvement
Study of total quality management (TQM), including Deming's philosophy, quality planning, quality cost principles, problem-solving methods and tools, the use of statistic^ methods for quality control and improvement, supplier relations, reliability concepts, and recent developments in quality. The course focus is on the management and continuous improvement of quality and productivity in manufacturing and service organizations. (0106-782 or equivalent) Credit **4**

0106-747 Managing Manufacturing Resources
This course focuses on the effective management of resources in manufacturing companies. Views are: (1) manufacturing strategy from a business prospective, (2) business process improvement, including change management, (3) human resource management-current relationships between companies and employees, issue of compensation and diversity, and personal career management, **(4)** risk management— how to identify, access and control those risks which are key, and (5) value/supply chain management, including strategic make-buy decisions, types of cooperative relationships with other firms, and related planning/control systems. (For MS in Manufacturing Management and Leadership) Credit **4**

0106-749 Manufacturing Strategy & Tactics
This course integrates the skills learned in operations management with the fundamental disciplines of accounting, financial, and marketing management. Key focuses in the course are manufacturing strategy, the creation and maintenance of a culture for continuous improvement, and the management of change. Manufacturing is investigated in a global context, including the foreign and domestic firms and the strategies and tactics employed by them. The viability of an economy without a manufacturing base is questioned. Teams develop, execute, and report on a manufacturing strategy audit. (0106-743 or equivalent) Credit 4

Decision Sciences

0106-066 **Graduate Math Review**
Two part graduate math course for students requiring review of basic algebra and statistics. Either or both parts may be required. Part I-Basic review of algebra Part 2-Basic review of statistics. **Credit 0**

0106-782 **Statistical Analysis in Decision Making**
A course in applied statistics emphasizing inference (estimation and testing). Topics to be covered include sampling distribution, estimation, test of hypothesis for single and two populations, statistical quality control methods, linear, multiple regression and model-building methods. (0106-066, statistics or equivalent) Credit 4

Management Information Systems

0112-700 **Information Technology Hardware & Software**
This course is designed to present the issues of rapid computer system changes, increased computer power and speed, reduced computer size, new peripherals and changes in user interaction. This course presents these issues of computing systems architectures and operating system software using a systems view. Credit 4

0112-710 **Management Information Systems Concepts**
This course is an introduction to the conceptual and theoretical foundations of management information systems and their role in modern organizations. The course will provide students with the concepts, tools, and techniques needed to understand and interpret information management issues, such as how to best incorporate information technology into an organization, from a managerial perspective. Due to the importance of E-Commerce and Enterprise Resource Planning (ERP) systems in modern organizations, special emphasis will be given to them throughout the course. Credit 4

0112-720 **Systems Analysis & Design I**
This course provides students with fundamental knowledge and skills required for successful analysis of problems and opportunities and the design and implementation of information systems. Provides students with knowledge and experience that will be useful in determining systems requirements and developing a logical design. Skills in project management will be learned and used throughout the course to facilitate team accomplishments. (Programming language) Credit 4

0112-725 **Systems Analysis & Design II**
This course builds on Analysis and Logical Design I. It discusses issues associated with data capture, organization, storage, extraction and modeling for planned and ad hoc reporting. Enables students to model data by developing conceptual and semantic data models. (0112-720) Credit 4

0112-735 **Network Technology**
This course is designed to give students basic knowledge of the networking strategies that are utilized within the corporate IS environment. Emphasis is on the current trends in local area networking as they relate to business needs. Class sessions are composed of lectures and discussions. (0106-700) **Credit** 4

0112-755 **Information Systems Management**
This course involves the study of information systems (IS) management and focuses on issues and problems faced by managers of information technology. Topics include information systems planning, computer-integrated manufacturing, systems development, establishment of IS standards, e-business, and other management principles relevant to IS. The course utilizes Harvard cases and research papers to illustrate important concepts. (0112-710) Credit 4

0112-760 **Integrated Business Systems**
This course provides hands-on experience with the navigation of the SAP R/3 systems and the concepts and technologies associated with enterprise systems integration. Topics include an overview of Enterprise Resource Planning (ERP) systems, the concepts and technologies required to integrate the systems of large business organizations, and hands-on experience using SAP software. **Credit** 4

0112-761 **Business Process Design & Workflow Analysis**
This course focuses on the procedures, tools, and concepts necessary for evaluating, building, and revising business processes within an organization. It introduces the standard systems analysis and design life cycle for defining and refining processes. Tools used in the course include object-oriented workflow design tools selected from ARIS, Rational Rose, Visio Professional and the workflow design tools that are part of SAP R/3. (0112-760 or permission of instructor) **Credit** 4

B. Thomas Golisano College of Computing and Information Sciences

Walter A. Wolf, Interim Dean

PROGRAMS

MASTER OF SCIENCE DEGREES IN:

Computer Science
Information Technology
Software Development and Management

ADVANCED CERTIFICATES AVAILABLE IN:

Interactive Multimedia Development

The B. Thomas Golisano College of Computing and Information Sciences (GCCIS) offers master of science degrees in computer science, information technology, and software development and management and an advanced certificate in interactive multimedia development. The programs offer the most current computing technology and are supported by extensive laboratory facilities. Courses are offered during the day and evening, allowing full- or part-time study. Information technology and software development and management are also offered online.

GCCIS is the newest college at RIT, having been formed in the summer of 2001. It focuses on the computing disciplines in the broadest sense. Included in the college are the departments of computer science, information technology, and software engineering and the IT lab. Interdepartmental and intercollege cooperation are basic to its function. The college has more than 60 faculty, 3,000 students, more than 20 technical and support staff, and extensive facilities dedicated to teaching and research and development.

The computer science and information technology departments have degree programs at the associate, baccaluareate, and master's levels. Both offer extensive evening courses that allow these degrees to be full- or part-time. Software engineering offers the bachelor of science degree. All departments require an extensive cooperative education experience.

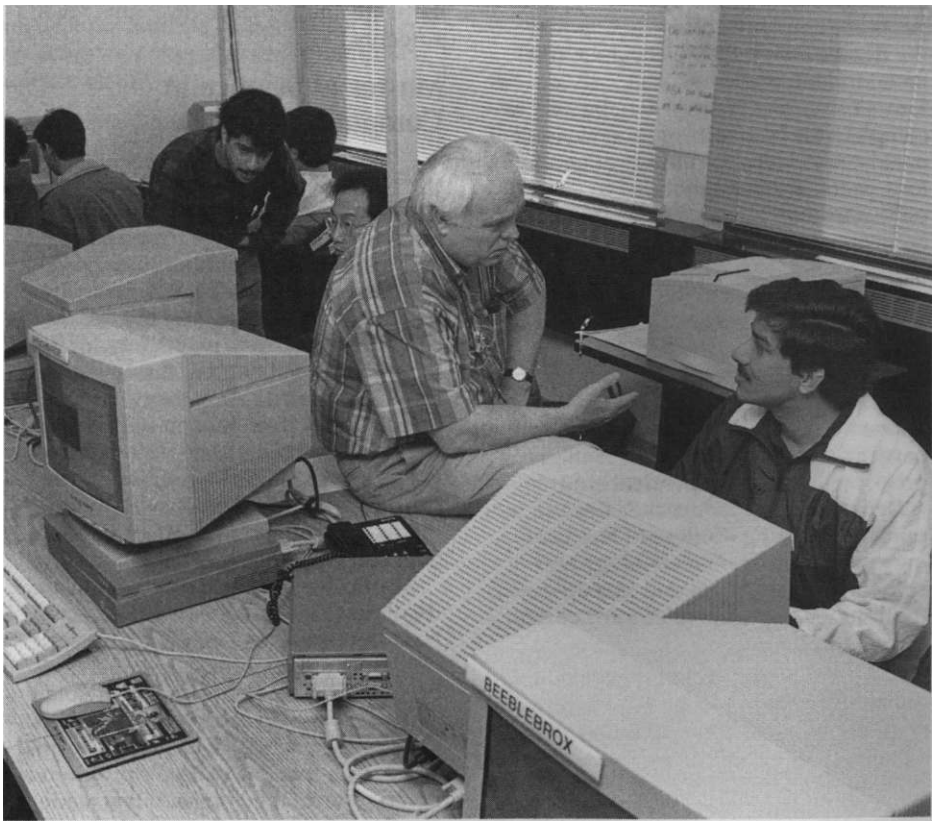
Faculty

Any academic department or program can be only as strong as its faculty. The GCCIS faculty is dedicated to teaching, applied research, and professional development, with an emphasis on student involvement and career preparation. Most have significant industrial experience in addition to outstanding academic credentials. Faculty members provide leadership in implementing innovative teaching techniques and in anticipating and meeting the needs of students and our industrial partners.

Resources

The highly technical nature of the GCCIS programs demands excellent facilities and equipment. Each department has extensive laboratories containing powerful PCs and workstations and appropriate, up-to-date software. Labs are available to students 16-18 hours a day except when being used for designated course sections. Internet, dial-up network, and Web access are also provided, insuring that our students have the tools necessary to complete their assignments and projects.

To provide space for this equipment, a new 25-thousand-square-foot building was erected in 1999 and is being expanded by 90 thousand square feet. This allows both general-use and specialized labs, such as home networking and computer vision. When the building is complete, most of the college will be housed in it and a contiguous building, which contains the IT lab. This proximity will encourage joint projects as well as interaction among students in different programs.



Computer Science

Margaret M. Reek, *Acting Chairperson*

The computer science MS program at RIT has a core curriculum, which is designed to give students a solid background in the theoretical principles underlying the field, and a wide variety of electives, which provide the opportunity to become proficient in current software technology The core ensures that graduates take with them the intellectual tools necessary to keep up-to-date in this rapidly evolving discipline, while the electives prepare our graduates to engineer modern computing systems and contribute in all aspects of the systems' life cycles. Students can also prepare for academic or research careers in computer science or a related discipline as well as further academic study.

The program is designed for students who have an undergraduate major or minor in computer science as well as those who have a strong background in a field in which computers are applied, such as engineering, science or business. Students can concentrate in distributed, parallel and network computing; systems hardware and software; programming languages; data communications; artificial intelligence; or theory of computing.

Computer science graduate courses are offered in the late afternoon and evenings. Many of our graduate students are employed and are pursuing the degree on a part-time basis. A full-time student, one who takes three or four courses per quarter, may be able to complete the course work in one year; part-time students can finish in two to four years. The time required to complete a master's thesis or project varies according to the student and the scope of the project; two quarters is typical.

Facility members in the department are actively engaged in consulting or research in the area of artificial intelligence, computational combinatorics and distributed computing systems. There are many opportunities for graduate students to participate in these activities for thesis or project work and independent study.

Related MS programs at RIT are computer engineering (College of Engineering) and information technology and software development and management (both in the department of information technology).

Computer facilities

The computer science department provides extensive facilities for students and faculty. The hardware associated with these facilities represents current technology, including:

- a graduate lab with 17 Sun Ultra 10 workstations and a graduate library
- More than 100 Sun Ultra 10 workstations
- A networking/distributed systems lab with 10 dual processor Pentiums and its own internal network

These computers operate under the UNIX operating system.

Computer science students also have access to the computers in the information technology labs (more than 100 PCs and Macs) and RIT's main Information and Technology Services facilities, as listed in the Student Services section of this catalog.

Ethernet is used to integrate the above systems and to connect the Graduate Computer Science Laboratory with other RIT computing facilities. These graduate networks are also available to support departmental research, theses, projects and course work. All students have full access to the Internet and the World Wide Web.

Graduate students have dial-up and Internet access and are encouraged to use home computers. (The RIT bookstore carries computer equipment and software and provides discounts for RIT students.)

Master of Science in Computer Science

Admission requirements

Applicants should have a baccalaureate or an equivalent degree from an accredited institution and a minimum grade point average of 3.0 (B). RIT undergraduate students in computer science or computational math may study for both their BS and MS degrees through accelerated programs.

Applicants from foreign universities should submit Graduate Record Exam (GRE) scores. (GRE scores also can be considered for applicants whose undergraduate grade point average is lower than 3.0.)

Applicants must satisfy prerequisite requirements in mathematics and computer science (listed below). If an applicant lacks some of these prerequisites, bridge program courses are available to allow students to achieve the required knowledge and skills. Generally, formal acceptance into the master's program is deferred until the applicant has made significant progress through these necessary courses.

The prerequisites are:

Mathematics

Differential and Integral Calculus
Probability and Statistics
Discrete Mathematics

Computing

Experience with a modern high-level language (e.g., C, C++, Java)
Data Structures
Assembly Language Programming
Software Design Methodology
Introductory Computer Architecture and Digital Logic
Operating Systems
Programming Language Survey (including Lisp)

The bridge program

Students whose undergraduate preparation or industrial experience does not satisfy the above content or grade point requirements may make up these deficiencies through up to a year of study, taking one or more of the following RIT courses, as prescribed by a graduate department adviser.

Mathematics

1016-251, 252, 253	Calculus
1016-351	Probability & Statistics (Calculus based)
1016-265	Discrete Mathematics

Computing

4003-231	Computer Science I
4003-232	Computer Science II
4003-233	Computer Science III
4003-704	Computer Organization
4003-707	Programming Practices or
4003-263	Computer Science for Transfers
4003-708	Introduction to Digital Design
4003-709	Programming Language Concepts
4003-713	Operating Systems

If a student matriculates before finishing the bridge program, all remaining bridge program courses must be completed with a grade of at least B; courses with lower grades must be repeated. Bridge program courses are not part of the 45 credits required for the master's degree, however, their grades are included in a student's graduate grade-point average unless taken before matriculation.

A bridge program can be designed in ways different from that described above. Often, other courses can be substituted, and courses at other colleges can be applied. (See the Computer Science Graduate Studies Handbook for more details.)

The curriculum

The graduate program of study is composed of the computer science graduate core, electives, advanced electives and a thesis paper or project for a total of 45 credits.

There are two tracks to the degree, the thesis track and the project track.

The thesis track consists of:
- Five required ("core") courses (20 credits),
- Electives (8 credits),
- Advanced electives (8 credits),
- Master's thesis (9 credits).

The project track consists of:
- Five required ("core") courses (20 credits),
- Electives (12 credits),
- Advanced electives (8 credits),
- Master's project (5 credits).

The computer science core consists of five courses:

4005-700 Foundations of Computing Theory
4005-710 Programming Language Theory
4005-720 Computer Architecture
4005-730 Distributed Operating Systems I
4005-800 Theory of Computer Algorithms

Students with a strong background in a core area may receive permission from the program coordinator to replace a core course with some other course, generally in the same area.

Electives and advanced electives are shown below; advanced electives are indicated by "†."

4005-704 Complexity & Computability
4005-705 Cryptography
4005-709 Topics in Computer Science Theory †
4005-711 Compiler Construction †
4005-719 Topics in Programming Languages †
4005-729 Topics in Computer Architecture †
4005-731 Distributed Operating Systems II †
4005-735 Parallel Computing I
4005-736 Parallel Computing II †
4005-739 Topics in Operating Systems †
4005-740 Data Communications & Networks I
4005-741 Data Communication & Networks II
4005-749 Topics in Data Communications †
4005-750 Introduction to Artificial Intelligence
4005-751 Knowledge-Based Systems †
4005-755 Neural Networks and Machine Learning †
4005-756 Genetic Algorithms †
4005-757 Intro, to Computer Vision †
4005-759 Topics in Artificial Intelligence +
4005-761 Computer Graphics I
4005-769 Computer Graphics II †
4005-771 Database Systems
4005-772 Database System Implementation

Students also may include elective courses from other RIT departments' graduate offerings. See http://www.es.rit.edu/~csdoc/graduate for a list of approved courses. Other departments' courses are primarily for their own majors and may have prerequisites that may not be approved for degree credit.

Electives provide breadth of experience in computer science and applications areas. Students who wish to include courses from departments outside of computer science need prior approval of their graduate adviser. Refer to the course descriptions in the departments of computer science, engineering and business for possible elective courses.

A program of study must be designed in cooperation with a graduate adviser.

The master's thesis or project

A thesis paper or project forms the capstone of the MS program. In order to register for either, a student must submit an acceptable proposal to the computer science faculty.

Financial aid

Scholarships and graduate assistantships are available in the department of computer science. Information may be obtained from:

Graduate Program Coordinator,
Department of Computer Science
Rochester Institute of Technology
102 Lomb Memorial Drive
Rochester, N.Y. 14623-5608
E-mail: gradinfo@cs.rit.edu

Information Technology

Edith A. Lawson, *Chairperson*

The information technology department offers an MS degree in information technology, an MS degree in software development and management, as well as a program of study leading to an advanced certificate in interactive multimedia development. Graduate courses are given at times of the day convenient to both part-time and full-time graduate students—usually late afternoon and evening. Both MS degree programs will take at least five or six quarters to complete. The advanced certificate may be accomplished in one calendar year.

The master of science in information technology enables graduates to contribute to the emerging interdisciplinary field of information technology in a variety of capacities. Students will learn a systematic approach to the design of information technology solutions to contemporary problems, including business and education. They also will develop skills in needs analysis for information technology. They will be able to design and develop interactive, multimedia-based information applications. Students will develop a strategic and technical understanding of networks and communication systems. Finally, students will be able to apply cognitive and organizational theories to the design of information technology applications and systems.

The master of science in software development and management provides students with state-of-the-art preparation for a broad spectrum of software engineering-related careers. Graduates acquire a solid base of technical and design skills along with insights into the importance of project management for software development. This program is also offered in a distance delivery format.

The advanced certificate in interactive multimedia development provides an opportunity for students to gain firsthand knowledge and expertise in the art and science of interactive multimedia design. As interactive technologies advance, the content and form of projects change, but the theme of our work is the enhancement of human communication in electronic environments. Students explore related issues through a series of six core courses in interactive multimedia development.

Laboratory facilities

The computing facilities of the department of information technology are driven solely by curricular needs. Our focus is on what our students need to do with the computer and networks we provide.

Many of our courses are laboratory based. Students have scheduled laboratory time each week with an instructor, who provides a structured experience that reinforces concepts covered in lecture.

Due to our cross-platform commitment, our labs contain Windows and Macintosh platforms. In addition, Unix is used in several specialized labs. Students use these labs to design and develop cross-platform applications. From the capture of media (sound, video, and print materials) to production of Web sites and computer-based training, IT has ample resources on both platforms.

The open labs provide students with access to computing outside of scheduled lab time and with employment opportunities similar to those they will experience after graduation. Many of our students also work as lab assistants, adding a practical dimension to their experiences.

In addition to general laboratory facilities for student support, the FT department has developed specialized laboratories for its concentrations in networking, system administration, multimedia, programming, and database implementation and administration.

The IT networking lab is designed to facilitate network exploration. Each of its stations consists of two PCs, a Macintosh, a router, and a hub. Each of the PCs runs "sniffer" software, making each a network analyzer. Additional equipment—including cable testers, breakout boxes, additional hubs, crimping tools, V.35 cables for serial routing, etc.—can be brought to the station from the equipment cage as needed for labs. In addition, each station is cabled to the lab infrastructure, allowing each station to be its own subnetwork in the network or to be directly connected to the network, which provides many possible topologies.

The IT systems administration lab is designed to facilitate experimentation in network management and system administration. Each stations contains four PC-compatible computers, normally configured as a Windows server, a Windows workstation, and two Unix platforms. However, students can reconfigure these machines as required and save their configurations using disk-imaging software on the lab image server. Images of the machines can be quickly saved and restored to make this an extremely flexible lab. Lab-wide servers and a networking infrastructure enrich the computer environment. The main switcher/router in this lab affords four subnetworks per station. Additional hardware and software, available from the equipment cage, allows student to configure more complex topologies.

The IT database lab is designed to facilitate experimentation with client/server database concepts. Each station consists of four machines: a Unix-based Oracle server; two Windows-based servers that can be configured to support a Web server or one of several database packages; and a client machine. Students begin by configuring single-user, one-tier environments and progress to multi-tier networked configurations, where multiple clients interact with an Oracle database through a Web server.

The IT multimedia lab includes a mix of high-end Windows and Macintosh systems, several of which are dual-monitor systems provided especially for multimedia work. Most of the systems support audio acquisition. There are several stations for image acquisition and digital and analog video capture. Students have access to several still and video digital cameras, a dedicated 3D camera set up, and video and audio streaming servers.

The IT computing facilities are connected to the gigabit RIT backbone with an OC3 connection to the Internet. Students have access to our facilities via Ethernet in their dorm rooms or via dial-up PPP connections from off-campus locations. Institutional facilities provide a location for students to develop their own Web presence. The overall campus facilities have consistently been rated by national surveys among the top 20 universities.

The general and specialized IT laboratory facilities make our environment one of the most up to date for undergraduate and graduate exploration of networking and software development in any university in the United States.

Master of Science in Software Development and Management

The software development and management degree program enables the matriculated student to study, develop and become proficient in the practices, methodologies and techniques at all levels in the software development process. The program is designed for students whose undergraduate majors are in a computing discipline. Ideally, students should have a background in software development before entering the program.

The underlying principle of this curriculum is that software development is a manageable process—that the problems encountered now and in the future will be amenable to solutions based on sound managerial methodology and reasoned application of technology.

Admission requirements

Applicants should have a baccalaureate or equivalent degree from an accredited institution and a minimum cumulative grade point average of 3.0 (B). Applicants must submit two professional recommendations.

Applicants from foreign universities should submit Graduate Record Examination (GRE) scores. The GRE score is recommended from those whose undergraduate grade point average is less than 3.0.

Applicants whose native language is other than English must take the TOEFL examination; a score of at least 570 (paper based) or 230 (computer based) is required. Applicants with a lower TOEFL score may be admitted conditionally and will take a prescribed program in English along with a reduced program course load.

Prerequisites

It is expected that students wishing to enter the master's program will have a solid programming background with knowledge of the Java and Visual Basic programming languages.

If a student does not have the necessary background, bridge courses are provided to allow students to meet these prerequisites. Formal acceptance into the master's program is possible even though the applicant must accomplish some additional bridge program courses.

The bridge program

Students whose undergraduate preparation or industrial experience does not satisfy the prerequisite can make up these deficiencies through study, taking one or more of the following RIT courses, as prescribed by the graduate program coordinator.

Visual Basic programming prerequisite

4002-217	Programming for Information Technology I
4002-218	Programming for Information Technology II
4002-219	Programming for Information Technology II
	or
4002-518	Visual Basic for Programmers

Java programming prerequisite

4002-714	Web programming (requires programming experience)

The bridge program courses are not part of the 48 credits required for the master's degree, *except for 4002-714, Web Programming.* Grades for bridge courses are not included in a student's graduate grade

point average if taken *before* matriculation; they are included if taken *after* matriculation.

A bridge program can be designed in ways different from that described above. Other courses can be substituted, or courses at other colleges can be applied. Contact the graduate program coordinator for approval.

The curriculum

The graduate program of study consists of 48 quarter credit hours comprising the project management cluster, the software development cluster, the application development cluster, two professional electives and the software development project. An optional cooperative work experience is possible.

The project management cluster consists of three courses:

4002-820 Economics of Software Development
4002-830 Project Management
4002-831 Process Management

The software development cluster consists of three courses:

4002-710 Object Technologies
4002-720 Data Object Development
4002-725 Component Development

The application development cluster consists of three courses:

4002-819 Integration Technologies
4002-821 Information Architectures
4002-825 System Architectures

Two professional electives

4002-895 Software Development *and* Management Capstone

Electives (8 credits)
The electives may be chosen from information technology, computer science, computer engineering, electrical engineering or business. Graduate courses from other departments also may be appropriate with the approval of the graduate program coordinator.

Cooperative education

An optional cooperative educational experience (co-op) is available for those students who wish to participate in order to gain industrial experience. Students register for course 4002-999, Graduate Cooperative Education, for 0 credits and at no cost. The Office of Cooperative Education and Career Services will help students find a co-op position, but students may find positions on their own. Normally, students should have completed at least half of the course work before finding a co-op position.

Financial aid

Partial tuition assistance scholarships are available from the department of information technology for full-time and part-time students who are not receiving significant financial aid from their employers.

RIT is not a traditional research university that provides a large number of teaching and graduate assistantships. The department has a limited number of graduate assistantships that are awarded for one academic year to full-time students. The assistantships involve helping students in the department's courses or supporting the computing environment of the department. Applications are accepted up to March 31 and are awarded in April for the following academic year. Contact the department of information technology for a graduate assistantship application.

Information

Additional information may be obtained by contacting:

Graduate Program Coordinator
Department of Information Technology
Rochester Institute of Technology
102 Lomb Memorial Drive
Rochester, N.Y. 14623-5608

E-mail: gradinfo@rit.edu
Telephone: 716-475-6179

Master of Science in Information Technology

The MS in information technology is a unique and flexible program that allows the student to craft his or her own program of study within the broad range of computing disciplines. Students build upon core requirements in the areas of current themes in information technology, fundamentals of telecommunications technology and fundamentals of Web-based multimedia. The specialty areas include interactive multimedia development, learning and performance technology, telecommunications technology, project management, electronic commerce and software development. In addition, students have the option of choosing courses from among the wide variety of imaging and technical fields offered within RIT, such as computer animation and computer graphics design. The degree, with the core courses as well as several of the concentrations, is also available in the distance delivery format.

Admission requirements

Applicants should have a baccalaure-' ate or equivalent degree from an accredited institution and a minimum cumulative grade point average of 3.0 (B). Applicants must submit two professional recommendations.

Applicants from foreign universities should submit Graduate Record Examination (GRE) scores. These scores may be required from those whose undergraduate grade point average is less than 3.0.

Applicants whose native language is other than English must take the TOEFL examination; a score of at least 570 (paper based) or 230 (computer based) is required. Applicants with a lower TOEFL score may be admitted conditionally and will take a prescribed program in English along with a reduced program course load.

Prerequisites

It is expected that students wishing to enter the master's program will have a background in programming, computer hardware and information technology.

Students without the necessary background should complete the prerequisites before applying to the program. Courses are available to satisfy the prerequisites.

Bridge program

Students whose undergraduate preparation or industrial experience does not satisfy the prerequisite can make up these deficiencies through study, taking one or more of the following RIT courses, as prescribed by the graduate program coordinator.

Programming

4002-217 Programming for Information Technology I
4002-218 Programming for Information Technology II
4002-219 Programming for Information Technology HI
or
4002-208 Introduction to Programming
4002-210 Programming with Classes
or
4002-700 Computer Programming & Problem Solving
4002-703 Algorithms & Data Structures

Hardware

4002-340 Computer Concepts & Software Systems
or
4002-709 Fundamentals of Computer Hardware
and

Background in Information Technology

4002-717 Information Integration
or
equivalent experience in information technology

The bridge program courses are not part of the 48 quarter credit hours required for the master's degree. Grades for bridge courses are not included in a student's graduate grade point average if taken *before* matriculation; they are included if taken *after* matriculation.

A bridge program can be designed in ways different from that described above. Other courses can be substituted, or courses at other colleges can be

applied. Contact the graduate program coordinator for approval.

Curriculum

The master of science in information technology consists of 48 credit hours of graduate study. The curriculum consists of a set of core courses with a choice of concentrations and electives.

Core courses		Credits
4002-718	Current Themes in Information Technology	4
4002-733	Fundamentals of Telecommunications	4
4004-741	Fundamentals of Web-Based Multimedia	4

Concentrations (24 credits)

Networking

4002-815	Intro, to Routing & Switching	4
4002-816	Intro, to Network Administration (4002-342 and 4002-402)	4
4002-822	Intro, to Network Programming (Knowledge of Visual Basic and 4002-815)	4

Prerequisites: This concentration has three prerequisite courses: 4002-340, Computer Concepts and System Software (prerequisite to MS program); 4002-733, Fundamentals of Telecom Technology (a core course); and 4002-342, Internetworking Lab. This *must* be taken before any of the courses and is another prerequisite to the MS program.

All of these courses, including 4002-342, have a required laboratory section that must be taken concurrently with the lecture section. None of these courses is offered online.

The course 4002-202, OS Scripting, will count as an elective for your MS program or can be part of another concentration.

Web Site and Multimedia Development

4004-737	Web Site Design & Technology	4
4004-745	Theories of Interactive Computing	4

and one of the following:

4004-739	Programming for the World Wide Web (4004-737 and a two-course programming sequence)	
4004-746	Programming for Interactive Multimedia (4004-730)	

Prerequisites: Course numbers in parentheses indicate prerequisites. In addition, in order to develop depth in this topic, there are two prerequisites for the concentration: 4004-741, Fundamentals of Web-Based Multimedia (core course and a prerequisite to 4004-730), and 4004-730, Interactive Media Implementation, an elective in the MS program.

Learning and Performance Technology

4002-722	Fundamentals of Instructional Technology	4
4002-723	Interactive Courseware	4
4002-724	Performance Support Systems Design	4

Electronic Commerce

4002-871	Technology in the Organization	4
4002-872	Inter-enterprise Computing	4
4002-873	Technology & Strategic Opportunity	4

Telecommunications Technology

4002-745	Transmission Systems	
4002-850	Network Planning & Control	4

and one of the following

4002-750	Distributed Systems	4
4002-855	Telecommunications Policy & Standards	4
4002-860	Enabling Technologies & Trends	4

Project Management

4002-820	Economics of Software Development	4
4002-830	Project Management	4
4002-831	Process Management	4

Special Topics

Students can use the special topics option to design a concentration with approval from the graduate program coordinator. Undergraduate courses in systems administration and database may be used as a concentration with prior approval.

Electives (4 or 8 credits)

The electives may be chosen from information technology, computer science, computer engineering, electrical engineering or business. Graduate courses from other departments also may be appropriate with the approval of the graduate program coordinator.

Capstone experience (4 or 8 credits)

A master's project or thesis will be required to meet graduation requirements. The capstone experience should build upon the student's concentrations and electives. It is important that students plan their course work toward completing the project or thesis in their intent area of interest. Each student will assemble a capstone experience committee consisting of three faculty members who will evaluate the project or thesis.

Students will register for four or eight credits for their capstone experience depending on the scope of the work.

Students who do an eight-credit capstone will take one less elective.

Cooperative education

An optional cooperative education experience (co-op) is available for those students who wish to participate in order to gain industrial experience. Students register for course 4002-999, Graduate Cooperative Education, for zero credits (at no cost). The Office of Cooperative Education and Career Services will help students find a co-op position, or students can find positions on their own. Normally, students should have completed at least half of their course work before finding a co-op position.

Financial aid

Partial tuition assistance scholarships are available from the department of information technology for full-time and part-time students who are not receiving significant financial aid from their employers.

RIT is not a traditional research university that provides a large number of teaching and graduate assistantships. The department has a limited number of graduate assistantships for full-time students that are awarded for one academic year. The assistantships involve helping students in the department's courses or supporting the computing environment of the department. Applications are accepted up to March 31 and are awarded in April for the following academic year. Contact the IT department for a graduate assistantship application.

Information

Additional information may be obtained by contacting:

Graduate Program Coordinator
Department of Information Technology
Rochester Institute of Technology
102 Lomb Memorial Drive
Rochester, N.Y. 14623-5608

E-mail: gradinfo@rit.edu
Telephone: 716-475-6179

Advanced Certificate in Interactive Multimedia Development

Admission requirements

Undergraduate degree applicants should have a baccalaureate or equivalent degree from an accredited institution and a minimum cumulative grade point average of 3.0 (B). Two professional recommendations must be submitted.

Applicants whose native language is other than English must take the TOEFL examination; a score of at least 570 (paper based) or 230 (computer based) is required. Applicants with a lower TOEFL score may be admitted conditionally and will take a prescribed program in English along with a reduced program course load.

Prerequisites

With the advance of the multimedia field, knowledge of programming has become necessary to complete all of the courses. Students must have programming skills equivalent to one undergraduate course. Bridge courses are available to complete this requirement.

The curriculum

As interactive technologies advance, the content and form of projects change—the theme becomes one of enhancing human communication within electronic environments. This certificate provides an opportunity for students to gain first-hand knowledge and expertise in the art and science of interactive multimedia design. In this program, students explore the theories of interactive computing, fundamentals of interactive multimedia, programming in an authoring language, multimedia design, and the impact of networked technologies in such areas as the Internet. Projects include the development of Web sites and interactive multimedia titles.

The curriculum consists of six courses:

		Credits
4004-730	Interactive Media Implementation	4
4004-737	Web Site Design & Technology	4
4004-741	Fundamentals of Web-Based Multimedia	4
4004-742	Interactive Multimedia Development	4
4004-745	Theories of Interactive Multimedia	4

And a multimedia elective from the 4004 courses.The curriculum can be completed in as few as three quarters.

Students will have at their disposal a variety of computer, video and digitizing equipment. Laboratory facilities are provided and frequently updated, often through collaborative efforts with other RIT departments.

Graduate Faculty B. Thomas Golisano College of Computing and Information Sciences

Walter A. Wolf, BA, Wesleyan University; MS, Rochester Institute of Technology; MA, Ph.D., Brandeis University—Interim Dean, Professor

Rayno Niemi, BS, MS, Ph.D., Rensselaer Polytechnic Institute—Interim Associate Dean, Professor

Department of Computer Science

Margaret Reek, BT, MS, Rochester Institute of Technology—Acting Department Chair, Professor

Julie A. Adams, BBA, BS, Siena College; Ph.D., MSE, University of Pennsylvania—Assistant Professor

Peter G. Anderson, BS, Ph.D., Massachusetts Institute of Technology—Professor

Jessica Bayliss, BS, California State University; MS, Ph.D., University of Rochester—Assistant Professor

Hans-Peter Bischof, BS, MS, University of Vim; Ph.D., University of Osnabriick—Assistant Professor

Warren Carithers, BS, MS, University of Kansas—Associate Professor

Henry Etlinger, BS, University of Rochester; MS, Syracuse University—Undergraduate Program Coordinator, Associate Professor

Roger S. Gaborski, BS, MS, State University of New York at Buffalo; Ph.D., University of Maryland—Graduate Program Coordinator; Associate Professor

James Heliotis, BS, Cornell University; Ph.D., University of Rochester—Professor

Edith Hemaspaandra, BS, MS, Ph.D., University of Amsterdam—Associate Professor

Trudy Howies, B.Tech., MS, Rochester Institute of Technology—Assistant Professor

Fereydoun Kazemian, BS, Queen Mary College; MS, Pittsburgh State University; Ph.D., Kansas State University—Associate Professor

Andrew Kitchen, MA, University of Edinburgh; MS, Rochester Institute of Technology; Ph.D., University of Rochester—Professor

Stanislaw Radziszowski, MS, Ph.D., University of Warsaw-—Professor

Kenneth Reek, AAS, BT, MS, Rochester Institute of Technology—Professor

Nan Schaller, BS, University of North Carolina; MS, Union College—Professor

Axel Schreiner, MS, Northern Illinois University; Ph.D., University of Illinois—Professor

Paul Tymann, BS, MS, Syracuse University—Associate Professor

James R. Vallino, MS, University of Rochester—Assistant Professor

Department of Information Technology

Edith Lawson, BS, University of Wisconsin at Stevens Point, MS, Rochester Institute of Technology—Department Chair; Associate Professor

Kevin Bierre, BA, State University of New York at Geneseo; MS, Cornell University and Rochester Institute of Technology—Assistant Professor

John A. Biles, BA, MS, University of Kansas—Undergraduate Program Coordinator; Professor

Dianne P. Bills, BA, University of Rochester; MS, Rochester Institute of Technology—Associate Department Chair; Graduate Program Coordinator; Assistant Professor

Nancy Doubleday, BS, MS, Rochester Institute of Technology—Instructor

Daniel Garrison, BS, Liberty University; MFA, Rochester Institute of Technology—Instructor

Sharon P. Getschmann, BS, Ithaca College, MS, Rochester Institute of Technology—Assistant Professor

Gordon Goodman, BS, State University of New York at Binghamton; MS, Rochester Institute of Technology—Associate Professor

Anne Haake, BS, University of South Carolina; MS, Rochester Institute of Technology; Ph.D., University of South Carolina—Assistant Professor

Bruce H. Hartpence, BS, MS, Rochester Institute of Technology—Assistant Professor

Tona Henderson, BS, Southwest Missouri State University; MS, University of Missouri—Instructor

Lawrence Hill, BS, MS, Rochester Institute of Technology—Assistant Professor

Edward Holden, BA, State University of New York at Oswego; MBA, Rochester Institute of Technology—Assistant Professor

Stephen Jacobs, BA, MA, New School for Social Research—Assistant Professor

Daryl Johnson, BS, St. John Fisher College; MS, Rochester Institute of Technology—Assistant Professor

Jai Kang, MA, Kent State University; MS, Georgia Institute of Technology, Ph.D., State University of New York at Buffalo—Assistant Professor

Stephen Kurtz, BA, University of Miami; MS, Rochester Institute of Technology—Professor

Jeffrey Lasky, BBA, University of New York; MBS, City University of New York; MS, University of Minnesota—Professor; Director, IT Lab

Elizabeth Lane Lawley, AB, MLS, University of Michigan; Ph.D., University of Alabama—Assistant Professor

James Leone, BS, University of Cincinnati; MA, Ph.D., Johns Hopkins University—Associate Professor

Peter Lutz, Ph.D., State University of New York at Buffalo—Professor

Wiley R. McKinzie, BA, University of Wichita, MS, State University of New York at Buffalo—Professor; Dean, College of Applied Science and Technology

William Mark McVea, BS, Rochester Institute of Technology; Ph.D., Purdue University—Assistant Professor

Rayno Niemi, BS, MS, Ph.D., Rensselaer Polytechnic Institute—Interim Associate Dean

Elouise Oyzon, BFA, MFA, Rochester Institute of Technology—Instructor

Sylvia Perez-Hardy, BS, MBA, Cornell University—Assistant Professor
Ronald Perry, B. Tech; MS, Rochester Institute of Technology—Facilities Coordinator; Professor
Andrew Phelps, BFA, Bowling Green University; MS, Rochester Institute of Technology—Instructor
Evelyn P. Rozanski, BS, State University of New York College at Brockport; MS, Syracuse University; Ph.D., State University of New York at Buffalo—Professor
Jeffrey Sonstein, BA, MA, New College of California, San Francisco—Assistant Professor
Elissa Spada, BS, MS, Rochester Institute of Technology—Instructor
William Stratton, BA, Ohio State; MA, Hunter College; MS, Ph.D., State University of New York at Buffalo—Associate Professor
Luther Troell, BS, MA, Texas A&I University; Ph.D., University of Texas-Austin—Associate Professor

Timothy Wells, BS, Eastern Washington State University; MBA, California State, Bakersfield—Associate Professor
Keith Whittington, BS, Rensselaer Polytechnic Institute; MS, Nova Southeastern University—Assistant Professor
Michael A. **Yacci,** BS, Ithaca College; MS, Rochester Institute of Technology; Ph.D., Syracuse University—Professor

Adjunct Faculty—Computer Science and Information Technology

Ralph Longobardi, Ph.D., Syracuse University
Lois Rixner, MS, Rochester Institute of Technology
Daniel Sorrentino, MS, Rochester Institute of Technology

Information Technology

4002-700 Computer Programming & Problem Solving
An introductory course in the use of computers, interactive environments, file systems, editor. Programming in a modern software development environment with a structured programming language such as C, covering: control structures, procedures and functions, recursion, arrays, pointers, file I/O, records. Application areas cover: numerical methods, sorting and searching, graphics, text processing. Programming projects will be required. This is a prerequisite course and cannot be taken for credit toward an MS/IT degree program. Credit 4

4002-703 Algorithms & Data Structures
Topics include data abstraction, data representation, data structures, such as linked lists, trees, stacks, queues, hash tables, sparse matrix techniques, searching and sorting techniques, file structure and maintenance. Programming projects will be required. This is a prerequisite course and cannot be taken for credit toward an MS/IT degree program. Credit 4

4002-709 Fundamentals of Computer Hardware
A study of the concepts of computer hardware design and organization needed for effective computer software design and system implementation. Topics include computer peripherals and interfacing techniques; Boolean algebra; digital logic design; integrated circuit logic families; central processing unit design; microprogramming; buses and addressing; interrupts and direct memory access; hierarchical memories; system performance evaluation; and survey of commercially available computers. (4002-700, 703) **Credit 4**

4002-710 Object Technologies
This is a course in the principles and techniques of designing and implementing software objects. Current software environments are used to explore effective design methods and concepts. Topics include basic object design, class definition and syntax, object-oriented design, software quality and object evaluation. Software design and programming projects are required. (Completion of SDM bridge or permission) **Credit 4**

4002-714 Java for Programmers
An introduction to an object-oriented programming language, such as Java, for the World Wide Web. This course will cover the creation of applet and application programs. Topics include: Internet concepts, basic language concepts (declaring and evaluation data, statements, expressions, control flow, and input), the development environment, essentials of applet programming (URL, audio, image, text, animation), classes and objects, error handling,debugging, threads, and the client/server environment. Programming projects will be required. (4002-210 or 216 or 317) Credit 4

4002-716 C++ Programming Workshop
A workshop in the C++ programming language intended for students to gain programming experience. This course will focus on modern programming concepts such as reusability, data abstraction, information hiding, exception handling and object-oriented design. Programming projects will be required. (4002-710 or permission of instructor) **Credit** 4

4002-717 Information Integration
How information is defined, stored, and distributed determines the organization's effectiveness. This course investigates the modern concepts of information as a strategic asset. This course addresses such questions as: What information currently exits? How is it defined? Who uses the information and for what purpose? How can this information be managed to the organization's and the individual's benefit? This is a prerequisite course and cannot be taken for credit toward an MS/IT degree program.Credit 4

4002-718 Current Themes in IT
This course provides entering graduate students in Information technology with an overview of current theory and issues in the field. Topics covered would include social and cultural impacts of technology virtuality digital communication, and online communities. Using reading from a variety of books and periodicals, students will be presented with views on information technology in a socioeconomic context. (4002-340 and 717) Credit 4

4002-720 Data Object Development
Introduction to analysis and design of data representations and data object implementation. Current software environments are used to explore effective data design implementation concepts. Topics include basic database design. Database transactions, data object design, database quality and error handling. Software design and programming projects required. (Completion of SD&M bridge) **Credit 4**

4002-722 Fundamentals of Instructional Technology
The world of information technology offers the possibility of transforming the way that instruction is designed and delivered. However, few information technology professionals understand the methods and materials of instructional design. As a professional in information technology, a student may be responsible for designing instruction-either in a business or an educational context. This course enables the student to be able to plan, organize, and systematically develop instructional materials. The course uses an Instructional Systems Design (ISD) model to analyze, design, deliver, and evaluate instruction. Credit 4

4002-723 Interactive Courseware
Computer software that teaches is referred to as courseware. This course was designed to help you make the transition from "general" Instructional Design (4002-722/510) into the actual application of these principles in a computer-based environment. Although the basic principles of instructional design hold true in all media environments, using these teaching and learning principles is somewhat different when developing instruction that will be delivered by computer. This course teaches procedures that have already been successful in the design and development of courseware. (4002-722) Credit 4

4002-724 Performance Support System Design
An electronic performance support system (EPSS) is a software technology designed to give each user what he or she needs when he or she needs it. It is designed to enable skilled performance without training. An EPSS can be defined functionally, by what it does. The job of an EPSS is to help a worker perform his or her job better. Typical components of an EPSS encompass tutorials, drills, simulations, and hypertexts, but often include expert systems, help systems, and intelligent job aids. This course examines some of the relevant literature supporting EPSS and provides students with the opportunity to design and develop several different components of a performance support system. (4002-722 and a two-course programming sequence) Credit 4

4002-725 Component Development
A programming course focused on the use, design and implementation of reusable software components. Students create and test components based on Active-X and on Java technology. Issues of reusable design, quality, component libraries, and interoperability are included. Design and programming project is required. (4002-710) Credit 4

4002-727 Digital Audio and Computer Music
Technologies and techniques for producing and manipulating digital audio and computer music are explored. Topics include digital representation of sound, synthesis techniques, digital audio recording and processing, MIDI and real-time performance issues, algorithmic composition, and application of digital audio to multimedia and Web production. Students also are required to pursue a related research topic that could lead to a Masters project or thesis. (4004-730) Class 4, Credit 4

4002-733 Fundamentals of Telecom Technology
The interaction of technology, procedures, and human resources are explored against the backdrop of modern business and society. Fundamentals operating principles, applications, and strategic issues related to data communications transmissions, telecommunications facilities, common carrier offerings, and networking are explored. Credit 4

4002-740 Switching Systems
A course covering the telephone network for information technologists. Topics include: an introduction to the public switched network in North America, digital switch architecture, call and feature processing, signaling and signaling systems, intelligent network architecture, introduction to traffic engineering and queuing theory, network switching methods, routing, congestion and flow control. A switch simulation-programming project in C/C++ is required. (4002-733) Credit 4

4002-745 Transmission Systems
This course focuses on details of transmission in wide area data networks. Included are discussions on analog and digital modulation, signal-to-noise ratios, sampling theory, transmission via copper, microwave, satellite, RF broadcast and fiber optics. Different types of transmission media will be compared with respect to bandwidth, error rates and cost effectiveness. Protocols and systems of interest to this course are SONET, ATM, Frame Relay, virtual circuits, Fast/Gigabit Ethernet and xDSL. (4002-733) Credit 4

4002-750 Distributed Systems
A study of the components necessary for distributed systems to be developed and deployed. Topics include basic models of distributed systems, basic network capability, interprocess communication, distributed objects and remote object invocation, operating system support, name services, and security. (4002-733) Credit 4

4002-810 Simulations & Learning Environments
A learning environment is an electronic environment in which students are provided resources from which to learn. These resources may include tutorials, but are generally far more experiential in nature. A valuable component within a learning environment is an instructional simulation, which provides an opportunity for learners to interact with a safe, virtual world. Kolb's experiential learning theory is a theoretical framework that can be used for designing learning environments. This course provides theoretical background along with hands-on development. (4002-722,216 or equivalent programming experience) Credit 4

4002-815 Introduction to Routing & Switching
This course is a laboratory-based course on the establishment of a data stream across the Internet. The focus is on providing a TCP/IP data stream for higher level services to operate over. It is primarily concerned with the network layer and below. Protocol suites other than TCP/IP may be studied. Students will learn how to connect together computers in a network, and then how to connect the separate networks together to form an internetwork. Bridging and switching concepts are investigated (such as the resolution of bridging loops through the appropriate algorithms). Routed and routing protocols and algorithms are studied and implemented. (4002-342; co-requisite: 4002-815 Lab) Credit 4

4002-816 Introduction to Network Administration
An investigation of key network services. Topics include DHCP, DNS, LDAP, NetBIOS and SNMP. As time allows, other related topics such as finger, ph, and whois will be explored. This course involves significant laboratory work. (4002-342 and 402; co-requisite 4002-816 Lab) Credit 4

4002-819 Integration Technologies
This course is an in-depth study of the major interoperability technologies. Exercises are used to illustrate how modern integration technologies address the economic and technical issues related to the development of integrated systems. Programming projects are required. (Completion of the SD&M software technology cluster) Credit 4

4002-820 Economics of Software Development
This course is an analysis of the factors that determine software cost, quality, and time to delivery. Topics include fundamentals of software development, identification of cost drivers, and analysis of productivity and quality data. Students use models to estimate software cost, delivery time, and operational reliability. (Completion of SDM bridge or permission) Credit 4

4002-821 Database Integration
This is a course in the principles and techniques of integrating components into information applications. Current software environments are used to explore effective principles and techniques. Topics include application specification and design, component integration techniques, application testing and verification. Software design and programming projects using components developed in the software technology cluster are required. Completion of SD&M software technology cluster) Credit 4

4002-822 Introduction to Network Programming
Network Programming is a course in the writing of simple client/server programs, using the TCP/IP network protocol stack. It works through the establishment of simple connectionless communications, through connection-oriented communications, to multi-client connection oriented communications. The objective is to expose the workings of TCP/IP at the transport layer, and provide the student with experience in writing simple network applications. (4002-216 or 218, and 4002-815; co-requisite: 4002-822 Lab) Credit 4

4002-825 Systems Architecture
A programming course focused on the application of interoperability technologies. Students develop integrated systems based on software components, applications, databases, Web sites, heterogeneous operating systems and networks. (4002-819) Credit 4

4002-830 Project Management
This is a course in the methods and techniques of managing a software development project. Topics include defining project goals, work breakdown structure, defining tasks, project plans, estimation and scheduling techniques, work monitoring and measurements. (Completion of SDM bridge) Credit 4

4002-831 Process Management
This is a course in the methods and techniques of managing a software development environment. Topics include development organization structure, team management, staff development, project selection and prioritization, cost/benefit analysis, role of standards, and organization communication. (Completion of SDM bridge) Credit 4

4002-835 Software Testing & Inspection
Topics covered include testing schemes (black-box, white-box), integration schemes, validation testing, graphic analysis. Reliability models (seeding, hazard) are covered. Software maintenance techniques and tools are covered. (4002-820) Credit 4

4002-850 Network Planning & Control
This course will examine the issues related to planning new enterprise wide networks as well as implementing changes to existing networks. Students will learn to design a network based on identified needs and constraints. WAN technologies such as ATM and Frame Relay will be combined with LAN technologies in the design of an enterprise internetwork. (4002-745 and 733) Credit 4

4002-855 Telecom Policy & Standards
This course studies forces on the telecommunications industry from outside. These come from two principal directions public policy and standards organizations. Public policy refers to the regulatory agencies that govern the industry. Both North American and European systems will be covered. Standards bodies and their role in the international standards arena will be discussed. Included will be CCITT, ANSI, ISO and NIST. (4002-733) Credit 4

4002-860 Enabling Technology & Trends in Telecommunications
This course endeavors to predict the effects of future technological innovations. To facilitate this, a number of new and promising technologies in transmission, switching, mass storage, processing and other areas are studied. Included will be study of new software technologies such as systems integration strategies, software reusability and object-oriented design methodologies. (4002-733) Credit 4

4002-871 IT & Organizational Process
If organizations are to remain competitive they will need to reevaluate their basic business processes. The topic of process reengineering has become an intriguing issue as it places information technology solely as a key enabling technology within organizations. Information Technology offers new opportunities to integrate and improve the effectiveness of an organization's internal work process. This course discusses a variety of types of organizations and the ways that technology can be used for strategic advantage.(MSIT core or equivalent background/experience) Credit 4

4002-872 Interenterprise Computing
Managers and technologists both need to be aware of the variety of new means of doing business. Information Technology has made it possible for multiple businesses to work together as an extended enterprise, sharing full access to vital information that enables them to do business more effectively. This course presents an in-depth study of alternative ways for organizations to conduct business electronically. Additionally, business can take advantage of current means of sharing information, via Internet and functioning as extended enterprises, and ways in which they are using Internet for commercial advantage. (MSIT core or equivalent background/experience) Credit 4

4002-873 IT & Strategic Opportunity
Using a variety of futuring techniques and exercises, this course prepares students to identify new strategic opportunities created by advances in information technology. The course looks at service organizations, manufacturing organizations, and also information organizations as described by Drucker. The course attempts to predict trends in technology within these types of environments, by looking for parallels in history, by mapping trends, and by examining the characteristics of new technologies according to their innovative characteristics. (MSIT core or equivalent background/experience) Credit 4

4002-890 Graduate Seminar in Applied Computer Studies
Current topics and advances in applications of computer technology for graduate studies. (Permission of instructor) Credit variable 2-4

4002-892 CSCW & GroupWare
This course will examine the role of information technology in collaborative work settings. An overview of relevant theory, technologies, and standards will provide the context for examining the integration and strategic use of email distributed networking, the WWW, conferencing and enhanced messaging. (4004-745) Credit 4

4002-893 Seminar Thesis & Project Preparation
This course provides a structure, methodology and forum for the development of capstone experience proposal development and committee selection. (Two-thirds of graduate course work, not including prerequisite courses) Credit 2

4002-895 Software Development & Management Capstone
A presentation demonstrating current awareness and understanding of trends impacting the software development and management field. Students prepare a portfolio summarizing their course work in the SD&M program and discuss the relationship of their course work to advances in software development technology and practice. (Enrollment in last quarter of study) Credit 4

4002-897 MS Thesis
Capstone experience for the master of science in information technology program. Student must submit an accepted thesis proposal in order to enroll. Credit 0-8

4002-898 MS Project
Capstone experience for the master of science in information technology. Student must submit an accepted proposal in order to enroll. (Permission of the Graduate Studies Committee) Credit 0-8

4002-999 Graduate Co-op
An optional cooperative educational experience is available for those students who wish to participate in order to gain industrial experience. (Completion of bridge program and five core courses) Credit 0

4004-728 Writing for Interactive Media
As more of our communications are delivered on interactive, non-linear platforms, the information should be developed in ways that take advantage of these technologies. This course will focus on the creation of a variety of different hypermedia/multimedia documents designed, drafted and delivered in hard copy and/or digital form. (4004-742) Credit 4

4004-729 Introduction to VRML
This course will focus on basic and advanced concepts of 3D environment creation and implementation within the virtual reality markup language (VRML) specification implemented on the World Wide Web. Students will work individually and in groups to create VRML environments on their own home pages and in a larger scale group environment. (4004-737 and 746) Credit 4

4004-730 Interactive Media Implementation
Students will build on their understanding of basic media types to develop interactive user interfaces to rich-media content, such as video, audio, graphics, and text. They will learn to control and synchronize multiple media assets in a variety of environments utilizing authoring tools such as Macromedia Director. Students will design and implement applications that support a high level of interactivity and develop strategies for delivering these programs via CD-ROM and the World Wide Web. Programming will be required. (4004-741) Credit 4

4004-737 Web Site Design & Technology
Assuming a basic knowledge of HTML coding and Web page design, this class moves into large-scale site development, and an introduction to advanced Web technologies. Building on the Web page design concepts introduced in 741, this course focuses on site design issues, including scalability, maintenance, and integration of Web technologies into the business or organizational context. Technologies introduced include cascading style sheets, dynamic HTML, basic JavaScript, and streaming media. (4004-741) Credit 4

4004-739 Programming for the World Wide Web
The world wide Web is no longer just linked, static html documents. Web pages can be generated dynamically and can interact with a user to modify pages on-the-fly, validate user inputs and entertain. This course is an overview of several forms of programming that are used in the creation of interactive and dynamic Web content. This course provides a practical overview of programming in the context of the World Wide Web. It will enable students to develop Web pages and Web sites that incorporate both client-side and server-side programming by installing and modifying existing scripts as well as writing new scripts. (4004-737 and a two-course programming sequence) Credit 4

4004-741 Fundamentals of Web-Based Multimedia
This class provides an introduction to Web based multimedia development and implementation. Topics covered include uses of Web-based multimedia in business and historical contexts, differences between Web-based and stand-alone multimedia, basic HTML and Web page design, digital image creation and manipulation, and the incorporation of audio, video, and animated components in Web-based multimedia students will learn to use computer-mediated communication and internet utilities in support of multimedia development. (Computer literacy) Credit 4

4004-742 Interactive Multimedia Development
The development of interactive multimedia requires principles garnered from a variety of disciplines. Through readings, critiques, exercises and discussions, students will explore what makes an interactive multimedia application (or component of an application) successful and what types of applications are best suited to interactive multimedia. This course provides an introduction to the design of interactive multimedia drawing upon user interface design, task analysis, analysis of audience characteristics, and usability testing as well as design and editing principles from animation and video production. Using the hardware and software tools learned in the Fundamentals course, students will implement and test designs as individual components and as integrated elements of interactive multimedia for interactive and instructional applications. (4004-741 and 745) Credit 4

4004-743 Interactive Multimedia Project
The project course is a capstone experience. Having achieved some proficiency with the tools and concepts of interactive multimedia, students are expected to produce a significant work that can be used as a portfolio piece. Examples of interactive multimedia are examined and discussed. As CD-ROM is increasingly the medium of choice for distribution of interactive multimedia, design constraints for using read-only media are discussed. Techniques and principles for managing larger and more complex projects involving teams are examined. (4004-746) Credit 4

4004-745 Theories of Interactive Computing
This course is a selected survey of a variety of theories from several disciplines such as cognitive psychology, human factors, computer-human interaction and instructional design that are relevant to the design of interactive multimedia. By examining the process of communication between people and between people and machines, we can learn to design interactions that optimize the communication process and lower the demands on the communicators. These interactions are therefore more effective, less prone to error and more efficient. Credit 4

4004-746 Programming for Interactive Multimedia
The goal of this course is to advance the student's programming skills for implementing multimedia. This course will include programming the computer to control graphics, text, audio and video images as well as implement navigational strategies, indexing of information, import and export of data. The course will look at both event-driven and time-driven models of interaction. Upon completion of the course, students will achieve an understanding of basic programming concepts such as control structures, variables and procedures as well as design strategies such defining requirements, top-down and bottom-up design using applicable software engineering principles and iterative design involving users. Learning will be project-based and, whenever possible, directly related to ongoing projects. (4004-730) Credit 4

4004-747 Topics in Interactive Multimedia
Interactive multimedia is a rapidly evolving field that is significantly influenced by changes in theory, storage media, computing hardware, authoring/presentation software and communication capabilities such as local and wide-area networks. In this course, students will be exposed to recent trends by hands-on development of interactive media projects. These will include development of interactive multimedia for use on multiple platforms, developing multimedia that can be accessed via the Internet, real-time interaction between users using networked multimedia and development of interactive CD-ROM-based multimedia. (4004-746) **Credit** 4

4004-748 Advanced Concepts in Computer Interface Design
This course incorporates the theories and practices of HCI (human computer interaction) and applies them to computer interface design. Designing for usability, human performance and evaluation form the basis for this course. Traditional and emerging methodologies, tool and metrics will be explored within the context of an iterative, user centered design philosophy. (4004-745) **Credit** 4

4004-751 Web-Database Integration
An introduction to technologies, techniques, and contexts for developing dynamic Web sites that are driven by back-end databases. Builds on concepts of Web programming and multi-user relational databases introduced in prerequisite classes. (4004-739 and 4002-485) Credit 4

Computer Science

4003-704 Computer Organization
A continuation of 4003-708, Introduction to Digital Design. Topics include instruction fetching, decoding and execution, CPU specification through a descriptive language, bus structures, microprogramming, interrupts, architectural differences, the assembly process, addressing, storage allocation, subroutines, parameter passing, looping, address modification, floating point representation, and simple I/O. Programming projects will be required. Alternative RIT offering: 4003-352, MCC: CSC-102, St. John Fisher: CSC-241, Nazareth College: CIS-243. (Introductory Programming, 4003-708) Class **3,** Credit **3**

4003-705 Discrete Mathematics
The fundamental concepts of discrete mathematics which are necessary for understanding further mathematical foundations of computer science. Topics include: structures defined on finite sets, elementary symbolic logic, patterns of mathematical proof, vectors and matrices, graphs, combinatorics, formal languages, abstract mathematical systems. The relevance of the chosen topics to computer science and the applications of computers to these topics will be stressed. (College algebra, computer literacy) Class **4,** Credit **4**

4003-707 Advanced Programming
An introductory course in the life-cycle issues of large and single/multi-programmer programs. Structured and modular programming, data abstraction and information hiding. Specific focus on modern programming practices (specification, design and prototyping, coding and verification, integration and maintenance) and tools (software engineering environments such as Unix and software engineering with languages such as C++). Programming projects will be required. (Algorithms & Data Structures) Class **4,** Credit **4**

4003-708 Introduction to Digital Design
An introduction to computer architecture and implementation. Topics include number systems, boolean algebra, combinatorial and sequential circuit design, flip-flops and adders, and storage mechanisms and their organization. Laboratory experiments introduce elementary integrated circuit building blocks including gates, flip-flops, counters, and elementary sequential circuits. Alternative RIT offering: 4003-351 MCC: CSC-106 U of R: CSC-250 or CSC-450 **Class 3, Credit 3**

4003-709 Programming Language Concepts
A study of the syntax and semantics of a diverse set of high-level programming languages. The languages chosen are compared and contrasted in order to demonstrate general principles of programming language design. The course emphasizes the concepts underpinning modern languages rather than the mastery of particular language details. Programming projects will be required. Alternative RIT offering: 4003-450 (4003-704, Algorithms and Data Structures, 4003-705 or 1016-265) Class 4, Credit 4

4003-713 Operating Systems
A general survey of operating system concepts. Topics include process synchronization, interprocess communication, deadlock, multiprogramming and multiprocessing, processor scheduling and resource management, memory management, overlays, static and dynamic relocation, virtual memory, file systems, logical and physical I/O, device allocation, I/O processor scheduling, process and resource protection. Programming projects will be required. Alternative RIT offering: 4003-440; MCC: CSC-212 (4003-704, 707) Class 4, Credit 4

4005-700 Foundations of Computer Theory
Introduction to the classical and contemporary theory of computation covering regular, context-free, and computable (recursive) languages with finite state machines, pushdown automata, and Turing machines. Basic concepts of computability theory. (Algorithms & Data Structures and 4003-705) Class 4, Credit 4

4005-704 Complexity and Computability
This course provides an introduction to complexity theory and computability theory. It starts with an overview of basic complexity classes, with special focus on NP-theory. This is followed by a study of problems complete for NP and PSPACE, the Church-Turing thesis, and undecidability of a selection of classical problems. Some advanced topics in computability, like degrees of unsolvability, the recursion theorem, or Godel's incompleteness theorem will be discussed. (4005-700) Class 4, Credit 4

4005-705 Cryptography
The course is devoted to the review of basic cryptographic algorithms, their implementations and usage. Classical encryption techniques and those of Rivest-Shamir-Adleman and E.L. Gamal will be seen in depth, and an overview of several others will be presented. The course also presents authentication schemes and interactive proof protocols. Students will write a term paper, either theoretical based on literature or reporting a student's own implementation or experiments with a chosen cryptographic scheme. Depending on the size of the group, some or all students will give a presentation to the class. (Algorithms & Data Structures and 4003-705) Class 4, Credit 4

4005-709 Topics in Computer Science Theory
Current topics in the field. The format of this course is a combination lecture and seminar. Students may register for this course more than once. Topics covered in the past include: arithmetic algorithms; data encryption; the Fast Fourier Transform; combinatorial optimization; logic. Programming projects may be required. (Set by instructor) Class, Credit variable, 1-4

4005-710 Programming Language Theory
An introduction to the basic concepts of programming language design. It begins with a survey of the issues that are involved in the design and implementation of languages. Specific tools for the description of syntactic and semantic structure are introduced. The balance of the course is an analysis of programming language structure, using these descriptive tools to give precise form to the discussion. Programming assignments will be required. (4003-705, 709) Class4, Credit 4

4005-711 Compiler Construction
The structure of language translators, lexical and syntactic analysis, storage allocation and management, code generation, optimization, error recovery. Programming projects will be required. (4005-700, 710) Class 4, Credit 4

4005-719 Topics in Programming Languages
Current topics in the field. The format of this course is a combination lecture and seminar. Students may register for this course more than once. Topics covered in the past include: logic programming; data flow, functional or applicative, and object-oriented languages; programming language semantics; formal verification. Programming projects will be required. (Completion of the Bridge program; permission of instructor) Class, Credit variable, 1-4

4005-720 Computer Architecture
Review of commercially available computer systems, including classical CPU and control unit design, register organization, primary memory organization and access, internal and external bus structures, and virtual memory schemes. Alternatives to classical machine architecture, such as the stack machine and the associative processor, are defined and compared. Parallel processors and distributed systems are also presented, along with an analysis of their performance relative to nonparallel machines. Programming projects are required. (4003-708, 704,707,713) Class 4, Credit 4

4005-729 Topics in Computer Architecture
Current topics in the field. The format of this course is a combination lecture and seminar. Students may register for this course more than once. Programming projects will be required. (Permission of the instructor; completion of Bridge program) Class, Credit variable, 1-4

4005-730 Distributed Operating Systems I
An introduction to the study of the hardware and software issues affecting the design of a distributed operating system. This course begins with an overview of processor networks and network protocols. It continues with the discussion of the issues that must be addressed in the design of a distributed operating system. The remainder of the course focuses on protocols and algorithms for handling process communication, synchronization, and coordination. (4003-709,713) Class 4, Credit 4

4005-731 Distributed Operating Systems II
This course addresses the practical issues involved in the design of a distributed operating system. The following topics are discussed: implementations of the process environment, processor scheduling, file systems, and the management of distributed memory. Examples of specific implementations will be discussed. Other topics (e.g., security) may be covered, at the discretion of the instructor. A group or individual project, involving the design and implementation of one or more components of a distributed operating system, will be a major component of this course. (4005-730) Class 4, Credit 4

4005-735 Parallel Computing I
A study of the hardware and software issues in parallel computing. Topics include an introduction to the basic concepts, parallel architectures and network topologies, parallel algorithms, parallel metrics, parallel languages, network topology, granularity, applications, parallel programming design and debugging. Programming projects will be required. (4003-709,713) Class 4, Credit 4

4005-736 Parallel Computing II
A study of selected topics in parallel algorithm design through the analysis of algorithms used in various areas of application. The course will investigate the interplay between architecture and algorithmic structure and will discuss the effect that these issues have on the complexity and efficiency of parallel algorithms. Programming projects are required. (4005-735; Parallel Computing I) Class 4, Credit 4

4005-739 Topics in Operating Systems
Current topics in the field. The format of this course is a combination lecture and seminar. Students may register for this course more than once. Topics covered in the past include: Unix internals; concurrency methods; Petri Nets; parallel programming and algorithms; security; operating systems performance; software environments; communicating sequential processes (CSP). Programming projects will be required. (Permission of the instructor; completion of Bridge program) Class, Credit variable, 1-4

4005-740 Data Communication & Networks I
This course is an introduction to the concepts and principles of computer networks. Students will design and implement projects using application protocols and will study transport, network, and data link protocols and algorithms. The course also includes an introduction to local area networks, data transmission fundamentals, and network security. Programming projects will be required. (Probability, 4003-707) Class 4, Credit 4

4005-741 Data Communication & Networks II
This course continues the study of computer networks begun in 4005-740, Data Communication & Networks I, emphasizing design principles and theoretical aspects of networks. Topics include the nature of communications media and signaling methods; analog and digital transmission; data link protocols; protocol proof techniques; routing, broadcasting, and multicasting; connection, disconnection, and crash recovery protocols; internetworking and security; network analysis and design using graph theory and queuing theory. (4005-713,740) Class 4, Credit 4

4005-749 Topics in Data Communications
Current topics in the field. The format of this course is a combination lecture and seminar. Students may register for this course more than once. Topics covered in the past include: network reliability, special-purpose protocols; error-correcting codes. Programming projects will be required. (Permission of the instructor; completion of Bridge program) Class, Credit variable, 1-4

4005-750 Introduction to Artificial Intelligence
An introduction to the field of artificial intelligence, including both theory and applications. A programming language that allows effective symbolic manipulation (PROLOG) is used to demonstrate the capability and limitations of the materials presented in class. Topics include search strategies and their implementation; logic; networks; frames and scripts; productions; symbolic manipulation and list processing; problem-solving methods; expert systems; natural language understanding; and selections from vision, robotics, planning and learning. Programming assignments are an integral part of the course. (4003-709) Class 4, Credit 4

4005-751 Knowledge-Based Systems
An introduction to the issues and techniques of building knowledge-based systems. Topics will include a survey of existing expert system architectures and implementations, knowledge representation techniques, expert system building tools, and knowledge acquisition. In addition to examining existing expert systems, students will implement expert systems. Programming projects will be required. (4005-750) Class 4, Credit 4

4005-755 Neural Networks & Machine Learning
Neural networks, systems with massively connected parallel primitive computing elements, are, metaphorically, computers structured after natural brains. Such systems promise much better performance than classical computers at pattern recognition and related areas. In this seminar, we will present several neural network models, introduce the current research activity, and develop some underlying mathematics. Students will have the opportunity to develop and present models, both paper and software simulated, and to utilize canned simulators. Students will be exposed to the current research literature. Programming projects will be required. (4005-700,710) Class 4, Credit 4

4005-756 Genetic Algorithms
Genetic algorithms provide a powerful approach for searching large, ill-behaved problem spaces. In this course, we will study the theoretical foundations of genetic algorithms as well as their application to a variety of search and optimization problems. The course will cover topics from the current research literature, and students will be expected to do a library research review and perform an experimental project. Programming projects will be required. (4005-700, 710) Class 4, Credit 4

4005-757 Introduction to Computer Vision
An introduction to the underlying concepts of computer vision and image understanding. The course will consider fundamental topics, including image formation, edge detection, texture analysis, color, segmentation, shape analysis, detection of objects in images and high level image representation. Depending on the interest of the class more advanced topics will be covered, such as, image database retrieval or robotic vision. Programming assignments are an integral part of the course. Class 4, Credit 4

4005-759 Topics in Artificial Intelligence
Current topics in the field. The format of this course is a combination lecture and seminar. Students may register for this course more than once. Topics covered in the past include: logic programming; natural language processing; pattern recognition; specialized AI languages and programming paradigms; robotics. Programming projects will be required. (Permission of the instructor; completion of Bridge program) Class, Credit variable, 1-4

4005-761 **Computer Graphics I**
A study of the hardware and software principles of computer graphics. Topics include an introduction to the basic concepts: 2-D transformations, viewing transformations, display file structure, geometric models, picture structure, interactive and noninteractive techniques, raster graphics fundamentals, 3-D fundamentals, graphics packages, and graphics systems. Students use and develop a graphics software system based on an accepted graphics standard. Programming projects are required. (4003-707,233) Class 4, Credit 4

4005-769 **Computer Graphics II**
This project-oriented course builds on topics developed in 4005-761. Expanded topics include standard graphics software, animation techniques, 3-D modeling methods, hidden surface and line algorithms, shading, antialiasing, color models, and design of the user interface. Students will be required to design and implement an interactive system for an application that incorporates several of the above areas. Programming projects will be required. (4005-761 or permission of the instructor) Class 4, Credit 4

4005-771 Database Systems
Broad introduction to database management systems (DBMS) and the design, implementation, and applications of databases. Topics include an overview of DBMS architectures; concepts and implementations of the relational model; SQL; database design and modeling techniques; and issues such as recovery, concurrency, physical implementation concerns and performance and management aspects. Optional topics include alternative approaches to designing database systems (for example, object-oriented or extended relational systems); distributed databases; databased machines; and database interfaces and languages. A database programming project is required. (Algorithms & Data Structures) **Class 4, Credit 4**

4005-772 **Database System Implementation**
An examination of the technical issues related to the implementation of shared access databases. Topics include concurrency control, transaction processing, reliability and recovery. Extensions to the distributed processing environment also are covered. Programming projects will be required. (4005-771) **Class 4, Credit 4**

4005-800 **Theory of Computer Algorithms**
A study of techniques to design and analyze the complexity of algorithms. The course will make students aware of a large number of classical algorithms and their complexity and will introduce the area of NP-completeness. Programming projects will be required. (Algorithms & Data Structures and 4003-705) **Class** 4, **Credit 4**

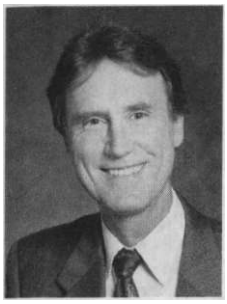
4005-890 **MS Thesis**
Capstone of the master's degree program. Student must submit an acceptable thesis proposal in order to enroll. (Permission of the Graduate Studies Committee) **Credit variable 1-9**

4005-891 **MS Project**
Alternative capstone of the master's degree program. Student must submit an acceptable project proposal in order to enroll. (Permission of the Graduate Studies Committee) **Credit variable 1-5**

4005-899 **Seminar**
Current advances in computer science. Previous topics have included: data encryption, arithmetic algorithms, natural language processing, robotics, computer animation, speech processing, syntactic pattern recognition. (Permission of the instructor) **Credit variable 1-4**

4005-999 **Graduate Co-op Education**
Six months of full-time, paid employment in the computing field. See the CS graduate program coordinator or RIT's Office of Cooperative Education for further details. (Good standing; completion of Bridge and 16 graduate credits) Credit 0

Kate Gleason College of Engineering



Harvey J. Palmer, Dean

The Kate Gleason College of Engineering offers comprehensive, innovative graduate programs in a range of engineering disciplines. Programs include the traditional master of science degree and the master of engineering degree as well as two interdisciplinary degrees with the College of Business and the College of Science.

The **master of science** degree leads to employment in engineering in an industrial environment or to further graduate study at the doctoral level. The master of engineering degree is primarily a terminal master's program leading to industrial employment. An industrial internship or an engineering case study replaces a traditional thesis.

Classes are flexible, with day, late afternoon and evening classes designed to meet the needs of both working professionals and full-time students.

Details of specific programs, including courses, research activities, thesis requirements and assistantships, follow. For information about the **master of science degree in materials science and engineering,** offered jointly with the College of Science, see page 111. For details about the **master of science degree in manufacturing management and leadership,** offered jointly with the College of Business, see page 44.

Study Options

Part-time study

The College of Engineering encourages practicing engineers in the greater Rochester industrial community to pursue a program of study leading to the master of science or master of engineering degree without interrupting their work at their place of employment. Consequently, many of the courses in the graduate programs in engineering are normally scheduled in the late afternoons or early evenings.

Students employed full time in industry are limited to a maximum of two courses or eight credits each quarter. A student who wishes to register for more

PROGRAMS

MASTER OF SCIENCE DEGREES IN:

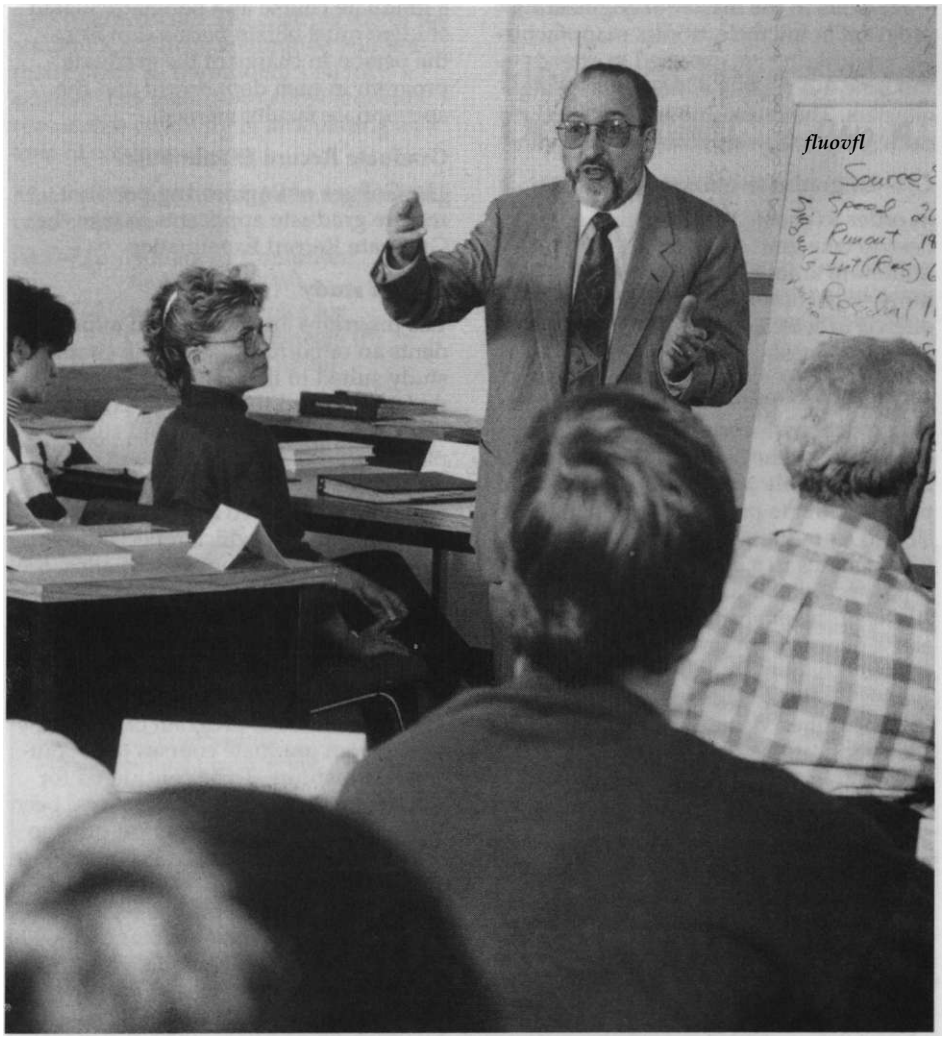
Applied Statistics
Computer Engineering
Electrical Engineering
Industrial Engineering
Manufacturing Management and Leadership (offered with the College of Business)
Materials Science and Engineering (offered with the College of Science)
Mechanical Engineering
Microelectronics
Manufacturing Engineering
Product Development

MASTER OF ENGINEERING DEGREES IN:

Engineering Management
Industrial Engineering
Manufacturing Engineering
Mechanical Engineering
Microelectronics
Manufacturing Engineering
Systems Engineering

ADVANCED CERTIFICATE AVAILABLE IN:

Statistical Quality



The Center for Quality and Applied Statistics, which offers a graduate degree in applied statistics and extensive non-credit seminars, is an integral part of the College of Engineering.

than eight credits while employed in full-time industry must obtain the permission of his or her adviser and the approval of the department head.

It is possible for a student to obtain the MS or ME degree in two academic years (or six academic quarters) by taking courses in late afternoons or early evenings only.

A student in the master of engineering degree program may earn academic credits for industrial experience that will be treated as internship experience while the student is enrolled in the program.

Full-time study

Even though graduate programs in engineering serve the needs of a large number of practicing engineers who wish to pursue a part-time program, the different programs also enroll full-time graduate students. A full-time student may take up to 18 credits per quarter.

A full-time student in the master of engineering degree program may choose to alternate academic quarters with his or her internship. A full-time student can normally complete the degree requirements in one calendar year.

Students in the master of engineering program in microelectronics manufacturing engineering are expected to attend full time during fall, winter and spring quarters. The internship is completed during the following summer and fall.

Off-site graduate courses

In order to enable the practicing engineer to take graduate courses with the minimum amount of inconvenience, a number of courses for RIT credit are offered in selected industrial locations at their request.

Admission requirements

Any student who wishes to become a candidate for the master's degree must first be formally admitted to the appropriate graduate program. Formal admission to a graduate program gives matriculated status to a student.

An applicant is admitted as a graduate student if he or she has received a bachelor's degree in engineering or a closely related school from an approved undergraduate school, and if an examination of the required documents indicates the qualifications to undertake a graduate program.

Graduate applicants who do not fully satisfy all admission criteria (such as appropriate baccalaureate degree, grades and other credentials) may be considered for admission with the condition that they will be required to take the appropriate bridge courses to make up their deficiencies. Such courses will not normally count toward the graduate credits required for the master's degree.

All applicants who are admitted prior to the conclusion of their baccalaureate program are required to submit their final transcript by the end of the first quarter of graduate work.

To be considered for admission it is necessary to file an Application for Admission to Graduate Study accompanied by the appropriate transcripts of previous undergraduate and graduate study, and two letters of recommendation.

Nonmatriculated status

An applicant is permitted to take graduate courses as a nonmatriculated student if he or she has a bachelor's degree from an approved undergraduate school and the necessary background for the specific courses in which he or she wishes to enroll. The courses taken for credit can usually be applied toward the master's degree when the student is formally admitted to the graduate program at a later date. However, the number of credits that will be transferred to the degree program from courses taken at RIT as a nonmatriculated student is normally limited to a maximum of 12 credits.

An applicant who wishes to enroll in a graduate course as a nonmatriculated student must obtain permission from the person in charge of the graduate program in each department and the appropriate faculty member.

Graduate Record Examination

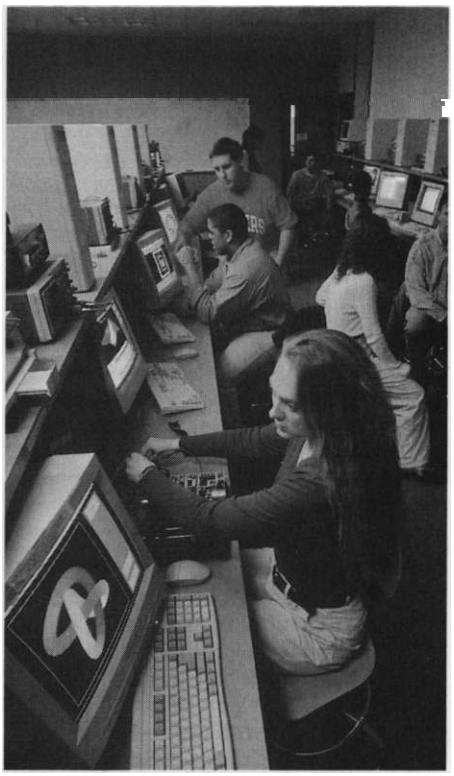
The College of Engineering does not require graduate applicants to take the Graduate Record Examination.

Plan of study

The programs are flexible and afford students an opportunity to plan a course of study suited to their own interests and directed toward their own objectives. Each graduate student should submit a plan of study to the department office within the first year after admission as a graduate student. To assure a coherent program and one which reflects the student's maturing capacities and aims, the plan may be revised on request.

Transfer credits

A maximum of nine quarter credits in a 45 credit hour program or 12 quarter credits in a 48 credit hour program can be transferred from graduate courses taken outside the Institute. To be considered for transfer credit, the course must have been taken within a five-year period prior to the date of the student's initial entry into a graduate program in engineering at RIT as a nonmatriculated or regular student. Courses taken at another institution after the student's initial entry into a graduate engineering program at RIT are also eligible for transfer credit. However, to ensure transferability, prior approval should be obtained. The student should contact the individual department office about the procedure for obtaining transfer credits.



Advanced computing facilities support graduate research and projects.

Faculty adviser

A member of the graduate faculty is appointed as a faculty adviser for each graduate student. The faculty adviser supervises the progress of the student towards the master's degree. For the master of engineering student, a second adviser (for the internship) will be assigned at the time that an internship proposal is submitted. This adviser will monitor and evaluate the student's internship experience (in cooperation with the student's industrial supervisor) and recommend to the department head the number of academic credits to be awarded for the experience. Nonmatriculated students should direct their questions to either the department head or the chairperson of the department's Graduate Committee.

Grade requirements

The average of the grades for all courses taken at the Institute and credited toward the master's degree must be at least a "B" (3.0). Transfer credits from other institutions and internship credits are not included in the computation of the cumulative grade point average. The policy on probation and suspension is explained in the section "Steps Toward Degree" in this bulletin. The student must pay careful attention to that policy.

If a student fails any required examination, the student's adviser may recommend to the dean that the student's performance be reviewed and appropriate action taken.

Thesis

For the MS student the thesis requirements vary among the different departments. The requirements of an individual department are stated in the sections describing each department's programs.

The thesis must comply with the following regulation:

Three copies of the thesis must be submitted to the departmental office before the certification date of the quarter in question. These copies are for transmittal to the Institute library, the departmental office and the student's thesis adviser. For detailed instructions about the organization of the thesis, the student should consult the brochure "Thesis Format," available at the departmental office.

Internship

For the ME student, an industrial internship of duration equivalent of up to two academic quarters in a full-time engineering position is an integral part of the program. A minimum of four and a maximum of 16 credits may be earned through the student's internship experience. The internship is selected to reflect each student's primary professional interest and is integrated with his or her curriculum.

In a limited number of cases, where a regular internship is not practical due to extraordinary circumstances, case studies may be substituted for internship. Such a substitution has to have the prior approval of the department head.

Maximum limit on time

The required credits for the master's degree must be completed within seven years after the student's initial registration in graduate courses at the Institute as a regular or nonmatriculated student.

Courses of instruction

Information about the courses that will be offered in a particular quarter will be available from the department office prior to registration. The Institute reserves the right to withdraw any course for which enrollment is insufficient, or to make any changes in the schedule of courses if necessary.

Financial aid

A limited number of teaching assistantships, research assistantships and tuition scholarships are available for graduate students. Detailed information is available from the appropriate department head.

Computer Engineering Department

Andreas Savakis, *Department Head*

The College of Engineering offers a master of science degree in computer engineering intended to build upon a bachelor of science degree in computer engineering. It is expected to accommodate recipients of BS degrees in electrical engineering or computer science after some additional course work. The degree requires 45 quarter credits starting at the five-course core curriculum. The requirements also include an area of concentration, graduate electives subject to faculty adviser's approval and nine quarter credits of master's thesis. Both the area of concentration and the thesis project must be approved by a student's graduate committee consisting of at least three faculty members, the majority of whom are computer engineering faculty. This allows a student to pursue an area of specialization in the field of computer engineering by completing a cohesive set of two courses apart from the background core requirements. The chairperson of the student's graduate committee will normally serve as the student's faculty adviser. The intent is to allow students reasonable creativity in articulating an area of concentration.

Master's degree in computer engineering core courses:

0306-722	Advanced Computer Architecture (W)
0306-740	Analytical Topics for Computer Engineers (F)
0306-759	Principles of Digital Interfacing (F)
0306-756	Multiple Processor Systems (S)
0603-709	Programming Language Survey (F, W, S)

The graduate curriculum will require the following courses above a BS degree in computer engineering:

5 courses in core (20 quarter credits)
2 courses in graduate electives (8 quarter credits)
2 courses in concentration (8 quarter credits)
9 credits in master's thesis project
45 quarter credits total

The area of concentration builds some expertise in preparation for conducting a successful graduate thesis project in an area within the discipline of computer engineering. The student may choose graduate electives subject to the approval of his or her faculty adviser. The total of all graduate courses transferred from other appropriate institutions of higher learning may not exceed nine quarter credits and the total of 600-level courses applicable to the program will not exceed eight quarter credits. No graduate credit will be considered for courses below the 600 level. The usual RIT graduate school requirements will apply, such as a grade of B or better for all transfer courses as well as the maintenance of a grade point average of 3.0 or better.

Electrical Engineering Department

S. Madhu, *Interim Department Head*

Admission requirements

Admission into graduate studies leading to the MS degree in electrical engineering requires a BSEE degree from an accredited program.

An applicant with a strong undergraduate record and a bachelor of science degree in another branch of engineering (mechanical, chemical, industrial, etc.) also will be considered for admission.

For information

For specific questions on the individual department programs contact:

Computer Engineering	475-2768	(Savakis)
Electrical Engineering	475-2165	(Madhu)
Industrial and Manufacturing Engineering	475-7142	(Mozrall)
Mechanical Engineering	475-5788	(Haines)
Microelectronic Engineering	475-6065	(Kurinec)
Applied Statistics	475-6990	(Voelkel)
Product Development	475-7102	(Smith)

Questions on course schedules and registration:

Computer Engineering	475-2768
Electrical Engineering	475-2164
Industrial and Manufacturing Engineering	475-7142
Mechanical Engineering	475-5788
Microelectronic Engineering	475-6065
Applied Statistics	475-2033
Product Development	475-7102

In this case the student must complete a certain number of undergraduate courses in order to bridge over to electrical engineering. Additional information is available from the department.

Focus areas

Within electrical engineering, a student can specialize in one of five separate areas for the MS degree: *control systems, communications, digital systems, integrated electronics, and signal and image processing.*

The boundaries between some of the areas are not as sharp as they were in the past, and students are urged to discuss the significance of their choices with graduate advisers in the department.

Plan of study

At the beginning of the program, every matriculated student must arrange to prepare a plan of study in consultation with his or her adviser.

Policies

The following general rules apply to all students:

- All students seeking the MSEE degree must satisfactorily complete the two core courses, 0301-701, Signals and Systems, and 0301-703, Matrix Methods in Electrical Engineering. Students are expected to take these courses immediately after entering the program, since they are prerequisites for many of the other graduate courses.
- Those students who have selected focus areas in control systems, communications, or signal and image processing must also take 0301-702, Random Signals and Noise. Students who want to develop minors in the above areas are also encouraged to take Random Signals and Noise.
- Each student must take at least four courses from the EE department in the chosen focus area.
- Each student may take three courses from a related area within the EE department.
- All course selections must be approved by one of the graduate advisers. All courses must be at 700-level or above with one exception: a student is allowed to take a maximum of two 600-level courses for full credit in the graduate program.
- All students must satisfy a research component through one of the following activities:

1. Graduate thesis (6-12 credit hours)

The inclusion of a thesis (0301-890) as a formal part of the MS degree program in electrical engineering is optional but strongly encouraged. Students who decide to write a thesis can earn a minimum of six credits and a maximum of 12 credits toward their degrees from the thesis, nine being the most common number of credits earned. Typically, students take nine approved courses for 36 credits to meet the course requirements.

Thesis work is done under the supervision of a faculty adviser and presented and defended before a thesis committee when complete. Thesis may be done in absentia.

2. Graduate research paper (5-12 credit hours)

A student may choose to write a "graduate paper" in lieu of a thesis. The graduate paper is an extensive term paper on a topic of professional interest. The objective of the graduate paper is to enable the student to undertake an independent and in-depth literature search and write a report summarizing the

Scheduled Course Offerings for 2001–2002

Focus Area	Fall 20011	Winter 20012	Spring 20013
Communications	701 Signals & Systems 702 Random Signals & Noise 794 Information Theory	703 Matrix Methods in EE 763 Stochastic Est. & Control	793 Error Correction & Detection
Control Systems	701 Signals & Systems 702 Random Signals & Noise 715 Machine Vision	703 Matrix Methods in EE 761 Modern Control Theory 763 Stochastic Est. & Control	765 Optimal Control 764 Digital Control System Design
Signal & Image Processing	701 Signals & Systems 702 Random Signals & Noise 715 Machine Vision	703 Matrix Methods in EE 761 Modern Control Theory 763 Stochastic Est. & Control 770 Pattern Recognition	779 Digital Image Processing
Integrated Electronics	701 Signals & Systems 711 Physics of Bipolar Devices 727 VLSI Design	703 Matrix Methods in EE 712 Physics & Scaling of CMOS Devices 726 Analog IC Circuits	713 Solid State Physics 730 Advanced Analog IC Design
Digital Systems	701 Signals & Systems 741 Design for Testability	703 Matrix Methods in EE 726 Analog IC Circuits 731 Design of High Performance Digital Systems	727 VLSI Design 732 Digital System Design with VHDL

Scheduled Course Offerings for 2002–2003

Focus Area	Fall 20021	Winter 20022	Spring 20023
Communications	701 Signals & Systems 702 Random Signals & Noise 794 Information Theory	703 Matrix Methods in EE 762 Nonlinear Control	793 Error Correction & Detection
Control Systems	701 Signals & Systems 702 Random Signals & 715 Machine Vision	703 Matrix Methods in EE 761 Modern Control Theory Noise 762 Nonlinear Control	765 Optimal Control 764 Digital Control System Design
Signal & Image Processing	701 Signals & Systems 702 Random Signals & Noise 715 Machine Vision	703 Matrix Methods in EE 761 Modern Control Theory 763 Nonlinear Control	779 Adaptive Signal Process.
Integrated Electronics	701 Signals & Systems 711 Physics of Bipolar Devices 730 VLSI Design	703 Matrix Methods in EE 712 Physics & Scaling of CMOS Devices 726 Analog IC Circuits	713 Solid State Physics 730 Adv. Analogic Design
Digital Systems	701 Signals & Systems 741 Design for Testability 727 VLSI Design 742 Adv. Microprocessor Software	703 Matrix Methods in EE 726 Analog IC Circuits 731 Design of High Performance Digital Systems	727 VLSI Design 732 Digital System Design with VHDL

Please note that these course offerings are subject to adequate enrollment.

findings. A faculty member interested in the paper's topic will serve as the student's supervisor and direct the scope and depth of the paper as well as the format of the final written version. The student must first consult a faculty member about a suitable topic for the paper and obtain consent. The course 0301-800, Graduate Paper, is used to register for the paper. *The student should plan to take at least five credit hours in 0301-800. The student choosing this option also is required to take a minimum of 10 courses for 40 credits.*

3. Comprehensive examination
   In this option, a student completes a total of 12 courses and passes a comprehensive exam given once every year.

- All graduate work must be completed within a seven-year period starting from the first course applied toward the MSEE degree. Also, a student who is pursuing thesis/project options may be required to register for continuation of thesis/project credits if he or she is not enrolled for any credits in a given quarter. For complete details, please consult the continuation of thesis/project/dissertation policies on page 10.

Transfer credits

A maximum of nine credit hours can be earned from courses available from other departments within RIT with the prior approval of the faculty/department adviser. For students transferring credits from other universities (limited to a maximum of nine hours), the total number of credits transferred from all sources outside the electrical engineering department cannot exceed nine.

Under some extraordinary circumstances, a resident full-time student may appeal the EE department and the Graduate Council for additional transfer credits.

Those electrical engineering students who have an interest in computer science as a minor area are encouraged to pay special attention to certain specific policies. The bridge courses 0602-701, 702, 703, 704 and 705 will be treated as advanced undergraduate courses; therefore, the total number of credit hours generated from these cannot exceed eight. Also, electrical engineers with interest in computer science are encouraged to complete certain sequences of appropriate courses (within the limits of allowable transfer credits) rather than take one or two courses at random. Please consult the department for more details.

Graduate student advising

All new students will be assigned a graduate adviser. The student generates a plan of study in consultation with his or her faculty adviser. That faculty member will continue to be the student's adviser until a research topic has been chosen. From that time, the thesis/paper adviser assumes the role of academic adviser as well.

Graduation requirements

The master of science degree in electrical engineering is awarded upon the successful completion of an approved graduate program consisting of a minimum of 45 credit hours. Those who choose the comprehensive examination option must complete 48 credit hours of course work. Under certain circumstances a student chooses or is required to complete more than the minimum number of credits.

Schedule of graduate courses, 700- and 800-level courses

EVERY FALL QUARTER

0301-701 Signals & Systems
0301-702 Random Signals & Noise
0301-794 Information Theory
0301-741 Design for Testability
0301-715 Machine Vision
0301-711 Physics of Bipolar Devices
0306-730 VLSI Design or equivalent

EVERY WINTER QUARTER

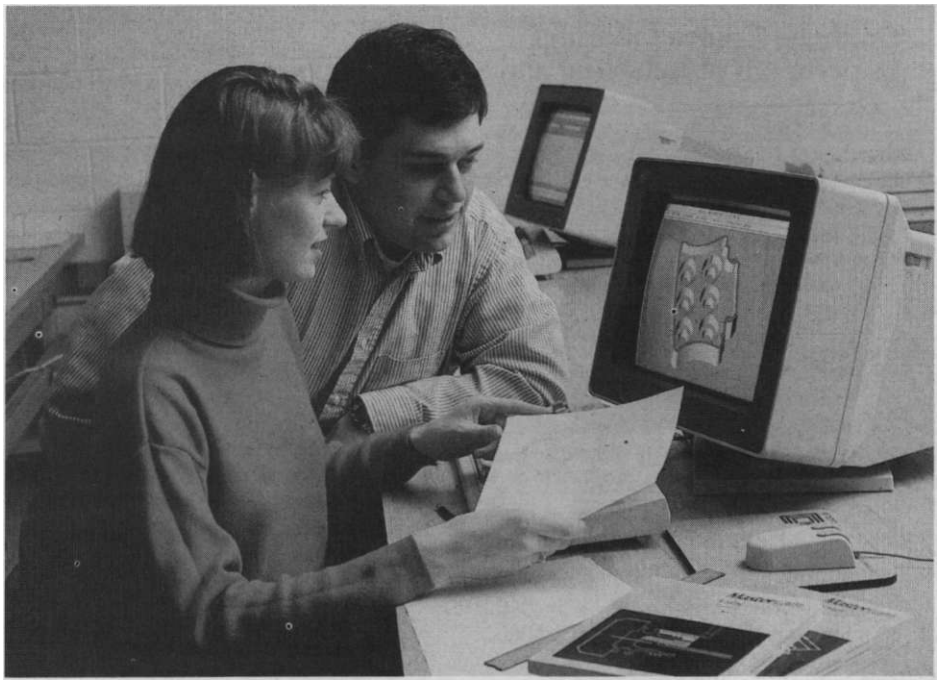
0301-703 Matrix Methods in Electrical Engineering
0301-763 Stochastic Estimation & Control
or
0301-762 Nonlinear Control
0301-749 Speech & Image Compression
or
0301-770 Pattern Recognition
0301-761 Modern Control Theory
0301-726 Analog IC Design
0301-712 Physics & Scaling of CMOS Devices
0301-731 Digital Design with VHDL

EVERY SPRING QUARTER

0301-793 Error Correction & Detection
0301-765 Optimal Control
0301-764 Digital Control Systems
0301-779 Digital Image Processing
or
0301-788 Adaptive Signal Processing
0301-730 Advanced Analog IC Design
0301-713 Solid State Physics
0301-730 VLSI Design or equivalent
0301-732 Design of High Performance Digital Systems

SUMMER QUARTER

A selected number of 700-level courses and 600-level courses will be available during the summer quarter. Consult the department for details.



Teamwork and collaboration in engineering courses reflect workplace realities.

600-LEVEL COURSES
Senior-level undergraduate professional electives. A maximum of two courses from the following list may be taken by a graduate student and counted towards the MS degree.

0301-605 Robotic Vision
0301-610 Analog Electronic Design
0301-614 Design of Digital Control Systems
0301-621 Microwave Engineering
0301-622 Antenna Design
0301-646 Power Electronics
0301-650 Design of Digital Systems
0301-651 ASIC Design
0301-655 Object-Oriented Programming with C++
0301-665 Microprocessor-Based Systems Design
0301-666 Microcomputer Systems
0301-670 Introduction to Microelectronics
0301-672 Optical Devices and Systems
0301-677 Digital Filters and Signal Processing
0301-679 Analog Filter Design
0301-692 Communication Networks
0301-693 Digital Data Communications
0301-694 Information Theory and Coding

Courses other than those listed in this bulletin are developed and offered periodically by the department of electrical engineering. Information will be available from the department office about a month before the beginning of each academic quarter. Course offerings are subject to minimum enrollment requirements.

Industrial and Systems Engineering Department

Jacqueline Reynolds Mozrall,
Department Head

The industrial and manufacturing engineering department offers two graduate degrees: a master of science (MS) and a master of engineering (ME). The MS in industrial engineering requires a maximum of 45 credit hours, which consists of at least nine 4-credit courses and a 9-credit thesis. The ME degree requires a maximum of 48 credit hours, which consists of at least 11 four-credit-hour courses and four-credit-hour internship. The exact makeup of the program will be determined by the student and the adviser working in concert. In general, students will take a variety of industrial engineering courses as a base and then concentrate on a specific area.

The MS and ME degrees can be earned with specialization in the following fields: industrial engineering, systems engineering, engineering management, or manufacturing engineering. Close cooperation with other engineering departments and the College of Business assures the master of engineering candidate of a wide selection of courses and a unique opportunity to build a program tailored to her or his professional interests and goals. The practice of applying computer methods to realistic problem solving is employed in all the above specialties.

Industrial engineering option

Industrial engineering is concerned with the design, improvement and installation of integrated systems of people, material, equipment and energy. Those choosing this option may develop a program of study to suit their interests in one or more of the following areas: operations research, ergonomics, computer-aided manufacturing or production systems.

Engineering management option

Those choosing this option may develop a program of study to suit their interests. This program combines traditional industrial engineering course work with selected (maximum three) courses from the College of Business, such as organizational behavior, accounting or finance.

Manufacturing engineering option

This option is jointly administered with the mechanical engineering department. The program consists of a required course, Design for Manufacture, plus at least one course in each of the following core areas: computer-aided design, manufacturing systems, computer-aided manufacturing, probability and statistics. Additional courses chosen by the student in the areas of operations research, ergonomics, computer-integrated manufacturing, production systems, or statistical analysis complete the requirements of this concentration.

Systems engineering option

Systems engineering is concerned with improving the decision making process by utilizing statistics, simulation, optimization and computer science. Students choosing this option are required to take the following courses in addition to two electives (MS students do not take any electives):

0303-758 Design of Experiments
0303-771 Data Structures Using C
0303-716 Statistical Analysis for Engineers II
0303-747 Microprocessor Applications
0303-701 Operations Research I
0303-729 Computer-Integrated Manufacturing
0303-702 Mathematical Programming
0303-750 Management of Quality Control Systems
or
0303-757 Reliability Engineering
0303-776 Case Studies

Graduate Course Offerings
Department of Industrial and Systems Engineering

Even Years (e.g., 02/03, etc.)

FALL	WINTER	SPRING
0303-625 Concepts in Manufacturing Eng.	0303-710 Systems Simulation	0303-729 Advanced Systems Integration
0303-702 Mathematical Programming	0303-720 Production Control	0303-734 Systems Safety Engineering
0303-760 Product/Process Development & Design	0303-731 Adv. Topics in Ergonomics & Human Factors	0303-750 Management of Quality Systems
	0303-755 Multicriteria Decision Making	0303-756 Decision Analysis
	0303-757 Reliability	0303-776 Case Studies

Odd Years (e.g., 01/02, etc.)

FALL	WINTER	SPRING
0303-625 Concepts in Manufacturing Eng.	0303-620 Engineering Economy	0303-701 Principles of Operations Research I
0303-758 Design of Experiments	0303-710 Systems Simulation	0303-711 Advanced Simulation Techniques
0303-760 Product/Process Development & Design	0303-716 Statistical Analysis for Engineering II	0303-734 Systems Safety Engineering
0303-775 Data Structures Using C	0303-720 Production Control	0303-750 Management of Quality Systems
		0303-776 Case Studies

Other courses will be taught on demand

Admission requirements

Admission into the graduate ME program within industrial engineering requires a BS degree in an engineering discipline and a 3.0/4.0 grade point average. Exceptions are made for the related fields of math and physics. Students with other backgrounds are considered for admission only after completing significant undergraduate course work in the engineering sciences. All applicants should have a fundamental knowledge of computers and probability/statistics.

Program of study

The student, in conjunction with his or her adviser, formulates a program of study based on the individual's academic background, professional goals, master of engineering degree requirements and the schedule of course offerings.

Schedule of Graduate Courses in Mechanical Engineering

OFFERED EVERY YEAR

FALL
0304-758 Engineering Vibrations
0304-838 Ideal Flows
0304-840 Signal Processing
0304-870 Mathematics for Engineers I

WINTER
0304-801 Design for Manufacture
0304-821 Advanced Vibrations
0304-823 Systems Modeling
0304-851 Convective Phenomena
0304-871 Mathematics for Engineers II
0304-874 Numerical Analysis
0304-885 Advanced Mechanics of Solids

SPRING
0304-743 Control Systems
0304-816 Finite Elements
0304-830 Introduction to CFD Analysis

OFFERED EVEN YEARS (e.g., 02/03, etc.)

FALL
0304-810 Introduction to Continuum Mechanics
0304-852 Advanced Turbomachinery

WINTER
0304-811 Theory of Elasticity & Plasticity
0304-834 Boiling & Condensation

SPRING
0304-820 Advanced Optimal Design
0304-864 Production Tool Design
0304-872 Analytical Mechanics
0304-875 Advanced Aerodynamics

OFFERED ODD YEARS (e.g., 01/02, etc.)

FALL
0304-835 Grid Generation
0304-842 System Identification
0304-865 Computer Implementation of Finite Elements

WINTER
0304-833 Heat Exchanger Design
0304-844 Nonlinear Dynamical Systems

SPRING
0304-831 CFD Applications
0304-846 Modal Testing & Signal Processing

Mechanical Engineering Department

Edward Hensel, *Department Head*

The graduate faculty of the mechanical engineering department is dynamic and committed to professional growth. Some of the current research activities include finite elements, vibrations, robotics, cardiovascular signal processing and system modeling, turbomachinery flows, laser-based flow measurement, applications of computational fluid dynamics, heat transfer, and computer-aided design and manufacturing. Research also is conducted in areas such as vibration damping, boiling heat transfer and thermal simulation of heat exchangers and electronic devices, non-linear dynamics, and fracture mechanisms in materials. Also, there is interest in software design and development for engineering applications, experimental heat transfer, developing techniques for airfoil optimization, flow in time-varying boundaries, two-phase heat transfer, heat and moisture transport in porous media, characterization of intermetallic materials, flow boiling and fluid mixing. The department houses several laboratories, which support vibration and modal analysis, robotics, industrial fluids applications, thermal analysis, biomedical systems analysis and materials science.

Extensive computing facilities include a large network of workstations, personal computers, VAX minicomputers, UNIX systems, laboratories equipped with Windows-based and Macintosh personal computers, and dial-in facilities. Students have access to a vast array of software packages, which include most programming languages and utilities, various word processing software, analytical and statistical data analysis, graph generation and spreadsheet packages. Software specifically used for mechanical engineering applications includes ALGOR, ANSYS, and Mechanica (finite element analysis); Working Model (mechanical modeling and analysis); FLUENT, FLOW3D, PMARC and TODOR (fluid/ thermal analysis); MATLAB/ Simulink and Lab VIEW (data acquisition and control system analysis); OptdesX (optimization); DFMAby Boothroyd/Dewhurst (designing for manufacturing assembly); and AUTOCAD, ProEngineer and IDEAS (CAD/CAE software).

Master of science degree program

The master of science degree in mechanical engineering is awarded upon successful completion of an approved graduate program consisting of a minimum of 45 quarter credit hours. A minimum of 36 credits are to be earned in course work, while independent capstone work carries a minimum of three credits and a maximum of nine credits.

A maximum of nine quarter credits may be transferred from graduate courses taken outside the Institute provided such courses will complement a student's proposed graduate program in the mechanical engineering department.

Upon matriculation into the MS program, the student should formulate a plan of study in consultation with his or her adviser.

Admission requirements

1. **A** bachelor of science degree in engineering or science is required.
2. If an applicant has a BS degree, but not in mechanical engineering, the graduate admissions adviser will recommend which undergraduate courses must be taken in order to acquire an acceptable background. At least a **3.0** grade point average in the recommended undergraduate courses is required before admission is granted to the mechanical engineering graduate program.

Program requirements

The four elements of study within the program include core courses, courses required within an elected focus area, selected elective courses and a capstone thesis/project with paper option.

Core courses

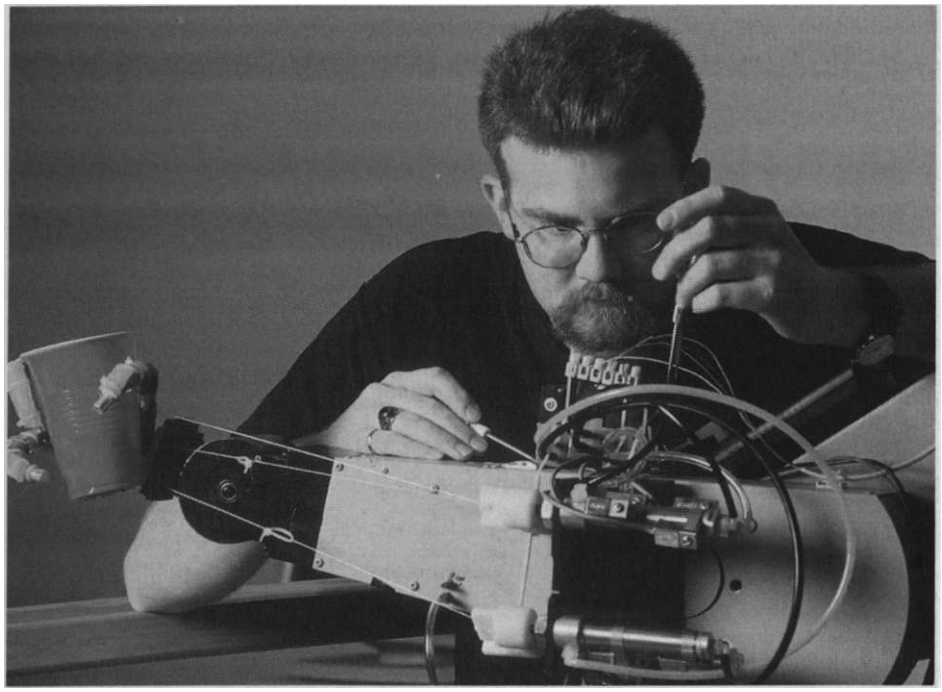
All graduate students in the MS program are required to complete:

0304-870 Mathematics for Engineers I (F)
0304-871 Mathematics for Engineers II (W)

Focus area courses

All graduate students in the MS **program are required to select one of the following focus areas and complete the following specific courses within that area:**

GROUP **A—MECHANICS**/DESIGN
0304-758 Engineering Vibrations (F)
0304-885 Advanced Mechanics of Solids (W)
0304-816 Finite Elements (S)



GROUP B—SYSTEMS/CONTROLS

0304-823 Signal Processing (F)
0304-840 Systems Modeling (W)
0304-743 Control Systems (S)

GROUP C—THERMO/FLUIDS

0304-838 Ideal Flows (F)
0304-851 Convective Phenomena (W)
0304-830 Introduction to Computational Fluid Dynamic Analysis (S)

Students may select courses outside their focus area for electives.

Elective courses

The following elective courses are available to the student for graduate credit:

0304-743 Control Systems (every year, S)
0304-758 Engineering Vibrations (every year, F, W)
0304-801 Design for Manufacture (every year, W)
0304-810 Introduction to Continuum Mechanics (even year, F)
0304-811 Theory of Elasticity & Plasticity (even year, W)
0304-816 Finite Elements (every year, S)
0304-820 Advanced Optimal Design (even year, S)
0304-821 Advanced Vibrations (every year, W)
0304-823 Systems Modeling (every year, W)
0304-828 Special Topics in Applied Mechanics (TBA)
0304-830 Introduction to Computational Fluid Dynamic Analysis (every year, S)
0304-831 Computational Fluid Dynamics (CFD) Applications (odd year, S)
0304-833 Heat Exchanger Design (odd year, W)
0304-834 Boiling & Condensation (even year, W)
0304-835 Grid Generation (odd year, F)
0304-838 Ideal Flows (every year, F)
0304-840 Signal Processing (every year, F)
0304-842 System Identification (odd year, F)
0304-844 Nonlinear Dynamical Systems (odd year, W)
0304-846 Modal Testing & Signal Processing (odd year, S)
0304-848 Special Topics in Thermo Fluid Systems (TBA)
0304-851 Convective Phenomena (every year, W)
0304-852 Advanced Turbomachinery (even year, F)
0304-864 Production Tool Design (even year, S)
0304-865 Computer Implementation of Finite Elements (odd year, F)
0304-872 Analytical Mechanics (even year, S)
0304-874 Numerical Analysis (every year, W)
0304-875 Advanced Aerodynamics (even year, S)
0304-885 Advanced Mechanics of Solids (every year, W)
1028-701 Introduction to Materials Science (F)
1028-705 Experimental Techniques (S)
1028-710 Materials Properties & Selection (TBA)
0307-712 Fundamentals of Statistics II
0307-770 Design of Experiments for Engineers

Students deficient in computational techniques are strongly advised to take 0304-874, Numerical Analysis, as an elective.

Based on the student's particular program needs, he or she may, with department approval, elect to take up to 12 credits from other departments in the Institute. Graduate students are allowed to take a maximum of two upper-level undergraduate (0304-6XX) electives in mechanical engineering specified in the course description section of the *Undergraduate Bulletin.* Some examples are:

0304-610 Topics in Mechanical Engineering Design (TBA)
0304-615 Robotics (F, W)
0304-618 Computer-Aided Design (S)
0304-620 Introduction to Optimal Design (F or W)
0304-624 Vehicle Dynamics (S)
0304-626 Automotive Control Applications (W)
0304-635 Heat Transfer II (S)
0304-638 Design of Machine Systems (TBA)
0304-640 Internal Combustion Engines (S)
0304-642 Air Pollution Dispersion Modeling (S)
0304-644 Introduction to Composite Materials (TBA)
0304-652 Fluid Mechanics of Turbomachinery (F or W)
0304-660 Refrigeration & Air Conditioning (S, Su)
0304-671 Aerostructures (S)
0304-672 Dynamics of Machinery (S, Su)
0304-675 Aerodynamics (S)
0304-678 Propulsion (W)
0304-682 Flight Dynamics (W)
0304-694 Stress Analysis (S or Su)

A student also may earn a limited number of credits by doing an independent study with guidance from a member of the graduate faculty. Some of the areas for independent study are selected topics in applied mathematics, energy methods in mechanics, analytical mechanics, nonlinear mechanics, fracture mechanics, heat transfer, fluid mechanics, thermodynamics, control systems, optimal control, thermal stresses, composite materials, biomechanics and viscoelasticity.

Course calendar

The core and focus area courses are offered every year, which enables a student to fulfill the core requirements in one academic year. The elective courses are generally given at least every other year. For further information on current course offerings, the student should contact the office of the mechanical engineering department, 475-5788 or 475-2163.

Independent capstone options

Once a student has completed about 20 quarter credit hours of graduate work, he or she should consider selecting one of the two options offered by the department with regard to completing the requirements of the master of science degree. The options are: 1) a five- to nine-credit-hour thesis, where thesis and course work total a minimum of 45 quarter credit hours or 2) a three-credit-hour project with paper, where the paper and course work total a minimum of 47 quarter credit hours. A student selecting either option is required to deliver a successful written and oral presentation of the work.

Master of engineering degree program

This is a post-baccalaureate internship program leading to the professional degree of master of engineering. The objective of the program is to provide the engineering BS graduate the means for earning a terminal master's degree, substituting a well-organized and carefully chosen industrial internship for the conventional thesis requirement of an MS degree.

An industrial internship of duration equivalent to two academic quarters in a specially developed engineering position is an integral part of the program. A minimum of eight and a maximum of 12 credits may be earned by the student from his or her internship experience. The internship position is selected to reflect each individual student's primary professional interest and is integrated with his or her curriculum.

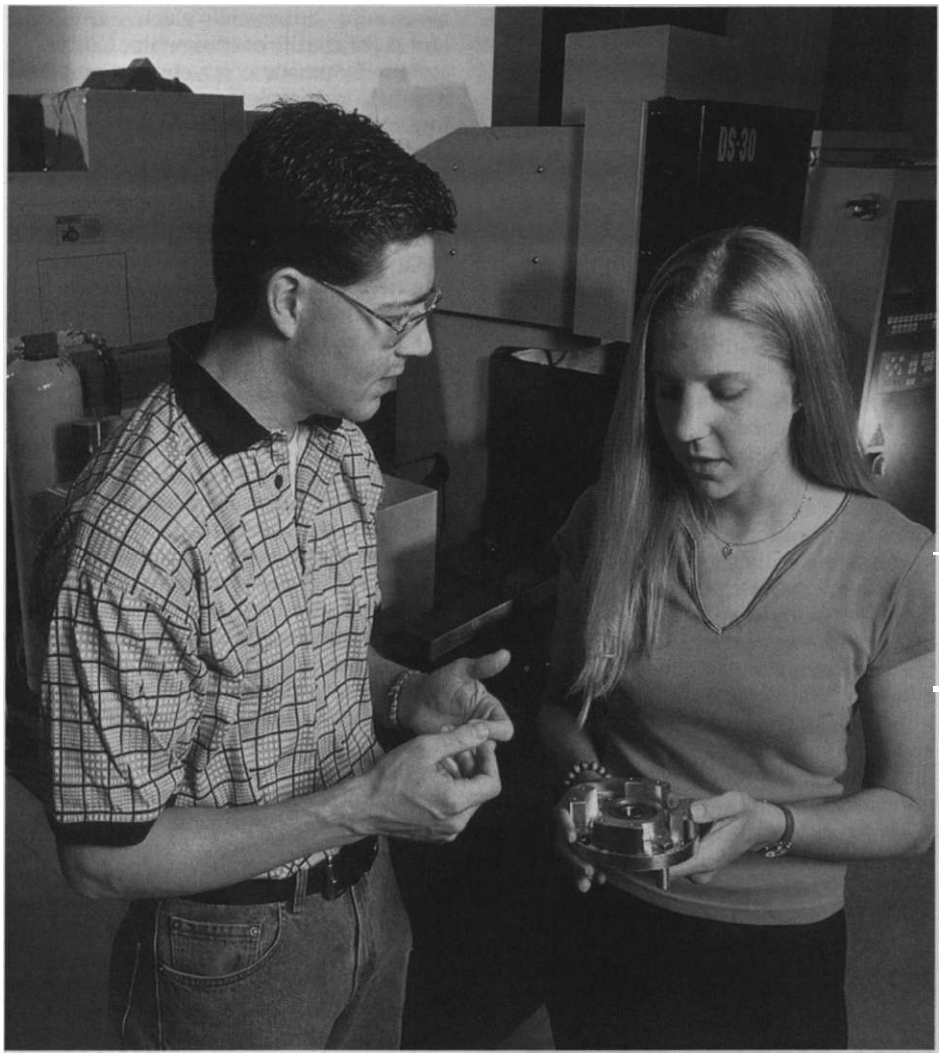
The program, although rooted in engineering, will be significantly interdisciplinary. By design, a student's program may range over several colleges of the Institute in assembling courses that will best help him or her meet his or her professional objectives. The credits for this program are distributed as follows:

Core Courses	8 credits
Concentration Courses	16 credits
Elective Courses	12-16 credits
Internship	12-8 credits

At least 20 credit hours of graduate-level course work, including the core (0304-870 and 0304-874), must be taken in the mechanical engineering department. Some possible concentration areas are in business, controls, manufacturing, materials science, statistics and design engineering. A minimum of 48 credits are required for the master of engineering degree.

Admission requirements for the master of engineering degree

The admission requirements, general standards and selection procedures for admission to the engineering program are similar to those for the MS degree program.



The manufacturing engineering program for the master of engineering degree

This program is offered jointly by the departments of mechanical engineering and industrial and manufacturing engineering. In this program, the student is required to take one course each from four different groups: computer-aided design, manufacturing systems, computer-aided manufacturing, and probability and statistics. In addition, the student is required to take a core course: 0304-801 Design for Manufacture. The balance of the course work can be completed by selecting appropriate courses from the course offerings in industrial and mechanical engineering.

A student seeking admission to the master of engineering degree in manufacturing engineering is expected to have undergraduate background in C++ programming, engineering materials, manufacturing processes, and probability and statistics.

Assistantships and scholarships

Some assistantships and scholarships may be available for full-time students. Appointment as a teaching assistant carries a 20-hour per week commitment to a teaching function and usually permits a student to take graduate work for eight credits per quarter. Appointment as a research assistant usually permits taking eight credits per quarter while the remaining time is devoted to the research effort, which often serves as a thesis subject. Information on tuition scholarships may be obtained from the Office of Part-time and Graduate Admissions, 475-2229.

Microelectronic Engineering Department

Santosh Kurinec, *Department Head*

The College of Engineering is proud to offer two master's programs in the area of microelectronics manufacturing. The *master of engineering* in microelectronics manufacturing engineering is a full-time intensive classroom- and laboratory-oriented program culminating with an internship. The *master of science* in microelectronics manufacturing engineering is a research-oriented program that includes the master's thesis. Both programs are intended to prepare students for a career in the semiconductor industry.

Students in these programs have hands-on experience in the design and processing of integrated circuits—the vital component in almost every advanced electronic product manufactured today. The undergraduate and graduate laboratories at RIT, designed for the microelectronics engineering program, are among the best in the nation.

The worldwide semiconductor industry is expected to double—growing from $100 billion to $200 billion—over the next five years. RIT graduates will provide a valuable resource to the semiconductor industry. The microelectronics engineering programs at RIT offer an unparalleled opportunity for students to prepare for professional challenge and success in one of the leading areas of engineering of our time.

The ME program

The master of engineering degree in microelectronics manufacturing engineering is awarded upon the successful completion of an approved graduate program consisting of a minimum of 48 credit hours: one transition course, seven core courses, two elective courses and eight credits of internship. Under certain circumstances, a student may be required to complete more than the minimum number of credits. The transition course is in an area other than that in which the BS degree was earned. For example, a chemistry major may be required to take a two-course sequence in circuits and electronics; an electrical engineer may be required to take an organic chemistry course.

The core courses are Microelectronics I, II, III; Microlithography I, II; and Microelectronics Manufacturing I, II. Elective courses may be selected from a list including CMOS, Defect Reduction and Yield Enhancement, Electronic Properties of Materials, Statistical Design of Experiments and others.

The program also requires an internship, which is paid employment in the semiconductor industry. The internship can be completed in industry or at RIT. It will involve the investigation of some problem or process directly related to microelectronics manufacturing engineering. This is not a thesis but usually requires a report and oral presentation at the end of the project.

Microelectronics

The Microelectronics I, II, III sequence covers all aspects of integrated circuit manufacturing technology such as oxidation, diffusion, ion implantation, chemical vapor deposition, metalization, plasma etching, etc. These courses emphasize modeling and simulation techniques as well as hands-on laboratory verification of these processes. Students use special software tools for these processes.

In the laboratory students design and fabricate silicon MOS and Bipolar integrated circuits. They learn how to operate all of the semiconductor processing equipment and how to create a process and manufacture and test their own integrated circuits.

Microlithography

The microlithography courses are advanced courses in the chemistry, physics and processing of microlithographic systems. Optical lithography will be studied through diffraction, Fourier and image assessment techniques. Scalar diffraction models will be utilized to simulate aerial image formation and influences of imaging parameters. Positive and negative resist systems, as well as processes for IC application, will be studied. Advanced topics will include chemically amplified resists; multiple layer resist systems; and electron beam, x-ray and deep UV lithography.

Laboratory exercises include projection system design, resist materials characterization, process optimization, electron beam lithography and excimer laser lithography.

Manufacturing

The manufacturing courses include topics such as scheduling, work-in-progress tracking, costing, inventory control, capital budgeting, productivity measures and personnel management. Concepts of quality and statistical process control are introduced to the student. The laboratory for this course is the student-run factory. Measurement of yield, defect density, wafer mapping, control charts and other manufacturing measurement tools are introduced to the student in the lecture and laboratory. Computer integrated manufacturing is also studied in detail. Process modeling, simulation, direct control, computer networking, database systems, linking application programs, facility monitoring, expert systems applications for diagnosis and training and robotics are all introduced and supported by laboratory experiences in the integrated circuit factory at RIT.

Selected Graduate Theses and Internship Paper Topics

"Biomechanics of Corneal Wound Healing"

"Vibration Analysis of a Thin Moving Web and Its Finite Element Implementation"

"Robotized Welding Cells Planning and Implementation Model"

"Investigation of Cell Mapping and Off-Line Programming with a Flexible Assembly System"

"Development and Characterization of a Submicron CMOS Process"

"Transition through Resonance in Linear and Nonlinear Systems"

"Simulation of a Morphological Image Progressor Using VHDL. Part 1: Mathematical Components. Part II: Control Mechanism"

"The Design and Implementation of an 8-bit CMOS Microprocessor"

"Process Development and Reliability of Thin Gate Oxides"

"A Field Emission Transistor Array for Writing Applications"

"Process Development of an Analog/Digital Mixed-Mode BiCMOS Process at RIT"

"Optical Properties of Thin Films"

ME schedule		Credits
FALL		
0305-701, 741	Microelectronics I, Lab	4
0305-721, 751	Microlithography I, Lab	4
	Transition	4
	Transition	4
WINTER		
0305-702, 742	Microelectronics II, Lab	4
0305-722, 752	Microlithography II, Lab	4
0305-731, 761	Microelectronics Manufacturing I, Lab	4
	Elective	4
SPRING		
0305-703, 743	Microelectronics III, Lab	4
0305-732, 762	Microelectronics Manufacturing II, Lab	4
	Elective	4
SUMMER		
	Internship	8

The MS program

The objective of the master of science program is to provide an opportunity for students to perform a master's level research project as they prepare for entry into the semiconductor industry or a Ph.D. program. The program requires strong preparation in the area of microelectronics, takes two years to complete and requires a thesis.

The prerequisites include a BS in engineering (such as electrical or microelectronics engineering), including one year of study of device physics, 1 ½ years of study of semiconductor fabrication technology, including lecture and laboratory, one course in microlithography and one course in VLSI:SI design. Students from RIT's BS in microelectronics engineering will meet these prerequisites. Students with a BS in electrical engineering may already have the VLSI Design course, the device physics and the semiconductor fabrication technology. Students who do not have all of the prerequisites can take those courses at RIT and still complete the master of science program in two years. The prerequisite courses will be completed during the first few quarters at RIT and will not count toward the 36 credits worth of graduate courses required for the MS degree.

The program consists of eight master's level (700 or higher) courses, including five from microelectronics engineering (0305). A variable-credit (1 or 0 credits) seminar/research course will be taken by all graduate students in this program each quarter that they are at RIT. Up to 4 credits will be allowed to count toward the required 36 hours. A nine-credit thesis will be required of all students in this program. The total number of credits needed for the master of science in microelectronics manufacturing engineering is 45.

Sample MS schedule		Credits
(For those who are not *graduates of RIT's microelectronics engineering program)*		
FALL		
0305-701, 741	Transition IC Technology, Lab	4
0305-721, 751	Transition Microlithography, Lab	4
0305-560	Transition Device Physics	4
0305-801	Seminar/Research	1
WINTER		
0305-702 742	Transition IC Technology, Lab	4
0305-731 761	Microelectronics Manufacturing, Lab	4
0305-722 752	Microlithography II, Lab	4
0305-801	Seminar/Research	1
SPRING		
0305-703 743	Transition IC Technology, Lab	4
0305-732 762	Microelectronics Manufacturing, Lab	4
0305-801	Seminar/Research	1
0305-899	Thesis	3
SUMMER		
Research		
FALL		
0301-723	Semiconductors	4
0305-XXX	Elective	4
0305-801	Seminar/Research	1
	Full-time Equivalency	3
WINTER		
0301-724	Semiconductor Devices I	4
0305-801	Seminar/Research	1
0305-899	Thesis	3
0305-XXX	Elective	4
SPRING		
0301-725	Semiconductor Devices II	4
0305-801	Seminar/Research	1
0305-899	Thesis	3
	Full-time Equivalency	4

Sample MS schedule		Credits
(For RIT microelectronics engineering graduates)		
FALL		
Research		
WINTER		
0305-731 761	Microelectronics Manufacturing, Lab	4
0305-722 752	Microlithography II, Lab	4
0305-801	Seminar/Research	1
	Full-time Equivalency	3
SPRING		
0305-732 762	Microelectronics Manufacturing, Lab	4
0305-XXX	Elective	4
0305-801	Seminar/Research	1
0305-899	Thesis	3
SUMMER		
Research		
FALL		
0301-723	Semiconductors	4
0305-XXX	Elective	4
0305-801	Seminar/Research	1
	Full-time Equivalency	3
WINTER		
0301-724	Semiconductor Devices I	4
0305-801	Seminar/Research	1
0305-899	Thesis	3
	Full-time Equivalency	4
SPRING		
0301-725	Semiconductor Devices II	4
0305-801	Seminar/Research	1
0305-899	Thesis	3
	Full-time Equivalency	4

Assistantships and fellowships

Some assistantships and fellowships may be available for full-time students. Appointment as a teaching assistant carries a 12-hour-per-week commitment to a teaching function and permits a student to take graduate work at the rate of 12 credits per quarter. Appointment as a research assistant also permits taking 12 credits per quarter while the remaining time is devoted to the research effort. Students in the MS program are preferred for research fellowships. Appointments provide full or partial tuition and stipend. Applicants for financial aid should write directly to the department head for details.

Applied Statistics Department

The John D. Hromi Center for Quality and Applied Statistics

Donald D. Baker, *Director*

Joseph G. Voelkel, *Chair*

Statistics is the science of making decisions in the face of uncertainty. Statistical thinking and methods are used over a broad spectrum of industrial, research, educational, business and government activities. The Kate Gleason College of Engineering at RIT, through the John D. Hromi Center for Quality and Applied Statistics, offers a master of science degree in applied statistics that provides state-of-the-art statistical thinking and methods. The college also offers an advanced certificate in statistical quality for students whose primary interest is in the field of quality.

The distinguished faculty members of the center include winners of the American Society for Quality's Shewhart Medal, Grant Award, Brumbaugh Award and Shewell Award, and fellows of ASQ and the American Statistical Association.

MS or advanced certificate

The MS degree program, which requires 45 credits (equivalent to 15 courses), is available to both part-time and full-time students. Those working toward their baccalaureate degree in certain RIT departments are eligible to apply for a joint BS/MS program. Cooperative education options are also available. The MS degree is also available in a distance-learning format, which is especially appealing to students who are unable to attend classes on campus.

Many of our students are full-time professionals who want to learn state-of-the-art statistical techniques to enhance their careers and their value to their companies. Others want to change careers and become statistical consultants for their companies. Those who do not fit the full-time professional category typically use the degree to gain employment either as statistical consultants or quality engineers.

Although this program is primarily intended for those students who do not wish to pursue a degree beyond the MS, a number of our former students are either working on, or have attained, a Ph.D.

The advanced certificate in statistical quality, which requires 18 credits (equivalent to six courses), is available to part-time students. These courses, a subset of the MS program courses, are offered both on campus and in the distance-learning format. Most of our advanced-certificate students are full-time professionals who want to learn current statistical and quality techniques to enhance their careers and value as employees.

Both programs are registered by the New York State Education Department and are accredited by the Middle States Association of the Council for Higher Education.

Full time or part time

Full-time students (four courses per quarter) complete the MS degree in one year if normal progress is made. Students pursuing the MS on a part-time basis (one or two courses per quarter) complete the degree in two to four years if normal progress is made. Part-time students pursuing the advanced certificate typically complete the requirements in four to six quarters of study.

BS/MS programs

The center has agreements with RIT's departments of Mathematics and of Industrial and Manufacturing Engineering that allow students to earn both BS and MS degrees in less time and with fewer courses than would be needed if both programs were pursued separately. Entry into these programs is handled through the undergraduate departments.

Cooperative education

Cooperative education allows qualified graduate students to attend school on a full-time basis during certain quarters and to earn a substantial salary during other quarters, typically as employees in a corporation. To qualify for cooperative education, students must complete at least one quarter of appropriate course work and receive department approval. Reverse cooperative education is also available, in which full-time employees get approval to study on a full-time basis, typically by alternating quarters of work and study.

Distance learning

Since 1979, when the university offered its first distance learning course, RIT has been a leader in the use of electronic forms of communication for course interaction. Our distance-learning courses have the same objectives, rigorous workload, tuition and academic credit as our on-campus courses. Both the MS degree and the advanced certificate are available through distance learning. No distinction is made between taking courses on campus or through distance learning. In particular, programs earned partly or entirely through distance learning are registered by the New York State Education Department and are accredited by the Middle States Association of the Council for Higher Education. Every distance-learning course offered by the center meets RIT's rigorous standards. Each course features either videotapes or CDs that are professionally prepared for distance learners, not simply videos of recent lectures that were captured on tape. Courses also include weekly or biweekly live chat sessions, using an electronic medium that allows students and instructor to interact.

Because distance-learning courses are designed for the motivated professional who is not able to attend on-campus classes, we recommend enrollment to those over 25 years of age with at least three years of professional employment.

Admission

Admission to the MS degree program will be granted to qualified holders of a baccalaureate degree from an accredited college or university who have an acceptable GPA and mathematics credits, including acceptable grades in university-level calculus through multiple integration, and acceptable probability and statistics college credits, equivalent to 0307-711 and 712. Applicants who fail to meet these requirements will be required to complete these prerequisites prior to matriculation in the graduate program. Admission to the certificate program requires a baccalaureate degree with the probability and statistics requirement but not calculus.

Entrance exams are not required. However, international students whose native language is not English must have a TOEFL score of at least 550. Courses are offered on an open-enrollment basis, which supports RIT's commitment to recurrent education.

Transfer and interdisciplinary credits

Credit for courses of graduate stature in statistics, mathematics, computer programming, operations research and other quantitative fields related to statistics may be accepted toward fulfillment of degree requirements at the discretion of the department with due regard to the candidate's objectives. A maximum of nine graduate credits can be accepted toward the MS degree, while three credits may be accepted toward the certificate. A course used toward fulfillment of another degree can be credited only if it corresponds to one of the core courses described below. Transfer credits for the certificate must be from a course covering the same subject matter as the course being waived.

To ensure credit toward the degree, the candidate should write the department indicating courses for which he or she would like transfer credit. Prior approval of such courses is required. More details can be obtained from the department secretary.

Nonmatriculated students

It is not necessary to be formally admitted or matriculated into the MS program in order to register for course offerings. However, students who desire to enter the MS program will be allowed to apply only four courses taken prior to matriculation into the program. This is done to encourage proper selection of courses and to allow for adequate administrative time for transcript review. Students who desire to enter the advanced certificate program will be allowed to apply only two courses taken prior to matriculation into the program.

Financial assistance

Financial assistance is available through the department and is awarded on a competitive basis to qualified applicants. Assistance is offered in several forms, including scholarships and graduate assistantships. Awards are generally given to full-time students, but exceptions may be made for qualified part-time students. For information on other sources of financial assistance, applicants should review the appropriate section of this bulletin.

Requirements, advanced certificate

Satisfactory completion of the following is required for the advanced certificate in statistical quality.

1. Basic familiarity with statistical software

Students should have basic familiarity with MINITAB, or equivalent, statistical software. This may be obtained by experience; by completion of Data Analysis Using MINITAB, a three-day, noncredit course in data analysis and statistical computing; or through 0307-742 Statistical Computing, taken for at least one credit.

2. Six courses

0307-721 Statistical Process Control
0307-731 Statistical Acceptance Control
0307-781 Quality Management
0307-782 Quality Engineering
0307-801,802 Design of Experiments I & II

3. Other requirements

The candidate must attain an overall average program grade of 3.0 (B) for graduation; see the department secretary for more details.

Requirements, master of science

Satisfactory completion of the following is required for the master of science in applied statistics.

1. Basic familiarity with statistical software

These are the same as the requirements for the advanced certificate. However, students who expect to work as statistical consultants are strongly encouraged to take 0307-742 Statistical Computing for 3 credits.

2. Six core courses

0307-801 Design of Experiments I
0307-802 Design of Experiments II
0307-821 Theory of Statistics I
0307-822 Theory of Statistics II
0307-841 Regression Analysis I
0307-842 Regression Analysis II

Students, in conjunction with their advisers' recommendations, should take the core courses early in the program. In any event, they must be taken within the first 30 credit hours of the degree.

3. Four required courses from a career option

There are four career options, each of which is designed to allow the students to specialize within their career endeavors. The four career options are:

Quality Control in Industry

0307-721 Statistical Process Control
0307-731 Statistical Acceptance Control
0307-781 Quality Management
0307-782 Quality Engineering

Industrial Statistics

0307-856 Interpretation of Data
0307-862 Reliability Statistics I
0307-875 Empirical Modeling
0307-883 Quality Engineering by Design

Statistical Theory and Methods

0307-824 Probability Models
0307-830 Multivariate-Analysis Theory
0307-831 Multivariate-Analysis Applications
0307-862 Reliability Statistics I

Reliability

0307-762 Reliability Management
0307-824 Probability Models
0307-862 Reliability Statistics I
0307-863 Reliability Statistics II

Advisers will help to identify the appropriate career option and to develop a total program structured to meet individual professional objectives. Students may instead, with the consent of their advisers, choose a set of career-option courses other than those listed above.

4. Five electives, thesis option or project option

Five additional courses are chosen by students with the help of their advisers. These courses are usually department courses but may include (along with the transfer credits explained previously) up to nine credits from other courses that are related to the program and that are consistent with students' professional objectives. Students, with the approval of their advisers, may choose to write a research thesis or research project instead of taking the full six electives.

Most theses are for 6 credits, reducing the number of electives to four; projects are usually for 3 credits.

5. Other requirements
The MS candidate must attain an overall average program grade of 3.0 (B), with no more than three grades of C, for graduation. A minimum of 24 credits in 800-level courses is required in the degree program. An oral examination is required for students enrolled in their last quarter of the program. The exam tests subject matter and verbal proficiency as well as the ability to perform as a statistician in a working environment. Course work must be completed within seven years. More details on these requirements may be obtained from the department secretary.

Students are strongly encouraged to develop writing, speaking, presentation and computer skills as they progress through the program.

Procedure

To be considered for admission it is necessary to file an application, submit transcripts of all previous undergraduate and graduate work, obtain two letters of recommendation and pay an application fee. (RIT graduates do not have to pay this fee.) Forms and instructions, including quarterly offerings and registration forms, may be obtained by writing to:

Director of Admissions
Rochester Institute of Technology
Bausch & Lomb Center
60 Lomb Memorial Drive
Rochester, NY 14623-5604

Advising

In consultation with a departmental adviser, a total program structured to achieve individual professional objectives is worked out with each student. Matriculated students will be assigned an adviser, with whom they are required to meet on a regular basis to review their progress toward meeting program requirements. Nonmatriculated students who wish to be advised should contact the department secretary.

Faculty

Both full-time and adjunct faculty teach in the program. All instructors have real-world experience in the subjects they teach, which is directly reflected in their approach to the subject matter. As part of their contracts with RIT, many of the full-time faculty work outside the MS program, through consulting and both public and contract-basis seminars. Many are also engaged in professional activities, present talks at professional society meetings, and publish research or application papers.

More information

More information, including course schedules and interim updates to this information, is available from the center's Web site, www.rit.edu/eng/cqas.

Master of Science in Product Development

Mark W. Smith, *Director*

Christine G. Kuhman, *Coordinator*

Joint program: Colleges of Business and Engineering

Product innovation is essential to business survival and growth. The creation and introduction of new products and services has reached an unprecedented level of complexity, requiring the coordination of diverse teams of professionals from R&D, marketing, finance, manufacturing, procurement, sales, and service. Companies need innovative leaders who possess a broad blend of business and technical skills, who understand markets and the value-chain, and who have the systems perspective necessary to commercialize products and services. The master of science in product development (MPD) program at RIT provides the educational foundation that technical professionals need to prepare them for high-impact management roles in product and technology innovation.

Overview

The MPD program is for experienced technical professionals who desire to move into product development leadership positions throughout their organizations. Emphasis is placed on cross-functional, end-to-end product development and the integrated systems perspective needed to conceive, create, launch, and support complex products. The two-year program, beginning each January, has been designed in an executive format where students continue to work at their companies while taking classes one day per week (except for full-time January program).

The MPD program is a joint degree program offered by RIT's College of Business and College of Engineering. Designed by academic and industry leaders, the curriculum integrates business and technical elements to provide leaders with the knowledge, skills, behaviors, and perspective to effectively deploy best-in-class product development methods, tools, and practices. The program integrates formal education, ongoing research, and industrial practice, and continuously refreshes the curriculum through active partnerships with other world-class universities, research centers, and companies.

Students acquire the foundation skills and strategic perspective necessary to become future leaders and senior managers responsible for driving business growth through innovation, and become effective change agents at their companies. They develop a mindset receptive to change and continuous improvement, an understanding of the enablers to business success, and an enhanced ability to recognize barriers to success early in the commercialization cycle when corrective actions are least costly.

Format

The MPD program occupies two calendar years, officially beginning each January and continuing for seven consecutive instructional quarters, including summers, until graduation at the end of the second year. Students attend classes full-time during the month of January, after which the program adopts a one-day per week "executive" format, with classes each Friday. Students take two courses per quarter, one in the morning and a second in the afternoon.

The January program

The MPD program begins with a concentrated session in the first year consisting of courses on Organizational Processes and Leadership in Product Development. The January program also includes workshops, tutorials, and lectures designed to augment coursework and prepare students for the rest of the MPD program. (The January program is not repeated in the second year).

Business trips

Approximately two business trips (including one international trip) will be taken to augment coursework and broaden exposure of the students to product development around the world. The focus of these trips will vary, and students will participate in selecting the venues most appropriate to meeting their objectives. When feasible, trips will be scheduled in conjunction with other university partners.

Curriculum

The MPD program is a 61-credit program that requires successful completion of 14 courses (10 required courses and four electives) plus a Capstone project. Students complete required courses in a defined sequence with the other members of their graduating class ("cohort" model).

Core Courses

Leadership in Product Development
Systems Engineering
Systems Architecture
Systems and Project Management

Foundation courses

Organizational Processes
Marketing Management
Engineering Risk-Benefit Analysis
Operations Management
Systems Optimization
Finance and Managerial Accounting

Elective courses

Four elective courses (16 credits) are required. The MPD program will offer a series of graduate level electives from both the College of Engineering and the College of Business during the normally scheduled class times each year. Students may select other courses approved by the program, but at least one elective must be from Business and another from Engineering.

Capstone project

Students must successfully complete a project (eight credits) during the final two quarters of the MPD program based on a real-world problem, often identified in the companies where they work. The corporate-oriented Capstone project encompasses the broad integrative aspects of new product development - it synthesizes, increases, and demonstrates the student's understanding and knowledge of previous program material and underscores the behaviors essential to product development leadership.

Sponsorship

The MPD program is a partnership between RIT, corporate sponsors, and program participants, with the program goal of helping companies improve leadership capabilities in product development. Therefore, sponsors must be committed to support their employee's full participation in the MPD program. In addition to tuition payment, support includes permitting students to attend classes, scheduled events, and business trips, and also involves a commitment to working with students to provide clear expectations and well-articulated career development plans that build on their education. Students not receiving full support from their employers should contact the program office for assistance.

Admission requirements and procedures

To participate in the MPD program, candidates should have the following credentials:

- An undergraduate degree in engineering or a related scientific or technical field with a minimum GPA of 3.0;
- At least five years experience directly related to product development. This experience must reflect continued growth and professional development.

Exceptions may be considered on a case-by-case basis.

For application information or further information about the MPD program:

Rochester Institute of Technology
Product Development Program
111 Lomb Memorial Drive
Rochester, NY 14623-5608
Tel: 716-475-7971 Fax: 716-475-7955
E-mail: MPDmail@rit.edu
Web site: http://www.mpd.rit.edu

Graduate Faculty College of Engineering

Harvey J. Palmer, BS, University of Rochester; Ph.D., University of Washington—Dean, Professor

Computer Engineering Department

Andreas Savakis, BS, MS, Old Dominion University; Ph.D., North Carolina State University—Department Head; Associate Professor, Digital Image Processing, Computer Vision

Roy Czernikowski, BEE, ME, Ph.D., Rensselaer Polytechnic Institute—Professor, Real-Time Computation, Computer Architecture and Distributed Systems

Mary Eshaghian, BS, MS, Ph.D, University of Southern California—Professor

Kenneth Hsu, BS, National Taiwan Normal University; MS, Ph.D., Marquette University—Professor, VLSI Design, Microcomputers and Control Systems

Yoonhee Kim, BS, Sooknyung Women's University, Korea; MS, Ph.D., Syracuse University, Assistant Professor

Nader Rafla, BS, University of Cairo, Egypt, MS, Ph.D., Case Western Reserve University—Associate Professor

Pratapa Reddy, BE.M. Tech., Osmania University, India; Ph.D., Indian Institute of Technology, Madras—Professor, Digital Systems

Muhammed E. Shaaban, BS, MS, University of Petroleum and Minerals, Saudi Arabia; Ph.D., University of Southern California—Assistant Professor, Computer Architecture, Parallel Computation

Pawel Sniatala, M.Sc., Ph.D., Poznan University of Technology—Visiting Assistant Professor, Microelectronics and VLSI Design

Electrical Engineering Department

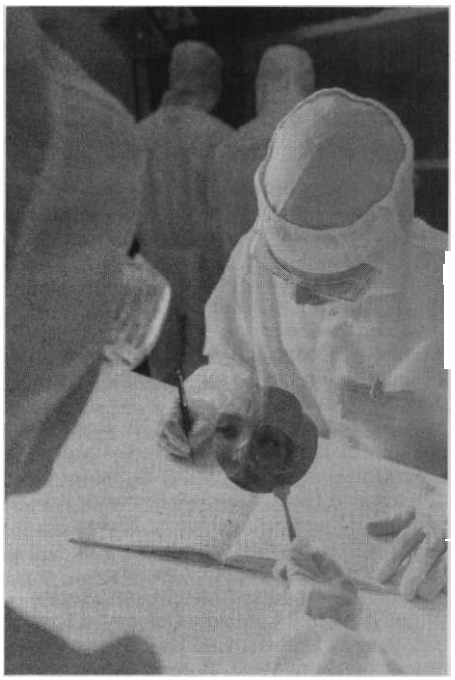
Vincent J. Amuso Sr., BS, Western New England College; MS, Syracuse University; Ph.D., Rensselaer Polytechnic Institute—Assistant Professor, Communications/Signal Processing

Sohail A. Dianat, BS, Aria-Mehr University, Iran; MS, Ph.D., George Washington University—Professor, Control Systems, Signal Processing

Lynn F. Fuller, BS, MS, Ph.D., SUNY Buffalo-Professor, Microelectronic Engineering

Michael P. Glazos, BS, MS, Ph.D., Purdue University—Assistant Professor, Control of Non-linear Systems

Mark Hopkins, BS, Southern Illinois University; MS, Ph.D., Virginia Polytechnic Institute—Associate Professor, Control Systems



Swaminathan Madhu, MA, University of Madras; MS, University of Tennessee; Ph.D., University of Washington—Interim Department Head; Professor, Signal Processing

Athimoottil V. **Mathew,** BEE, Jadavpur University, India; M. Tech., Indian Institute of Technology; Ph.D., Queen's University (Ontario)—Professor, Control Systems, Robotic Vision

Ponnathpur R. Mukund, BS, MS, Ph.D., University of Tennessee—Associate Professor, VLSI Design, Electronic Devices and Circuit Design

Dan B. Phillips, BS, State University College at Buffalo; MS, Ph.D., University of Rochester—Visiting Assistant Professor

Sannasi Ramanan, BS, BE, M.Tech., Ph.D., Indian Institute of Technology—Associate Professor, Semiconductor Devices

Raghuveer Rao, BS, Mysore University, India; ME, Indian Institute of Science, Bangalore, India; Ph.D., University of Connecticut—Gleason Professor, Image and Signal Processing

V. C. V. **Pratapa Reddy,** BE, M.Tech., Osmania University, India; Ph.D., Indian Institute of Technology, Madras—Professor, Digital Systems and Microprocessors

Ferat E. **Sahin,** BS, Istanbul Technical University, Turkey; MS, Ph.D., Virginia Polytechnic Institute—Assistant Professor

David Sumberg, BA, Utica College of Syracuse University; MS, Ph.D., Michigan State University—Associate Professor, Optics

Fung-I Tseng, BS, Taiwan University; MS, Chiao-Tung University; Ph.D., Syracuse University—Professor, Electromagnetics, Optics

Renan Turkman^ Diplome d'lngenieur (MS); Docteur-Ingenieur (Ph.D.), Institut Nationale des Sciences Appliques, Toulouse, France—Professor, Integrated Circuits, Semiconductor Devices and Processing

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Industrial & Systems Engineering Department

Andres L. Carrano, BS, Universidad Catolica Andres Bello, Venezuela; MS, Ph.D., North Carolina State University—Visiting Assistant Professor

Michael E. Kuhl, BS, Bradley University; MS, Ph.D., North Carolina State University—Assistant Professor

Matthew M. Marshall, BS, Rochester Institute of Technology; Ph.D., University of Texas—Assistant Professor

Jacqueline Reynolds Mozrall, BS, Rochester Institute of Technology; MS, North Carolina State University; Ph.D., SUNY Buffalo-Department Head; Associate Professor, Industrial Engineering, Human Factors

Madhu Nair, BS, Rochester Institute of Technology; MS, Lehigh University—Instructor, Computer-Aided Manufacturing

Nabil Z. Nasr, BS, Helwan University, Egypt; MS, Rutgers University; M.Eng., Pennsylvania State University; Ph.D., Rutgers University—Associate Professor, Brinkman Professor of Screw Machine Technology, Robotics, NC Programming, Manufacturing

Sudhakar R. Paidy, BS, Osmania University, India; MS, Ph.D., Kansas State University—Professor, Statistics, CIM, Reliability, and Operations Research

N. Richard Reeve, BS, MS, Ph.D., SUNY Buffalo—Professor, Applied Operations Research

Paul H. Stiebitz, BS, ME, Rochester Institute of Technology—Associate Professor, Simulation and Operations Research

Brian K. Thorn, BS, Rochester Institute of Technology; MS, Ph.D., Georgia Institute of Technology—Associate Professor, Applied Statistics, Behavior Science

Mechanical Engineering Department

Edward Hensel, BS, Clarkson University; Ph.D., New Mexico State University—'Department Head

Diane M. Amuso, BS, Western New England College; MS, Rensselaer Polytechnic Institute—Lecturer

Stephen Boedo, BA, State University of New York at Buffalo; MS, Ph.D., Cornell University—Assistant Professor

Richard G. Budynas, BME, Union College; MS, University of Rochester; Ph.D., P.E., University of Massachusetts—Professor, Applied Mechanics, Vibrations

Agamemnon L. Crassidis, BS, MS, Ph.D., State University of New York at Buffalo—Assistant Professor

Elizabeth A. DeBartolo, BS, Duke University, MS, Ph.D., Purdue University—Assistant Professor

Hany A. Ghoneim, BS, MS, Cairo University, Egypt; Ph.D., Rutgers University—Professor, Finite Elements, Vibrations

Amitabha Ghosh, B.Tech., M.Tech., Indian Institute of Technology, India; Ph.D., Mississippi State University—Professor, Computational Fluid Dynamics, Aerodynamics

Surendra K. Gupta, B.Tech., Indian Institute of Technology, India; MS, University of Notre Dame; Ph.D., University of Rochester—Professor, Materials Science, Computer Software, Image Processing

Charles W. Haines, AB, Earlham College, MS, Ph.D., Rensselaer Polytechnic Institute—Professor, Applied Mathematics

Satish G. Kandlikar, BE, Marathwada University, India; M.Tech., Ph.D., Indian Institute of Technology—Professor, Thermal Systems and Energy

Mark Kempski, BS, Purdue University; MS, Ph.D., SUNY Buffalo—Professor, Biomechanics

Kevin Kochersberger, BS, MS, Ph.D., Virginia Polytechnic Institute and State University—Associate Professor, Signal Processing, Structural Dynamics, Design

Jeffrey D. Kozak, BS, Gannon University; MS, Ph.D., Virginia Polytechnic and State University of Virginia—Assistant Professor

Alan H. Nye, BS, MS, Clarkson College; Ph.D., University of Rochester—Professor, Solar Physics, Lasers

Ali Ogut, B.Ch.E., Hacettepe University, Turkey; MS, Ph.D., University of Maryland—Professor, Fluid Mixing, Thermal Fluid Sciences

Brett J. Pokines, BS, MS, State University of New York at Buffalo; Ph.D., Virginia Polytechnic Institute and State University—Assistant Professor

Risa J. Robinson, BS, MS, Rochester Institute of Technology; Ph.D., State University at Buffalo—Assistant Professor

William T. Scarbrough, BS, MS, Rochester Institute of Technology—Lecturer

Frank Sciremammano Jr., BS, MS, Ph.D., University of Rochester—Associate Professor, Geophysical Fluid Dynamics and Environmental Engineering

Josef S. Torok, BS, University of Akron; MS, Ph.D., Ohio State University—Professor, Theoretical and Applied Mechanics, Applied Mathematics, Dynamic Systems

P. Venkataraman, B.Tech., Indian Institute of Technology; MS, Ph.D., Rice University—Associate Professor, Optimal Control, Fluid Mechanics, Optimal Design

Wayne W. Walter, BE, State University of New York Maritime College; MS, Clarkson College; Ph.D., P.E., Rensselaer Polytechnic Institute—Gleason Professor, Applied Mechanics, Robotics, Vibrations

John D. Wellin, BS, MS, Rochester Institute of Technology—Visiting Assistant Professor

Microelectronic Engineering Department

Santosh Kurinec, BS, MS, Ph.D., University of Delhi, India—Department Head; Professor, Materials, Solid State Devices, Sensors

Lynn F. Fuller, BS, MS, Ph.D., SUNY Buffalo—Motorola Professor, Analog I.C. Design, Semiconductor Manufacturing, Process Integration

William J. Grande, BS, New Jersey Institute of Technology; MS, Ph.D., Cornell University—Visiting Assistant Professor, Microelectromechanical Systems (MEMS), Plasma Etching, Chemical Mechanical Planarization (CMP)

Karl Hirschman, BS, MSEE, Rochester Institute of Technology—Assistant Professor, Semiconductor Manufacturing, Process Integration

Michael A. Jackson, BS, MS, Ph.D., SUNY Buffalo—Associate Professor, Surface Analysis, Integrated Circuit Metrology, Solid State Devices, Materials

Philip D. Rack, BS, Georgia Institute of Technology; Ph.D., University of Florida—Visiting Assistant Professor, Materials, Thin Film Processes, Phosphors

Bruce W. Smith, BS, MS, Ph.D., Rochester Institute of Technology—Professor, Microlithography

Renan Turkman, Diplome d'lngenieur (MS); Docteur-Ingenieur (Ph.D.), Institut Nationale des Sciences Appliques, Toulouse, France—Professor, Process Modeling and Simulation, Solid State Devices, Power Semiconductor Devices, Process Integration

Applied Statistics Department

Donald D. Baker, BA, Trinity College; M.Ed., MBA, Ph.D., University of Rochester—Professor, Director, Quality Standards, Quality Management and Problem Solving

Peter Bajorski, MS, University of Wroclaw; Ph.D., Technical University of Wroclaw—Assistant Professor, Statistical Consulting, Nonparametric Methods, Categorical Data Analysis, Visualization Methods, Exploratory Data Analysis

Anne M. Barker, BA, Nazareth College; MS, Rochester Institute of Technology; Ph.D., University of Rochester—Assistant Professor, Taguchi Methods, Design of Experiments, Statistical Process Control, Regression Analysis

Thomas B. Barker, BS, MS, Rochester Institute of Technology—Associate Professor, Statistical Experimental Design, Taguchi Methods, Psychometric Scaling, Regression Analysis

John D. Hromi, BS, Carnegie-Mellon University; BEE, Clemson University; M. Litt., University of Pittsburgh; D. Engr., University of Detroit—Professor Emeritus

Stephen M. LaLonde, BS, State University at Potsdam, MS, Ph.D., Syracuse University—Assistant Professor

Daniel R. Lawrence, BA, BS, University of Akron; MA, Ball State University; MS, Rochester Institute of Technology; Ph.D., University of Toronto—Associate Professor, Multivariate Analysis (especially of categorical data), Qualitative Measurement, Psychometrics, Survey Design and Analysis

Joseph G. Voelkel, BS, Rensselaer Polytechnic Institute; MS, Northwestern University; Ph.D., University of Wisconsin-Madison—Associate Professor, Chair, Experimental Design, Process Modeling and Improvement, Multivariate Analysis, Reliability, Nonparametrics

Note: Prerequisites are within parentheses at the end of the course description.

Electrical Engineering

0301-701 Signals & Systems
Required of all graduate students, this course provides an understanding of complex variables and transform calculus. Topics include theory of complex variables; transformations; analyticity; singularities; complex integrations; Cauchy's and residue theorems; series expansions. Taylor and Laurent series; conformal mapping; advanced topics in continuous-time Fourier series and transforms; Laplace transforms (existance, inversion integral, branch points, and applications to discrete-time systems), Fourier analysis of discrete-time signals (discrete Fourier transform-"DFT"), fast Fourier transform-"FFT" and applications of the FFT algorithm. Credit 4

0301-702 Random Signals & Noise
In this course the student is introduced to random variables and stochastic processes. Topics covered are probability theory, conditional probability and Bayes theorem, discrete and continuous random variables, distribution and density functions, moments and characteristic functions, functions of one and several random variables, Gaussian random variables and the central limit theorem, estimation of a random variable, random processes, stationarity and ergodicity, auto correlation, cross-correlation and power spectrum density, response of linear prediction, Wiener filtering, elements of detection, matched filters. (Graduate standing) **Credit 4**

0301-703 Matrix Methods in Electrical Engineering
This course is required of all graduate students. It deals with the elements of linear algebra and states variables as applied to continuous and discrete-time systems, Topics include linear vector spaces, matrices, matrix transformations, Cayley-Hamilton theorem, state variables, canonical realizations of state equations, state transition matrix, solution of state equations, stability analysis and applications. **Credit 4**

0301-711 Physics of Bipolar Devices
An advanced level course in electronic transport in semiconductors and the operation of bipolar devices (pn junction diodes, bipolar junction transistors and semiconductor-controlled rectifiers). Topics include electron drift, diffusion and carrier lattice interactions, energy band diagrams in non-uniformly doped semiconductors, continuity equations, impact ionization, tunneling, advanced static and dynamic analysis of diodes and bipolar transistors, design of bipolar devices. **Credit 4 (F)**

0301-712 Phys & Scaling of CMOS Development
An advanced level course on MOSFET's and submicron CMOS devices. Topics include MOS capacitators, gated diodes, long channel MOSFET, subthreshold conduction and offstate leakage, short channel effects, ion-implanted channels, buried-channel PMOS, CMOS scaling and structural design of submicron CMOS, advanced well technologies and latch-up immunity, CCDs and memory devices (EPROMs, EEPROMs including Flash EEPROMs, SRAMs, DRAMs). **Credit 4 (W)**

0301-713 Solid State Physics
An intermediate level course on the physical properties of semiconductors for engineering students. The emphasis is on semiconductor materials and fundamental solid state physics. Topics include electronic structure of atoms, crystal structures, direct and reciprocal lattices, Bragg diffraction, Bloch electrons, energy band theory, effective mass theory, energy-momentum relations in direct and indirect band gap semiconductors, intrinsic and extrinsic semiconductors, statistical physics applied to carriers in semiconductors, density of states, and lattice vibrations. Credit 4 (S)

0301-715 Machine Vision
The course introduces both high- and low-level digital image processing techniques with emphasis on applications. The major topics are binary images (orientation and center calculations, projections, run-length coding, morphological filters, optimal binary filters), gray-level images (enhancement, nonlinear filters, segmentation, object identification, discriminators), time varying images, motion analysis, **3-D** information. **Credit 4 (F)**

0301-726 Analog IC Design
A course in the analysis and design of bipolar analog integrated circuits. Topics include device models, amplifiers, current sources and active loads, output stages, operational amplifiers, precision reference design and analog circuit design in bipolar LSI. Course will involve circuit design and computer simulation projects. **Credit 4**

0301-727 VLSI Design
A course in the design of very large scale integrated circuits at the level of Mead and Conway's VLSI Design. Topics include MOS devices and circuits, n-channel MOS process, data and control flow in systematic structures, implementing integrated system design, system timing and examples of LSI computer systems. (0301-724,670 and a course in computer architecture) **Credit 4**

0301-730 Advanced Analog IC Design
An advanced course in analog integrated circuit design. Students will study bipolar and MOS realization of operational amplifiers, analog multipliers, A to D and D to A converters, switched capacitor filters and more. The students will participate in design projects including circuit design, layout and SPICE simulation. (0301-726) Credit **4**

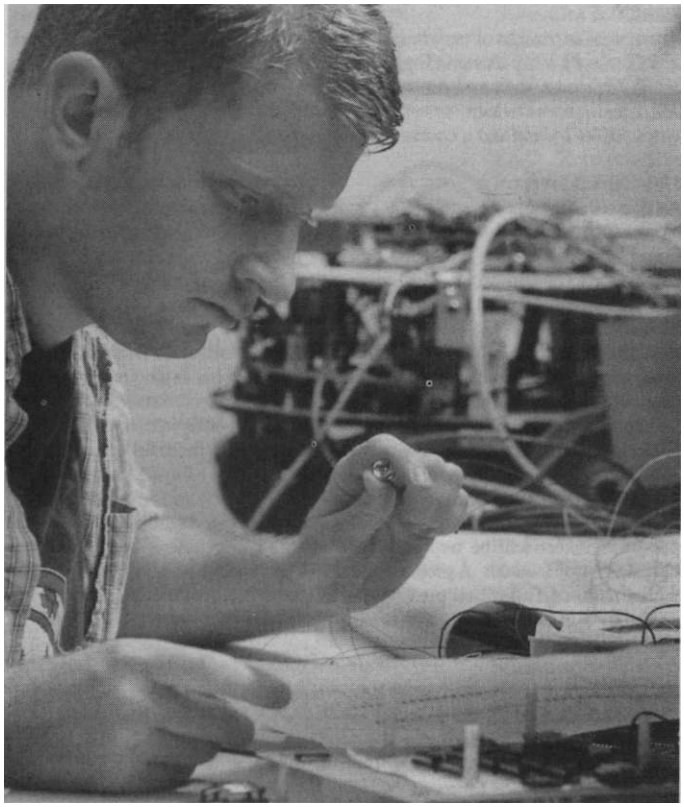
0301-731 Design of High Performance Digital Systems
This course deals with the practical aspects of modern packaging techniques for assembly of electronic systems and the effects of these techniques on electronic and thermal performance characteristics. The stress is on system and subsystem packaging rather than on component packaging and includes both surface-mount and through-hole printed circuit boards as well as multi-chip modules. Design for assembly, design for test, design for reliability, and embedded microprocessor systems are all considered. Along with the usual examinations, a paper or project will be required. Will include presentations by experienced industrial professionals. A project similar to a term paper will be required along with an oral and a written presentation of the project results. Projects are supported by Sun workstations and commercial CADENCE software. (0301-650 or equivalent) Credit 4

0301-732 Digital System Design with VHDL
This course deals with the practical aspects of digital system design using the IEEE-standard VHSIC Hardware Description Language (VHDL) and a modern commercial development system. The course begins with a brief summary of the syntax of VHDL followed by several examples of hardware modeling. Simulation of VHDL models with test benches is discussed, and the applications of VHDL to top-down design methodology are presented. Two projects will be required. The first is primarily to attune the student to the VHDL development system, while the second is a real subsystem designed and implemented on programmable devices. The course will be supported by the Altera-VHDL software and hardware and/or by the Xilinx-VHDL hardware and software. (0301-650 or equivalent) Credit **4**

0301-741 Design for Testability
This course deals with the design systems for testability and for maintainability. A survey of criteria for testability is given. A discussion of fault simulation and test pattern generation is included. Random test pattern generators and associated data compression schemes such as signature analysis are also described. Scanning techniques (both scan path and boundary scan) are discussed. The tradeoffs between built-in testing capacity and additional silicon structures are weighed. A small project, usually involving simulation, will be required. (0301-650) Credit 4

0301-742 Advanced Microprocessor Software Design
An introduction to the theory and application of top-down design, structure, abstraction, segmentation, high-level languages, and operating systems to real-time programs for microprocessors. Students will become proficient in a structured high-level language. Topics include structure diagrams, separate module compilation, data types, data structures, self-documenting code, procedures, meaningful variable names, linkage with other languages, object code libraries, operating system calls, multi-tasking concurrent and re-entrant programs, and symbolic debugging. (0301-365 or a high-level programming language) Credit 4

0301-749 Speech & Image Compression
Modern compression techniques used in efficient digital transmission and storage of speech and image waveforms are dealt with. Topics include digital communication channels, sampling and reconstruction of one-dimensional and two-dimensional signals, coding concepts, bit rate, coder complexity, rate distortion and information-theoretic bounds, characteristics of speech and image waveforms, quantization techniques, uniform nonuniform, logarithmic, optimum (Max), entropy coding, adaptive, pulse code modulation (PCM) of audio and video waveforms, DPCM, ADPCM, and delta modulation, linear prediction, transform coding, optimum (Karhunen-Loeve) transform and its gain, suboptimum transforms, DFT, DCT, DST, DHT, and DWHT, special coding schemes, run-length coding, block truncation coding, sub-band coding, vector quantization, comparative performance of various schemes. Computer assignments and demonstrations are involved. Credit 4



0301-754 Analytical Tech I
Required of all graduate students, this course provides an understanding of complex variables and transform calculus. Topics include theory of complex variables; transformations; analyticity; singularities; complex integration; Cauchy's and residue theorems; series expansions. Taylor and Laurent series; conformal mapping; advanced topics in continuous-time Fourier series and transforms; Laplace transforms (existance, inversion integral, branch points, and applications), Z-transform (ROC, inversion integral, properties and applications to discrete-time systems), Fourier analysis of discrete-time signals (discrete Fourier transform (DFT), fast Fourier transform (FFT) and applications of the FFT algorithm. Credit 4

0301-755 Analytical Tech II
This course is required of all graduate students. It deals with the elements of linear algebra and states variables as applied to continuous and discrete-time systems. Topics include linear vector spaces, matrices, matrix transformations, Cayley-Hamilton theorem, state variables, canonical realizations of state equations, state transition matrix, solution of state equations, stability analysis and applications. Credit 4 (W)

0301-756 Analytical Tech III
In this course the student is introduced to random variables and stochastic processes. Topics covered are probability theory, conditional probability and Bayes theorem, discrete and continuous random variables, distribution and density functions, moments and characteristic functions, functions of one and several random variables, Gaussian random variables and the central limit theorem, estimation of a random variable, random processes, stationarity and ergodicity, autocorrelation, cross-correlation and power spectrum density, response of linear systems to stochastic inputs, introduction to linear prediction, Wiener filtering, elements of detection, matched filters. (Graduate standing) Credit 4

0301-761 Modern Control Theory
An advanced course in control theory, topics covered include review of state-space formulation of SISO systems, solution of state equations, STM and its properties, application of state-space concepts, state variable design, multivariate systems, preliminaries, systems of lease order, stability and control. (0301-700,701,513) Credit 4

0301-762 Nonlinear Control Systems
This course is an introduction to the physical nature and mathematical theory of nonlinear control systems behavior using phase plane techniques. Liapunov theory (including Aizerman's method, variable gradient methods and the Lure forms), perturbation methods, describing function techniques, and Papov's criterion and analysis of switching and relays are discussed. These are applied to both piecewise-linear and analytical nonlinear systems. (0301-761) Credit 4

0301-763 Stochastic Estimation & Control
This course is concerned with the control of systems in the presence of uncertainties. Topics to be discussed: modeling of stochastic processes, estimation theory, least squares estimation, maximum-likelihood estimation, MAP estimation, optimum filtering and prediction, optimum smoothing and interpolation, the Wiener-Hopf equation, solution to casual and non-casual cases, state estimation, Kalman filtering, discrete and continuous time filters, Riccati equation, optimum feedback control in presence of noise, LQC problem and applications. (0301-702, 761) Credit 4

0301-764 Digital Control Systems
An introduction to the analysis and design of control systems in which the microcontroller plays a principal role. Topics include sampled data systems, Z and W-place analysis and design, algorithm generation and the effect of computer word length on noise and stability. The student will be expected to make use of the digital computer in the implementation of design procedures. (0301-701) Credit 4

0301-765 Optimal Control
An introduction to the calculus of variations. Topics covered include conditions of optimality; optimizing transient performance by statistical and variational procedures, dynamic programming and Pontryagin's maximum principle; and the design of optimal linear systems with quadratic criteria. (0301-761) Credit 4

0301-767 Power Semiconductor Circuits
The objective of this course is to provide an adequate application-oriented knowledge to those interested in the areas of control, power and power electronics. Topics to be discussed: preliminaries, basic principles of static switching thyristor theory, triggering, commutations; rectifiers; principles of controlled rectification, analysis of single- and three-phase controlled rectifiers; inverters; series and parallel SCR inverters, design of inverters, sine wave filters; forced commutation inverter, McMurray inverter, DC systems, principles of AC-DC conversion, choppers, DC motor drives, dual converter; cyclo-converter, controls. Modeling and simulation of thyristor circuits; thyristor models approximations, digital simulation of choppers, inverters and cyclo-converters, areas of further research. Demonstration experiments will be set up. Also individual projects by interested students will be encouraged. Credit 4

0301-768 Adaptive Signal Process
An introduction to the fundamental concepts of adaptive systems; open and closed loop adaptive systems; adaptive linear combiner; performance function and minimization; decorrelation of error and input signal. Adaptation algorithms such as steepest descent, LMS and LMS/Newton algorithm. Noise and misadjustments. Applications will include system identification, deconvolution and equalization, adaptive arrays and multipath communication channels. (0301-756 or permission of instructor) Credit 4

0301-769 Fuzzy Logic & Applications
This course introduces fuzzy logic and its applications in areas like control systems, image processing, decision making, etc. Major topics: fuzzy sets, rule base, generation and combinations of rules, defuzzification. Fuzzy systems, choice of fuzzy variables, their division into fuzzy sets, choice of membership functions, the effect of these on system performance. Applications: discussion of published works and student projects using fuzzy logic. Students are required to research the published literature and/or do projects and take an active part in these discussions.

0301-770 Pattern Recognition
This course introduces the mathematical techniques applied to the recognition of patterns in signals. It deals with classical techniques as well as treating the more recent strategies of neural networks. Although the techniques are described in a general way, the course eventually applies these methods to the recognition of patterns in images. Topics include Bayes decision theory, parametric and non-parametric techniques, the use of linear discriminant functions and the use of neural networks in pattern recognition. Methods of feature selection will also be discussed. Applications to images will include image preprocessing for edge detection and edge following algorithms. Applications will also deal with the use of Fourier, Cosine and Moment image descriptors. Class 4, Credit 4

0301-772 Special Topics
Topics and subject areas that are not among the courses listed are frequently offered under the title of Special Topics. Such courses are offered in a normal format; that is, regularly scheduled class sessions with an instructor. (No regular course schedule) **Credit 4**

0301-775 Optical Engineering I
An introduction to the properties of optical components and their combination into systems, primarily from a geometrical optics point of view. The course develops paraxial matrix method with application to zoom lens design and extends the matrix method to meridional rays and skew rays and develops FORTRAN programs for the reduction of spherical aberration, coma, astigmatism and curvature of field. It also covers aspherical surfaces, Schmidt system, photometry and the design of projection and achromatic systems. **Credit 4**

0301-776 Electro-optics
This course deals with the principles of the laser and its operation. It covers ray tracing in an optical system, Gaussian beams, optical resonators, interaction of radiation and atomic systems, theory of laser oscillation, Q-switching and mode-locking. It also covers some specific laser systems and electro-optic modulation of laser beams. (0301-472 or equivalent) Credit **4**

0301-778 Fiber Optics
This course introduces the basic concepts of wave propagation in fibers. It reviews basic waveguide equations and applies the theory to dielectric slab waveguide, step-index and graded-index fibers. It covers the techniques of source coupling and splicing and discusses optical sources such as semiconductor lasers and LED. Applications to communication systems will also be discussed. (0301-472 or equivalent) **Credit 4**

0301-779 Digital Image Processing
This is an introductory course in digital image processing which begins with a study of two-dimensional signal processing and transform methods with applications to images. Image sampling is discussed followed by gray level description of images and methods of contrast manipulation including linear/nonlinear transformation and histogram equalization and specification. Image smoothing methods are considered including spatial and frequency domain low pass filtering, AD-HOC methods of noise removal and median filtering. Following this, methods of image sharpening are studied including derivative methods and high pass filtering. Edge and line detection methods are discussed using masks and hough transforms, methods of image segmentation and degradation and image restoration, including deblurring. Several extensive computer and DSP lab assignments are required. (0301-755, 754 or permission of instructor) **Credit 4**

0301-780 Independent Study
This course number should be used by students who plan to study a topic on an independent study basis. The student must obtain the permission of the appropriate faculty member before registering for the course. Credit 4

0301-788 Advanced Topics in Digital Signal Processing
This course covers signal processing techniques that are widely used but not covered in fundamental signal processing courses. Topics include review of random processes, spectral estimation, periodgram, Blackman-Tudey spectral estimation, rational transfer function models, AR, MA and ARMA spectral estimators, maximum likelihood spectral estimation, two-dimensional spectral estimation, multirate DSP, sampling and signal reconstruction, decimators and interpolators and quadrature mirror filters (QMF), homomorphic signal processing, multiplicative homomorphic systems for convolution, homomorphic image processing and complex cepstrum, effects of finite register length in DSP, effect of number representation on quantization, quantization in sampling analog signals, finite-register-length effects in realizations of FIR and IIR filters, introduction to higher order spectra. (0301-756) Credit 4

0301-793 Error Detection & Error Correction
This course covers linear block codes and convolutional codes. The major linear block codes to be covered are Hamming, BCH, Golay and Reed-Solomon codes. The fundamental structure of linear block codes will be developed and applied to performance calculations. The structure of cyclic codes will be developed and applied to encoders and decoders. The major error correction methods, including error trapping, majority logic decoding and the BCH algorithm will be developed and the Biterbi and sequential decoding algorithms will be studied. Questions of system performance, speed and complexity will be examined. (0301-756) Credit 4

0301-794 Information Theory
This course introduces the student to the fundamental concepts and results of information theory. This is a very important course for students who want to specialize in signal processing, image processing, or digital communication. Topics include definition of information, mutual information, average information or entropy, entropy as a measure of average uncertainty, information sources and source coding, Huffman codes, run-length constraints, discrete memoryless channels, channel coding theorem, channel capacity and Shannon's theorem, noisy channels, continuous sources and channels, coding in the presence of noise, performance bounds for data transmission, rate distortion theory. (0301-756) Credit **4**

0301-795 Optical Engineering II
This course emphasizes the application of wave optics to optical systems. It covers various applications of wave optics to optical systems. Topics include Michelson interferometer, Fourier transform spectroscopy, Fabry-Perot interferometer, thin films, methods of synthesis for dielectric multilayer filters, Fraunhofer and Fresnel diffraction, Fourier optics, spatial filtering and holography. (0301-474 or equivalent) **Credit** 4

0301-800 Graduate Paper
This course number is used to fulfill the graduate paper requirement under the non-thesis option for the MS degree in electrical engineering. The student must obtain the approval of an appropriate faculty member to supervise the paper before registering for this course. Credit **5**

0301-890 Thesis
An independent engineering project or research problem to demonstrate professional maturity. A formal written thesis and an oral defense are required. The student must obtain the approval of an appropriate faculty member to guide the thesis before registering for the thesis. A thesis may be used to earn a minimum of 6 credits and a maximum of 12 credits. The usual is 9 credits. **Credit variable**

Graduate Co-op Education [Optional]
Three to six months of full-time paid employment in the Electrical Engineering field. This course is optional and is offered during summer quarters only. See the EE Graduate program coordinator or RIT's Office of Cooperative Education for further details. (Good academic standing, completion of Bridge and a minimum of 16 graduate credits, and approval of the academic advisor).

Industrial and Systems Engineering

0303-701 Principles of Operations Research I
Applied linear programming. Computational techniques for solving constrained optimization problems. Linear programming, the Simplex method and variations, duality and sensitivity testing. **Credit 4**

0303-702 Mathematical Programming
An introduction to the mathematical foundations of nonlinear optimization techniques. Development of programming algorithms and computer-aided solutions of nonlinear optimization problems. Credit **4**

0303-710 Systems Simulation
Methods of modeling and computer simulation of stochastic and dynamic manufacturing systems are discussed. A high-level simulation language such as ProModel, SIMAN, etc., will be used to model the system and examine system performance. Model validation, design of simulation experiments, variance reduction techniques and random number generation will be discussed as time permits. (0303-715,775 or equivalent) Credit **4**

0303-711 Advanced Simulation Techniques
An advanced course in developing simulation models using good model building, verification and validation procedures. Emphasis will be on review and use of probability distributions, simulation output data analysis for making good decisions, comparison of alternative system configurations, use of designed experiments and the use of advanced simulation techniques. Real world case studies will be examined to convey understanding and teaching of the material. Students will be asked to build models, so simulation experience and working knowledge of a simulation language will be required. (0303-503)

0303-716 Statistical Analysis for Engineers **II**
A first course in least squares linear regression. Topics covered include estimation of model parameters, significance testing of model parameters, detection and treatment of influential observations, model adequacy checking and variable selection techniques. May not be used as a professional elective. (0303-715) Credit **4**

0303-720 Production Control
A systems approach to the design of production control operations. Investigation of forecasting, operations planning, inventory control and scheduling. Case studies and the design of actual production systems are encouraged. (0303-701, 0303-715) Credit 4

0303-723 Facilities Planning
Principles of plant layout and material handling. Topics covered include criterion selection, cost elements, the layout design process, SLP, computerized plant layout and quantitative plant layout and material handling techniques relating to operations research. Includes site visits and a facility design project. **Credit 4**

0303-725 Technological Forecasting
Technological forecasting is concerned with the Delphi method, SOON charts, trend extrapolation, relevancy trees, cross input analysis, internally consistent scenarios and decision matrices. The course will provide a thorough introduction to the basic concepts and techniques of technological forecasting. **Credit 4**

0303-729 Advanced Systems Integration
This course introduces concepts and techniques needed to specify, design and implement computer-integrated manufacturing systems. Students will become familiar with real-world data acquisition problems and will work with interface electronics for process monitoring and control. (0303-775 or 0303-503 and 0303-302 or permission of instructor) **Credit 4**

0303-730 Ergonomics & Human Factors
A survey course of human factors and ergonomics emphasizing a systems approach in looking at human capacity for physical and mental work versus the demands placed upon the human by the task, machine and environment. Various models of human performance are covered. **Credit 4**

0303-731 Advanced Topics: Ergonomics & Human Factors
Advanced topics are selected based on current ergonomic and human factors issues and interests of students. Course is taught using a seminar format. (0303-730 or equivalent) **Credit 4**

0303-732 Work Physics & Biomechanics
Theoretical fundamentals of human body physiology and mechanics applied to work. Development applications of biomechanics and biomechanical models. Kinematics of the link system of the body and extremity joints. (0303-730 or equivalent) Credit 4

0303-733 Cognitive Engineering
Measurements of human performance. Fundamentals of human information processing and how they relate to the design of human-machine systems. (0303-730 or equivalent) **Credit 4**

0303-734 Systems Safety Engineering
Acquaints students with practical aspects of safety engineering. Students acquire a working knowledge of legal and technical aspects of safety. Focuses on a systems approach to safety engineering. Topics include Workers Compensation, OSHA, Consumer Product Safety Commission and NIOSH Guidelines and various hazard analysis and utilization techniques. Students also are exposed to various theories of accident causation, research methodology and ways of evaluating safety programs and related research. Professional elective. **Class** 4, **Credit** 4 **(S)**

0303-740 Numerical Control & Manufacturing
Numerical control is the simple but powerful programming language used by machine tools (i.e., mill or lathe) to automatically machine complex workpart geometry under real-time computer control. Three levels of NC programming will be studied: manual programming, conversational programming, and the use of off-line CAD/CAM tools based on interactive graphics and process simulation. Extensive laboratories will be run using state-of-the-art CNC machine tools. Students will gain hands-on experience with multi-axis milling, turning and electrodischarge machining (EDM). Advanced manufacturing topics such as computer-aided manufacturing (CAM) and computer-aided process planning (CAPP) will be addressed through lectures, discussion and a comprehensive CAD/CAM design project. Professional/Technical Elective. **Credit 4**

0303-741 Applied Robotics in Manufacturing Systems
This course introduces the fundamentals of robotics and robotics applications in manufacturing systems. The course deals with analysis of robotic systems, robotic selection and feasibilities, integration of robots in manufacturing systems, design of robot work stations, materials handling, programming, control and safety. (Permission of instructor) Credit 4

0303-742 Artificial Intelligence Applications in Manufacturing
An introductory course in the development and application of "intelligent" (knowledge-based) systems within the realm of manufacturing. Students will be exposed to various programming languages (e.g., LISP and/or ProLog) and expert system development shells. Topics to be explored include knowledge representation schemes, search strategies and their implementation, computer-aided process planning, robot/AGV path planning, automated scheduling, pattern recognition, knowledge-based systems and neural networks. Credit **4**

0303-747 Microprocessors Applications
Automated manufacturing processes demand effective computer-microprocessor interfacing. This course will provide the necessary knowledge of assembly language programming and digital hardware interfacing techniques. The role of macro-assemblies, high-level languages and systems software aids to develop efficient modular programs will be discussed. One or more specific manufacturing related applications will be implemented. Microprocessor architectures and interfacing to several hardware elements such as VART, PIA, A/D, D/A and other LSI chips will be covered. A greater emphasis will be placed on software aspects such as modularity, data structure, interrupt handling, and communication protocols to design efficient hierarchical control systems for computer-integrated manufacturing. Credit 4

0303-750 Mgt Quality Control Systems
This is a survey course designed to expose upper-level students to managerial aspects of quality control systems. Ideas from a number of quality consultants (Juran, Gryna, Crosby, Taguchi, etc.) will be covered to give students an overview of topics such as fitness for use, quality costs, quality planning, statistical quality control and experimental design for quality improvement. (Graduate standing or consent of the professor; 0303-715) **Credit 4**

0303-755 Multicriteria Decision
Decision making is the process of selecting a possible course of action from all available alternatives. In most real-world problems multiplicity of criteria for judging the alternates is unavoidable. This course explores some of the multiple objective and attribute methods to analyze conflicting and incommensurate criteria. (0303-701,702) **Credit 4**

0303-756 Decision Analysis
This course presents the primary concepts of decision analysis. Topics important to the practical assessment of probability and preference information needed to implement decision analysis are considered. Decision models represented by a sequence of interrelated decisions, stochastic processes and multiple criteria are also considered. (0303-715 or equivalent) **Credit 4**

0303-757 Reliability
This course deals with mathematical concepts and techniques for modeling and analyzing the reliability of systems. (0303-715 or equivalent) Credit **4**

0303-758 Design of Experiments
This course presents the primary concepts of experimental design. Its applied approach uses theoretical tools acquired in other mathematics and statistics courses. Emphasis is placed on the role of replication and randomization in experimentation. Numerous designs and design strategies are reviewed and implications on data analysis are discussed. (0303-715 or equivalent) Credit 4

0303-760 Product/Process Development & Design
This course introduces the principles of developing manufacturable electromechanical products. Topics include product development models, systems and product architectures, requirements analysis, systems engineering tools and techniques, structured design methods, design for manufacturing, and life cycle analysis. Requires acceptance into the MM&L program or permission of instructor. (0303-625) **Credit 4**

0303-762 Manufacturing Systems Modeling & Performance
Course studies two interrelated subjects: mathematical modeling, and manufacturing simulation modeling and analysis. A high-level manufacturing system modeling language is utilized. An introduction to the methods used to establish and analyze manufacturing performance measures is also covered. Credit **4**

0303-766 Manufacturing Systems
The course introduces the principles of planning and designing modern manufacturing systems that are consistent with corporate objectives. Topics include enterprise and manufacturing strategies, architecting manufacturing systems, systems thinking and systems concepts, process and management choices, architecting focused manufacturing systems, architecting flexible manufacturing systems, architecting efficient manufacturing systems, manufacturing in the extended enterprise, manufacturing support systems, justification and planning and information systems for manufacturing. Requires acceptance into the **MM&L** program or permission of instructor. **Credit 4**

0303-771 Special Topics in Industrial Engineering
This is a variable credit, variable topics course that can be in the form of a regular course or independent study under faculty supervision. Credit variable (maximum 4 per course number)

0303-775 Data Structures Using C
An introductory course in data structures and algorithms using the C programming language. Topics include sorting, searching and lists. This course can be used as a foundation for many computer-based courses in engineering. **Credit 4**

0303-776 Case Studies
The analysis and solution of complex systems problems for students enrolled in the Systems Engineering Option. Cannot be used as a professional elective at the undergraduate level. Course is capstone for Systems Engineering ME students. **Credit 4**

0303-777 Engineering Internship
This course number is used by students in the master of engineering degree program to register for an internship experience. The number of credits is to be determined by the student's faculty adviser and is subject to the approval of the Graduate Committee of the College of Engineering. **Credit variable**

0303-785 Engineering Risk Benefit Analysis
This course presents the student with the many frameworks helpful for balancing risks and benefits in situations involving human safety, potential environmental effects and large financial uncertainties. ERBA emphasizes three methodologies: decision analysis, cost-benefit analysis (in the presence of uncertainty), and probabilistic risk assessment. **Credit 4**

0303-799 Independent Study
This course number should be used by students who plan to study a topic on an independent study basis. The student must obtain the permission of the appropriate faculty member before registering for the course. Students registering for more than four credit hours must obtain the approval of both the department head and the adviser. **Credit variable**

0303-890 Research & Thesis
In conference with a faculty adviser, an independent engineering project or research problem is selected. The work may be of a theoretical and/or computational nature. A state-of-the-art literature search in the area is normally expected. A formal written thesis and an oral defense with a faculty thesis committee are required. Submission of bound copies of the thesis to the library and to the department and preparation of a written paper in a short format suitable for submission for publication in a refereed journal are also required. Approval of department head and faculty adviser needed to enroll. **Credit variable (1 to 9) (F, W, S, Su)**

Mechanical Engineering

0304-743 Control Systems
Introduces the student to the study of linear control systems, their behavior and their design and use in augmenting engineering system performance. Topics include control system behavior characterization in time and frequency domains, stability, error and design. This is accomplished through classical methods that employ the use of Laplace transforms, block diagrams, feedback control, root locus, and Bode diagrams. A companion laboratory will provide students with significant hands-on analysis and design experience. (0304-543) **Class 3, Lab 3, Credit 4 (S)**

0304-758 Engineering Vibrations
This is a course on the theory of mechanical vibrations with an emphasis on design applications and instrumentation. Fourier analysis techniques, numerical and experimental analysis and design methods are presented in addition to theoretical concepts. Vibrations of single-degree of freedom systems are covered including free damped and undamped motion; harmonic and transient forced motion including support motion, machinery unbalance, and isolation. Modal analysis of multi-degree of freedom systems is introduced. In addition to laboratory exercises on vibration instrumentation, an independent design project is assigned. (0304-543) Class 3, Lab 2, Credit 4 (F, W)

0304-801 Design for Manufacture
This is a required course in the manufacturing option of the master of engineering degree program. The course is offered jointly by the departments of Industrial and Manufacturing Engineering and Mechanical Engineering and presents an overview of the factors influencing product design and the manufacturing cycle. Topics include component design and analysis, design for manufacturability as well as function and design for manual and automated assembly. Students will gain hands-on experience with the Boothroyd/Dewhurst system to quantify design efficiency through a term project. The various manufacturing processes as they relate to modern trends in DFM are covered in detail. (Graduate standing) Class 4, Credit 4 (W)

0304-810 Introduction to Continuum Mechanics
A rigorous basis for the study of advanced fluid mechanics and solid mechanics is presented. Cartesian tensors. Analysis of stress and deformation. Motion of continuous medium. Applications to theory of elasticity, thermoelasticity, viscoelasticity and fluid mechanics. (0304-871) Class 4, Credit 4 (even year, F)

0304-811 Theory of Elasticity/Plasticity
Stress-strain relations and formulation of boundary value problems. State of plane strain, state of plane stress. Solutions by potentials and Airy stress functions. Torsion of bars with circular, elliptic, rectangular cross-sections. Stresses and displacements in thick cylinders, disks and spheres. Contact stress problems. Energy principles. (0304-810) Class 4, Credit 4 (even year, W)

0304-816 Finite Elements
This is an introductory course on the modern theory of finite element analysis. Although the necessary mathematics will be kept to a minimum, the course content has been designed to provide the skills necessary to write an F. E. program and to understand the structure and capabilities of commercially available codes. Applications to problems in structural mechanics, heat transfer and fluid mechanics. (0304-870, 885) Class 4, Credit 4 (every year, S)

0304-820 Advanced Optimal Design
Applied topics from nonlinear programming and design optimization. Multivariable unconstrained and constrained optimization. Gradient based methods. Numerical techniques developed using MATLAB. Discrete and global optimization. Application to an engineering problem through a final project. (0304-871, 874) Class 4, Credit 4 (every year, S)

0304-821 Advanced Vibrations
Vibration of discrete multi-mass systems using matrix methods. Normal mode theory and matrix eigenvalue extraction procedures. Matrix forced response. Practical examples using two-and-three degrees of freedom. Vibration of continuous systems. Computer simulations. (0304-758) Class 4, Credit 4 (every year, W)

0304-823 Systems Modeling
This course is designed to introduce the student to state-space modeling techniques and response characterization. Both lumped and distributed parameter systems will be considered. System performance will be assessed through numerical solution using MATLAB/Simulink. Traditional closed-form solution methods utilizing Laplace and Fourier transforms, transfer functions are also discussed. (0304-543 or equivalent) Class 4, Credit 4 (every year W)

0304-828 Special Topics: Applied Mechanics
In response to student and/or faculty interest, special courses which are of current interest and/or logical continuations of regular courses will be presented. These courses will be structured as ordinary courses with specified prerequisites, contact hours and examination. (Graduate standing) Class 4, Credit 4 (TBA)

0304-830 Introduction to CFD Analysis
This graduate core course covers basic numerical techniques applicable to equations in fluid mechanics and heat transfer. Numerical methods required for programming partial differential equations are introduced. Course work involves analytical programming and design examples. Commercial software is also explored. **(0304-838,851) Class 4, Credit 4 (every year S)**

0304-831 CFD Applications
This course introduces the students to some of the commercial **CFD** codes being used for solving thermal-fluid problems. After an introduction to in-house **CFD** codes, students are expected to complete an individual **CFD** study project including a written report and a presentation of the results as part of the course requirements. **(0304-830,851) Class 4, Credit 4 (odd years, S)**

0304-833 Heat Exchanger Design
This course presents an overview of the different heat exchangers used in industry including shell-and-tube, plate, tube-fin, and plate-fin heat exchangers. Analytical modeling of recuperators, regenerators, and transient performance is also covered. Thermal design methods for designing shell-and-tube and compact heat exchangers are presented. Students are required to carry out a major design project in the course. **(0304-514; 0304-550** or **851) Class 4 Credit 4 (odd** years, **W)**

0304-834 Boiling & Condensation
This course provides a basic understanding of the phase change phenomena associated with boiling and condensation heat transfer. This knowledge is applied in the design of industrial systems such as evaporators, condensers and distillation columns. Students are required to undertake a major design project in the course. **(0304-514,550) Class 4, Credit 4 (even years, W)**

0304-835 Grid Generation
This graduate elective course introduces modern topics in the theory of grid generation techniques. Although the primary focus will be on the topics of thermal/fluid sciences, the applicability of the theory holds in other fields of interest as well. Topics include algebraic and elliptic grid generation, structured and unstructured grids, and boundary element methods. Some commercially available software will be introduced. **(0304-830) Class 4, Credit 4 (odd years, F)**

0304-838 Ideal Hows
This graduate core course covers the fundamental topics in the theory of aerodynamics and high speed flows. The course discusses modern aerodynamic applications in the areas of wing and airfoil design, wind tunnel testing and compressible flows. **(0304-415) Class 4, Credit 4 (every year, F)**

0304-840 Signal Processing
This course introduces the student to discrete-time signal processing fundamentals, analog-to-digital conversion, and computer-based data analysis. Analytical mathematical developments are supplemented with hands-on computer-based laboratory and homework assignments that promote practical understanding. Topics covered include continuous time and discrete time convolution, correlation, Fourier transformation, and power spectral estimation. Coverage includes the DFT, FFT, z-transform, autocorrelation and cross correlation functions, and spectral estimation. **(0304-870) Class 4, Credit 4 (every year, F)**

0304-842 System Identification
This course introduces the student to continuous-time and discrete-time identification from input-output data series. Practical aspects of the "synthesis" of system character will involve data conditioning, analog-to-digital conversion, and computer-based system analysis using MATLAB. Analytical mathematical developments are supplemented with hands-on computer-based laboratory and homework assignments that promote practical understanding. Topics covered include system response functions, non-parametric and parametric model estimation, model definition and validation, and system response prediction; builds on topics covered in **0304-840,** Signal Processing, and supplements this material as appropriate. **(0304-823,840) Class 4, Credit 4 (odd years, F)**

0304-844 Nonlinear Dynamical Systems
This course is an introduction to nonlinear systems theory and is intended for students in engineering and the physical sciences. Non-linear systems are classified and analyzed using both analytical and computational methods. The emphasis is on the stability and bifurcation theory of discrete and continuous nonlinear systems. Specific examples from mechanics and other areas are discussed in detail. **(0304-870) Class 4, Credit 4 (odd years, W)**

0304-846 Modal Testing & Signal Processing
This course covers the important aspects of obtaining good modal data so that the natural frequencies, damping ratios, and mode shapes of a structure can be determined. Signal processing as applied to modal analysis will be covered including the auto- and cross-correlation functions, Fourier series and transforms, sampling and filtering and DFT/FFT theory. Transducers, excitation methods and commonly used practices in setting up a modal test will be discussed. Curve fitting techniques to extract modal parameters such as SDOF, MDOF, orthogonal polynomial and time domain will be covered. **(0304-758)** Class **4,** Credit **4 (odd** years, **S)**

0304-848 Special Topics: Thermo Fluid
In response to student and/or faculty interest, special courses that are of current interest and/or logical continuation of regular courses will be presented. These courses will be structured as ordinary courses with specified prerequisites, contact hours and examination. A listing of topics for special courses is found at the end of this section. (Graduate standing) **Class 4, Credit 4 (TBA)**

0304-851 Convective Phenomena
This course introduces the student to the flow of real incompressible fluids. The differential approach is used to develop and solve the equations governing the phenomena of mass, momentum, and heat transfer. The material in the course provides the necessary background for a study of computational fluid dynamics. **(0304-415,514) Class 4, Credit 4 (every year, W)**

0304-852 Advanced Turbomachinery
This course introduces the student to some of the advanced topics in turbomachinery. Topics include airfoil theory, two-and three-dimensional flow analysis in radial and axial turbomachines, and turbomachinery flow stability characteristics. Students are expected to do a design project using FLUENT Computational Fluid Dynamics code. **(0304-550,652) Class 4, Credit 4 (even years, F)**

0304-864 Production Tool Design
This is a course in the core group, CAD, of the manufacturing engineering option in the master of engineering degree program. Design of production tooling, jigs and fixtures for the economical manufacture of modern parts is covered in detail. The student must do research in current publications, and complete and present a project. Project, selection can usually be arranged to incorporate an assembly of parts from the student's normal work. There will be field trips to local specialty firms. (Graduate standing) **Class 4 Credit 4 (even years, S)**

0304-865 Computer Implementation
This is a course in the core group, CAD, of the manufacturing engineering option in the master of engineering degree program. It emphasizes the application of the finite element method to problems in the area of static and dynamic structural analysis, heat transfer, and analogous solution. A standard commercial software package is used for these applications where the general structure, operating characteristics and use of a complex program are presented. Topics include the finite element method; shape factors, element formulation, and the element library; program sequencing; general modeling methods (loads, constraints, material factors, mesh generation, interactive graphics, model conditioning); convergence, error analysis and the "patch" test, vibration and heat transfer analysis, and analogous analysis such as acoustics, illumination, etc. **(0304-816)** Class **4,** Credit **4 (odd** years, **F)**

0304-870 Mathematics for Engineers I
A concise introduction to the concepts of matrix and linear algebra, including determinants, eigenvalues, systems of linear equations, vector spaces, linear transformations, diagonalization, orthogonal subspaces and the Gram-Schmidt orthonormalizing procedures. The use of complex exponentials in differential equations is introduced. Fourier series, Laplace and Fourier Transforms are also presented. (Graduate standing) **Class 4, Credit 4 (every year, F)**

0304-871 Mathematics for Engineers II
This course is based on classical analytical methods in engineering and science. Topics covered are orthogonal functions including Fourier Series, Fourier Integrals, Bessel functions, Legendre Polynomials, Sturm-Liouville problems and eigenfunction expansions; an introduction to calculus of variation including problems with constraints; vector analysis including the directional derivative, the gradient, Green's Theorem, the Divergence Theorem and Stokes' Theorem; Laplace transform methods. (Graduate standing) **Class 4, Credit 4 (every year, W)**

0304-872 Analytical Mechanics
This is a course on advanced dynamics and variational methods. Newtonian vector mechanics and energy formulations are applied to two- and three-dimensional problems involving discrete and continuous dynamical systems. The concepts of Virtual Work, Hamilton's principle, and Lagrange's equations are thoroughly covered. Vibrations and multi-body systems are emphasized. The course also includes and introduction to the calculus of variations. **(0304-543, 871) Class 4, Credit 4 (even years, S)**

0304-874 Numerical Analysis
This course emphasizes the development and implementation of methods available to solve engineering problems numerically. Specific topics include root finding for algebraic and transcendental equations, systems of linear and nonlinear equations, interpolation of numerical data and curve fitting, numerical differentiation and integration, ordinary and partial differential equations, including initial and boundary value problems. (0304-870) **Class 4, Credit 4 (every year, W)**

0304-875 Advanced Aerodynamics
This course covers the fundamental topics of aerodynamics and high speed flows. It discusses modem aerodynamic applications in the areas of wing and airfoil design, wind tunnel testing, and compressible flows. (0304-550, 675) **Class 4, Credit 4 (even years, S)**

0304-877 Internship
This course number is used by students in the master of engineering degree program for earning internship credits. The actual number of Credits is to be determined by the student's faculty adviser and is subject to the Graduate Committee of the College of Engineering. Credit **variable**

0304-880 Independent Study
An opportunity for the advanced student to undertake an independent investigation in a special area under the guidance of a faculty member. A written proposal is to be forwarded to the sponsoring faculty member and approved by the department head prior to the commencement of work. (Graduate standing) **Credit variable (maximum of 4 credits per quarter) (every year, F, W, S, SU)**

0304-885 Advanced Mechanics of Solids
This course extends the student's knowledge of stressed mechanical components covered in Mechanics of Materials and lays the foundation for a follow-on course in finite elements. The basic relationships between stress, strain, and displacements are covered in more depth. Stress and strain transformations, plane elastic problems, and energy techniques are covered. Topics from Advanced Strength of Materials include beam bending and torsion problems not covered in Mechanics of Materials. (0304-347) **Class 4, Credit 4 (every year, W)**

0304-888 Project with Paper
The student must demonstrate an acquired competence in an appropriate topic within mechanical engineering. The topic is chosen in conference with a faculty adviser. The work may involve an independent research and/or a design project and/or a literature search with a demonstration of acquired skill. A written paper, approved by the adviser and the department, and an oral presentation of the work are required. **Credit 3 (F, W, S, SU)**

0304-890 Research & Thesis
In conference with an adviser, a topic is chosen. Periodic progress reports and a final written document with an oral examination are required. (Four of the five graduate core courses) **Credit variable (5 to 9** credits **total) (F, W, S, SR)**

Microelectronic Engineering

0305-701 Microelectronics I
An intermediate course in the study of integrated circuit processing. Topics include diffusion, ion implantation, bipolar and MOS processes. Extensive use of CAE tools such as SUPREM. **Class 3, Credit 3 (F)**

0305-702 Microelectronics II
An intermediate course in the study of integrated circuit processing. Topics include atomic models for diffusion, oxidation and ion implantation. Process integration for bipolar and MOS device fabrication is studied in detail. **Class** 3, **Credit** 3 **(W)**

0305-703 Microelectronics III
Students learn materials issues and thin film processing techniques used to manufacture semiconductor devices. Topics include basic vacuum technology, plasma physics, sputtering, evaporation (resistive, electron beam, laser ablation), chemical mechanical planarization, chemical vapor deposition, and etching. The mechanisms of each process are explored and relevant material chemistries are discussed. Thin film growth models are also explained and processing variables are related to material properties. Class 3, Credit 3 (S)

0305-721 Microlithography I
Selected topics from organic, polymer, physical and photographic chemistry important to the understanding of photoresists and optical lithography. Photoresist processes such as negative, positive, reversal, dyed, antireflective coatings, image stabilization and modeling and simulation of photographic processes. Class 3, Credit 3 (F)

0305-722 Microlithography II
A course covering advanced resist systems for optical lithography including antireflective coatings, bi-layer resists, tri-layer resists, and silylation. Electron beam lithography, x-ray lithography, and deep-UV lithography will also be covered. Technologies will be studied from both chemical and physical standpoints. Class 3, Credit 3 (W)

0305-731 Microelectronics Manufacturing I
A course in CMOS manufacturing. Topics include CMOS process technology, work in progress tracking, CMOS calculations, process technology, long channel and short channel MOSFET, isolation technologies, back-end processing and packaging. Class 3, Credit 3 (W)

0305-732 Microelectronics Manufacturing II
A course in CMOS manufacturing. Topics include query processing, measuring factory performance, factory modeling and scheduling, cycle time management, cost of ownership, defect reduction and yield enhancement, reliability, 6 sigma manufacturing, process modeling and RIT's advanced CMOS process. Class 3, Credit 3 (S)

0305-741 Microelectronics I Lab
Laboratory work includes the fabrication of MOS integrated circuits providing an introduction to all I. C. fabrication processes and safety. To be taken concurrently with 0305-701. Lab 3, Credit 1 (F)

0305-742 Microelectronics II
Lab Students learn how to design processes to realize a variety of device structures and properties. Extensive use of CAE tools such as SUPREM. To be taken concurrently with 0305-702. Lab 3, Credit 1 (W)

0305-743 Microelectronics III Lab
This laboratory course complements the lecture material presented in 0301-703. Each of the topics covered in 0301-703 has a designed laboratory to give students practical, hands-on experience with thin film processing equipment. The specific laboratories include 1) vacuum pump-down and evaporation, 2) dc sputtering, 3) reactive magnetron sputtering, 4) chemical mechanical planarization, 5) atmospheric pressure chemical vapor deposition, 6) low pressure chemical vapor deposition, and 7) plasma and reactive ion etching. (0305-703) Lab 3, Credit 1 (S)

0305-751 Microlithography I Lab
Laboratory course topics emphasize photolithographic process characterization techniques and statistical design of experiments. To be taken concurrently with 0305-721. Lab 3, Credit 1 (F)

0305-752 Microlithography II Lab
Process characterization will be studied through experimental design techniques. To be taken concurrently with 0305-722. (0305-721) Lab 3, Credit 1 (W)

0305-761 Microelectronic Manufacturing I Lab
The laboratory for this course is the student-run factory. Lot tracking, data collection, lot history, cycle time, turns, CPK and statistical process control are introduced to the students. Silicon wafers are processed through an entire CMOS process and tested. Students design unit processes and integrate them into a complete process. Students evaluate the process steps with calculations, simulations and lot history, and test completed devices. To be taken concurrently with 0305-731. (0305-701) Lab 3, Credit 1 (W)

0305-762 Microelectronic Manufacturing II Lab
Laboratory experiences are related to the operation of the student-run integrated circuit factory. Silicon wafers are processed through a complete CMOS **process.** To be taken concurrently with 0305-732. **Lab 3, Credit 1 (S)**

0305-770 Independent Study
This course number should be used by students who plan to study a topic on an independent basis. The student must obtain the permission of the appropriate faculty member before registering for the course. Credit variable

0305-777 Internship
This course number is used to fulfill the internship requirement. The student must obtain the approval of the department head before registering for this course. Credit variable

0305-801 Seminar/research
Weekly seminar series intended to present the state of the art in microelectronics research. Other research-related topics will be presented such as library search techniques, patent considerations, ethics, small business opportunities, automated data collection, thesis writing, effective presentations, etc. Required of all MS microelectronic engineering students for one credit each up to four credits. After four credits, graduate students are required to register each quarter for no credits. (Graduate standing in MS in microelectronics manufacturing engineering) Credit **0 to 1 (F, W,** S)

0305-890 Special Topics
In each case, consult instructor before registering. Examples: Advanced Process and Device Simulation (W, odd years); Integrated Circuit Test Methodologies (S, even years); Microelectromechanical Devices and Sensors (W, S); Smart Power Integrated Circuits and Devices (W, odd years); Compound Semiconductors and Devices (W, even years); Automation in Semiconductor Manufacturing (S, even years); Monolithic Microwave Integrated Circuits (S, odd years). **Class 4, Lab 0, Credit 4**

0305-899 Thesis
The master's thesis in microelectronic engineering requires the student to prepare a written thesis proposal for approval by the faculty; select a thesis topic, adviser and committee; present and defend thesis before a thesis committee; submit a bound copy of the thesis to the library and to the department; prepare a written paper in a short format suitable for submission for publication in a journal; complete course work and thesis within a seven-year period; register for one credit of Continuation of Thesis each school term (except summer quarter) after the 45 credits required for the master's degree until the thesis is completed. (Graduate standing in MS in microelectronic engineering) **Class 0, Lab 0, Credit variable 6 to 12 (typically 9) (F, W, S, SR)**

Computer Engineering

0306-720 Electronic Design Automation
The creation of large, complex electronic systems has grown beyond the capabilities of any number of people without computer support. Successful completion of large design projects requires that computers be used in virtually all aspects of design. This course will investigate some of the basic design automation tools and algorithms in order to understand their capabilities, limitations and internal operations. Topics covered will be the VHDL hardware description language, simulation techniques, design synthesis, placement and routing, and design verification methods. Laboratory projects in the use and creation of design automation tools will be required. (0306-561 or equivalent; 0306-630/730 also suggested) **Class 4, Credit 4 (F, W)**

0306-722 Advanced Computer Architecture
This course will emphasize the impact of VLSI and communication issues on computer architecture. Topics covered will include highly concurrent, multiprocessor and fault-tolerant computer systems as well as data flow architectures. Modeling techniques for system verification will also be included. (0306-551 or 0605-720) Class 4, Credit 4 (W)

0306-730 VLSI Design
An introduction to the design and implementation of Very Large Scale Integration (or VLSI) including NMOS and PMOS devices, CMOS circuits and digital subsystems. The procedures for designing and implementing digital integrated systems will be covered including the Mead and Conway structured design approach consisting of the use of stick diagramming, scaling of CMOS design rules and techniques for estimating time delays. Emphasis will be placed on the use of static CMOS circuits and regular structures such as programmed logic arrays in custom and standard cell-based designs. The use of workstations with Mentor Graphics design tools for circuit simulation and physical layouts will be stressed. Graduate level laboratory design projects will be required. Class **4,** Credit **4** (F,S,SU)

0306-731 VLSI Design Projects
A second course in the design and implementation of Very Large Scale integration (VLSI) circuits and systems. Emphasis will be placed on the design and use of dynamic precharge and precharge-evaluate CMOS circuitry including Domino, NORA and Zipper CMOS logic, and subsystems. Basic requirements of a clocking system and a general clocking strategy for timing design in both static and dynamic CMOS circuits will be investigated. Topics on the design and use of a standard cell library in the implementation of large system designs will be covered. The use of workstations with Mentor Graphics design tools and Synopsys synthesis tool suite will be required in laboratory projects leading to the design, VHDL synthesis and testing of an integrated circuit device. **Class 4, Credit 4 (W,** S)

0306-740 Analytical. Topics for Computer Engineering
This course begins by reviewing signal and system analysis techniques for analyzing linear systems. It includes Fourier techniques and moves on to present fundamental computational techniques appropriate for a number of applications areas of computer engineering. A section on numerical linear algebra will include techniques for analyzing discrete time signals and systems. Other major course areas are symbolic logic and discrete optimization techniques, including computer representations of networks, shortest-path problems and minimum spanning tree problems. (1016-265 or 0602-705 and preferably 0605-700) Class **4,** Credit **4 (F)**

0306-741 Design for Testability
This course will introduce the concepts of failure mechanisms and fault modeling in digital circuits. It describes various test strategies for the digital systems. Techniques to integrate design and test for VLSI circuits will be included. Design for autonomous test, SCAN-PATH concepts and testability analysis will be discussed. Built-in self-test (BIST) techniques will be detailed. Concepts of easily testable logic will be introduced. In addition, testability bus and the boundary-scan techniques will be included for system-level testability. **Class 4, Credit 4(F)**

0306-756 Multiple Processor Systems
Introduces basic concepts of parallel and high-performance computing and current methodologies and trends in the design and programming of multiprocessor systems. Theoretical models of parallel computing and performance metrics are studied and contrasted with practical parallel system architectures, programming environments, and benchmarking techniques. Parallel architectures are classified according to mode and degree of parallelism, memory organization, and type and typology of interconnection networks used in the design. The suitability of various architectures in meeting demands is studied in depth including the study of representative examples of current commercial machines. Students will complete programming assignments on a parallel computer illustrating practical issues. A review and analysis of a commercial parallel processor system or an active research area is required; written review presented in class. (0306-722) **Class 4, Credit 4** (S)

0306-758 Fault Tolerant Digital Systems
Formal models and concepts in fault diagnosis. Test generation. Design for testability techniques. Design techniques to achieve fault tolerance. System evaluation techniques. The design of practical fault-tolerant systems. Fault-tolerant design of VLSI circuits and systems. (0603-400 or 0301-650 or 0301-750 or 0306-561,0306-550 or 0603-720) **Class 4, Credit 4**

0306-759 Principles of Digital Interfacing
The objective of this course is to give students basic concepts of interfacing to microcomputer bus systems, including familiarity with various peripheral components currently available. Students will gain experience in the actual implementation of microcomputer systems. The course is hardware oriented, but some high-level software will be required to make the experimental systems operational. (0306-561 or equivalent) **Class 3, Lab 3, Credit 4 (F)**

0306-761 Engineering Design of Software
An advanced course moving the student beyond computer programming to the engineering of complex software systems. At the end of this class, students will be able to make the right selection of design methodologies or architectures, produce executable structure models that can be verified by computer, formulate a design that meets all functional and performance requirements, and perform trade-off analyses that enhance decision making. Students will work in teams on large-scaled software projects. (Knowledge of software engineering process models and related activities, basic familiarity with a high level programming language) **Class 4,** Credit **4 (F, W)**

0306-762 Concurrent Software Design
This course introduces methods for developing and designing concurrent software, which consists of many cooperating processes. Formal logical formulas are used to characterize sets of states and sets of program behaviors. The software is then analyzed by manipulating these logical formulas. Several classical concurrent programming problems such as critical sections, producers and consumers, and resource allocation are examined. Practical examples and exercises are used to illustrate key points and evaluate design tradeoffs. (Permission of instructor) **Class 4, Credit 4 (S)**

0306-772 Special Topics in Computer Engineering
Topics and subject areas that are not among the courses listed here are frequently offered under the title of Special Topics. Such courses are offered in a normal format; that is, regularly scheduled class sessions with an instructor. Credit variable (no regular course schedule)

0306-784 Digital Image Processing Algorithm
This is a graduate-level course that emphasizes the computational and algorithmic techniques required for processing digitized pictorial images. The acquisition and quantization of digital images are described, followed by analysis and filtering techniques. Segmentation, projection and reconstruction techniques are discussed. Finally, bi-level image processing is discussed, including contour filling and thinning techniques. Programming projects will be required. (Competence in calculus, engineering math and structured programming is required) Class **4,** Credit **4**

0306-800 Graduate Project
This course will fulfill the graduate project requirement under the non-thesis option of the MS degree in computer engineering. The student must obtain departmental approval as well as approval from the appropriate faculty members who supervise the project before registering for this course. **Credit 0-5**

0306-890 Thesis
An independent engineering project or research problem to demonstrate professional maturity. A formal written thesis and an oral defense are required. The student must obtain the approval of an appropriate faculty member to guide the thesis before registering. The thesis may be used to earn a minimum of 5 and a maximum of 9 credits. Credit variable

Applied Statistics

0307-701 Statistical Concepts
A service course designed for those not majoring in statistics that emphasizes statistical thinking instead of mathematical manipulations. This is a concept-based introduction to the subject. Topics include sampling and experimentation, methods of displaying and summarizing data, probability, correlation, and formal statistical reasoning. This course is given as a distance learning course only. It does not count as credit for, and is not a prerequisite for, either the advanced certificate or the MS degree. (None) Credit 4

0307-711 Fundamentals of Statistics I
For those taking statistics for the first time. Topics: organizing observed data for analysis, insight, and understanding of variability; learning to understand probability as the science of uncertain events; concepts of random variables and their associated probability models; meaning and practical use of the central limit theorem. This course does not count as credit for either the advanced certificate or the MS degree. (Consent of department) Credit 3 or 4

0307-712 Fundamentals of Statistics II
Continuation of 0307-711. Topics: concepts and strategies of statistical inference for making decisions about populations on the basis of sample evidence; tests for independence and for adequacy of a proposed probability model; separation of total variability of a system into ^identifiable components through analysis of variance; regression and correlation models for studying the relationship of a response variable to one or more predictor variables. This course does not count as credit for either the advanced certificate or the MS degree. (0307-711 or consent of department) Credit **3 or 4**

0307-721 Statistical Process Control
A practical course designed to provide in-depth understanding of the principles and practices of statistical process control. Topics include statistical concepts relating to processes, Shewhart charts for measurement and attribute data, CUSUM charts, EWMA charts, measures of chart performance, tolerances, specifications, process capability studies, short-run control charts. (0307-712 or consent of department) Credit **3 or 4**

0307-731 Statistical Acceptance Control
How to apply modern process-oriented sampling plans to assess performance of product and processes. Topics include single, double, multiple and sequential sampling plans, variables sampling, techniques for sampling continuous production, skip-lot plans, chain plans, AOQL schemes, AQL sampling systems and recent contributions to literature. (0307-712 or consent of department) Credit **3 or 4**

0307-742 Statistical Computing
A course in statistical computing using MINITAB (one credit) and SAS (two credits) statistical software. The course will cover basic procedures; the creation, manipulation and analysis of data; graphics; and macros. (0307-712 or consent of department) **Credits 1,2 or 3**

0307-751 Math for Statistics
This is a survey of mathematical tools of some of the more mathematically rigorous statistics courses of the MS program. The topics include partial and higher-order differentiation, various methods of integration, the gamma and beta functions, and a brief overview of linear algebra, all in the context of application to statistics. (The course assumes calculus prerequisites for the program have been met; it is not a substitute for the program's calculus requirements.) (0307-712) **Credit 3**

0307-762 Reliability Management
This course reveals many of the management tools used in the aerospace industry, introducing reliability as a scientific discipline to be implemented in an industrial setting. Topics include introduction to reliability, maintainability and testability; reliability requirements, definitions, program planning; methods used for vendor selection and surveillance; reliability testing, screening and burn in; failure definitions, reporting, analysis, classification; reliability acceptance testing, qualification testing; software reliability/software quality; reliability growth models. (0307-712) Credit **3**

0307-770 Design of Experiments for Engineer & Science
This course covers the fundamentals of the logical and economical approach to the design and analysis of engineering, scientific and industrial experiments. It integrates the essential organizational aspects of experimentation with proven statistical approaches. Designs covered include the two-level factorial and fractional factorial, response surface designs (CCD), blocking designs when randomization is restricted, nested designs to uncover sources of variation. The appropriate analysis methods complement the designs. Simulation modeling and robust design show the power and applicability of the information derived from the designed experiments. This course is intended for non-CQAS students. It does not count as credit for either CQAS advanced certificates or the CQAS MS degree. (1016-314 or 1016-351 or 0307-712 or equivalent) **Credit 4**

0307-781 Quality Management
This course focuses on ASQ's Certified Quality Manager body of knowledge and introduces process improvement methodologies, including the Six-Sigma framework. Topics include quality standards and awards, organization for quality, customer satisfaction, continuous improvement, team management, quality costs, project management, process improvement methodologies. (Consent of department) Credit **3** or **4**

0307-782 **Quality Engineering**
This course, in conjunction with 0307-781, covers the non-statistical elements in ASQ's Certified Quality Engineer body of knowledge. Topics include quality philosophies, elements of a quality system, quality planning, supplier management, quality auditing, quality and management tools, process and material control, measurement systems, and safety and reliability. (Consent of department) **Credit 3 or 4**

0307-784 **Statistical Consulting**
This course prepares students for real-world use of the analytical and planning tools learned in other courses, with the assumption that the consultant will generally be a company employee. Students role-play clients and consultants utilizing videotaped simulated interviews to encourage class discussion. Topics include the psychology of statistical consulting, report writing, lecture note preparation, database search, the business aspects of consulting, and proposal writing. A major team project integrates the learning. (0307-802) Credit 3

0307-801 **Design of Experiments I**
How to design and analyze experiments, with an emphasis on industrial applications. Topics include the role of statistics in scientific experimentation, completely randomized designs, randomized complete block designs, nested designs, Latin square designs, incomplete block designs, general factorial designs, split-plot designs. (0307-712) Credit **3 or 4**

0307-802 **Design of Experiments II**
Continuation of 0307-801. Topics include two-level factorial and fractional-factorial designs, three-level designs, response surface designs, evolutionary operation (EVOP). (0307-801) **Credit 3 or 4**

0307-803 **Design of Experiments III**
A continuation of the DOE sequence covering more advanced but applied topics and providing a strong foundation for handling complex and nonstandard situations. Topics include design and analysis of general, complete balanced designs, including continued study of variance components, mixed models, split-plot, and arbitrarily complex "no-name" designs; restricted and unrestricted forms of the model; design and analysis of general unreplicated designs; optimal designs for nonstandard situations, using D-optimality and related criteria; generalized linear models. (0307-802,0307-841) **Credit** 3

0307-821 **Theory of Statistics I**
This course introduces the student to the fundamental principles of statistical theory while laying the groundwork for study in the course sequel and future reading. Topics include classical probability, probability mass/density functions, mathematical expectation (including moment-generating functions), special discrete and continuous distributions, and distributions of functions of random variables. (0307-712) Credit 3

0307-822 **Theory of Statistics II**
Building on foundations laid in the first course, this second course in statistical theory answers some of the "How?" and "Why?" questions of statistics. Topics include the sampling distributions and the theory and application of point and interval estimation and hypothesis testing. (0307-821) **Credit** 3

0307-824 **Probability Models**
An introduction to stochastic processes, this course is intended to encourage a greater appreciation of statistical theory, while at the same time more fully enabling students to read, understand and even contribute to statistical journals. Topics include Poisson processes and their relationship to uniform, exponential, gamma and beta distributions; the basics of queuing theory; and discrete-time Markov chains. Characteristic functions using Taylor series to approximate the mean and variance of functions of one or more random variables are among miscellaneous topics. (0307-821) **Credit** 3

0307-830 **Multivariate-analysis Theory**
Multivariate data are characterized by multiple responses. This course concentrates on the mathematical and statistical theory that underlies the analysis of multivariate data. Some important applied methods are covered. Topics include matrix algebra, the multivariate normal model, multivariate t-tests, repeated measures, MANOVA and principal components. (0307-712.0307-801 is useful; 0307-822 is recommended.) **Credit** 3

0307-831 **Multivariate-analysis Applications**
This course includes some theory, but concentrates on the applications of multivariate analysis methods. The course relies heavily on the use of computer software. Topics include principal components, factor analysis, canonical correlation, discriminant analysis, cluster analysis and scaling. (0307-712.0307-830 is useful.) **Credit** 3

0307-841 **Regression Analysis I**
A course that studies how a response variable is related to a set of predictor variables. Regression techniques provide a foundation for the analysis of data from designed experiments. Topics include happenstance versus designed experiments, simple linear regression, the matrix approach to simple and multiple linear regression, analysis of residuals, transformations, weighted least squares. (0307-712; 0307-801 is useful.) **Credit** 3 **or 4**

0307-842 **Regression Analysis II**
A continuation of 0307-841. Topics include dummy variables, orthogonal polynomials, selection of best linear models, regression applied to analysis of variance problems, nonlinear estimation, and model building. (0307-841) **Credit** 3 **or 4**

0307-851 **Nonparametric Statistics**
The emphasis of this course is on how to analyze certain designs when the normality assumption cannot be made, with an emphasis on applications. This includes certain analyses of ranked data and ordinal data. The course provides a review of hypothesis testing and confidence-interval construction. Topics include sign and Wilcoxon signed-rank tests, Mann-Whitney and Friedman tests, run tests, chi-squares tests, rank correlation, rank order tests and Kolmogorov-Smirnov statistics. (0307-801) Credit 3

0307-856 **Interpretation of Data**
How to use statistics in troubleshooting processes and interpreting data. Topics include coordination of use of statistical measures, employing control charts in data analysis, outlier tests, analysis of small-sample data, narrow-limit gauging, analysis of means for variables and attributes data, identification of assignable causes. (0307-801) Credit 3

0307-862 **Reliability Statistics I**
A methods course in statistical aspects of reliability. Topics include applications of normal, log-normal, exponential and Weibull models to reliability problems; censored data; probability and hazard plotting; series systems and multiple-failure modes; strength and stress models; maximum likelihood estimation; introduction to accelerated-life models and analysis. (0307-801 and 0307-841. 0307-822 is recommended) Credit 3

0307-863 **Reliability Statistics II**
A continuation of Reliability Statistics I. Topics include demonstration testing, accelerated life tests, systems reliability, competing risks, burn-in, reliability growth, and introduction to repairable systems. Some topics introduced in Reliability Statistics I are covered in more depth. (0307-862) Credit 3

0307-864 **Advanced Acceptance Sampling**
An advanced course in the utilization of process oriented sampling plans in modern quality control. Topics include basis of acceptance sampling, Mood's theorem, attributes plans, variables plans for process parameters and proportion nonconforming, sampling schemes including Dodge-Romig and ANSI/ASQC Z1.4, plans for special applications, rectification and continuous procedures, cumulative results plans, compliance sampling, reliability sampling, administration of acceptance control. (0307-731) **Credit** 3

0307-865 Repairable Systems
Most reliability courses and texts cover techniques that are only applicable to items that are non-repairable. This course is intended to clarify some common misconceptions about repairable systems and provide techniques that are appropriate for use in systems that are improving or degrading with age. Topics include review of probability concepts, stochastic processes applied to repairable systems, misconceptions about repairable systems, statistical analysis of repairable systems failure data, reliability growth models, tests for reliability growth or deterioration, examples and case studies, Cox's proportional hazard model. (0307-862 and 0307-824) Credit 3

0307-867 Decision Making with Bayesian Methods
This course covers essential ideas in statistical decision analysis. Topics include how to make the best decision under conditions of uncertainty; utilities, risk, and decision diagrams; Bayesian philosophy and methods; assessment of probabilities. (0307-712) Credit 3

0307-871 Application Survey Design/Analysis
This course is an introduction to sample survey design and analysis in many fields of applications, with emphasis on practical aspects of survey methodology. Topics include sampling population elements; random, stratified, ratio, cluster, systematic and two-stage cluster sampling; wildlife populations; questionnaires; sample sizes. (0307-712) Credit 3

0307-873 Time Series Analysis/Forecast
The course develops statistical methods in modeling and forecasting of time series data with emphasis on model identification, model fitting and diagnostic checking. Topics include survey of forecasting methods, regression methods, moving averages, exponential smoothing, seasonality, analysis of forecast errors, Box-Jenkins models, transfer function models. (0307-841) Credit 3 or 4

0307-874 Stochastic Process Control
The aim of statistical process control is to detect process instability, find its cause, and eliminate it. In contrast, stochastic (or engineering, or automatic) process control (APC) is designed to automatically react to process instability by adjusting the process back to target. This course shows how to build empirical models to develop control algorithms to design robust process-adjustment schemes. Topics include interface between SPC and APC; transfer functions; fundamentals of APC, such as feedback control, feedforward control, comparison to classical feedback control approaches (including PID controllers), advanced APC topics. (0307-873) Credit 3 or 4

0307-875 Empirical Modeling
A course in model building based on the application of empirical data gathered through appropriate experimental design and analyzed through regression techniques. Topics: choosing the appropriate response variable; psychometric scaling; experimental design methods, including response surface and methods of steepest ascent/descent, deconfounding methods in fractional-factorial designs. A major project involves the development of a product from initial market research through specification setting via experimental design, and manufacturing quality assurance through process simulation. (0307-802 and 0307-841) Credit 3

0307-880 Design/Analysis of Mixture Experiments
Mixture experiments, those in which the response depends only on the proportion of the components added and not their actual amount, are used widely in the chemical, material-science, food-science and related fields. Topics include unconstrained designs; models, canonical polynomials; constrained regions, pseudocomponents, multiple constraints, algorithms for constrained regions; major/ minor components; analysis of mixture experiments, including effects and response traces; mixture-amount designs; mixture-process-variables designs; design optimality. (0307-802,841) Credit 3

0307-883 Quality Engineering by Design
This course introduces the Taguchi approach to off-line quality control including loss function, signal-to-noise utility function, parameter design and tolerance design leading to improved products and processes at lower costs. During the presentations of the Taguchi concepts, full attention is given to the controversial aspects of these methods, the basis for the controversies, and alternatives to the methods that follow better statistical protocol. Students get to see the power of robust design in a set of carefully constructed exercises that illustrate the major components of parameter design and tolerance design. (0307-802) Credit 3

0307-886 Sample Size Determination
This course presents procedures to determine the proper sample size needed for the most commonly applied statistical methods. Topics include confidence intervals and hypothesis tests for the parameters of applied distributions and approximations to distributions. Sample size determination for designed experiments is covered extensively. (0307-802) Credit 3

0307-889 Independent Study Project
Credit will be assigned at the discretion of the candidate's advisor and will depend on the character and involvement of the project. A written proposal setting forth the character and procedures involved will be required of the candidate and may be modified at the discretion of the candidate's advisor before approval is given to proceed. Credit 1,2,3,6 or 9

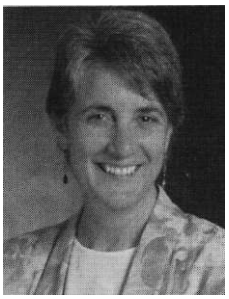
0307-891 Special Topics in Applied Statistics
This course number provides for the presentation of subject matter of important specialized value in the field of applied statistics not offered as a regular part of the statistics program. (Consent of department) Credit 3

0307-895 Statistics Seminar
This course (or sequence of courses) provides for one or more quarters of independent study and research activity. This course may be used by other departments of other colleges at RIT to provide special training in statistics for students who desire an independent study program in partial fulfillment of graduate degree requirements. (Consent of all departments involved) Credit 3

0307-896 Thesis
For students working for the MS degree who are writing a research thesis. (Consent of department) Credit 3,6 or 9

0307-899 Individual. Achievement Project
Research project under faculty supervision for students working for the MS degree. (Consent of department) Credit 1-9

College of Imaging Arts and Sciences



Joan Stone, Dean

The College of Imaging Arts and Sciences offers the most comprehensive graduate imaging programs in the world, encompassing design, science, technology, engineering, management, crafts and fine arts. The college is a diverse, world-class collaboration of six schools: the School of Art, School of Design, School for American Crafts, School of Photographic Arts and Sciences. School of Film and Animation, and School of Printing Management and Sciences. Its scope gives students a perspective that can be found nowhere else—a place where students create fine art using centuries-old methods and push the edges of digital creativity. At no other university can you explore so many different aspects of the imaging fields to such a level of professional excellence. In addition, RIT, as a career-oriented university, offers expertise in the professional aspects of running a studio or gallery.

RIT's world-class faculty are noted for their excellence, from creating award-winning sculptures and visual communications to receiving international recognition as innovators in their fields. They excel in the practice of their profession, using state-of-the-art equipment and studio facilities that can support both course work and research. Their role as mentors is evidenced in the national awards won by their students. In 1996, for example, graduate students in the college received the prestigious Graduate Film Honorarium of the Princess Grace Award; a computer graphics design alumnus was awarded a Golden Globe in 1997; and an emerging filmmaker was awarded the overall grand prize in the Adobe Flash Point Student Design Contest for multimedia projects. Students also received a "finalist" designation in the People's Choice Awards at the Macromedia International User Conference and Exhibition. An industrial design student received an award from Volvo of North America for his winning child car seat in the Design for Automobile Safety Competition at the 2000 World Traffic Safety Symposium. Fourteen woodworking alumni and faculty are featured in the prestigious *Design Book Seven* produced by *Fine Woodworking* magazine.

With this practical, professional experience, graduates' success upon employment is excellent. Their achievements represent what our programs are about: excellence through exploration and experimentation.

PROGRAMS

MASTER OF FINE ARTS IN IMAGING ARTS:

- **Photography**
- **Computer Animation**
- **Film**

MASTER OF FINE ARTS:

- **Ceramics and Ceramic Sculpture**
- **Computer Graphics Design**
- **Fine Arts Studio**
- **Glass and Glass Sculpture**
- **Graphic Design**
- **Industrial Design**
- **Medical Illustration**
- **Metals/Jewelry Design**
- **Woodworking and Furniture Design**

MASTER OF SCIENCE FOR TEACHERS

MASTER OF SCIENCE:

- **Graphic Arts Systems**
- **Graphic Arts Publishing**
- **Printing Technology**

Master of Fine Arts Degrees

The MFA is a professional, terminal degree for artists, designers, craftspersons, animators, photographers, and filmmakers. Those seeking the graduate degree desire to leave a lasting impression on their fields by devotion to their work, high standards of discipline, and educational ideas. Students who possess a baccaluareate degree will develop expertise in their major area and in related fields under the guidance of professionals.

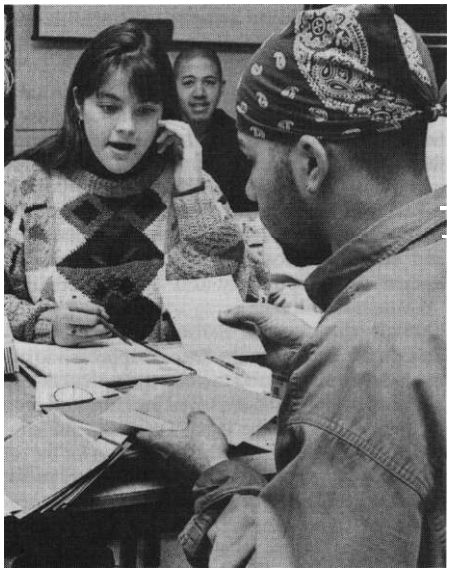
The college sponsors many guest lectures, seminars, and exhibits to further encourage personal and professional growth.

The MFA is generally a two-year, full-time program that involves the presentation of a thesis.

General Information

Acceptance for graduate study

Students are admitted to graduate study by action of the Graduate Committee. Enrollment in graduate courses does not constitute admission to the graduate program, and credit is not given for courses taken prior to acceptance unless the grade received in the course is a "B" or higher; in such a case the student, if



Graduate students in art, design and crafts can earn either the master of fine arts or the master of science in teaching degree.

admitted to graduate study, may petition for a grant of credit, but not in excess of 12 quarter credit hours.

A student may be admitted who needs additional undergraduate study requirements. This study will be structured for breadth or increased performance in areas designated and will be determined at the time of acceptance.

Such prerequisites must be satisfied as defined in the letter of acceptance, which applicants will receive prior to admission as graduate students. Extended study may require additional time on campus.

Human Gross Anatomy and biology or equivalent content is necessary for the MFA in medical illustration.

Upon full acceptance into any of the graduate programs the student is considered qualified to pursue the degree. This status would be changed by evidence of poor performance in the program. A 3.0 grade point average must be maintained. A student is accepted into the program with the understanding of full-time status unless granted part-time status at admission.

Admission as a nonmatriculated student

Students who have a baccalaureate degree and who wish to take particular courses may be admitted as nonmatriculated students to courses for which they are qualified. They may receive graduate credit, but it may not be submitted toward degree requirements. Students deficient in admission requirements or competence may take undergraduate courses, as advised, to qualify for admission.

Those coming from foreign countries where the baccalaureate is not given for programs in the practice of art may be admitted to graduate study if the diploma or certificate received approximates the standards of the BFA, BA or BS degrees, and their academic records and portfolios indicate an ability to meet graduate standards.

Admission procedure

To apply for admission to graduate study a student must submit the following items:

- Application: Submit your graduate application for admission accompanied by the application fee to the Office of Graduate Enrollment Services in the envelope provided in the application packet. When making your program choice, do so by indicating the major on page six of the application. Applicants should indicate for which degree they are applying: the master of fine arts (MFA) or master of science in teaching (MST)

Some programs are sequential in nature and begin in fall quarter only.* Art education is a full-time program offered only during the regular three quarters of the academic year.

- Transcripts: Evidence of a baccalaureate degree is required, so request that official transcripts be sent to the Office of Graduate Enrollment Services from all colleges and universities previously attended.
- Recommendations: Submit two letters of recommendation from individuals familiar with your education and/or work experience.
- Personal statement: Submit a personal statement of objectives as indicated on page 9 of the admissions application. This statement should indicate in what manner the Institute's graduate program would assist in attaining these goals. See the application form for directions.
- Portfolio: See guidelines

• Major courses for art education, computer graphics design, graphic design, and medical illustration are offered only during fall, winter and spring quarters. Art education applicants should arrange a personal interview by calling 716-475-7562.

Portfolio guidelines for graduate applicants

Graduate students applying for admission into the School of Art, School of Design or the School for American Crafts are required to present a portfolio of art/design/craft work that is used in totally assessing the performance and academic capabilities of the applicant.

1. The portfolio should consist of at least 20 to 40 pieces of the applicant's best work. 35mm slides are preferred, displayed in 8½ " x 11" vinyl slide protector pages. (Additional computer files for video or interactive media samples should be stand-alone files that will preferably run on Macintosh operating systems.)
2. Slide portfolios will be kept by the school until the graduate application and scholarship process is complete. Slides will be returned by the school only when return postage is enclosed.
3. While every precaution will be taken to ensure proper care and handling, the Institute assumes no responsibility for loss or damage to slides. Label your slides with your name and address. Projects/slide content should be identified.

Please send portfolio and application materials to:

Rochester Institute of Technology
Office of Graduate Enrollment Services
58 Lomb Memorial Drive
Rochester, NY 14623-5604
716-475-2229

Any correspondence concerning applications, catalogs and portfolios should be addressed to the Office of Graduate Enrollment Services.

Bevier Gallery

During the year, the Bevier Gallery presents a continuing series of important exhibitions planned to present new directions in the fields of the arts, design and the crafts, as well as to honor the

Ceramist Vesta E. Adu-Gyamfi, MFA '88, School for American Crafts, returned to campus for "Celebrating Womanhood Through Pottery," a part ofRIT's Distinguished Alumni Colloquia Series. A native of Ghana, Adu-Gyamfi draws her work from the mystique of women in her world, in matrilineal societies. "I try to project the great responsibilities of being female, from birth to death. How the earth, the sea, everything, is related to woman." A 1995-96]. William Fulbright Senior Scholar, she has exhibited her work around the world.

works of the past. The gallery, architecturally impressive and a part of the college, serves to enrich the cultural life of the community and the Institute at large and to inform and inspire the college's graduate body.

The Faculty Show, Graduate Thesis Shows and Student Honors Show are annual events on the gallery calendar.

Transfer of credit

Graduate work pursued to the extent of 12 quarter hours (nine semester hours) may be applied at the discretion of the Graduate Committee to specific course requirements, depending on the nature of the student's program and major, if completed within the five preceding years. This evaluation will be made after one quarter of full-time study.

Policy regarding student work

The School of Art, School of Design, and School for American Crafts reserve the right to retain student work for educational use or exhibition for a period of time not to exceed one and one-half quarters beyond the year the object has been made.

Attendance regulations

The programs of the college utilize the studios and shop experiences as an essential part of the educational program; therefore it is imperative that the student regularly attend all classes unless specifically excused for special projects or activities by the instructors. Failure to attend classes, and to complete assignments, will be taken into consideration in grading.

Graduate scholarships, assistantships and other financial aid

If you are interested in being considered for a graduate scholarship, check the box on page 7 of the graduate application packet and submit with the other required application materials by March 1.

Applications for graduate and teaching assistantships are usually mailed out in early spring to applicants and current graduate students. If you have questions, contact the appropriate school office: School of Art, 716-475-7562; School of Design, 716-475-2668; School for American Crafts, 716-475-5778.

Need-based financial aid such as loans and grants may be investigated through the Office of Financial Aid.

School of Art

Master of Fine Arts Programs

Fine Arts Studio—Painting/Printmaking/Sculpture/New Forms. The master of fine arts studio program has intensive study in painting, printmaking, sculpture and related media leading to mastery in the fine arts field on a professional level. Faculty guidance focuses upon research strategies that support sequential studio production leading to individual solutions. Critical discussion is developed from both the traditions of fine art and contemporary directions in our culture. These contemporary and historical concepts stimulate and provoke the development of an individual approach to expression. Moving forward from the sound fundamental backgrounds of their undergraduate art programs, students explore advanced techniques in painting, sculpture, and nontoxic printmaking. These may be pursued singly, combined, or brought together with nontraditional media to create *new forms.* This work, along with critical dialogues about contemporary art, lead the student toward the production of a body of work and report for the master's diesis.

Medical illustration. The master of fine arts program in medical illustration enables students to exhibit thought and problem solving in their portfolio through accurate translations of medical and scientific concepts into effective visual support for instruction or advertisement. Students learn to demonstrate effective research techniques and efficient use of time and resources during concept and development of projects to satisfy course assignments.

Requirements for admission to the MFA degree programs

For U.S. and Canadian students, applicants should hold the baccalaureate degree in a field of the arts, sciences or education from a regionally accredited college in the United States or Canada and demonstrate, through the quality of the undergraduate record and creative production, a genuine, professional potential. (See also section regarding nonmatriculated students.) The undergraduate degree should include 75 quarter credit hours (50 semester hours) in studio courses.

International students need a minimum TOEFL score of 550 (paper-based total) or 213 (computer-based total). Those coming from countries where the baccalaureate degree is not given for programs in the practice of art may be admitted to graduate study if the diploma or certificate received approximates the standards of the BFA, BA or BS degrees and if their academic records and portfolios indicate an ability to meet graduate standards.

The Master of Science for Teachers

This one-year program may be taken in one of 10 studio areas and, in addition, art education. The MST-art education concentration leads toward permanent art N-12 certification to teach in the public schools of the State of New York and features pedagogical studies and student teaching. Classes begin in September and end in May.

The MST-Studio offers a concentration in a studio art program with supporting courses, if desired, from graduate offerings in other schools and departments of the Institute.

The studio concentration may be taken in graphic design, industrial design, fine arts studio, ceramics and ceramic sculpture, glass, metals/jewelry, and woodworking and furniture design. In addition, this MST also may lead to certification if provisional or temporary certification was earned as an undergraduate. This program may be completed in one year and may start or be completed in summer sessions.

	MST STUDIO MST candidates in one of the 10 areas	**MST ART EDUCATION**
Major	24	22 credits
Minor	9	
Humanities	**8**	20 Social Sci.
Forms of Inquiry	**2**	
Electives	5	**6**
Thesis	48 credits*	48 creditst

* *One year or summers*
† *September start only*

Requirements for admission to the MST degree programs

The applicant should have received the baccalaureate degree in a field of the arts from a regionally accredited college or university in the United States or Canada with a major concentration in art, art education or industrial arts education. Applicants with different backgrounds should refer to the section on nonmatriculated students. The undergraduate studies should include a minimum of 54 quarter credit hours (36 semester hours) in drawing, painting, design or the crafts. If the applicant for admission holds the BA or BFA degree and seeks the MST degree in art education, the undergraduate program must have included the studio course distribution required by the New York State Education Department. For those holding the BS degree in art education and provisional certification, the graduate concentration should be in one of the studio areas, and the program must include a minimum of 10 quarter credit hours in liberal studies or humanities.

A student is accepted into the program with the understanding of full-time status unless granted part-time status at admission.

Teacher education and certification

The teacher of arts and crafts in college or high school, the teacher or administrator of art programs in schools and community centers, the instructor in occupational skills and the private teacher of art will find in the depth and breadth of the master's program a way of extending and improving the skills and content background necessary for effective teaching. The student who possesses a baccalaureate degree with provisional certification for the teaching of art or industrial arts in the State of New York can achieve permanent certification within the structuring of the master of science for teachers program (in one of the 10 studio areas) or the master of fine arts.

Graduates of teacher education programs at RIT have a 95 percent pass rate on the New York State Teacher Certification Examination.

Master of Science for Teachers Program

The **master of science for teachers** program requirements include two categories of studies:

1. MST ART EDUCATION
   Master of science for teachers in *art education* for those holding the BFA or BA (art major) degree and seeking permanent certification for teaching in public schools. The degree offers a concentration consisting of background courses in:

	Credits
Education, Psychology and Sociology	20
Art Education Concentration: Methods and Materials in Art Education, Seminar in Art Education, Practice Teaching	22
Studio electives	6
Total credits	**48**

2. MST STUDIO
   The master of science for teachers degree in the area of the student's major interest and chosen from one of the 10 areas (ceramics and ceramic sculpture, glass and glass sculpture, metals/jewelry, woodworking and furniture design, graphic design, fine arts studio, and industrial design) is for those holding the BS degree in art education or industrial arts education who desire permanent certificates or for the BA or BFA student wishing advanced study. The degree offers a major concentration of studies designed to meet the needs of individual students and may include appropriate or relevant courses from other schools and departments of the Institute.

   The following general pattern of studies covers degree requirements:

MAJOR CONCENTRATION:	Credits
Studio art or crafts	24
Humanities, art history	8
Forms of Inquiry	2
Minor Concentration	9
Electives	5
Total credits	**48**

School of Art

Roberly Ann Bell, BFA, University of Massachusetts at Amherst; MFA, State University of New York College of Technology at Alfred—Associate Professor
Bob Cole, BA, MS, University of Maryland—Professor
William Finewood, BA, State University College, Geneseo; MFA, Syracuse University—Assistant Professor
Robert Heischman, BFA, Miami University; UCFA, Ruskin School of Art—Professor
Joyce Hertzson, BFA, Rhode Island School of Design; MFA, Indiana University— Professor
Glen R. Hintz, BA, Lafayette College; MS, The Medical College of Georgia—Assistant Professor, Medical Illustration
Keith Howard, Painting Diploma, National Art School, Australia; Master's in Studio Art, New York University—Associate Professor, Fine Arts Studio
Margaret O. Lucas, BS, Hampton University; MA, Virginia Commonwealth University; D.Ed., Pennsylvania State University—Professor
Thomas R. Lightfoot, BA, BFA, University of Connecticut; MFA, Instituto Allende, San Miguel de Allende, Gto.; Mexico; Ed.D., Columbia University—Associate Professor; Chairperson, Fine Arts
James Perkins, BS, Cornell University; MFA, Rochester Institute of Technology—Assistant Professor, Medical Illustration
Luvon Sheppard, BFA, MST, Rochester Institute of Technology—Professor
Alan D. Singer, BFA, Cooper Union; MFA, Cornell University—Associate Professor
Bruce Sodervick, BS, Indiana University; MFA, Southern Illinois University—Professor
Carol Woodlock, BFA, Alberta College of Art; MFA, Concordia University—Assistant Professor, Art Education

School of Design

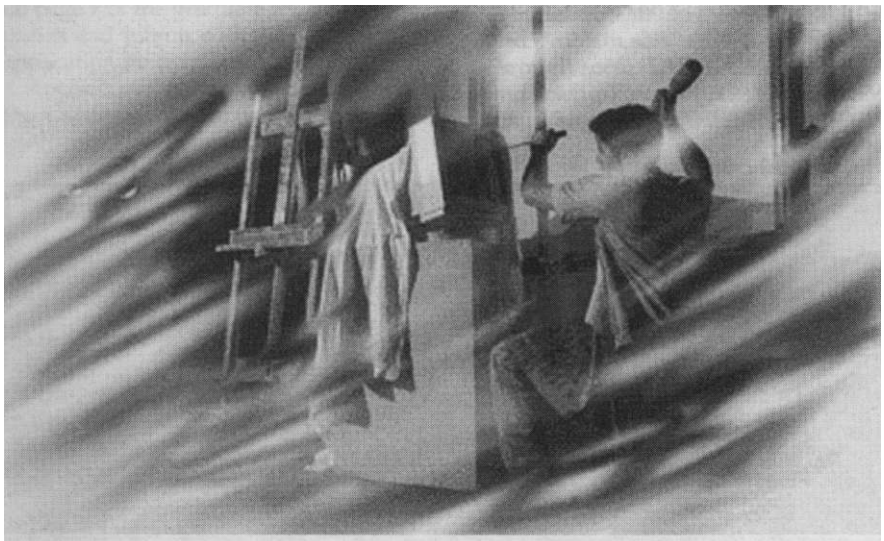
Master of Fine Arts Programs

The School of Design offers three professional MFA degree programs for advanced study: graphic design, industrial design, and computer graphics design. These unique programs allow for advanced study that integrates creativity, philosophy, history, theory, applied concepts, and technology. Students who possess a baccalaureate and seek to advance their skills or change careers find our programs to be challenging and professionally based. The School sponsors many guest lecturers, interdisciplinary projects, and special events to encourage personal professional growth.

The school also offers five unique cross-disciplinary courses within its graduate curriculum. All graduate students in the School of Design MFA programs take the following courses: Design Forum, Design History Seminar, Design Theory & Methods Seminar, Design Issues Seminar, and Design Research.

Involvement in these new cross-disciplinary courses helps to foster a sense of community among students and faculty and encourages dialog and interaction on the design, philosophy, process, practice, history, goals, and responsibilities across the design disciplines.

The computer graphics design and graduate graphic design programs are sequential and *require Fall entry.* The application deadline is **March 1.** Applications reviewed and accepted after this date are based upon seats available, and applicants are put on a waiting list. The industrial design program accepts applicants on a rolling basis.



Combining the traditional and the contemporary is the theme of the Web pages for RIT's art schools.

Computer Graphics Design

Robert Keough, *Coordinator*
716-475-7914 E-mail: rpkfaa@rit.edu

The master of fine arts degree program in computer graphics design is at the center of a revolution in which visual communication is planned, designed, coordinated, produced and disseminated by means of digital media. This exciting, graduate-level professional program combines knowledge of design theory and methods with skills in the application of recent software and hardware developments that have vastly expanded the designer's creative capabilities.

The impact of digital systems technology has changed how society communicates and how designers integrate knowledge and skills with technology. The digital age has turned the computer into both medium and tool. A strong understanding of design principles, visualization, semiotics and digital technology is required to be successful at developing computer graphics applications.

The computer graphics design program represents and fosters a multimedia approach to the design of electronic communications that synthesizes sound, animation, three-dimensional modeling, interface design, human factors, authoring languages, digital video, and special-effects imaging. Our students focus primarily on innovative approaches toward the design of interactive digital media, including interactive exhibits, training and education modules, and Web site development.

Graphic Design

Deborah Beardslee, *Coordinator*
716-475-2664 E-mail: dabfaa@rit.edu

Graphic design is a professional major that consists of a sequence of courses addressing advanced visual communication problems and emphasizes meaning, form and function. In a professional studio setting, students work with faculty on the understanding and implementation of design process; design theory; history and criticism; research methods; visual aesthetics; typography; imagery; systems design; information design; ethics and values; project development and evaluation; and cross-disciplinary problem-solving methods.

Course work and thesis projects incorporate both theory and application in the solution of hypothetical or actual design problems. Courses within this major evidence a balanced approach toward the application of electronic media and traditional processes. Final design outcomes may range from small- or large-scale two-dimensional, printed artifacts to electronic, time-based and/or interactive applications. Special lectures, guest speakers, exhibits and workshops complement the studio work experience. Student projects also utilize other RIT resources such as the Graphic Design Archive and the Cary Graphic Arts Collection.

Industrial Design

Craig McArt, *Coordinator*
716-475-5895 E-mail: cjmfaa@rit.edu

The master of fine arts degree program is available for students pursuing specialized study in industrial design at the graduate level for the purpose of career enhancement or redirection. The educational experience is project oriented, requiring research into design methods and technologies. Industry collaboratives provide an experiential dimension.

The first year of study includes seminar courses in design history, issues, research, theory and methods, which are common to all graduate students in the School of Design. In addition, there are studio courses that focus on industrial design applications. Extensive course work in utilizing Alias software for product modeling and animation fills out the program.

In the second year, students conduct research and develop a thesis project, which is presented in a graduate thesis exhibition and is documented in a written thesis report.

Master of Fine Arts in Computer Graphics Design

Major	42
Minor Electivest	18
Design Core*	15
Thesis	15
Total	90 quarter credits

Master of Fine Arts in Industrial Design

Major	27
Minor †	15
Electives	15
Design Core*	15
Liberal Arts	4
Thesis	14
Total	90 quarter credits

Master of Fine Arts in Graduate Graphic Design

Major *	30
Minor †	**15
Electives	17
Liberal Arts	14
Thesis	14
Total	90 quarter credits

** Design Core is a series of courses that all the MFA majors (industrial design, graphic design, computer graphics design) in the School of Design must take. Graduate graphic design integrates these as part of the major credits listed.*

+ Minors are taken within the College of Imaging Arts and Sciences and in other colleges at the Institute. This is done with approval from the individual programs' graduate adviser/coordinator. The minor should support the goal of the MFA degree.

School of Design

Nancy A. Ciolek, BFA, MFA, Indiana State University—Associate Professor; Chairperson, School of Design

Deborah Beardslee, BFA, Syracuse University; MFA, Virginia Commonwealth University—Associate Professor, Graduate Program Coordinator, Graphic Design

Mary Ann Begland, BS, Ohio State University; MFA, Kent State University—Associate Professor, Graphic Design

Robert M. Kahute, BID, BFA, Syracuse University; MFA, Rochester Institute of Technology—Professor, Industrial Design

Robert P. **Keough,** BFA, MFA, Rochester Institute of Technology—Professor; Graduate Program Coordinator, Computer Graphics Design

Heinz Klinkon, BFA, MFA, Rochester Institute of Technology—Associate Professor, Graphic Design

Patti J. Lachance, BFA, Heron School of Art at Indiana and Purdue Universities at Indianapolis; MFA, Rochester Institute of Technology—Associate Professor, Graphic Design

Craig J. McArt, BID, Syracuse University; MFA, Rochester Institute of Technology—Professor, Graduate Program Coordinator, Industrial Design

Bruce I. Meader, BFA, MFA, Carnegie Mellon University—Associate Professor, Graphic Design

R. Roger Remington, BFA, Rochester Institute of Technology; MS, University of Wisconsin—Professor, Graphic Design

James C. Ver Hague, BS, Massachusetts Institute of Technology; MS, Rensselaer Polytechnic Institute; BA, MFA, State University of New York at Buffalo—Professor, Computer Graphics Design

School for American Crafts

The Master of Fine Arts

The MFA is a professional, terminal degree for practicing artists, craftspersons or designers who desire to leave a lasting impression on their fields by devotion to their work and high standards of discipline and artistic ideals. The MFA is generally a two-year, full-time program that involves the presentation of a thesis. The thesis includes written documentation and formal exhibition of a body of work.

Studio residence program

The School for American Crafts offers a craft residence program. Residents will be accepted in ceramics and ceramic sculpture, glass and glass sculpture, metals/jewelry design, and woodworking and furniture design. This is an opportunity for the development of craft skills and aesthetic concepts.

Residence positions are limited and will be awarded by portfolio, transcript references and a statement of purpose. An interview is required. Accepted candidates are required to enroll for at least six credits of audit per quarter, be present in the studio during class hours and contribute up to six hours of work in the studio area. In exchange, the school will provide work space, major equipment and supportive tutorial instruction. The resident is invited to participate in visiting artists sessions, lectures and all other studio activities.

Participants may be graduates continuing preparation for graduate study, early career professionals developing techniques and designs for production in their own future studios or teachers on leave who wish to work again in an academic environment.

Inquiries should be made to Residence Program, College of Imaging Arts and Sciences, School for American Crafts, Rochester Institute of Technology, 73 Lomb Memorial Drive, Rochester, N.Y. 14623-5603.

MFA

Major	42 credits
Humanities	10
Graduate Forum	3
Electives (optional minor)	15 (18)
Thesis	19
	91 credits

Requirements for admission to the MFA degree programs

For U.S. and Canadian students, applicants should hold a baccalaureate degree in a field of arts, sciences or education from a regionally accredited college in the United States or Canada and demonstrate, through the quality of the undergraduate record and creative production, a genuine, professional potential. (See also section regarding non-matriculated students.) The undergraduate degree should include 75 quarter credit hours (50 semester hours) in studio courses.

International students need a minimum TOEFL score of 550 (paper-based total) or 213 (computer-based total). Those coming from countries where the baccalaureate degree is not given for programs in the practice of art may be admitted to graduate study if the diploma or certificate received approximates the standards of the BFA, BA or BS degrees and if their academic records and portfolios indicate an ability to meet graduate standards.

Master of Fine Arts Program

The master of fine arts program for the School for American Crafts includes five categories of study:

	Credits
1. MAJOR CONCENTRATION	42
Designed to give depth of experience in the area of the student's major interest and chosen from one of the 12 areas: ceramic and ceramic sculpture, metalcrafts and jewelry design, woodworking and furniture design, glass, industrial design, graphic design, fine arts (painting), fine arts (printmaking), medical illustration and computer graphics design.	
2. Humanities	10
3. Graduate Forum	3
4. Electives	15(18)
Optional Minor	
5. Thesis	18
Total credits	91

Ceramics and ceramic sculpture. The ceramics studio embraces the contemporary spectra of aesthetic ideas and innovative techniques to educate and train professional artists/craftspeople. It strives to support students' career goals with pragmatic information and suitable facilities and equipment.

Our structured courses address specific issues inherent to utilitarian pottery, vessel aesthetics, ceramics sculpture and mixed media. The ceramics program also receives substantial reinforcement from the other craft studios because they, too, explore similar formats and concerns that face artists and craftspeople about to enter the 21st century.

Glass and glass sculpture. This two-year program is structured on the basis of individual needs, interests and professional preparation as they may be determined through individual/group discussions. A rapid series of exploratory works is developed during the first year with emphasis on broadening technical and aesthetic understanding. The second year's focus will be on developing a body of work based on a sustained interest from the first year's investigation. The final work must be supported by a written thesis, a high quality portfolio and an exhibition.

Metals/jewelry design. This program is structured on the basis of individual needs, interests and background preparation as they may be determined through faculty counseling. All aspects of metalsmithing are explored. The program gives the student a broad exposure to metal working techniques, expands the student's knowledge of applied design, strengthens perceptual and philosophical concepts and develops an individual mode of expression. This sequence leads to the master's thesis, inaugurated by the student and overseen by the faculty.

Woodworking and furniture design. This program leads to the terminal degree in the studio arts. Men and women come to the program from diverse backgrounds such as architecture, interior design, industrial design, art history, law, teaching, etc., as well as undergraduate wood programs. In the first year, students identify issues in their technical and aesthetic background and, along with faculty, create a program of study to address these areas. Simultaneously, they discover directions in their work that are promising for further exploration. Based upon this experience, they develop a thesis proposal and, in the second year, create a comprehensive body of work. This work culminates in the end-of-the-year graduate thesis exhibition in the college gallery and a written thesis in support of the work.

GRE and TOEFL exams

The GRE exam is not needed for the School of Art, School of Design or School for American Crafts. International students must have a TOEFL score of at least 550.

School for American Crafts

Wendell Castle, BFA, MFA, University of Kansas—Artist-in-Residence, Chair; Professor, School for American Crafts
Julia Galloway, BFA, New York State College of Ceramics, MFA, University of Colorado—Assistant Professor, Ceramics
Richard Hirsch, BS, State University of New York College at New Paltz; MFA, Rochester Institute of Technology—Associate Professor, Ceramics, School for American Crafts

Max L. Lenderman, BS, MS, Indiana State University; MFA, University of Kansas-Professor, Weaving and Textile Design, School for American Crafts
Albert Paley, BFA, MFA, Tyler School of Art, Temple University; Ph.D. (honorary), University of Rochester—Artist-in-Residence, Charlotte Fredericks Mowris Chair in Contemporary Crafts; Professor, School for American Crafts
Mark Stanitz, BFA, MA, Kent State University—Associate Professor, Metals/Jewelry Design, School for American Crafts
Richard Tannen, BS, Cornell University; Cert, of Mastery, Boston University—Associate Professor, Woodworking and Furniture Design, School for American Crafts
Michael Taylor, BS, Middle Tennessee State University; MA, MFA, East Tennessee State University—Professor, Glass, School for American Crafts
Leonard A. Urso, BFA, MFA, State University of New York College at New Paltz—Associate Professor, Metalcrafts and Jewelry, School for American Crafts

School of Printing Management and Sciences

The School of Printing Management and Sciences offers three master of science degree programs: graphic arts publishing, graphic arts systems and printing technology. For the latest information, visit our Web site: http://mastersinprinting.rit.edu.

Admission requirements

Prior to being admitted to a master of science degree program, applicants must satisfy the Graduate Admission Committee of the School of Printing Management and Sciences that their previous training, ability and practical experience indicate a reasonable chance of success. Applicants may be admitted who hold a baccalaureate degree from an accredited institution. The School of Printing Management and Sciences encourages applicants with undergraduate records at the B (3.0) level or higher. Requirements are:

Written RIT application
Earned baccalaureate degree
Official undergraduate transcript
Two recommendations
An on-campus interview when possible
Undergraduate GPA of 3.0 or higher
Foundation course work, if required
TOEFL score of at least 550 (international students)

Application deadlines

Candidates are encouraged to apply to the graduate program at any time during the year. However, those applicants who do not have a printing background should complete the admissions procedures before April 10,2001, to allow sufficient time to make arrangements to attend the Foundation Program. Applicants who hold an undergraduate degree in printing and meet all foundation course requirements should apply before July 23, 2001. Students are permitted to begin their regular graduate classes only in September.

Foundation Program

The Foundation Program is common to all three graduate programs within the School of Printing Management and Sciences. It begins in June and provides students who have little or no printing background with the opportunity to gain the required background before commencing regular courses in the fall quarter. During the admissions process, graduate coordinators evaluate the background of an applicant to his or her program to determine whether a portion of the Foundation Program might be waived because of prior course work or work experience.

The Foundation Program involves the following course work. The technical courses listed below are offered in the School of Printing Management and Sciences during the summer. Most applicants who do not have printing backgrounds take these courses at RIT because they are usually not offered elsewhere.

Graphic Software Applications—Grad
Imaging Technology—Grad
Imaging Processing—Grad
Printing Processes—Grad
Planning and Finishing—Grad

Another course, Technical Writing, is not offered as part of the summer Foundation Program but is required. If the applicant has taken this course content as an undergraduate, the requirement will be waived. If not, it may be taken at RIT or another undergraduate institution.

In addition to the above Foundation Program courses, graphic arts system students must complete the following courses—Accounting, Economics, Organization Behavior, and Marketing. These courses are required but are not taught in the Foundation Program. Graphic arts systems students need to have completed these courses in their undergraduate work, or they will need to complete them, preferably before beginning their graduate program.

Students may begin their graduate courses in the fall if they are lacking no more than two Foundation courses. It is possible for them to complete these during the academic year.

The Foundation courses are scheduled during a 9- tolO-week period beginning the first week in June. The courses are sequential—students complete one course before beginning the next one.

If an applicant has had a particular subject area waived, he or she will be excused from that section of the Foundation Program. A student must complete the Foundation Program with an overall B average before he or she can begin required courses in the graduate program to which he or she has been accepted.

Master of Science Degree in Graphic Arts Publishing

Len Leger, *Coordinator*
716-475-6026 E-mail: lwlppr@rit.edu

The digital revolution has begun. Next-generation technologies are transforming the workplace and creating new challenges for the entire graphic communications industry. The competitive and fast-changing nature of today's marketplace requires printing and publishing professionals who can react to market needs more quickly than ever before. The graphic arts publishing program is a full-time, one-year program.

Electronic publishing program

This program focuses on various segments of electronic publishing from the most elaborate high-volume systems for the production of newspapers, books, and magazines to single-user, desktop systems for producing newsletters, office forms, and short reports. The growth potential of electronic publishing is startling, and all graphic communications companies will need experienced professionals to work as publishing systems architects, font and format managers, specialized programmers, and corporate publishers. You'll examine the software and hardware considerations and management strategies that relate to electronic publishing, and you'll study the theoretical aspects of publishing and reproduction technology in laboratories equipped with the latest in electronic publishing systems.

The curriculum

2081-702	Graphic Reproduction Theory	4
2081-703	Trends in Printing Technology	4
2081-722	Ink, Color & Substrates	4
2081-723	Contemporary Publishing	4
2081-741	Color Image Processing Systems OR	4
2081-711	Tone & Color Analysis	4
2081-742	Document Processing Languages	4
2081-743	Markets for Electronic Publishing	4
2081-xxx	Digital Printing & Publishing	4
2081-840	Project Design I	2
2081-841	Project Design II	4
	Electives	12
	Total Credits	**48**

Online option

The graphic arts publishing master's program is offered online for those students who are unable to attend on-campus courses. Please contact Barbara Birkett for more information at 716-475-2889; e-mail babppr@rit,.edu.

Master of Science Degree in Graphic Arts Systems

Len Leger, *Coordinator*
716-475-6026 E-mail: lwlppr@rit.edu

Today's printing and publishing companies require cutting-edge technology, a clear understanding of the changes taking place in the marketplace, and the vision to appreciate the implications of new opportunities. There is a tremendous demand for better-educated, highly flexible and innovative decision makers who will pave the way for even more advanced systems in the years to come. Industry leaders will be vitally aware of how competitors are adapting to the environment: what markets they are going after; what specialization they are developing; and what pricing strategies they are using.

An innovative, integrated curriculum

Today's graduates must be equipped with people skills and knowledge of financial controls, cost allocation systems, pricing strategies, and long- and short-range planning. Well-rounded graduates with a solid technical background have another distinct advantage—they are ready to assume responsibility their first day on the job. Our graduate program in graphic arts systems gives you the managerial and technical knowledge you need to be successful in the 21st century.

The curriculum

2081-702	Graphic Reproduction Theory	4
2081-709	Trends in Printing Technology	4
2081-722	Ink, Color & Substrates	4
2081-741	Color Image Processing Systems OR	4
2081-711	Tone & Color Analysis	
2081-742	Document Processing Languages	4
2081-xxx	Digital Printing & Publishing	4
2080-707	Estimating & Analyzing in Graphic Arts	4
2080-712	Operations Management in Graphic Arts	4
2081-840	Project Design I	2
2080-841	Project Design II	2
	Electives	8
	Total Credits	48

Master of Science Degree in Printing Technology

Len Leger, *Coordinator*
716-475-6026 E-mail: lwlppr@rit.edu

Although it might seem like another age, it was just a few short years ago when terms like "digital workflow" and "electronic publishing" were unknown to most people in the graphic communications industry Today, the challenge of keeping up with technological change is difficult and even risky. Every decision has an impact on productivity across the organization and affects its ability to compete in the marketplace. Which technologies to adopt and how quickly to proceed?

A focus on technology

The printing technology program provides you with an in-depth understanding of technical printing and imaging concepts and exposure to high-level research methods. Although this program provides a broad exposure to the graphic communication industry, it allows students an opportunity to specialize in a relevant technical area. The program offers the maximum flexibility in terms of tailoring the program to meet individual needs. Recent students have focused on information technology or computer graphic design depending upon interest and aptitude.

The curriculum

2081-702	Graphic Reproduction Theory	4
2081-709	Trends in Printing Technology	4
2081-722	Ink, Color & Substrates	4
2081-741	Color Image Processing Systems OR	4
2081-711	Tone & Color Analysis	
2081-742	Document Processing Languages	4
2081-xxx	Digital Printing & Publishing	4
2081-840	Project Design I	2
2080-841	Project Design II	2
	Electives	16
	Total Credits	48

Elective offer options

Elective courses are selected by the student to develop additional expertise in a particular area of interest. All programs offer flexibility in terms of tailoring the program to meet individual needs. Recent students have focused on information technology or computer graphic design, depending upon interest and aptitude. The electives may be selected from the School of Printing Management and Sciences catalog or from courses offered by other RIT colleges. All elective courses must be preapproved by the program coordinator.

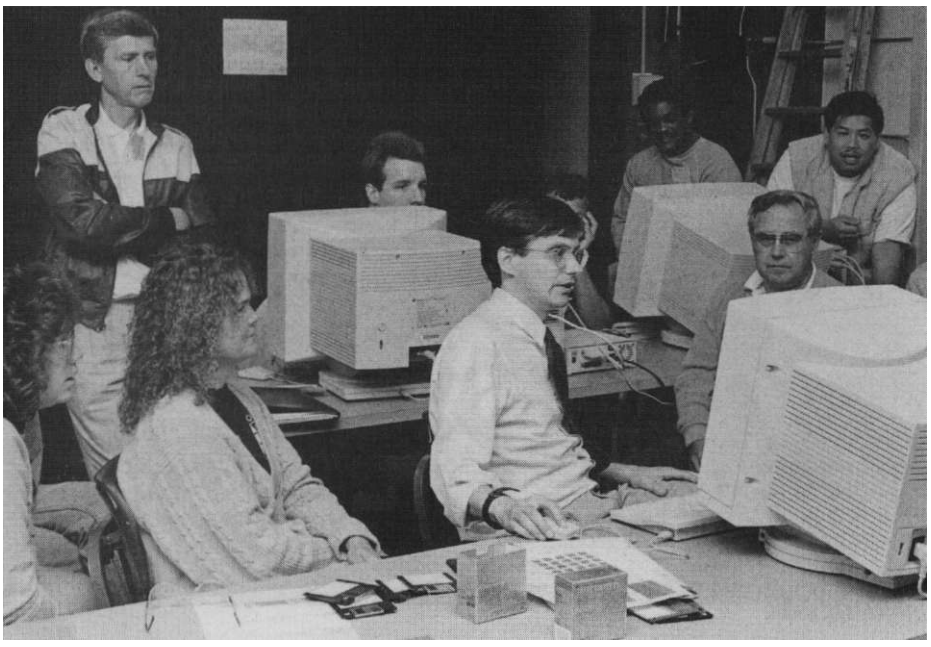
Thesis option

Students in all three graduate programs may choose the thesis option, which provides an opportunity to demonstrate original thinking and creativity in the search for new knowledge in the graphic communications industry Students choosing the thesis option have an intense interest in a topic and a desire to make a significant contribution to the body of knowledge in the industry. Fellowship awards are often available to help fund their research. Students choosing the thesis option must enroll in 2081-890, Methods, and 2081-703, Statistical Inference. The three required courses total 16 credits, which may be taken instead of required electives and Project Design I and n. Total credits for the master's degree remain at 48 credit hours.

The fast track

The graphic communications industry is large and extremely varied and continues to be driven by changes in technology. Graduates from our master's program are working as professionals in production management, marketing, technical sales, research and development, quality assurance, administration, teaching, and other areas. A graduate degree from RIT's School of Printing Management and Sciences pays off by attracting leading employers from every graphic communications discipline. The program placement rate has been close to 100 percent for the past several years.

A graduate degree from RIT's School of Printing Management and Sciences can be your road map to a creative, prosperous, and exciting career. Three programs offer you the comprehensive knowledge of printing technology, electronic publishing, and graphic arts systems needed to be successful as a manager and leader in the graphic communication industry. With state-of-the-art facilities and technology, internationally renowned faculty, and unequaled course offerings, RIT's School of Printing is widely considered the premier provider of graphic communications education in the world.



Professor Frank Cost (center) demonstrates imaging techniques in the Electronic Prepress Laboratory.

Laboratory facilities

With $50 million worth of equipment in 17 labs, the School of Printing is the only school in the world with leading-edge resources in every aspect of graphic communications, imaging, and printing.

Electronic Prepress Lab (EPPL)

The EPPL features 21 fully configured and networked Macintosh G3 workstations, the latest graphics and imaging software, and a complete selection of black-and-white and color output devices by Epson, Canon, Hewlett-Packard, Imation/Rainbow, Xerox, Agfa, Iris, and others.

Color Proofing Lab

This lab features the Kodak digital color proofing system in addition to state-of-the-art color proofing systems by Fuji, Dupont, Scitex/Iris, and 3M.

Desktop Scanning Lab

This facility reflects the growing range of image capture tools available to professionals, including a Scitex flatbed scanner, two Howtek Scanmasters, two UMAX PowerLook scanners, an Agfa T-5000 scanner, and an Eagle Colorgetter.

Production, Planning, and Image Capture Lab
Color Management and Color Measurement Lab
Color Image Processing Lab
Design and Typography Lab
Orienting Applications Lab (PAL)
PAL Prepress Lab
Print Materials Testing Lab
Newspaper Lab
Flexography Lab
Gravure Lab
Offset Lithography Lab
Binding and Finishing Lab
Digital Printing Lab

Selected Graduate Theses Topics School of Printing Management and Sciences

- "FOLD—The Definitive Guide to Folding for Print Publications"
- "SGMI-Based Publishing"
- "FrameMaker Software Application Handbook"
- "Line Reproduction in Mapping Utilizing the Four-Color Process Model"
- "Implementation and Integration of Wide-Format Printing Systems"
- "An Investigation into the Development of a Software Tool for the Design of Book Pages"
- "A Study of Print Brokering in the United States"

School of Printing Management and Sciences

Barbara Birkett, BA, Aquinas College; MBA, University of Michigan; MBA, Rochester Institute of Technology; CPA, Maryland—Associate Professor, Printing Management
Robert Y. Chung, BA, Eastern Washington State University; MS, Rochester Institute of Technology—Professor, Color Management
Edward Granger—Melbert B. Cary Jr. Professor
Samuel B. Hoff, BA, MA, California State University—Associate Professor, Electronic Image Assembly
Barry Lee, BS, MS, Rochester Institute of Technology—Assistant Professor, Flexography and Gravure Process
Len Leger, BS, State University of New York College at Potsdam; MS, University of Rochester—Graduate Program Coordinator-Associate Professor, Printing Management
David Pankow, MLS, Columbia University—Curator, Melbert B. Cary Jr. Graphic Arts Collection; Professor
Frank J. Romano, BA, City University of New York—Administrative Chair; Professor, Electronic Publishing
J. A. Stephen Viggiano, MS, Rochester Institute of Technology—Printing Technology; Sr. Imaging Scientist, RIT Research Corp.; Adjunct Professor

Associates

David Avery—Assistant Professor, Lithography Process
Twyla Cummings, BS, MS, Wright State University; Ph.D., Union Institute—Associate Professor
Herbert H. Johnson, BS, Rochester Institute of Technology—Associate Professor, Book and Magazine Production
C.R. Myers—Assistant Professor, Electronic Prepress Systems
Michael Riordan—Visiting Professor, Color Image Processing Systems

School of Film and Animation

The School of Film and Animation offers a graduate program: the master of fine arts in imaging arts with concentrations in computer animation and film.

Master of Fine Arts Degree In Imaging Arts

Johnny Robinson, *Animation Chair, Film and Animation*
716-475-2754, animate@rit.edu

Malcolm Spaull, *Coordinator, MFA Program, Film and Animation*
716-475-6127, mgscdm@rit.edu

The master of fine arts program in imaging arts emphasizes a broad interpretation of animation and filmmaking as an art form, with the intention of inspiring and nurturing the individuality of each student as a creative, productive person. The program encourages graduate study in filmmaking, animation, visualization, and other imaging arts as a means to personal aesthetic, intellectual and career development.

The MFA curriculum provides a flexible pattern of study that is continually sensitive to the needs of each student, building upon the strengths that each individual brings to the program. A full range of courses in 2D computer animation, 3D computer animation, drawing for animation, stopmotion animation, special effects and film are available. Successful completion of the program enables a student to seek careers in film or animation production.

Program goals

1. Provide students the opportunity to use animation film and other imaging arts as a means to pursue a career and earn a livelihood.
2. Provide students the opportunity to use animation film and other imaging arts as a means to enrich their personal lives and society as a whole.
3. Provide a nurturing intellectual environment that encourages a sense of community, creativity, scholarship and purpose.

Degree requirements

The MFA degree in imaging arts normally requires a minimum of two years of full-time course work as a resident graduate student. A minimum of 90 quarter credit hours of graduate work is outlined below. These minimums may be exceeded, either at the wish of the candidate or as a result of the need to cover certain areas of study.

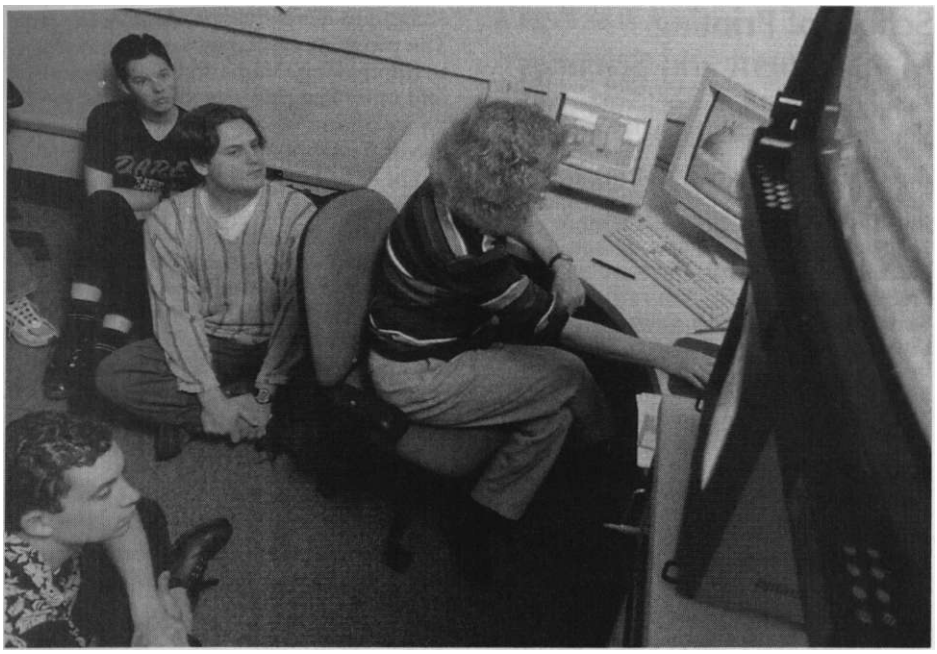
The 90 hours do not include undergraduate work required by action of the MFA admission committee in accepting a particular applicant nor do they include undergraduate prerequisites for graduate courses.

Computer Animation

The computer animation concentration incorporates courses in 2D and 3D computer and camera animation.

The computer animation concentration consists primarily of courses in single-frame filmmaking taught in the School of Film and Animation and programming courses offered in Computer Science and Information Technology. Course work includes exercises and major projects in both two- and three-dimensional computer animation as well as support courses in filmmaking technique and interactivity.

The Computer Animation degree encompasses work in three areas of study:



Credits

1. Concentration (computer animation) designed to give depth of experience in the area of the student's primary interest. All students complete required course and other course work is selected from many flexible alternatives.	40
2. History and aesthetics of film and related art forms	15
3. Electives	19
4. Research Seminar, Graduate Seminar, and Research & Thesis	16
Total Credits	**90**

Distribution of work within these guidelines is subject to modification based upon the candidate's background, abilities and interests. An individualized course of study will be prepared with the advice of the graduate faculty and made a matter of record. Modifications in this prescribed program thereafter must be approved and recorded.

Graduate Faculty Imaging Arts Computer Animation Concentration

Carl (Skip) Battaglia, MS, Syracuse University; BA, Boston University—Professor
Stephanie Maxwell, MFA, San Francisco Art Institute—Associate Professor
Howard Lester, BA, MFA, University of California at Los Angeles—Administrative Chair; Professor
Johnny Robinson, BFA, MFA, Syracuse University—Animation Chair; Assistant Professor
Maria Schweppe, MA, Ohio State University; BA, University of Kansas—Director of Visualization; Associate Professor

Film

The film concentration incorporates courses in film, video, scriptwriting, and animation. Students produce fiction, documentary, and experimental films.

The Film degree encompasses work in three areas of study:

Credits

1. Concentration (film) designed to give depth of experience in the area of the student's primary interest. All students complete required course; other course work is selected from many flexible alternatives.	4C
2. History and aesthetics of film and related art forms	15
3. Electives	19
4. Research Seminar, Graduate Seminar, and Research & Thesis	16
Total Credits	**90**

Distribution of work within these guidelines is subject to modification based upon the candidate's background, abilities, and interests. An individualized course of study will be prepared with the advice of the graduate faculty and made a matter of record.

Modifications in this prescribed program thereafter must be approved and recorded.

Graduate Faculty Imaging Arts Film Concentration

Cat Ashworth, MA, State University of New York at Buffalo—Assistant Professor
Charlie Boyd, MFA, Pennsylvania State University—Assistant Professor
Adrianne Carageorge, MFA, Ohio University—Associate Professor
Howard Lester, BA, MFA, University of California at Los Angeles—Administrative Chair of the School of Film and Animation; Professor
Johnny Robinson, BFA, MFA, Syracuse University—Animation Chair; Assistant Professor
Maria Schweppe, MA, Ohio State University; BA, University of Kansas—Director of Visualization Studies; Associate Professor
Malcolm Spaull, MFA, Rochester Institute of Technology—MFA Coordinator; Professor

General Information

Electives

Elective courses are available in animation, film, video, multimedia, screenwriting, printmaking, painting, sculpture, communication design, museum studies, crafts, bookmaking, typography, color photography, new media, studio photography, advertising photography, perception, sensitometry, computer graphics, art history and archival preservation and conservation. There are also opportunities for independent studies, internships and concentrations.

The faculty

The MFA in imaging arts computer animation program is supported by a staff of 12 full-time faculty members with the School of Film and Animation and a variety of adjunct faculty members. Faculty and course work are also available from the School of Photographic Arts and Sciences, School of Printing Management and Sciences, School of Art, School of Design, and School for American Crafts as well as from the College of Liberal Arts.

Admission requirements

Students with a baccalaureate degree or equivalent from an accredited college or university, or equivalent, are eligible for admission provided they present a portfolio of work that demonstrates their skills, visual sophistication, and aesthetic awareness. Acceptance depends on the strength of portfolios as judged by the graduate faculty, past academic performance, letters of recommendation, and personal statements of purpose.

There are no examination requirements for admission to this MFA program. If applying with an undergraduate GPA of less than 3.0, however, the GRE or GMAT test is strongly recommended. Personal interviews, whether in person or by phone, are encouraged but not required. Applicants who are capable of good academic work as well as artistic visual expression and who demonstrate an interest in the exploration of new artistic ideas and experiences will be favored. The graduate faculty will make recommendations based on the above interlocking criteria.

Students who are evaluated to have MFA potential but need additional study in preparation for graduate courses will be advised to take such courses either prior to entrance or during their first year of study. The graduate faculty will make recommendations.

To apply for admission to graduate study, students must submit an official transcript of their undergraduate degree(s), an acceptable portfolio (slides, videotape, CD, etc.), a statement of purpose detailing why they want to attend graduate school and what they will bring to the program, and a minimum of two letters of reference. All correspondence concerning applications or catalogs should be addressed to the director of Graduate Enrollment Services.

Transfer credit

Graduate-level course work taken prior to admission to the program should be submitted for approval upon entrance into the program. Up to 12 quarter credit hours (8 semester hours) of B or better graduate work is transferable toward the degree with the approval of the graduate faculty.

Portfolio

The portfolio, along with written records of accomplishment and recommendations, serves to inform the faculty of the applicant's imaging accomplishments. It provides a visual statement of the candidate's performance to date in terms of his or her skills, aesthetic development and maturity.

Applicants are encouraged to submit their best visual work in their portfolio whether computer generated or not. Photography, painting, film, animation, illustration, web page design and other forms of visual expression can be included. Do not send master tapes or originals of any work.

Admission selection for the fall quarter in the imaging arts program is made in the spring from among all portfolios and completed applications received. Admission to the animation program occurs on a rolling basis; that is, students can be admitted in any quarter, although fall is preferable. Applications should be postmarked by February 15 to optimize the opportunity for fall admission. Portfolios and completed applications will be reviewed as they are received. Once the available slots are filled, qualified candidates will be placed on a waiting list and any slots that open will be filled by candidate at the top of the list.

For instructions on submitting slides, see imaging arts photography Submit a list of work included on video with any tapes, which includes the tide and length of the work as well as your role in production. Include a table of contents on a CD.

Submit the portfolio with the application material to Graduate Enrollment Services. Send your materials to:

Rochester Institute of Technology
Office of Graduate Enrollment Services
58 Lomb Memorial Drive
Rochester, N.Y. 14623-5604
716-475-2229
gradinfo@rit.edu

Grades and time limit

The average of all grades for graduate credit taken at the Institute must be at least a B (3.0) to qualify for the MFA imaging arts degree. Thesis hours are usually taken over several quarters. Only the letter R is recorded, indicating a thesis in process. No letter grade is assigned. Acceptance or rejection of the thesis is made by the candidate's thesis board and the graduate faculty.

All course work, including an accepted thesis, must be completed within seven years of entrance into the program.

Screenings

Screenings are required for all student-produced films and are coordinated through the professor or the thesis chair.

Thesis

The thesis project should be an original production appropriate to the major commitment of the degree candidate. A written report will be prepared for inclusion in the library. Specific directions are available in the "MFA Guide for Students and Faculty: Policy Regarding Student Work." The School of Film and Animation reserves the right to retain copies of student-produced films to be used for educational purposes, to show to prospective students, and as examples of student productions. Graduates must also leave the school copies on videotape or CD of complete work and master's thesis projects.

Cultural influences

Rochester is a unique place for anyone seriously interested in a broad pursuit of studies in imaging arts. Fine-art imaging at RIT is keeping pace with some of the newer visual imaging methods through courses in computer graphics, interactive installations, virtual reality, computer animation, and Web page design. The Rochester area is enhanced by such outstanding resources as the International Museum of Photography and Film at the George Eastman House and the Visual Studies Workshop.

The MFA program in imaging arts computer animation at RIT is unique in that it is the only such program housed in a School of Film and Animation with full production facilities and the additional support of highly specialized faculty in photography, imaging science, computer science and information technology, and printing.

School of Photographic Arts and Sciences

Master of Fine Arts Degree in Imaging Arts Photography

Willie Osterman, *Coordinator; MFA Program, Photography*
716-475-2616

The master of fine arts program in imaging arts emphasizes a broad interpretation of photography as an art form, with the intention of inspiring and nurturing the individuality of each student as a creative, productive person. The program encourages graduate study in photography as a means to personal, aesthetic, intellectual and career development.

The MFA curriculum provides a flexible pattern of study that is continually sensitive to the needs of each student, building upon the strengths that each individual brings to the program.

The degree in imaging arts is offered with academic concentration in photography. Successful completion of the program enables a student to seek careers in education, museum or gallery work or as a self-employed professional.

Program goals

1. Provide students the opportunity to use photography as a means to pursue a career and earn a livelihood.
2. Provide students the opportunity to use photography as a means to enrich their personal lives and society as a whole.
3. Provide a nurturing intellectual environment that encourages a sense of community, creativity, scholarship and purpose.

Photography

This concentration provides students with the opportunity to pursue a rigorous course of study in fine art photography and related media. Contemporary fine art photography incorporates the study of theory and methods that extend back in time to the beginnings of photography and forward to present day digital and experimental techniques Students engage in discursive studies, extensive research and experimental learning in a content-rich environment. Parallel courses

in art and related media history, theory, and criticism complement core classes in photography-related studies.

Fine Artist Electives

Elective courses are available in animation, video, multimedia, screen writing, printmaking, painting, sculpture, communication design, museum studies, crafts, bookmaking, typography, color photography, new media, studio photography, advertising photography, perception, sensitometry, computer graphics, art history, and archival preservation and conservation. There are also opportunities for independent studies, internships and concentrations.

The faculty

The MFA in imaging arts program is supported by a staff of 40 full-time faculty members with the School of Photographic Arts and Sciences and adjunct faculty members at the International Museum of Photography, George Eastman House and the Visual Studies Workshop, as well as RIT's Image Permanence Institute.

Faculty and course work are also available from the School of Printing Management and Sciences, School of Art, School of Design and School for American Crafts as well as from the College of Liberal Arts.

Admission requirements

Students with a baccalaureate degree or equivalent from an accredited college or university, or equivalent, are eligible for admission provided they present a portfolio of work that demonstrates their skills, visual sophistication and aesthetic awareness. Acceptance depends on the strength of portfolios as judged by the graduate faculty, past academic performance, letters of recommendation and personal statements of purpose.

There are no examination requirements (e.g., GRE) for admission to these MFA programs. Personal interviews are encouraged but not required. Applicants who are capable of good academic work as well as artistic visual expression and who demonstrate an interest in the exploration of new artistic ideas and experiences will be favored. The graduate faculty will make recommendations based on the above interlocking criteria.

Students who are evaluated to have MFA potential but need additional study in preparation for graduate courses will be advised to take such courses either prior to entrance or during their first year of study. The graduate faculty will make recommendations.

To apply for admission to graduate study, students must submit an official transcript of their undergraduate degree, an acceptable portfolio, a statement of purpose detailing why they want to attend graduate school and what they will bring to the program, and a minimum of three letters of reference. All correspondence concerning applications or catalogs should be addressed to the director of Graduate Enrollment Services. Portfolios for the photography degree will be accepted in slide format only.

Transfer credit

Graduate-level course work taken prior to admission to the program should be submitted for approval upon entrance into the program. Up to 12 quarter credit hours (8 semester hours) of B or better graduate work is transferable toward the degree with the approval of the graduate faculty.

Portfolio

The portfolio, along with written records of accomplishment and recommendations, serves to inform the faculty of the applicant's imaging accomplishments. It provides a visual statement of the candidate's performance to date in terms of his or her skills, aesthetic development and maturity.

Applicants should send 20 slides representing a cohesive body or bodies of recent work. *Detailed instructions for labeling and packaging slide portfolios are given on the following page.*

Admission selection for the fall quarter in the imaging arts program is made in the spring from among all portfolios and completed applications received. Applicants should be certain that portfolios are postmarked no later than February 1 to ensure review of the application. Admission occurs only once a year.

Portfolio instructions

- Submit 35mm slides only.
- Submit no more than 20 slides on a single slide sheet.
- Place a red dot in the lower left corner of each slide mount.
- Label each slide with your name, title of work, date, size of work.
- Do not use glass slide mounts or thick tape to label or mask slides.
- Number slides 1 to 20 in the order you wish them projected.
- Include a slide list.
- Include a self-addressed, STAMPED envelope for the return of your slides. We cannot return slides lacking sufficient postage or adequate packaging. We will retain the slides of admitted applicants.
- Submit the portfolio with the application material to:

Send your portfolio to:
Rochester Institute of Technology
Office of Graduate Enrollment Services
58 Lomb Memorial Drive
Rochester, N.Y. 14623-5604
716-475-2229

Degree requirements

The MFA degree in imaging arts normally requires a minimum of two years of full-time resident graduate study. A minimum of 90 quarter credit hours of graduate work is outlined below. These minimums may be exceeded through the intent of the candidate or as a result of necessity to cover certain areas of study.

The 90 hours do not include undergraduate work required by action of the MFA admission committee in accepting a particular applicant or undergraduate course prerequisites for graduate courses.

The Master of Fine Arts in Imaging Arts: Photography

The MFA degree encompasses work in three areas of study:

	Credits
1. Concentration designed to give depth of experience in the area of the student's primary interest. All students complete required course and other course work is selected from many flexible alternatives.	40
2. History and Aesthetics and History and Criticism of Imaging Arts and related art forms	15
3. Electives	19
4. Research Seminar, Graduate Seminar and Research & Thesis	16
Total Credits	90

Distribution of work within these guidelines is subject to modification based upon the candidate's background, abilities and interests. An individualized course of study will be prepared with the advice of the graduate faculty and made a matter of record. Modifications in this prescribed program thereafter must be approved and recorded.

Grades and time limit

The *average* of all grades for graduate credit taken at the Institute must be at least a "B" (3.0) to qualify for the MFA imaging arts degree.

Thesis hours are usually taken over several quarters. Only the letter "R" is recorded, indicating a thesis in process. No letter grade is assigned. Acceptance or rejection of the thesis is made by the candidate's thesis board and the graduate faculty.

All course work, including an accepted thesis, must be completed within seven years of entrance into the program.

Photo gallery

The photo gallery is used to exhibit graduate thesis work, student work and works of contemporary imagemakers. Students who wish to exhibit their work in the gallery are required to adhere to the published gallery guidelines.

Thesis

The thesis exhibition/project should be an original body of work appropriate to the major commitment of the degree candidate. A written thesis will be prepared for inclusion in the Wallace library. Specific directions are available in the MFA guide for students and faculty.

Policy regarding student work

The School of Photographic Arts and Sciences reserves the right to retain at least one original piece of work from a student's MFA Thesis Show for inclusion in the MFA Collection to be used for educational and exhibition purposes. Graduates must also leave the school one set of not less than 20 slides or a videotape or CD of thesis work completed for the master's degree.

Cultural influences

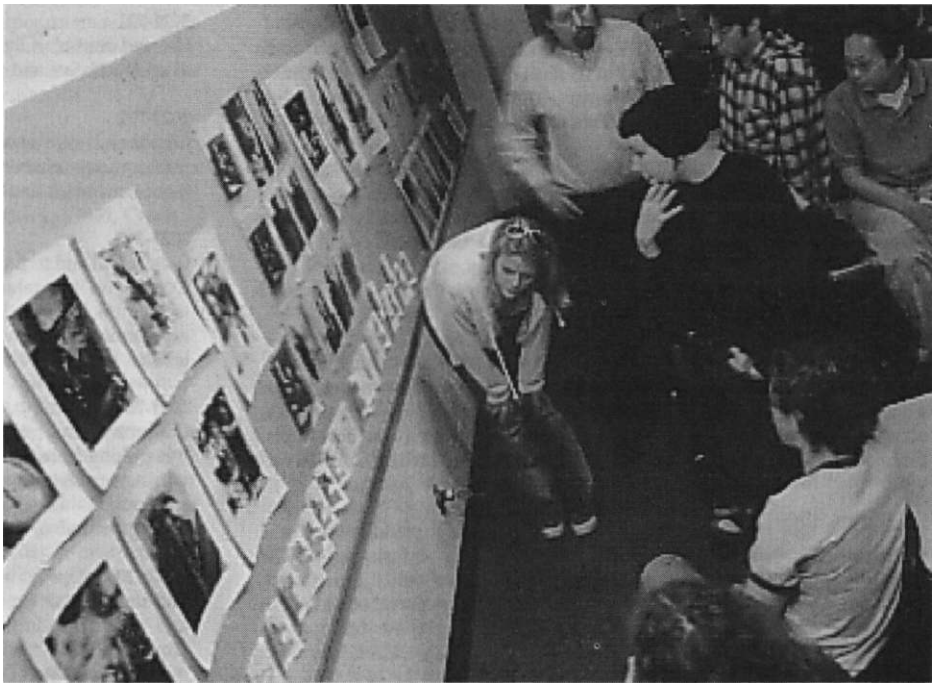
Rochester is a unique place for anyone seriously interested in a broad pursuit of photographic studies. Fine-art imaging at RIT is keeping pace with some of the latest visual imaging methods. The Rochester area is enhanced with outstanding physical and human resources. In addition to those located in the College of Imaging Arts and Sciences at RIT, there are resources to be found in two major additional institutions heavily involved in photographic education and innovation: the International Museum of Photography at the George Eastman House and the Visual Studies Workshop.

The MFA program in imaging arts at RIT is unique in that it is the only such program housed in a School of Photographic Arts and Sciences with a support faculty of 40 highly specialized and diverse instructors. The program is designed to reflect this diversity.

Graduate Faculty
School of Photographic Arts and Sciences

Imaging Arts Photography Concentration

Willie Osterman, MFA, University of Oregon—Program Chair; Associate Professor
Patti Ambrogi, MFA, Visual Studies Workshop-—Associate Professor
Angela M. Kelly, MA, Columbia College—Associate Professor
Elaine O'Neil, BFA, Philadelphia College of Art; MS, Illinois Institute of Technology—Professor
Elliott Rubenstein, MFA, State University of New York at Buffalo; MA, St. John's University—Professor
E. Kenly White, BA, Princeton University; MA, MFA, University of New Mexico—Associate Professor
Jeff Weiss, BS, University of Michigan—Associate Professor



Art History/Graduate Studies

2037-785 Forms of Inquiry
The exploration and organization of forms of inquiry in the fields of art, craft, and design. Class 2, Credit 2 (offered each year)

2037-790 Graduate Forum
The presentation and discussion of issues in aesthetics, criticism, creativity and perception as they relate to art, design and craft will be undertaken. Points of view to be clarified through critical writing. Required for MFA; to be taken prior to Thesis. Class 2 Credit 3

School of Art

Art Education

2011-701, 702 Art Education Methods/Materials
Intensive study of curriculum in terms of teaching materials for both studio and appreciation aspects of elementary, early secondary and high school art education. Includes studio and elementary school teaching experience. Class 2, Lab 9, Credit 5 (F, W) (offered on sufficient demand)

2011-820 Seminar in Art Education
Evaluation and study of the practice teaching experience. Discussion of the professional role of the art teacher in terms of professional associations, supervision, teacher training and research. A final project on some intensively studied aspect of art education is required. Lab 25, Credit 3 (S) (offered on sufficient demand)

2011-860 Practice Teaching
A seven-week full-time practice teaching experience in secondary school, including professional duties of the art teacher in humanities courses, publication advising, audiovisual work and supervision. Supplements the studio-theoretical education. Meets the state education requirements. Credit 9 (S) (offered on sufficient demand)

Illustration

2021-761,762,763, 764 Illustration Graduate Elective
Individual drawing projects related to graduate students' major area of study. Opportunity to refine drawing skills on the graduate level. Elective offerings are Adobe PhotoShop, Personal Focus, and Figure in Motion. Lab 6, Credit 3 (offered each year)

Medical Illustration

2020-781 Medical Illustration Topics I
This is an introductory course; designed to acquaint the illustration student with art techniques commonly used in medical illustration and with the medical library and audio-visual television-supporting milieu in which the medical illustrator works. Lab 6, Credit 3 (offered each year)

2020-782 Medical Illustration Graphics
A course emphasizing the use of computer software and hardware as a resource for generating titles, charts and graphs, schematics and illustrations as vehicles to meeting instructional and communicative needs. Students will learn the various techniques available and will apply those techniques while designing pamphlets, in-house publications and poster exhibits. Lab 6, Credit 3 (offered each year)

2020-783 Anatomical Studies
Sketches drawn from human dissection are translated into instructional illustrations using watercolor wash and pen and ink. Emphasis will be on rapid but accurate sketching and observation in the laboratory, with a representation of form and structure in living tissue for publication. Lab 6, Credit 3 (offered each year)

2020-784 Medical Illustration Topics II
A continuation of Anatomical Studies I with students translating sketches drawn from human dissection into full-color instructional illustrations. Techniques studied include watercolor, color pencil, airbrush and mixed media. Emphasis will be on rapid but accurate sketches leading to the description of living tissue for the preparation of surgical illustration. Lab 6, Credit 3 (offered each year)

2020-785 Surgical Procedures I
The application of creating instructional aids designed to increase learner understanding of surgical procedures and concepts. Sketches are to be drawn while observing the surgery, consulting with the surgeon for accuracy of detail and development. The final preparation of the art work will match its intended use (e.g., publication, slide graphic, computer graphic, etc.) Lab 6, Credit 3 (offered each year)

2020-786 Surgical Procedures II
A continuation of the concepts begun in 785; specifically, combining anatomical knowledge with surgical observation to construct a concise and accurate surgical series. Students will concentrate on communicating essential surgical concepts to a specific audience, as well as ensuring that their artwork will meet the demands of reproduction. Lab 6, Credit 3 (offered each year)

2020-890 Research & Thesis: Medical Illustration
The development of a thesis project initiated by the student and approved by a faculty committee. Primarily a creative production, the thesis must also include a written report and participation in a graduate thesis show. Lab 9-42, Credit 3-14 (offered every quarter)

Fine Arts Studio

2021-710 Intro to Fainting: Acrylic Graduate Elective
A course in the basic materials and processes of acrylic painting. Students will explore the expressive and stylistic possibilities of the medium. Subjects will include various interpretations of still life and model as well as individual projects. Discussion of work will focus on form, composition, and color. Lab 6, Credit 3

2021-711 Intro to Painting: Oils Graduate Elective
This course introduces students to oil painting. Along with learning about the properties and techniques of this medium, students will be encouraged to experiment and seek solutions to problems of composition and structure in painting. Preparatory sketches and studies will be encouraged for the production of finished works. Lectures, demonstrations, examples, and slide talks will compliment the growth gained through the students' creation of a variety of paintings from both observation and imagination. Lab 6, Credit 3

2021-712 Intro to Painting: Figure Graduate Elective
The fundamentals of representational figure painting in oils or acrylics using traditional materials and process. Color mixing and painting application techniques related to depicting the figure and its immediate environment will be explored. Observational study of form, space, and quality of light will be stressed. Lab 6, Credit 3

2021-721 Watercolor Graduate Elective
Use and control of the technique of water color painting. Exploring watercolor as an illustrative and painting media. Lab 6, Credit 3

2021-722 Contemporary Drawing Graduate Elective
Emphasis is on drawing and the development of form, space and expression from a variety of sources, including the human figure. Emphasis on basic techniques, materials and concepts for further study are explored. Studio 6, Credit 3

2021-730 Intro to Printmaking: Etching Graduate Elective
Conceptual and technical assignments introduce the basic techniques in etching focusing on line, value and texture. An investigation of line using the following techniques: line etch, litho crayon, open bite, scraping, and burnishing. Personal expression will be encouraged through variations in the use of line, value and texture. Lab 6, Credit 3

2021-731 Intro to Printmaking: Litho Graduate Elective
Conceptual and technical assignments that introduce the basic techniques in lithography focusing on line, value, and texture. An investigation of form relationships using the techniques of etching on litho-plates and stones; using pencils, crayons, inks, and transfer imagery to create and encourage personal expression. Lab 6, Credit 3

2021-733 Intro to Printmaking: Non-Toxic Graduate Elective
The student will explore of a wide range of non-toxic printmaking processes and techniques. In the mastery and application of these processes and techniques the student will achieve personal aesthetic goals. Studio 6, Credit 3

2021-761, 762, 763, 764 **Fine Arts Studio Graduate Elective**
Traditional sculptural concepts will evolve through a variety of processes and materials-predominately clay, plaster, cement, stone, paper and metal. The human figure is presented as a subject for study and for use as a springboard to invention. **Lab 6, Credit 3 (offered each year)**

2021-775 **Sculpture Assemblage Graduate Elective**
One of the most basic approaches to creating Sculpture, this course involves assembling or bringing together parts/pieces to form a whole. Spontaneous and immediate contact with unique materials, creative processes and the degree of sculptural impact may all be characterized as extremely direct. This straightforward confrontation offers no flashy techniques, seductive material or process to hide behind. Instead, at the onset, basic sculptural manipulation must occur. **Lab 6, Credit 3**

2021-776 **Sculpture: Figure Graduate Elective**
This sculpture course investigates the study of human form through the development of sculpted clay figures working directly from living models. Emphasis is placed on exploring the following sculptural elements: the underlying 3-dimensional structure of the human figure; proportions of the human figure; volume, mass & surface anatomy; gesture; support & balance; figurative spatial relationships; expressive qualities of human form; use & control of basic material & processes related to figure sculpture. **Lab 6, Credit 3**

2021-780, 781, 782 **Fine Arts Studio Graduate I**
Fine Arts Studio: enter into a critical discourse and examination of ideas and relationships in the fine arts. Critiques, guest artists, lectures and discussion along with studio production. Painting: develop painting skill in oil, acrylic, watercolor, drawing through individual studio investigation under the direction of fine art faculty. Sculpture: sculpture concepts are explored through a variety of processes and materials, including clay, plaster, cement, stone, wood & metal. These concepts reveal themselves through separate sections devoted to the human figure, installation, public art or other contemporary manifestations of sculpture. Printmaking: non-toxic printmaking techniques and processes are the means for students to develop along independent lines and directions for contemporary fine art printmaking. **All** areas: Lab 6, Credit 3/qtr

2021-790, 791, 792 **Fine Arts Studio Graduate II**
Fine Arts Studio: enter into a critical discourse and examination of ideas and relationships in the fine arts. Critiques, guest artists, lectures and discussion along with studio production. Painting: develop painting skills in oil, acrylic, watercolor, drawing through individual studio investigation under the direction of fine art faculty Sculpture: sculpture concepts are explored through a variety of processes and materials, including clay, plaster, cement, stone, wood & metal. These concepts reveal themselves through separate sections devoted to the human figure, installation, public art or other contemporary manifestations of sculpture. Printmaking: non-toxic printmaking techniques and processes are the means for students to develop along independent lines and directions for contemporary fine art printmaking. All areas: Lab 6, Credit 3/qtr

2021-890 **Research & Thesis: Fine Arts Studio**
The development of a thesis project initiated by the student and approved by a faculty committee. Primarily a creative production, the thesis must also include a written report and participation in a graduate thesis show. **Lab 9-42, Credit 3-14 (offered every quarter)**

School of Design

Graphic Design

2010-711 **Design Theory & Methods Seminar**
Graduate students in graphic design, computer graphics design and industrial design will use this lecture-based seminar to explore many cross-disciplinary theories and problem-solving methods that can be used by designers. Through selected readings from current periodicals, critical writing, hands-on involvement, presentations and guest lectures, students will broaden their awareness of topics such as systems thinking, brainstorming methods, semiotic theory, visual rhetoric, problem solving and evaluation methods in order to sharpen their understanding of the design process. Information will be directed toward meaningful concept development and the selection and use of appropriate structures for design problem solving. **Lec 3, Credit 3**

2010-712 **Graduate Typographic Design**
This course is centered on learning about typographic variables and visual organization methods. Focused decision making related to visual hierarchy, readability and communication is stressed. Projects involve the process of creating a thematic, sequential typographic design application. **Lab/Studio 6, Credit 3**

2010-713 **Design History Seminar**
Graduate students in graphic design, computer graphics design and industrial design will be provided with a basis in the history of design which complements the overall graduate core in the School of Design as well as specific coursework in each major field of design study. In a seminar format, the students realize the course objectives through participatory means. Interdisciplinary in nature, the course is thematic and emphasizes performance on the part of the student in dynamic dialogue on course topics. The course content focuses on subjects relative to the history of design (people, processes, products, places), critical thinking and contextual historical issues. Students are expected to write critical essays and questions and to participate in weekly discussion groups. On-line technology is utilized in addition to slide lectures, video tapes and other forms of media. Lec **3,** Credit **3**

2010-716 Image Forms
This introductory course investigates formal visual aesthetics related to graphic design problem solving. Emphasis is on the process of image analysis, ideation and synthesis. Applied use of imagery focuses upon clear message making and audience understanding. Image-generation tools range from traditional electronic media as appropriate for specific projects. An extended studio project in form analysis and articulation is the primary activity. Lab/Studio **6,** Credit **3**

2010-717 Graduate Systems Design
This course investigates various approaches toward visually and conceptually organizing components of graphic design problems (i.e. words, photographs, illustrations, diagrams, abstract shapes, textures, lines, colors, etc.) for the purpose of clear, unified communication. Projects may include the creation of multiple components within a common framework. Lab/Studio **6,** Credit **3**

2010-718 Graduate Information Design
This course stresses the importance of reader and user responses to written and visually presented information. Projects stress clarity and accessibility while investigating a variety of formats (i.e. charts, diagrams, business forms, tables, maps, instructional materials, wayfinding systems, graphic user interfaces, etc.) Lab/Studio **6,** Credit **3**

2010-721 Project Development & Evaluation
This course involves the application of theory and methods to the planning of a design project. Each student is responsible for formulating a comprehensive project development plan, including the use of evaluation method(s) during appropriate stages of the project. Lab/Studio **6,** Credit **3**

2010-722 Graduate Graphic Design Applications
This is an advanced course in which the students apply formal aesthetic principles in systematically solving applied problems on thematic, content-intensive topics. Emphasis is placed on the relationship between form and communication. Projects are defined, structured and implemented by the student. Lab/Studio **6,** Credit **3**

2010-724 Graduate Graphic Design Topics
This course is tailored to the specific needs of the students enrolled. Potential topics may include: design planning, human factors, interface design, writing and design, design for electronic media, and application of new technologies. The course involves research and design applications relevant to the selected course topic. Studio/Lab **6,** Credit **3**

2010-726 Design Issues Seminar
This graduate course experience exposes first year graduate students majoring in graphic design, computer graphics design and industrial design within the School of Design to the range of contemporary issues that face their design professions. Topics will include, but not be limited to, issues related to human factors, accessibility, green design, ethical decision-making, audience appropriateness, educating the public about design, the democratization of design and the role of the designer in society. Selected readings from current periodicals, critical writing, group dialogue, presentations and guest lectures will be integrated into the course as appropriate. Lec **3,** Credit **3**

2010-731 Graduate Design Forum
This course will introduce School of Design graduates to the graduate programs, foster a sense of community among students and faculty, acquaint students with various resources within the Institute and Rochester and encourage an on-going dialog on the commonality of design philosophy, process, practice, and goals across the design disciplines. Through the lectures, selected readings, a team project, presentations, and writing assignments, students will use this forum to become more familiar and comfortable with a free exchange of ideas about design, broaden their awareness of important interdisciplinary design considerations, and sharpen their communication and design criticism skills. Lec **3,** Credit **3**

2010-761, 762,763,764 Graphic Design Elective
Please refer to description for Graphic Design (MFA major) below. **Lab 6, Credit 3 (offered every quarter)**

2010-890 Thesis: Graphic Design
The development of a thesis project initiated by the student and approved by a faculty committee is required. Primarily the solution of an applied design problem, the thesis must also include a written report and participation in a graduate thesis show. **Lab 9-42, Credit 3-14 (offered every quarter)**

Computer Graphics Design

Due to the evolving changes in technology, the computer graphics design program offers special topics courses on a variety of subjects, including digital video, virtual reality, advanced Web design, and 3-D animation. Prospective students should consult the CGD Web site and quarterly Schedule of Courses bulletin for current course offerings.

2014-713 Design Research
This course will focus primarily on developing students' research skills and exposing them to a range of writing techniques. Emphasis will be on exposure to a wide range of research resources, including the more traditional library vehicles, newer developments on the World Wide Web, and relevant archives and special collections. This course will begin to establish each student's thesis direction in very general terms by including the development of a preliminary thesis proposal and establishing an overview of research directions. **Studio 6, Credit 3**

2014-780 Introduction to Computer Graphics
New opportunities are available to computer graphics designers that did not exist just a few years ago. During the quarter, students will be introduced to the ideas, concepts, uses, and general principles of interactive media as it relates to the most rapidly growing communications media. The course will include several web design projects/ exercises to develop the students' understanding of interface design, Web design, software logic, aesthetic considerations and issues related to interactive media. The student will be expected to complete assigned projects and readings. **Lab/Studio 6, Credit 3 (offered every year)**

2014-781 Authoring Computer Graphics Design
Exposure to computer graphic algorithms, design heuristics, design methodology and program structures of two-dimensional imagery for multimedia design. Projects involve programming in an authoring language. **Lab 6, Credit 3 (offered every year)**

2014-782 3-D Computer Graphics Design
Extension of previous visualization skills and design experiences to include three-dimensional objects. The course will provide fundamental concepts for more advanced studies in 3D animation, virtual spaces, and multi-dimensional navigation spaces. **Lab/Studio 6, Credits 3**

2014-784 Digital Typography
A study of today's digital typography. Hands-on experiences in production typesetting, prepress planning for accurate typographic reproduction, as well as type used as a visual image. This course also deals with typography for animation, special effects and interactive media. **Lab 6, Credit 3 (offered every year)**

2014-785 Instructional Multimedia
Interactive and other software packages will be used to create instructional programs for different age groups. Course work will include subject matter research; developing objectives; creating graphics, sound and interactivity; and program evaluation. Each student will produce an instructional multimedia program. **Lab** 6, **Credit** 3 **(offered every year)**

2014-786 Multi-dimensional Computer Animation
This course will cover two-dimensional key frame, film loop, real-time recording and other digital techniques to automatically create animation applications for film, video, interactive, and multimedia and Web presentations. **Lab 6, Credit 3 (offered every year)**

2014-787 Advanced Computer Graphics Design I
Advanced exploration of computer graphics applications. Projects could include such topics as interactive multimedia presentations, computer-generated special effects, digital type development, computer-aided instruction lessons, TV and electronic mail promotions and computerized animation. **Lab 9, Credit 3 (offered each year)**

2014-890 Thesis: Computer Graphics Design
The development of a thesis project initiated by the student and approved by a faculty committee. Primarily a creative production, the thesis must also include a project report and participation in a graduate thesis show. **Lab 942, Credit 0-14 (offered every quarter)**

Industrial Design

2035-706 Design Collaborative Graduate
Advanced product development involving teamwork and collaboration with an industry design group providing technical information, marketing concerns and outside review of work. This course, with special criteria for graduate students, may be offered simultaneously with Design Collaborative 2035-506 and taught by the same instructor. **Studio 6, Credit 3**

2035-708 Furniture Design Graduate
Experience in the design of furniture for a defined sector of the contract market is acquired through a project exercise involving industry collaboration. This course, with special criteria for graduate students, may be offered simultaneously with Furniture Design 2035-508 and be taught by the same instructor. **Studio 6, Credit 3**

2035-711 Advanced Computer Modeling I
The first of three required graduate-level electronic media courses. The emphasis in this beginning level (Level 1) modeling course is learning software tools competency through assigned exercises and creative projects. The objective is student understanding of the nature, location, and use of all tools commonly available at the professional level for electronic surface modeling in degree 3 and higher B-spline curves and surfaces. Learning simple effect-of-motion techniques (turntable animation, fly-around animation) is included. **Studio 6, Credit 3**

2035-712 Advanced Product Design Graduate
The application of design methods and skills to advanced level projects in industrial design. This course, with special criteria for graduate students, may be offered simultaneously with Advanced Product Design 2035-512 and taught by the same instructor. **Studio 6, Class 3**

2035-721 Advanced Computer Modeling II
The second of three required graduate-level electronic media courses. The emphasis in this second level (Level 2) modeling course is learning higher software competency-techniques-for modeling complex and difficult shapes through assigned exercises and creative projects. The objective is student understanding of the most efficient use of professionally-preferred tools for electronic surface modeling in degree 3 and higher B-spline curves and surfaces. (Advanced Computer Modeling or consent of instructor) **Studio 6, Credit 3**

2035-731 Advanced Computer Modeling III
The third of three required graduate-level electronic media courses. The goal for this third-level (Level 3) modeling course is learning higher software competency directed toward team working. The emphasis is in strategizing the process of modeling complex and difficult shapes to achieve results typically expected by professional project team members, through assigned exercises and creative projects. Included are the methods and techniques for flawless transferring of design intent of these electronic surface models to and from other professional-level surface and solids software. **(2035-721** or **consent of** instructor) **Studio 6, Credit 3**

2035-732 Exhibit Design
Design of trade show and similar exhibits, including gallery exhibits, involving structure, graphics, lighting, and layout of space. Students will develop concepts through plan and elevation drawing as well as perspective renderings for presentation. **Studio 6, Credit 3**

2035-741 Professional Practice
Business and ethical practices in the industrial design profession are examined through case studies and designer interviews. Students discuss matters of professional practice, debate issues of ethical professional behavior, prepare business correspondence, and analyze the function of industrial design in the business environment. **Lec. 3, Credit 3**

2035-761, 762, 763, 764 Industrial Design Graduate Elective
The reasoned application of theoretical and practical background to advanced projects in industrial design. **Lab 6, Credit 3 (offered every quarter)**

2035-840 Thesis Research
Guidance in selecting and planning a thesis project, conducting a search for background material, and writing a thesis proposal. (Second year graduate ID major or consent of instructor) **Lec 3, Credit 3**

2035-890 Thesis: Industrial Design
The development of a thesis project initiated by the student and approved by a faculty committee. Primarily a creative production, the thesis must also include a written report and participation in a graduate thesis show. Lab 9-42, Credit 3-14 (offered every quarter)

School for American Crafts

Ceramic & Ceramic Sculpture

2040-761, 762,763, 764 Ceramic Graduate Elective
Basic instruction and experience in ceramic design, fabrication and production of ceramic forms is undertaken. This study provides ceramic technology and terminology and gives experience with clays along with fundamental forming techniques. The development of design awareness is encouraged through lectures and critiques. Lab fee required Lab 6, Credit 3 (offered every quarter)

2040-781 Graduate Ceramics Studio I
This is the first of a four-quarter sequential class covering the advanced aesthetics and techniques in ceramics. This program is structured on the basis of the individual student's needs, interests and background preparation as they may be determined through faculty counseling. There will be a strengthening of ceramic techniques, design fundamentals and encouragement of personal expression. The student will be encouraged to evaluate new techniques, materials and concepts. This sequence leads to the master's thesis, proposed by the student and approved by the faculty. Lab fee is required. Lec 3, Studio 12, Credit 9

2040-782 Graduate Ceramics Studio II
This is the second of a four-quarter sequential class covering the advanced aesthetics and techniques in ceramics. This is a continuation of the program developed on the basis of the individual student's needs, interests and background preparation techniques, design fundamentals and encouragement of personal expression. The student will be encouraged to evaluate new techniques, materials and concepts. This sequence leads to the master's thesis, proposed by the student and approved by the faculty. Lab fee is required. Lec 3, Studio 12, Credit 9

2040-783 Graduate Ceramics Studio III
This is the third of a four-quarter sequential class covering the advanced aesthetics and techniques in ceramics. This is a continuation of the program developed on the basis of the individual student's needs, interests and background preparation as they may be determined through faculty counseling. The student will begin to seriously experiment with issues and themes that may prove relevant to their final selection of a thesis topic. The student will be encouraged to evaluate new techniques, materials and concepts. This sequence leads to the master's thesis, proposed by the student and approved by the faculty. Lab fee is required. Lec 3, Studio 12, Credit 9

2040-784 Graduate Ceramics Studio IV
This is the fourth of a four-quarter sequential class covering the advanced aesthetics and techniques in ceramics. This is the culmination, prior to the thesis studio course, of the program developed on the basis of the individual student's needs, interests and background preparation as they have been determined through faculty counseling. The student will seriously pursue issues and themes that are relevant to their final thesis topic. The student will be encouraged to utilize new techniques, materials and concepts. This sequence leads to the master's thesis, proposed by the student and approved by the faculty. Lab fee is required. Lec 3, Studio 12, Credit 9

2040-890 Ceramics Graduate Thesis
The development of an acceptable thesis project, initiated by the student and approved by the student's thesis committee and chairperson of the school. Primarily a creative production resulting in a body of work, the thesis will include a written report which addresses the body of work. The work will be exhibited in the graduate thesis show. Lec 3, Studio 12, Credit 0-18

Glass

2041-761, 762, 763, 764 Glass Graduate Elective
Collaborative work in the student's major area of study and glass fabrication is encouraged. Various techniques, both hot and cold, wiil be considered in different quarters: casting, slumping, fusing, blowing, neon, engraving, sand carving, cutting, electroplating, lamp working and sculptural construction. Course emphasis on personal, independent development encouraging contemporary thought and concept. Lab fee required. Lab 6, Credit 3 (offered every quarter)

2041-781 Graduate Glass Studio I
This is the first of a four-quarter sequential class covering the advanced aesthetics and techniques in ceramics. This program is structured on the basis of the individual student's needs, interests and background preparation as they may be determined through faculty counseling. There will be a strengthening of ceramic techniques; design fundamentals; and encouragement of personal expression. The student will be encouraged to evaluate new techniques, materials, and concepts. This sequence leads to the master's thesis, proposed by the student and approved by the faculty. Lab fee is required. Lec 3, Studio 12, Credit 9

2041-782 Graduate Glass Studio II
This is the second of a four-quarter sequential class covering the advanced aesthetics and techniques in ceramics. This is a continuation of the program developed on the basis of the individual student's needs, interests, and background preparation techniques; design fundamentals; and encouragement of personal expression. The student will be encouraged to evaluate new techniques, materials, and concepts. This sequence leads to the master's thesis, proposed by the student and approved by the faculty. Lab fee is required. Lec 3, Studio 12, Credit 9

2041-783 Graduate Glass Studio III
This is the third of a four-quarter sequential class covering the advanced aesthetics and techniques in ceramics. This is a continuation of the program developed on the basis of the individual student's needs, interests and background preparation as they may be determined through faculty counseling. The student will begin to seriously experiment with issues and themes that may prove relevant to their final selection of a thesis topic. The student will be encouraged to evaluate new techniques, materials and concepts. This sequence leads to the master's thesis, proposed by the student and approved by the faculty. Lab fee is required. Lec 3, Studio 12, Credit 9

2041-784 Graduate Glass Studio IV
This is the fourth of a four-quarter sequential class covering the advanced aesthetics and techniques in ceramics. This is the culmination, prior to the thesis studio course, of the program developed on the basis of the individual student's needs, interests and background preparation as they have been determined through faculty counseling. The student will seriously pursue issues and themes that are relevant to their final thesis topic. The student will be encouraged to utilize new techniques, materials and concepts. This sequence leads to the master's thesis, proposed by the student and approved by the faculty. Lab fee is required. Lec 3, Studio 12, Credit 9

2041-890 Glass Graduate Thesis
The development of an acceptable thesis project, initiated by the student and approved by the student's thesis committee and chairperson of the school. Primarily a creative production resulting in a body of work, the thesis will include a written report, which addresses the body of work. The work will be exhibited in the graduate thesis show. Lec 3, Studio 12, Credit 0-18

Metalcrafts & Jewelry Design

2042-761, 762, 763, 764 Metals Graduate Elective
This course offers students fundamental, intermediate and advanced fabrication/forming techniques as they apply to hollow ware and jewelry design. Creative designs and innovative artistic concepts are encouraged. Individual and group instruction covers the properties of various metals, the use of the shop equipment and safety procedures as they apply to metal smithing. Lab 6, Credit 3

2042-781 Graduate Metals Studio I
This is the first of a four-quarter sequential class covering the advanced aesthetics and techniques in ceramics. This program is structured on the basis of the individual student's needs, interests and background preparation as they may be determined through faculty counseling. There will be a strengthening of ceramic techniques, design fundamentals and encouragement of personal expression. The student will be encouraged to evaluate new techniques, materials and concepts. This sequence leads to the master's thesis, proposed by the student and approved by the faculty. Lab fee is required. Lec 3, Studio 12, Credit 9

2042-782 Graduate Metals Studio II
This is the second of a four-quarter sequential class covering the advanced aesthetics and techniques in ceramics. This is a continuation of the program developed on the basis of the individual student's needs, interests and background preparation techniques, design fundamentals and encouragement of personal expression. The student will be encouraged to evaluate new techniques, materials and concepts. This sequence leads to the master's thesis, proposed by the student and approved by the faculty. Lab fee is required. Lec 3, Studio 12, Credit 9

2042-783 **Graduate Metals Studio** III
This is the third of a four-quarter sequential class covering the advanced aesthetics and techniques in ceramics. This is a continuation of the program developed on the basis of the individual student's needs, interests and background preparation as they may be determined through faculty counseling. The student will begin to seriously experiment with issues and themes that may prove relevant to their final selection of a thesis topic. The student will be encouraged to evaluate new techniques, materials and concepts. This sequence leads to the master's thesis, proposed by the student and approved by the faculty. Lab fee is required. (2042-782) Lec 3, Studio 12, Credit 9.

2042-784 **Graduate Metals Studio** IV
This is the fourth of a four-quarter sequential class covering the advanced aesthetics and techniques in ceramics. This is the culmination, prior to the thesis studio course, of the program developed on the basis of the individual student's needs, interests and background preparation as they have been determined through faculty counseling. The student will seriously pursue issues and themes that are relevant to their final thesis topic. The student will be encouraged to utilize new techniques, materials and concepts. This sequence leads to the master's thesis, proposed by the student and approved by the faculty. Lab fee is required. Lec 3, Studio 12, Credit 9

2042-890 **Metals Graduate Thesis**
The development of an acceptable thesis project, initiated by the student and approved by the student's thesis committee and chairperson of the school. Primarily a creative production resulting in a body of work, the thesis will include a written report which addresses the body of work. The work will be exhibited in the graduate thesis show. **Lec** 3, **Studio** 12, **Credit** 0-18

Weaving & Textile Design

2043-761,762,763,764 **Textile Graduate Elective**
This is the study and appreciation of weaving and textile techniques, soft sculpture, off-loom weaving and printing. Design approaches are stressed. Lab fee required. **Lab 6, Credit 3 (offered every quarter)**

Woodworking and Furniture Design

2044-761,762,763, 764 **Wood Graduate Elective**
This is a course in woodworking techniques and procedures. It enables the student to gain design competency through wood and an individual solution to wood projects based on suggested needs. Lab fee required
Lab 6, Credit 3 (offered every quarter)

2044-781 **Graduate Wood Studio** I
This is the first of a four-quarter sequential class covering the advanced aesthetics and techniques in ceramics. This program is structured on the basis of the individual student's needs, interests and background preparation as they may be determined through faculty counseling. There will be a strengthening of ceramic techniques, design fundamentals and encouragement of personal expression. The student will be encouraged to evaluate new techniques, materials and concepts. This sequence leads to the master's thesis, proposed by the student and approved by the faculty. Lab fee is required. **Lec 3, Studio 12, Credit 9**

2044-782 **Graduate Wood Studio** II
This is the second of a four-quarter sequential class covering the advanced aesthetics and techniques in ceramics. This is a continuation of the program developed on the basis of the individual student's needs, interests and background preparation techniques, design fundamentals and encouragement of personal expression. The student will be encouraged to evaluate new techniques, materials and concepts. This sequence leads to the master's thesis, proposed by the student and approved by the faculty. Lab fee is required. **Lec 3, Studio 12, Credit 9**

2044-783 **Graduate Wood Studio** III
This is the third of a four-quarter sequential class covering the advanced aesthetics and techniques in ceramics. This is a continuation of the program developed on the basis of the individual student's needs, interests and background preparation as they may be determined through faculty counseling. The student will begin to seriously experiment with issues and themes that may prove relevant to their final selection of a thesis topic. The student will be encouraged to evaluate new techniques, materials and concepts. This sequence leads to the master's thesis, proposed by the student and approved by the faculty. Lab fee is required. (Pre-requisite 2044-782) **Lec 3, Studio 12, Credit 9**

2044-784 Graduate Wood Studio IV
This is the fourth of a four-quarter sequential class covering the advanced aesthetics and techniques in ceramics. This is the culmination, prior to the thesis studio course, of the program developed on the basis of the individual student's needs, interests and background preparation as they have been determined through faculty counseling. The student will seriously pursue issues and themes that are relevant to their final thesis topic. The student will be encouraged to utilize new techniques, materials and concepts. This sequence leads to the master's thesis, proposed by the student and approved by the faculty. Lab fee is required. Lec **3,** Studio **12,** Credit **9**

2044-890 Wood Graduate Thesis
The development of an acceptable thesis project, initiated by the student and approved by the student's thesis committee and chairperson of the school. Primarily a creative production resulting in a body of work, the thesis will include a written report, which addresses the body of work. The work will be exhibited in the graduate thesis show. Lec **3,** Studio **12,** Credit **0-18**

School of Film and Animation

2065-701,702,703 History & Aesthetics of Film Animation
An extended comparative survey of the history and aesthetics of film that will explore the four basic forms of the medium: fiction, documentary, animated and experimental. Emphasis is on determining the unique characteristics of the medium and how those characteristics are used as a means of interpretation and expression. Credit **4** (F,W,S)

2065-711, 712,713 Film & Animation Core
Major emphasis is placed on the individual's learning to generate and intensify his or her personal statement through creative projects. Some of the projects are assigned, while others are selected by the candidate. Work is critiqued weekly by the instructor. Credit 4 (F, W, S)

2065-716 Digital Audio Tools/Animation
Students in this course learn technical and aesthetic concerns which organize the design, recording, and editing of sound in animated motion pictures. Student projects focus on recording and editing sound in digital form, and shaping the sound for expressive and narrative purposes. Class **2,** Credit **2 (F)**

2065-721 Animation & Graphic Film **1**
An introduction to the techniques and practice of graphic and animated film production. This course provides training and practical experience in a wide variety of approaches to single-frame motion picture production. Students produce a number of short film exercises utilizing both existing and original artwork. Some techniques covered in the course are: direct modification of the film surface; eel, ink and paint animation; and kinestasis. Screenings of professionally made films will illustrate each technique. Proficiency in drawing is not required. (No prerequisites required). Class 2, Discussion 1, Lab 2, Credit 4 (F, S)

2065-722 Animation & Graphic Film **2**
A continued introduction to the techniques and practice of graphic and animated film production. This course provides training and practical experience in a number of approaches to single-frame film making in addition to those covered in 2065-721. Some techniques covered in the course are: three-dimensional animation; optical printing; computer animation; and hand-drawn sound. Screenings of professionally made films will illustrate each technique. Proficiency in drawing is not required. (2065-721) Class 2, Discussion 1, Lab 2, Credit **4 (W)**

2065-723 Animation & Graphic Film **3**
This course provides practice in all phases of single-frame film production. Students produce a 16mm, 90-second graphic film with sound, utilizing one or more techniques learned in the preceding two quarters, (permission of instructor) Class **2,** Discussion **2,** Lab **2,** Credit **4** (S)

2065-727 Scriptwriting for Animation
This course explores the principles of dramatic structure and storytelling in both fiction and nonfiction animated film and video. Students prepare short scripts suitable for production and prepare finished storyboards from those scripts. Credit **4 (F)**

2065-731 Film & Video: Tools & Technology
An intensive tools and technology course that will allow the student t work in the digital video format. This course will examine the technical concerns of single and double system portable video production and editing. Production skills in camera work, editing and sound recording will be covered (2065-203). Credit **5 (F, W)**

2065-737 2-D Computer Animation I
Students in this course create animated sequences and projects using a commercial animation software package for a popular microcomputer. In addition to mastering specific software, students learn the principles of digital computer operation and how those principles apply to the problems of animation with computers. (2065-721) Credit 4

2065-738 2-D Computer Animation II
This course focuses on the integration of computer animation into film and video. Students produce a finished animated project on film or videotape with sound, which can be used as a portfolio piece. Emphasis is placed upon various postproduction strategies which involve such techniques as combining computer animation with live action, the addition of film and video special effects and combining computer animation with existing film or video imagery. (2065-721) Credit 4 (S)

2065-741 Graduate Drawing Animation: Dynamics
This advanced course focuses on drawing of drawn animation and is one of the three different courses in drawing for animation offered. Each course provides a different focus. The courses do not need to be taken in sequence. Students explore the use of acceleration and deceleration squash, and stretch, maintaining volume, anticipation, secondary action, overlapping action, paths of motion, follow-through, exaggeration. A variety of examples of drawn animation will be screened in class. Gesture drawing from live models may be included. (Figure in Motion). Studio 6, Credit 3 (F)

2065-742 Graduate Drawing Animation: Sequences
This advanced course focuses on structuring the shots in a scene and is one of the three different courses in drawing for animation offered. Each course provides a different focus. The courses do not need to be taken in sequence. Flexibility is provided for students at different stages of development. Students leam how to break a scene into shots. They develop shots into a sequence. They storyboard the sequence. They learn to compose the frame for action and to juxtapose one shot against the next. Students learn to use exposure sheets to plan our animation. They animate short sequences using acquired skills. A variety of examples drawn animation will be screened in class. Gesture drawing from live models may be included. (Figure in Motion) Credit 3, Studio 6 (S)

2065-743 Graduate Drawing Animation: Characters
This advanced course focuses on character development for animation and is one of three different courses in drawing for animation offered. Each course provides a different focus. The courses do not need to be taken in sequence. Students produce character sheets. They explore different perspectives of the character drawing from imagination. They use the characters in sequential frames of motion. A variety of drawn animation examples will be screened in class. Gesture drawing from live models may be included. (Figure in Motion) Studio 6 Credit 3(W)

2065-747 3-D Computer Animation I
Students begin work in modeling three-dimensional space and manipulating objects within that space with particular attention to the role of color and color effects in animation. Emphasis is on color as a vehicle of expression and the techniques used to model, shade, display and record three-dimensional objects. (2065-721) Credit 4 (F, W, U)

2065-750, 751,752,753 Special Topics - Graduate
Advanced topics of current or special interest designed to broaden and intensify the student's ability to use animation as a means of communication and expression. Credit 3-9

2065-756, 757, 758 Film & Animation Workshop
Each faculty member offers a different opportunity for students to explore the multiplicity of ways that photography or filmmaking can be used as a vehicle for expression and communication. Visual research, group critiques, field trips, studio and laboratory practice are used. Credit 4

2065-762 Stop Motion Animation
Explore techniques for producing stop motion animation. Gain familiarity with the use of a variety of materials which may include clay, puppet, foam, latex and more. Develop techniques for making armatures and skeletons and creating joints. Learn how to measure movement from frame to frame. Research and write about a stop motion technique or animator. (2065-331 or 2065-721) Lec 3, Lab 2, Credit 4

2065-771, *Til*, 773 Graduate Seminar I, II, III
The seminar provides an opportunity for all MFA students to develop a sense of community and to openly discuss matters jof concern, to discuss each other's animations or films, to meet with visiting artists on campus and to participate in a thesis sharing from time to time. (JPHC) Credit 2 (F, W, S)

2065-781,782, 783 Alternative Processes
An advanced course in the production and presentation of still or moving images using historical and contemporary visual imaging processes. Emphasis is on extending the students' experience in image making by incorporating alternatives to conventional animation or filmmaking into their work. Processes to be covered include lighting, inverse kinematics, digital cinematography, particles, procedural animation, compositing, montage and combinations of techniques. Credit 4 (F, W, S)

2065-786, 787, 788 Contemporary Issues
A study of current issues relevant to fine art photography and filmmaking, how they relate to broader historical/cultural issues and how they might suggest future directions. Credit 2

2065-799 Independent Study
Learning experiences not provided by formal course structure may be obtained through the use of an independent study contract, (approval required) Credit 1-9

2065-841, 842, 843 Research Seminar
Thesis Seminar serves as a planning stage for preparing a research thesis proposal and for an ongoing critique and discussion of the research in progress. Issues related to exhibitions, publications, copyright, distribution, and gallery also are covered, (restricted to JPHC) Credit 2 (F, W, S)

2065-890 Research & Thesis: Film & Animation
The thesis is designed and proposed by the candidate. It is considered his or her culminating experience in the program, involving research, a creative body of work, an exhibition or suitable presentation and a written illustrated report (approval required). Credit 1-12

Graduate Photography

2066-701, 702, 703 History & Aesthetics of Photography
A required seminar which surveys and examines the development of the medium beginning with pre-history. Students will explore the first applications of photographic documentation, portraiture, art and science and will study photography in the context of modernist and post-modernist critical discourse. Credit 3 each class

2066-711, 712, 713 Photography Core
Students engage in a rigorous group critique process to develop a mature body of work which combines experimental and analytical learning methods. They develop aesthetic and technical strategies for the production and presentation of art work and move through independent theoretical research and in contemporary art concepts and methodologies which inform practice. On successful completion of the required core courses, in the first year, students are eligible to be considered for advancement to thesis. Credit 4 each class

2066-750,751,752,753 Special Topics Workshop
Advanced topics of current or special interest designed to broaden and intensify the student's ability to use photography and related media. Recent topics have included Beyond the Family Album, Women and Visual Imaging, Warhol and Beuys, Art and Censorship, Digital Media Cafe, Negotiating Identity and Mural Photography. Credit 4

2066-754 Museum Studies
Students study advanced topics related to museum and gallery practice through internships, research and projects which are formally proposed by the student. Emphasis is placed on the function and administration of museums and galleries, and so on the conceptual nature of curating and planning exhibits. (Graduate status) Credits 1-9

2066-756, 757, 758 Photographic Workshop
Each faculty member offers a different opportunity for students to explore the multiplicity of ways that photography and related media can be used as a vehicle for expression and communication. Visual research, group critiques, field trips, studio and laboratory practice and critical readings are used. Workshops may be taught as a theme class or on an individual basis to provide students with critical feedback on projects. Recent theme classes include: Digital Media Cafe, Web Seminar, Electronic Arts Seminar, and Imaging the Self. Credit 4 each class

2066-760 Photo Workshop for Teachers
A graduate course in the principles and practices of photography designed especially for the high school or community college teacher, counselor, or adviser, who may be involved in instruction or career guidance in photography or film/video. Both black-and-white and color photography are presented and applied in actual picture-making experiences. Both the aesthetic and the technical aspects of photography are stressed. Teaching methods, course development and ideas in visual communications are examined. Teaching technique relevant to the instruction of photography will be stressed. Career opportunities in photography will be explored. Credit **6** (not offered **every year)**

2066-762 Dadaism, Surrealism & Photography
This seminar examines the work of a group of artists, known as the Dadaists, who rejected the social order and values that produced World War I. The student will, in turn, explore surrealism, the art movement that moved beyond the "destructive program of Dada" and replaced it with a more creative approach to human values and life. **Lec** 3, **Credit** 3

2066-764 Minor White Seminar
A study of the photography and philosophy of Minor White and his contribution to photographic publications, photographic education and photography as an art form. **Credit 3 (not offered every year)**

2066-765 Photography Extensions
Strip photography, slit/scan photography and stroboscopy are used to probe and artistically manipulate spatial and temporal dimensions in order to create unseen poetic expressions of a space/time continuum. Perceptual principles and technical problems associated with the production and exhibition of such images are studied. **Credit 4**

2066-768 Conservation Procedures
The principles of photographic conservation and archival practice in a museum context will be presented through lecture, practical demonstration and field visits to local museums. Included are the methods for examining photographs, stabilizing them and restoring them. Special emphasis will be given to proper techniques for display and storage of photographs, together with instruction on how to gain access to information and materials pertinent to those activities. Credit 4.

2066-770 Photography in the Desert Southwest
An extended workshop for students to photograph and travel in the Four Corners region of the American Southwest with an instructor leading a camping tour through New Mexico, Utah, Colorado and Arizona. Federal and state campgrounds are used exclusively. Students participate in day trips and hikes or make their own daily itinerary. No darkroom facilities are available during the trip. Maps and reading assignments introduce students to the geology, climate, history and cultures of the Southwest. (Basic photography experience) Credit 3-9

2066-771 Graduate Seminar Graduate
Seminar is designed to engage students in dialog with guest speakers and faculty on their professional work. Each class involves a professional presentation by a different speaker to be followed by discussion. Activities which foster the emerging career of the artist are stressed. **Credit 2**

2066-772 Teaching Photography
A graduate course concerned with the art and craft of teaching photography in formal and informal settings and in accordance with accepted learning principles. **Credit 4 (not offered every year)**

2066-774 Landscape as Photo
This seminar surveys the major artistic, mythological, political and economic issues influencing the development and use of landscape photography in America from the 1840s to the 1990s. The student will be introduced to a diverse group of historical and contemporary image makers, (no prerequisite; open as an elective pending enrollment by majors) Credit 3

2066-775 Early Photo Processes
This is a non-laboratory technical course that surveys the structure and deterioration mechanisms of major historical photographic processes. It examines the technical basis of preservation strategies within a museum archive, and presents an approach to preservation that is integral with collection management and curatorial function (no pre-requisites). **Class** 3, **Credit** 3

2066-778 Modernism: Photography, Art & Culture
Modernism is a term used to describe how life in Europe and America from the 1880's to the 1960's was transformed by 20th century science, technology, and principles of practices of art and culture through the past century. Students will study how pioneers Picasso and Duchamp abandoned the conventions of their perspective and construction of the figure then replaced these traditions with new methods of representation (pre-requisites none). Class **3,** Credit **3**

2066-781,782,783 Alternative Processes
An advanced course in the production and presentation of still or moving images using historical and contemporary visual imaging processes. Emphasis is on extending the students" experience in image making by incorporating alternatives to conventional photography into their work. Processes to be covered include various light sensitive emulsions, and the production of the visual book. Credit **4**

2066-786,787,788 Contemporary Issues
A study of current issues relevant to fine art photography and related media, how they relate to broader historical/cultural issues and how they might suggest future directions. Emphasis is placed on the integration of critical theoretical discourses and studio practice. **Credit 2**

2066-791 Photography Preservation I
Introduction to the basic philosophy, ethics, concerns and methods of conservation. This course will cover the various materials, sources of supply, workshop design, examination methods, documentation style, monitoring systems, utilized in the protection of photographs. **Lec 4, Lab 1, Credit 4**

2066-792 Photography Preservation II
Introduction to the tools, materials and methods of providing intimate protection for photographs through proper mounting, housing and stabilization intervention. Special focus is given to the development of practical skills in protective housing construction utilized in display and storage. **Lec 3, Lab 2, Credit 4**

2066-793 Chemistry: Photography Deterioration
Introduction to the environmental factors and underlying chemical mechanisms that cause photographs to stain, fade, or otherwise deteriorate while in storage or on exhibition. Students will use actual samples in laboratory sessions to illustrate the forms of deterioration, learn about heat, light, humidity, pollution, and their effects on photographs. Emphasis will be placed on determining appropriate storage conditions for photographs of various types.**Lec 4, Lab 1, Credit 4**

2066-799 Independent Study
Learning experiences not provided by formal course structure may be obtained through the use of an independent study contract. **Credit 1-12**

2066-841,842,843 Research Seminar
The seminar serves as a planning stage and forum for preparing the research thesis proposal and for an ongoing critique and discussion of the research in progress. Additionally this course will review the thesis process, provide guidelines and resources for thesis preparation and presentation of the written thesis research paper. Over the course of the quarter the research proposal will be completed and submitted to thesis advisors for critique and approval. Credit **2**

2066-890 Research & Thesis
The thesis is designed and proposed by the candidate to a committee of graduate faculty. It is considered his or her culminating experience in the program, involving the development of independent research leading to new work. There are three components to the thesis: the thesis exhibition, the thesis paper and the public defense. The defense is a defense of both the paper and the exhibit. **Credit 1-12**

School of Printing Management and Sciences

2080-707 Estimating & Analyzing - Graphic Arts Systems
Course content covers the application of information from other management and technical courses to comprehensive situations in estimating. Its aim is to provide the student with an understanding of the relationships between estimation, pricing and the supply and demand forces which occur in the marketplace and to expose students to several printing specialties so they may appreciate the various cost advantages and disadvantages involved in the use of particular technologies. Class sessions include lectures, discussions, labs and project presentations by students. In addition to normal reading assignments, the student will be required to prepare and deliver an oral report or a written term paper on a topic related to an estimating, pricing, time study, or some other cost-related problem of special interest to the student. **Class 4,** Credit **4**

2080-712 Operations Management in Graphic Arts
Designed to give the student a broad perspective of the many topics related to managing a printing facility. Topics include an examination of the systems approach to production management, the use of statistics and other quantitative techniques in methods and decision analysis, the cost-volume-price relationship in printing production and the effect of organizational structure on decision making, line-staff relationships and management personnel. Class **4,** Credit **4**

2080-717 Marketing & Economic Application in Graphic Communication
The role, importance and principles of marketing are combined with selected topics from microeconomics that relate to a printing company's plans for the future. Extensive outside reading is required to facilitate the use of class time for practice and discussion of the materials. **Class 4, Credit 4**

2080-840 Project Design I
Weekly lectures provide the fundamental theory of the research and the theoretical constructs for the project design. Guest speakers and field trips will be used to enrich the learning experience and to introduce students to the rich variety of resources available. Students will apply the theory to the selection of their project topic and methodology. Students will complete a review of relevant literature, select a suitable project topic, research methodology and advisor by the end of the quarter. **Lec 2, Credit 2**

2080-841 Project Design II
Weekly lectures provide the fundamental theory of the research project design, especially, the data collection, measurement and reporting components. Guest speakers and field trips will be used to enrich the learning experience and to introduce students to the rich variety of resources available. Students will apply the theory to the selection of their project topic and methodology. Students will complete the data collection, data analysis and final report writing by the end of the quarter. Students will prepare and present their research findings at a graduate symposium, composed of faculty, staff and peers. (2080-840) Lec **2,** Credit **2**

2081-701 Research Methods in Graphic Arts
The theory and applications of the principles of scientific research in the graphic arts will be covered, including a systematic study of the scientific method, hypothesis generation, the nature of theory, types of research, research design and measurement. The study of problems in the graphic arts includes ink and paper, reproduction methods and quality control. **Class 4, Credit 4**

2081-702 Graphic Reproduction Theory
Analysis of the basic theories of graphic reproduction and study of the principles underlying prevalent and proposed printing processes; special topics include present and proposed systems of printing based on electrostatics; lasers; study of hybrid systems and the significance and application of interdisciplinary methods. The case study approach is used. Class **4,** Credit **4**

2081-703 Statistical Inference
The purpose of this course is to provide graduate students in the School of Printing Management and Sciences with an introduction to the field of statistics and its application to graduate research projects. In addition, current uses of statistics in the printing industry are examined. Class **4,** Credit **4**

2081-709 Trends in Print Technology
An examination of the environmental and social forces that have affected the development of printing technology to the present time, as well as those forces, present and predicted, that will affect the state of printing technology in the future. **Class 4, Credit 4**

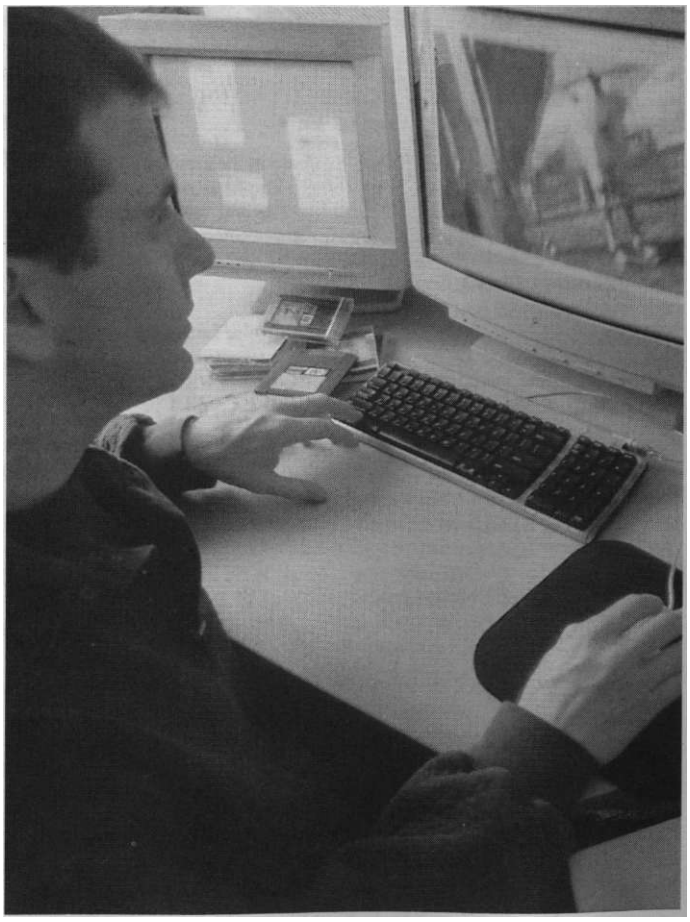
2081-711 Tone & Color Analysis
This course addresses principles and practices of color measurement for color matching and color image rendering in graphic arts imaging. Emphases are placed on the analyses and rendering of spot colors and pictorial images with the use of ICC-based color management systems. Topics include densitometry, CIE colorimetry, color management systems, graphic arts technology standards, and process control. There are lab assignments on color measurement and tone and color analyses. A self-directed project is required. The instruction is a combination of lectures (live and video-taped), demonstrations, discussions of lab assignments, and when appropriate, guest speakers. Lec **3, Lab 3,** Credit **4**

2081-722 Ink Color & Substrates
A study of the physics of light and color, basic color theory, color measurements and color systems. Included are applications of color theory to the graphic arts. The chemistry and physics of ink and substrates and their interaction are covered. Emphasis is given to the problem of ink, color and substrates in each printing process. Class **4,** Credit **4**

2081-723 Contemporary Publishing
An overview of contemporary book, magazine and newspaper publishing with emphasis on comparative editorial, production, circulation and marketing strategies. Advantages and disadvantages of the various kinds of publishing are discussed relevant to meeting the needs of society. Cost structures of the various publishing industries are explored, as are strategies of new acquisitions. Class **3,** Credit **4**

2081-730 History of the Book
The "book" or codex, in manuscript and printed form, has served for more than a thousand years as the principal record of human imagination and achievement. This course will begin with a discussion of early methods of preservation of information, but will concentrate on post-15th century developments in the techniques and technology of printing and illustrating books. An important printer will be selected from each century (beginning with the 15th and concluding with the 20th) and thoroughly discussed, including an analysis of the cultural and technological influences which shaped the products of his press, as well as those of his contemporaries. **Class** 2, **Credit** 2

2081-733 History & Technology of 20th Century Fine Printing
A follow-up course to History of the Book (2081-730) in which students will explore the growth of the private press movement in Europe and America and its influence on commercial printing. The course will begin with a survey of the seminal English private presses of the late 19th century and conclude with an examination of the England Collection of modern American private presses. Particular emphasis will be given to the technological and philosophical aspects of private press printing, including a comparison of the perceived aesthetics of the hand press vs. the machine press. (2081-730) Class **3,** Credit **3**



2081-737 Book Production
The many-faceted role of production is explored in the examination of the publishing cycle from manuscript to bound books. Emphasis is placed on an understanding of the production and editorial systems and the interaction between them. Production and cost requirements for composition, printing, binding and distribution for trade books, textbooks, journals and special editions are thoroughly discussed. Class **3,** Credit **3**

2081-741 Color Image Process Systems
This course will introduce the student to the concepts underlying the digital representation and manipulation of images. Students will be evaluated based on examinations and a term project. Class **3,** Lab **3,** Credit **4**

2081-742 Document Processing Languages
This course will introduce the student to the concepts underlying modern document processing systems. Students will be evaluated by examination and will be required to complete a term research project. **Class 4, Credit 4**

2081-743 Markets for Electronic Publications
An examination of the various product and market segments of the electronic publishing industry from corporate, commercial and vendor viewpoints, along with the effects of market forces upon the various segments. Course conducted by lecture and discussion. **Class 4, Credit 4**

2081-761 Introduction to Multimedia Publishing
This basic course introduces students to the various concepts, tools, and techniques of multi-media publishing. It includes an overview of applications, plus an introduction to various programs for creating and producing presentations. A basic introduction to scripting and program development will be presented. Projects will be assigned regularly, and will be presented in the form of problems to be solved by the student using tools and instructions provided by the instructor. **Class 3, Lab 3, Credit 4**

2081-785 Creative Print Finishing
The first part of the course gives the student an unusual opportunity to gain a better understanding of the structures, methods, materials and tools available to create attention-getting printed pieces. The second part of the course covers electronic publishing and printing, including an introduction to on-demand printing and custom book technologies. On-demand items must be processed into an attractive, marketable form, whether it is a single volume or small edition. Creative binding capabilities combined with electronic printing offer a competitive advantage that conventionally printed books cannot provide. (2081-775) Class 3, Lab 3, Credit 4

2081-840 Research Projects
Individual research projects in which independent data are collected by the student, followed by analysis and evaluation. A comprehensive written report is required. Consent of advisor is required. Credit variable 1-4.

2081-890 Thesis
An experimental survey of a problem area in the graphic arts. Credit 8

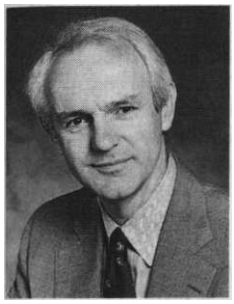
Printing Graduate Foundation Courses

2081-773 Graphic Arts Imaging Techniques—Graduate
This required professional course is designed to give students a basic understanding of the various printing processes, the application of photography to each with an emphasis on materials and equipment currently used in industry for the reproduction of monochromatic images. Class 3, Lab 3, Credit 3

2081-774 Printing Process—Graduate
Consideration of four printing processes with particular emphasis on lithography. In the area of lithography, the course seeks to give students an understanding of the basis, capabilities, limitations, and applications of this process. The gravure section provides a broad overview of the underlying concepts and principles common to the process. The course considers both cylinder imaging and presswork. In screen printing, the focus is on the technological changes that are causing screen printing to become more of a commercialized process. The flexography section emphasizes the role of flexography in the graphic arts. Technical aspects from artwork through presswork and inks are demonstrated. Credit 5

2081-775 Planning & Finishing—Graduate
This course will enable students to understand printing production from design to finishing. Topics include preparing production specifications for image assembly, printing, and print finishing. Course includes laboratory experiments and problem-solving projects. Students learn about computerized bindery equipment, quality considerations, and methods for evaluating materials and testing the physical structures of bound products. Credit 2

College of Liberal Arts



Andrew M. T. Moore, Dean

The College of Liberal Arts offers master of science degrees in the following areas: school psychology, communication and media technologies, and public policy.

The (specialist level) master of science degree and advanced certificate in school psychology is designed for graduate students who desire a career focusing on the psychological evaluation of, and intervention for, children in school settings. Students who complete the two-year academic program and the 1,200-hour full-year internship have excellent placement opportunities as psychologists who evaluate and counsel children in school and agency settings.

In addition, a joint program offered with RIT's National Technical Institute for the Deaf allows students to complete the specialist degree in school psychology and an advanced graduate certificate in school psychology and deafness in a three-year period, including two summer sessions. That program is described on page 128.

These elective graduate courses complement the professional emphasis of the degree programs by exploring the broader human knowledge and social implications embodied in these areas of study. By providing this humanistic perspective, these courses play an integral role in the professional education, making a direct and distinctive contribution to the student's preparation for a specialized career.

The master of science degree in communication and media technologies prepares students not only to analyze and anticipate communication problems but also to create and implement solutions to these problems. These objectives are achieved through a curriculum that combines advanced courses in communication theory, research and audiences, law and ethics, and courses in professional or applied technologies.

Graduates of the master of science degree in public policy will be well grounded in qualitative and quantitative theories and methodologies and in sound ethical principles. The curriculum is designed to provide the students with the skills to collect, organize, and analyze relevant science and technology policy data.

The college provides a number of graduate courses that serve as electives for some of the master's degree programs offered by other colleges at RIT.

PROGRAMS

MASTER OF SCIENCE

Communication and Media Technologies
Public Policy
School Psychology

ADVANCED CERTIFICATES AVAILABLE IN:

School Psychology
School Psychology and Deafness

Master of Science Degree in Communication and Media Technologies

716-475-6649

Communication and the technologies for message creation and dissemination are at the center of dramatic economic, social, and cultural changes occurring as a result of technological development and global connectedness. The master of science in communication and media technologies (CMT) is an interdisciplinary advanced program of study combining liberal arts courses in communication with course work in an applied or professional program. CMT graduates will be adept at the analysis of communication problems, the development of solutions, and the creation of messages as a result of their combined training in the social sciences, humanities, and applied technologies.

Communication courses rooted in the humanities and social sciences provide students the opportunity to gain broad, historical understanding of issues in communication, including ethical, legal, and social dimensions. Additional courses give students advance guidance in the creation of written and visual message content. Courses in applied technologies or professional programs provide opportunities for implementation and application. The required thesis combines knowledge, practice, original research, and application under the guidance of a Graduate Advisement Committee.

CMT graduates are prepared for careers as communication experts in such venues as commerce, industry, education, entertainment, and government as well as for graduate work toward a doctoral degree.

Admission requirements

Applications for admission are accepted for all four academic quarters, but most full-time students begin their program of study in the fall. Admission to the program is based on the following criteria:

- Graduate application
- Successful completion of the baccalaureate degree at an accredited college or university accompanied by official transcripts
- Cumulative undergraduate grade point average of 3.0 or above (on a 4.0 scale)
- Minimum score of 1500 on the Graduate Record Examination
- Minimum TOEFL score of 600 for speakers of English as a second language
- Three letters of reference from academic advisers, major professors, and/or supervisors or managers
- Submission of a writing portfolio

All credentials must be submitted and reviewed before the student completes 16 quarter credit hours of graduate work in the program.

Degree requirements

Earning the communication and media technologies degree requires completion of a minimum of 45 quarter credit hours of graduate course work, distributed as follows: four required communication courses (16 quarter credit hours) plus three or four communication electives (12-16 quarter credit hours) offered by the Department of Communication; three or four courses (12-16 quarter credit hours) in applied professional or technical course work from one of RIT's other colleges; and five to nine thesis/project credit hours earned in the department of communication. A CMT student will create a Graduate Advisement Committee by the end of the first quarter of study; the committee will be

comprised of at least one faculty member from the department of communication and one faculty member from an appropriate applied technical program from another RIT college. The committee advises and guides the student's elective course selection and course sequencing. With the guidance and approval of the Graduate Advising Committee, students design and conduct a thesis/research project appropriate to their course of study and to their career goals.

Required Communication courses (16 credits)		Credits
0535-701	History of Media Technologies & Industries	4
0535-702	Communication Theory & Audiences	4
0535-703	Research Methods in Communication	4
0535-704	Communications Law & Ethics	4
0535-800	Project/Thesis	5-9

Communication electives (12-16 credits)
Students are required to select three communication electives from the choices below; a fourth elective is optional. History of Media Technologies and Industries, and Communication Theory and Audiences, are prerequisites for all communication electives.

0535-xxx	Electronic Communication & Society	4
0535-xxx	Crafting the Message	4
0535-xxx	International Media	4
0535-xxx	Teaching & Training Technologies	4
0535-xxx	Public Relations & Advertising	4
0535-xxx	Visual Communication	4
0535-xxx	Special Topics in Communication	4

Applied professional or technical courses (12-16 credits)
Students are required to select three applied professional or technical courses from the choices below; a fourth applied or technical course is optional.

College of Imaging Arts and Sciences

2081-709	Trends in Printing Technology	4
2081-723	Contemporary Publishing	3
2081-742	Document Processing Languages	4

College of Applied Science and Technology

0602-718	Current Themes in Information Technology	4
0602-733	Fundamentals of Telecommunications	4
0604-741	Fundamentals of Web-Based Multimedia	4

College of Business

0105-761	Marketing Concepts	4
0105-766	International Marketing	4
0105-767	Marketing Communications	4
0105-772	Marketing on the Internet	4
0102-740	Organizational Behavior and Leadership	4
0102-741	Leading Change in a Quality Organization	4
0102-742	Introduction to Technology Management	4
	Managing the High-Tech Firm	4

Master's thesis/project

A thesis or project is required of all CMT students. The thesis/project topic should complement the student's academic graduate interests and scholarly training. Topic selection and method(s) for implementing the thesis/project occurs in consultation with the student's Graduate Advisement Committee.

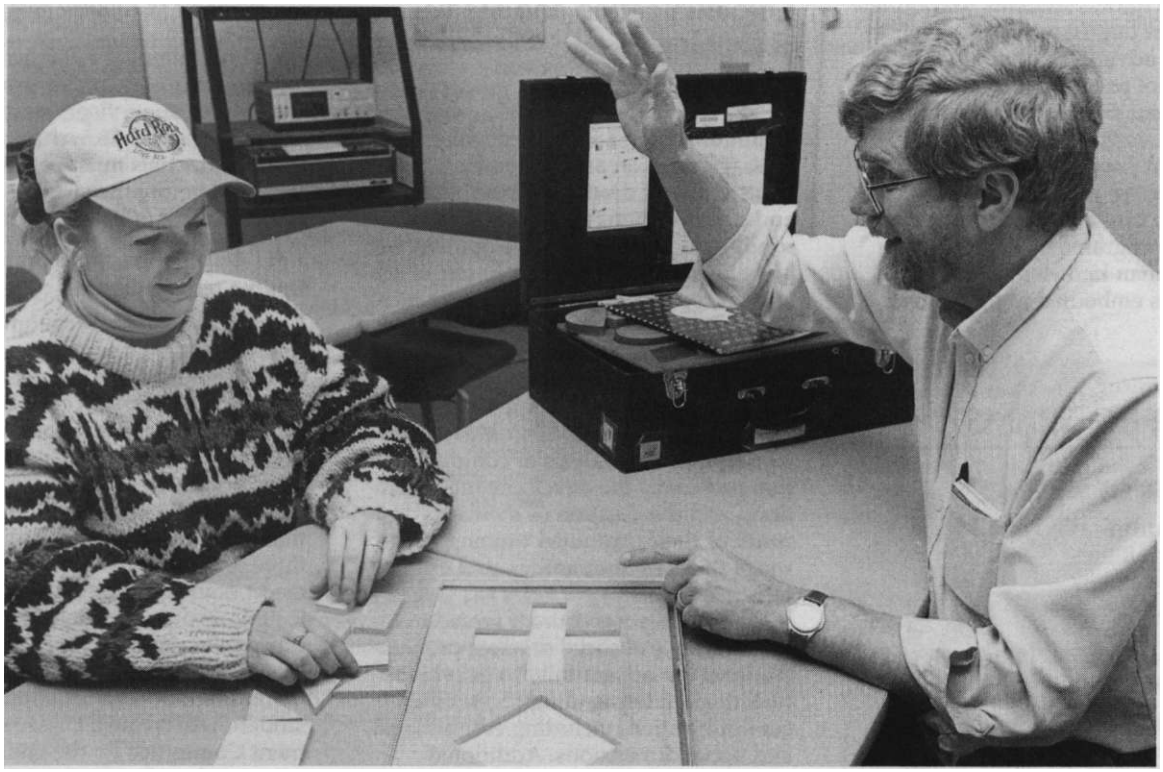
Financial aid

Financial assistance, including alternative loan programs and federal and state programs, may be available through the RIT Financial Aid Office (716-475-2186; 716-475-6909 TTY). Graduate assistantships and Kern Professor research assistantships are available on a competitive basis; contact the department of communication (716-475-6649) for more information.

Proposed plan of study

FALL QUARTER

History of Media Technologies and Industries
Communication Theory and Audiences
Communication Elective *or* Applied Professional/Technical course



Graduate students wishing to work with the deaf community find RIT a unique place, with specialized programs that include an advanced graduate certificate in school psychology and deafness.

WINTER QUARTER
Research Methods in Communication
Communication Elective
Communication Elective *or* Applied Professional/Technical course

SPRING QUARTER
Communications Law and Ethics
Communication Elective
Communication Elective *or* Applied Professional/Technical course

SUMMER QUARTER
Communication Elective *or* Applied Professional/Technical course
Thesis/Project

Graduate Faculty Department of Communication

Bruce A. Austin, BA, Rider College; MS, Illinois State University; Ph.D., Temple University—Professor, Communication
Grant C. Cos, BA, University of Massachusetts; MA, Emerson College; Ph.D., Kent State University—Assistant Professor, Communication
Diane S. Hope, BS, State University of New York College at Brockport; MS, Ph.D., State University of New York at Buffalo—Professor, Communication
Keith B. Jenkins, BA, University of Arkansas; MA, Ph.D., Florida State University—Assistant Professor, Communication
David R. Neumann, BA, Ithaca College; MA, Ph.D., Bowling Green State University—Professor, Communication
Rudolph R. Pugliese, BA, State University of New York College at Oneonta; MA, State University of New York College at Brockport; Ph.D., Temple University—Associate Professor, Communication
Patrick M. Scanlon, BA, State University of New York, Albany; Ph.D., University of Rochester—Associate Professor, Communication

Master of Science Degree in Public Policy

M. Ann ***Howard,*** *Chair*
Public Policy, 716 475-5104, mahgsh@rit.edu

Public policy in the College of Liberal Arts is a broadly based unique technology-liberal arts-science program. Program graduates will make significant contributions in industry, at federal, state and local levels of government, and in the private not-for-profit sector.

The master of science in public policy emphasizes education in science and technology, interdisciplinarity, and integration of qualitative and quantitative analytical skills, plus a solid grounding in liberal arts. The program includes qualitative and quantitative theories and methodologies as well as ethical and democratic principles, so that graduates can work effectively to collect, organize, and analyze relevant science and technology policy data. The master of science degree is considered the terminal degree for a professional career in public policy.

Each master's student will have one or more interdisciplinary specializations and will be able, therefore, to understand and analyze policy issues from multiple perspectives. As we have come to understand the world as increasingly systemically global, the need for policy analysts who are able to see beyond their specialization is now well recognized. This need can be seen in such areas as environmental policy, information and communication policy, and in the impact economic and technological globalization has on a wide range of domestic policies.

Admission requirements

Two options are available to students interested in a master of science degree in public policy at RIT

Students may enter the program from the public policy bachelor of science program and earn a combined BS/MS in five years. (For admission requirements to the BS program, consult the Undergraduate Bulletin or visit the RIT undergraduate Admissions Web site at www.rit.edu/~960www/admin.)

To be admitted into the graduate portion of the BS/MS track, a student must meet the following criteria:

- Completion of all requirements of the first two years of the BS curriculum
- A GPA of at least 3.0

During spring quarter of their third year, undergraduate students who have chosen the BS/MS combined degree program will be officially admitted into the MS program based on having met the requirements detailed above.

The following admission requirements are for students wishing to enter the master of science program from other RIT programs or from outside the Institute.

- Successful completion of the baccalaureate degree at an accredited college or university
- Minimum 3.0 grade point average (GPA) overall
- Two writing samples
- Calculus required; data analysis recommended
- Two formal letters of reference
- Minimum TOEFL of 570 for students who do not speak English as their native language
- All applicable requirements listed in the Graduate Studies Bulletin

Degree requirements

A minimum of 48 quarter credit hours is required for completion of the master of science in public policy.

The BS/MS student may obtain 12 quarter credit hours of graduate work in the fourth year of the curriculum. These courses will be selected from the policy electives with the consent of the adviser and the instructor. Thus, it is expected that the BS/MS student would need to take only 36 hours in the fifth year.

Students transferring into the MS program from other BS degree programs at RIT or from outside the Institute will be required to complete the third year sequence (Public Policy Analysis I, II, III) or demonstrate that they have equivalent skills for completion of the degree. The 12 credits will be counted toward the students' minimum requirement of 48 quarter credit hours. This means that they could complete the degree in one calendar year (working throughout the summer quarter).

The graduate curriculum has a required three-course sequence: Readings in Public Policy Advanced Theory and Methods in Policy Analysis, and Evaluation Research. These required courses focus in particular upon developing a high level of quantitative and qualitative policy analysis skills. In addition, students will choose seven policy courses within their area of specialization from the courses listed below or work through independent study with appropriate faculty on specific policy areas. Students are also required to successfully complete a master's thesis.

BS/MS Curriculum (Fourth Year)

FALL	CREDITS
Liberal Arts Concentration or Minor	4
Policy Track Course	4
Free Elective	4
Policy Elective (MS)	4*
Policy Colloquium	0
Total Credits	**16**

WINTER	
Liberal Arts Concentration or Minor	4
Policy Track Course	4
Free Elective	4
Policy Elective (MS)	4*
Policy Colloquium	0
Total Credits	**16**

'Students who are continuing through the MS degree may take up to 12 quarter credit hours for graduate credit. The courses will be selected with the consent of both the adviser and the instructor.

SPRING	
Liberal Arts Concentration or Minor	4
Senior Seminar	2
Policy Track Course	4
Public Policy Senior Project	4
Policy Elective (MS)	4*
Policy Colloquium	0
Total Credits	18

SUMMER CO-OP

Master of Science in Public Policy

Course Sequence

FALL	CREDITS
Seminar: Readings in Public Policy	4
Policy Courses	12
Policy Colloquium	0
Total Credits	16

WINTER	
Seminar: Advanced Theory & Methods in Policy Analysis	4
Policy Courses	8
Thesis Research	4
Policy Colloquium	0
Total Credits	16

SPRING	
Seminar: Evaluation Research	4
Policy Courses	8
Thesis Research	4
Policy Colloquium	0
Total Credits	16

Public Policy Analysis Sequence (Public Policy Analysis I-III) (12 credits)

(For course descriptions, consult the Undergraduate Bulletin or visit the public policy Web page at www.rit.edu/~690www/LA)

Students entering the MS program from other degree programs or from outside RIT must complete this sequence to avoid the randomness of many attempts at interdisciplinarity. This sequence provides students with a context in which to integrate the various disciplinary dimensions of the program. These courses are essential to achieving the overall learning objectives of the program, which include a more holistic, integrative educational experience. By meeting this programmatic goal, graduates will be able to take a systematic approach to the understanding of policy decision making and analysis.

**Students who are continuing through the* MS *degree may take up to 12 quarter credit hours for graduate credit. The courses will be selected with the consent of both the adviser and the instructor.*

Public policy courses

The student may choose, with counsel from their adviser, seven courses from the following list. There are no disciplinary distribution requirements.

Information & Communications Policy

0535-710 The Media Industry (College of Liberal Arts, Communication)
0535-711 International Media (College of Liberal Arts, Communication)
0535-712 Visual Communications (College of Liberal Arts, Communication)
0521-xxx Intellectual Property Rights (College of Liberal Arts, Public Policy)
0101-730 Business Law I (College of Business)
0101-731 Business Law II (College of Business)
0102-740 Introduction to Technology Management (College of Business)
0102-741 Organizational Behavior & Leadership (College of Business)
0602-855 Telecommunication Policy & Standards (College of Applied Science & Technology, Telecommunications Technology)
0602-873 Information Technology & Strategic Opportunity (College of Computing & Information Sciences, Information Technology)
0602-717 Information Integration (College of Computing & Information Sciences, Information Technology)
0106-750 Information Technology Hardware & Software (College of Business, Management of Information Systems)
0106-755 Information System Management (College of Business, Management of Information Systems)

Environmental Policy

0607-752 The Legal Environment (College of Applied Science & Technology, Packaging)
0607-731 Advanced Packaging Economics (College of Applied Science & Technology, Packaging)
0630-750 Environmental Health & Safety Management (College of Applied Science & Technology, Environmental, Health & Safety Management)
0630-770 Risk Assessment Management & Communication (College of Applied Science & Technology, Environmental, Health& Safety Management)
0630-780 Legal & Regulatory Issues (College of Applied Science & Technology, Environmental, Health & Safety Management)

Science, Technology Policy/Method

0508-704 Science, Technology Policy Seminar (College of Liberal Arts, Science, Technology & Society)
0307-867 Decision Making with Bayesian Methods (College of Engineering, Applied Statistics)
0307-871 Applied Survey Design & Analysis (College of Engineering, Applied Statistics)
0106-755 Information System Management (College of Business)
0101-730 Business Law I (College of Business)
0515-702 Global Policy (College of Liberal Arts, Sociology)
0515-703 Appropriate Technology (College of Liberal Arts, Sociology)

Graduate Faculty Public Policy

Franz Foltz, BS, MS, Pennsylvania State University; Ph.D., Rensselaer Polytechnic Institute—Assistant Professor, Science, Technology, and Society

M. Ann Howard, Cornell University; JD, Rutgers University; - Associate Professor, Public Policy/Science, Technology, and Society.

Murli M. Sinha, AB, Bihar University, India; MA Patna University, India; MA, City College of City University of New York; Ph.D., Cornell University - Professor, Sociology.

Master of Science Degree in School Psychology

Advanced Certificate in School Psychology

V. *K.* ***Costenbader,*** *Director, School Psychology, 716-475-6701*

The College of Liberal Arts offers a nationally accredited graduate program leading to the master of science degree and advanced certificate in school psychology. The program prepares students for provisional certification as school psychologists in New York State. It is designed to provide students with a strong background in psychological foundations and to develop their professional skills and competencies in counseling, evaluation and consultation.

School psychologists work with young children (birth to age five); elementary, junior high and high school students; teachers and administrators; parents; and professionals. They offer services that lead to the amelioration of existing student difficulties, and they attempt to

prevent school problems. Through diagnostic testing, counseling, consultation and intervention, school psychologists help students deal with learning and behavioral difficulties and help improve students' adjustment to school and community.

Admission requirements

Admission to the program is based on the following criteria:

- Successful completion of the baccalaureate degree at an accredited college or university
- Cumulative grade point average of 3.0 or above
- Completion of at least 18 semester hours in behavioral sciences with a grade of B or above
- Prerequisite courses:
  General Psychology
  Elementary Statistics
  Child or Developmental Psychology
  Abnormal Psychology
- Minimum Graduate Record Examination (GRE) scores:
  Verbal—550
  Quantitative—500
  Analytic Reasoning—500
  Foreign students—minimum TOEFL score of 580
- Evidence of professional commitment and potential for developing effective relationships with children, youth and adults:
  Letters of reference
  Student essay about goals and related experience
- An individual interview

All credentials must be submitted and reviewed before the student completes 12 quarter credit hours of graduate work in the program. Applications are due by March 1. Later applications will be reviewed on a space-available basis.

Course numbers and titles		Credits
Required Psychological Foundation and Professional Courses		*20*
0514-701	Advanced Developmental Psychology	4
0514-702	Psychology of Teaching/ Learning	4
0514-723	Developmental Psychopathology	4
0514-752	Children & Trauma	4
0515-701	Cultural Diversity in Education	4
Required Statistics and Research Methodology		*11*
0514-728	Statistics	4
0514-759	Experimental Design	4
0514-890	Thesis OR	
0514-891	Project (1 per quarter for 3 quarters)	3
Required Specialized Courses		*44*
0514-724	Interpersonal Intervention Skills	4
0514-726	Psychoeducational Assessment I	4
0514-730	Seminar—Professional & Legal Issues	4
0514-731	Psychoeducational Assessment II	4
0514-732	Psychoeducational Assessment III	4
0514-733	Applied Behavioral Analysis	4
0514-734	Linking Assessment to Intervention	4
0514-742	Biological Basis of Behavior	4
*0514-743	Foundations of Education/ Curriculum	4
0514-744	Advanced Counseling	4
0514-745	Alternative Assessment Techniques	4
0514-749	Advanced Consultation	4
Required Field Experience		*21*
0514-712-717	Practicum I, II, III, IV, V & VI	12
0514-777	Internship I, II & UI	9
Total quarter credit hours		96

**Indicates elective*

Proposed plan of study

First year

FALL QUARTER
Psychoeducational Assessment I
Interpersonal Intervention Skills
Applied Behavioral Analysis
Practicum I

WINTER QUARTER
Psychoeducational Assessment II
Advanced Consultation
Advanced Development Psychology
Practicum II

SPRING QUARTER
Psychoeducational Assessment III
Advanced Counseling
Developmental Psychopathology
Practicum III

Second year

FALL QUARTER
Experimental Design
Alternative Assessment Techniques
Psychology of Teaching /Learning
Practicum IV

WINTER QUARTER
Biological Basis of Behavior
Statistics
Linking Assessment to Intervention
Practicum V

SPRING QUARTER
Cultural Diversity in Education
Ecological Psychology
Seminar—Professional & Legal Issues
Practicum VI
Project/Thesis
(1 credit hour continuation)

Third year

FALL QUARTER
Internship I
Project/Thesis
(1 credit hour registration continuation)

WINTER QUARTER
Internship II
Project/Thesis
(1 credit hour registration continuation)

SPRING QUARTER
Internship III

Degree requirements

A minimum of 96 quarter credit hours is required for completion of the program. Before registering for the internship, students must pass a portfolio review. A cumulative grade point average of 3.0 or above is required.

Advanced Certificate in School Psychology and Deafness

The College of Liberal Arts, in collaboration with the National Technical Institute for the Deaf (NTID), offers an advanced certificate in school psychology and deafness. This program option has two different tracks that provide specialized training in providing appropriate psychological services to deaf and hard-of-hearing learners. Some students elect to earn the advanced graduate certificate in school psychology and deafness concurrently with the specialist-level school psychology program. Certified school psychologists, in contrast, are offered the opportunity to return to school on a part-time basis, without career interruption, to take only the specialized courses. In addition to course work offered by the school psychology program, students in this advanced certificate program take two courses offered by NTID's teacher preparation program, the master of science in secondary education of students who are deaf or hard of hearing (MSSE).

This program is designed for school psychologists who will work with deaf and hard-of-hearing children and youth. It is one of only two programs nationwide that merges the school psychology and deafness specialization for practicing school psychologists.

The curriculum is designed to prepare school psychologists to work effectively with deaf and hard-of-hearing students. Courses emphasize the cultural context of the development of these children and youth and the interactions occurring among the child and the family, the school, the hearing and the deaf communities, and the legal system. The course work focuses on an interdisciplinary, ecological perspective of deafness.

Admission requirements

Tentative admission decisions are made at the time of matriculation into the specialist level school psychology program. Formal admission decisions are made at the end of the first year. Preference will be given to students with experience and/or expressed interest in working with deaf and hearing-impaired learners.

Program prerequisites

Course titles	Cr. hrs.
YEAR ONE	
Fall Quarter	
ASLI or ASLII	
Winter Quarter	
ASL II or ASL III	
Developmental Issues with Deaf and Hard-of-Hearing Learners (instead of the Advanced Placement Course)	4
Spring Quarter	
ASL III or ASL IV	
YEAR TWO	
Fall Quarter	
Deaf Students: Educational & Cultural Diversity (MSSE course)	4
Sign Language Development Practicum IV	2
Winter Quarter	
Psychoeducational Assessment & Educational Planning I	2
Sign Language Development Practicum V	2
Spring Quarter	
Psychoeducational Assessment II	2
ASL in the Workplace	2
Exam Week, Spring Quarter	
Perspectives on Teaching Deaf & Hard-of-Hearing Students (MSSE course)	2
Summer I (Four weeks, three hours a day)	
Counseling & Consultation Process with Deaf and Hard-of-Hearing Learners	4
YEAR THREE	
One quarter of internship in a setting providing services to deaf and hard-of-hearing learners	
Project/thesis on topic related to school psychology and deafness	
Total quarter credit hours	**24**

Advanced certificate requirements

- Successful completion of the specialist degree in school psychology
- Successful completion of 24 quarter units above the specialist degree
- Completion of course work with a cumulative average of B or better and a B or better in both assessment/educational planning courses
- Demonstrated proficiency in sign language communication at the Intermediate Plus skill level (as assessed by the Sign Communication Proficiency Index, classroom performance and observations in applied settings)

Graduate Faculty

School Psychology

Brian Barry, BA, St. John Fisher College; MSSc, Ph.D., Syracuse University—Associate Professor, Psychology

Virginia K. Costenbader, BA, Dickinson College; MS, Ph.D., Syracuse University—Professor, Psychology

Jennifer Lukomski, BA, Williams College; MA, Gallaudet University; Ph.D., University of Arizona—Assistant Professor, Psychology

Paul McCabe, BA, University of Rochester; MA, Ph.D., Hofstra University—Assistant Professor, Psychology

Murli M. Sinha, AB, Bihar University, India; MA, Patna University, India; MA, City College of City University of New York; Ph.D., Cornell University—Professor, Sociology

Humanities

Frank Annunziata, AB, Manhattan College; MA, City College of the City University of New York; Ph.D., Ohio State University—Professor, History

Bruce A. Austin, BA, Rider College; MS, Illinois State University; Ph.D., Temple University—Professor, Communication

Charles D. Collins, AB, Rutgers University; MA, Ph.D., University of Iowa—Professor, Fine Arts

Tina Lent, BA, MA, University of California at Los Angeles; Ph.D., University of Rochester—Associate Professor, Fine Arts

David B. Suits, BA, Purdue University; MA, Ph.D., University of Waterloo—Assistant Professor, Philosophy

Houghton Wetherald, BA, Brown University; MA, Oberlin College—Professor, Fine Arts

Note: Prerequisites are within parentheses at the end of the course description.

Liberal Arts Elective Courses

0505-702 Film History & Criticism
This course examines the historical development of film as an art and the differing interpretations of its meaning, traced through major films by important directors. Emphasis will be placed on the varying critical methodologies by which films can be analyzed. Class 4, Credit 4 (offered occasionally)

0505-703 American Architecture
An examination of American architecture from the 17th century to the present designed for the graduate level of study. Emphasis will be placed on American building art in the late 19th and 20th centuries. Class 4, Credit 4 (offered occasionally)

0505-705 Theories of Aesthetics
A course for the art-oriented graduate student centering on the student's search for a supportable and reliable basis for making value judgements about works of art as well as introducing the student to major concepts in aesthetics. Class 4 Credit 4 (Offered Occasionally)

0505-707 Cubism to the Present
Cubism as a way of seeing and as an expression of 20th century thinking. Differences and similarities with art forms of earlier eras and other cultures will be discussed. Class 4, Credit 4 (offered on sufficient demand)

0505-711 20th Century American Art
An investigation of American art from the Civil War to the present. Emphasis will be placed on the visual arts but many references will be made to music and architecture. Class 4, Credit 4 (offered occasionally)

0505-712 Arts & Crafts in a Tribal Society
A study of the function of primitive art and the techniques of its production, including the use of clay, stone, fibers, bark, wood, bronze, gold, etc. Hair styling, body painting and scarification also will be discussed. Class 4, Credit 4 (offered occasionally)

0505-713 Contemporary Issues in Art
This course offers the graduate art student the opportunity to investigate those aspects of 20th century art that question the very nature of art and the role of the artist in today's and tomorrow's society. Class 4, Credit 4 (offered occasionally)

0505-714 Art: Vision & Concept
Though the course will develop chronologically from the Medieval period to the present, emphasis will be placed on a close analysis of (1) selected works of art, including paintings, sculpture and architecture, and (2) the development of the unique oeuvre of selected artists. Topics chosen for study will be limited in number but treated in depth. Topical choices will be based on richness and import of the formal and/or conceptual content embodied therein. Some background in the history of art is helpful but not necessary. Class 4, Credit 4 (offered occasionally)

0505-715 Picasso
The impact of Picasso and his circle on 20th century art. Their affinities with modern scientific and philosophical attitudes also will be discussed. Class 4, Credit 4 (offered occasionally)

0505-716 Rembrandt
A detailed analysis of the art and times of the Baroque master. Emphasis will be placed on the development of his style and technique, on his and other artists' relationship to their society and to the character of the baroque outlook. Class 4, Credit 4 (offered occasionally)

0505-717 Topics in Music History
This course is a study of various aspects of music in different historical environments with emphasis on analogies between music and the other fine arts. Class 4, Credit 4 (offered occasionally)

0505-721 Oriental Art: China & Japan
A seminar exploring the philosophical and cultural perspectives underlying traditional Asian art as a prelude to examining selected topics in Chinese and Japanese art. Emphasis will be placed on the application of research techniques and critical methods of an individual selected area of interest that may serve as a foundation for continuing study. Class 4, Credit 4 (offered occasionally)

0505-722 Oriental Art: India & Southeast Asia
A seminar exploring the philosophical and cultural perspectives underlying traditional Asian art as a prelude to examining selected topics in Indian and Southeast Asian Art. Emphasis will be placed on the application of research techniques and critical methods of an individually selected area of interest that may serve as a foundation for continuing study. Class 4, Credit 4 (Offered occasionally)

0505-723 Art and Politics
The purpose of the course is to familiarize the student with the relationships that can exist between the art world and society. Fundamental questions concerning the social/political role of the artist (questions that are often overlooked in most curriculums) will be investigated. Questions dealing with public funding of the arts, the ideologic/political nature of art education, the function of art as a catalyst for political change, and other questions will be examined. Class 4, Credit 4 (offered occasionally)

0507-701 History of American Educational Thought
A historical analysis of change and continuity in American educational history from colonial through contemporary America. Special emphasis will be given to the development of the field of deaf education in the United States. Lectures, seminar discussions, and readings offer comprehensive coverage of the salient intellectual themes of American educational history. Class 4, Credit 4 (offered annually)

0509-705 Seminar in Philosophy of Art & Aesthetics
The four-hour meetings of this seminar are based largely on discussion of course material, and participation of all students is required. Familiarity with some Philosophy and with the general history of 20th Century Western art is helpful. The questions discussed are philosophical questions about art and aesthetic experience: Can art be defined? What is the relationship between art and beauty, art and truth, art and knowledge, art and judgement, art and politics, art and interpretation, art and contemporary philosophical theory? Readings will cover a wide range of philosophical reflection from its early roots in Plato to the contemporary Postmodern. Class 4, Credit 4 (offered annually)

0509-706 Philosophy of Mind
An investigation into concepts concerning mental experience. The basic question is "What is consciousness? "The question hides some presuppositions and raises many further questions. Can we be conscious of consciousness ? What does it mean to be conscious ? Is there a mind-brain identity ? Can we describe mental experiences in non-mentalistic terms ? Can computers think ? It will be the business of this course to explore these and other related questions and to see what progress has been made in attempting to answer them. Class 3, Credit 4 (offered occasionally)

School Psychology

0514-701 Advanced Developmental Psychology
This course will cover the major theoretical approaches to the understanding of human development. Areas of study will include, but not be limited to, cognitive development, language development, development of personality, social development and moral development. (See admission requirements for prerequisites or receive permission of instructor.) **Class 4, Credit 4 (offered annually)**

0514-702 Psychology of Teaching & Learning
This course is designed to review and apply basic psychological principles, stage theories, and fundamentals of learning to the classroom setting. This will be accomplished through an examination of the role of teachers, which includes their responsibility for teaching curriculum, classroom management, and the social and emotional growth of the students. In addition, a primary focus will include the explication of learning disabilities, including subtype analysis, diagnosis, and intervention strategies. It is hoped that through an increased understanding of the teaching and learning process, school psychologists will be more effective as consultants to enhance the learning process, particularly for special needs learners. **Class 4, Credit 4 (offered annually)**

0514-712 Practicum I
The practica serve as a bridge from theory and research to the professional practice of school psychology. They allow the student to become familiar with the organization and operation of schools. A weekly classroom seminar will be provided in addition to a placement in a school setting. The practica experiences are a major part of the preparation for the field placement/internship. (Matriculation in the school psychology program) **Class 2, Credit 2/qtr.**

0514-713 Practicum II
The practica serve as a bridge from theory and research to the professional practice of school psychology. They allow the student to become familiar with the organization and operation of schools. A weekly classroom seminar will be provided in addition to a placement in a school setting. The practica experiences are a major part of the preparation for the field placement/internship. (Matriculation in the school psychology program) **Class 2, Credit 2/qtr.**

0514-714 Practicum III
The practica serve as a bridge from theory and research to the professional practice of school psychology. They allow the student to become familiar with the organization and operation of schools. A weekly classroom seminar will be provided in addition to a placement in a school setting. The practica experiences are a major part of the preparation for the field placement/internship. (Matriculation in the school psychology program) Class **2,** Credit **2**/qtr.

0514-715 Practicum IV
The practica serve as a bridge from theory and research to the professional practice of school psychology. They allow the student to become familiar with the organization and operation of schools. A weekly classroom seminar will be provided in addition to a placement in a school setting. The practica experiences are a major part of the preparation for the field placement/internship. (Matriculation in the school psychology program) **Class 2, Credit 2/qtr.**

0514-716 Practicum V
The practica serve as a bridge from theory and research to the professional practice of school psychology. They allow the student to become familiar with the organization and operation of schools. A weekly classroom seminar will be provided in addition to a placement in a school setting. The practica experiences are a major part of the preparation for the field placement/internship. (Matriculation in the school psychology program) **Class 2, Credit 2/qtr.**

0514-717 Practicum VI
The practica serve as a bridge from theory and research to the professional practice of school psychology. They allow the student to become familiar with the organization and operation of schools. A weekly classroom seminar will be provided in addition to a placement in a school setting. The practica experiences are a major part of the preparation for the field placement/internship. (Matriculation in the school psychology program) **Class 2, Credit 2/qtr.**

0514-723 Developmental Psychopathology
This course focuses on maladaptive behavior of children and youth. Models of deviant behavior are presented, with attention to physiological, learned and environmental bases of behavior. Assessment and treatment approaches are discussed. (See requirements for admission for prerequisites or receive permission of instructor.) **Class 4, Credit 4**

0514-724 Interpersonal Interviewing Skills
This course provides opportunities for graduate students to interview individual clients, applying effective, cognitive, and behavioral approaches to the counseling situation. Under supervision, graduate students develop their counseling skills in relation to special methods populations, client concerns, and problem situations. (See requirements for admission for prerequisites or receive permission of professor.) Class 4, Credit 4

0514-726 Psychoeducational Assessment I
This introductory course in a series of assessment courses will study assessment generally, types of tests and their uses, strengths and weaknesses of specific instruments, principles of reliability and validity, scales and norms. Students will acquire an understanding of the quantitative and qualitative aspects of measurement. There will be extensive laboratory experience with a variety of instruments which measure academic achievement and sensory-motor perception. Emphasis will be placed on the clinical use of tests in schools and other settings. (Matriculation in the school psychology program or permission of instructor.) Class 4, Credit 4

0514-728 Inferential Statistics
This course will train students in understanding and using inferential statistical concepts. Special attention will be placed upon use of computer applications, conceptual understanding of statistical tests, proper selection of statistical test, and proper interpretation and reporting of results. Topics include a brief review of descriptive statistics, confidence intervals, hypothesis testing, power, effect size, one-sample z and t tests, two-sample t tests, and one-way ANOVA. (See requirements for course admission for prerequisites or receive permission of instructor.) Class 4, Credit 2

0514-730 Sr. Prof. & Legal Issues
Historic foundations and current critical professional issues, roles and functions of the school psychologist are emphasized in the course. Legal and ethical issues that bear on the role of the psychologist in the school are considered. (Matriculation in the school psychology program plus 32 quarter credit hours successfully completed in the program or permission of instructor) Class 4, Credit 4

0514-731 Psychoeducational Assessment II
This course concentrates on the development of theory and applied skills in intellectual assessment. Students learn to select and administer individual intelligence tests, to interpret results, to form test-based recommendations for intervention, and to provide written and oral reports. Assessment of persons who are culturally different or disabled is emphasized. (0514-726 and matriculation in the school psychology program) Class 4, Credit 4

0514-732 Psychoeducational Assessment III
This course uses interview, behavioral observation, rating scales and projective measures for assessment of child and adolescent social/emotional functioning and adaptive behavior. Students gain experience administering, interpreting and reporting results of measures currently used in the practice of psychology in the schools. (Matriculation in the school psychology program plus 0514-726 and 0514-731 or permission of instructor) Class 4, Credit 4

0514-733 Applied Behavior Analysis
This course is designed to provide students with knowledge and understanding of behavioral assessment and intervention strategies. Students will first learn and review the fundamentals of human learning, according to behavioral and learning theorists. Students will then apply principles of learning to the classroom for assessment, intervention, and evaluation purposes. Finally, this course prepares students to use collaborative problem solving in the application of behavioral techniques. Class 4, Credit 4

0514-734 Psychoeducational Assessment IV
This is an applied course in the diagnostic evaluation of exceptional children and adolescents. Students select, administer and integrate test data, and report results and recommendations for intervention to parents, teachers and to multidisciplinary evaluation teams. An overview of relevant information on theory of exceptionality and current status of diagnosis and treatment of exceptional children and adolescents is provided. (0514-726, 0514-731 and 0514-732 and matriculation in the school psychology program) Class 4, Credit 4

0514-739 Ecological Psychology
With special emphasis on schools, this course examines the relationship between the behavior of individuals and the social and physical environment in which they act. By examining social psychological research as well as systems and social learning theories it will illuminate the interactive relationship between individuals and the systems within which they move. The course will pay particular attention to the ways in which such variables as school and class size, gender and racial composition, spatial design and organizational structure affect academic and social behavior. (See requirements for admission for prerequisites or receive permission of professor) **Class 4, Credit 4**

0514-742 Biological Basis of Behavior
This course is designed to review the neurophysiological and neuropsychological bases of behavior as it pertains to developmental disorders. Students will identify functional neuroanatomy, neuroimaging techniques, and various neurological and neuropsychological disorders. Students will apply findings and research to contemporary problems and issues facing school psychologists. **Class 4, Credit 4**

0514-743 Foundations of Education/Curriculum
This course will develop an understanding of the changing nature of the schools and the continuing need for the school psychologist to become involved as a change agent and participant in the educational process. Legal and ethical considerations will be addressed. Issues surrounding curriculum, classroom management, and methods of instruction will be discussed. (See requirements for admission for prerequisites or receive permission of instructor.) **Class 4, Credit 4**

0514-744 Advanced Counseling
This course focuses on the development of counseling skills used with children and adolescents in individual and group settings. Students are given the opportunity to integrate theory, research, and processes relative to individual and group work. Treatment plans are developed. Techniques for facilitating group counseling are emphasized. Crisis intervention is reviewed. (0514-724) (See requirements for admission for prerequisites or receive permission of professor.) **Class 3,** Credit **4**

0514-745 Alternative Assessment
The prime focus of this course is on the assessment of academic problems in the classroom with special emphasis on the collection of data that allow the planning of interventions. Students will learn alternative direct methods of academic or behavioral assessment for both performance and skill deficits. Alternative assessment techniques include Curriculum Based Assessment, Curriculum Based Measurement, and Analogue Assessment. Emphasis will be on the integration of these assessment techniques, collaborative problem solving, systematic observation, the principles of applied behavior analysis and the psychology of learning for the purposes of intervention development. Prerequisites for this course include: 0514-733, 0514-749, 0514-726, 0514-731, 0514-732. (See requirements for admission for prerequisites or receive permission of professor) **Class** 4, **Credit** 4

0514-749 Advanced Consultation
This course will concentrate on the development of consultation skills for the psychologist in the schools. Students will acquire an understanding of the basic models of consultation and the stages in the consultation process. Extensive laboratory work will involve observations of trained consultants, role play and experiences in client- and consultee-centered case consultation. Readings will focus on pertinent research in school-based consultation. (Matriculation in the School Psychology Program plus 16 quarter credit hours successfully completed in the program or permission of instructor.) **Class 4, Credit 4**

0514-752 Children & Trauma
This course examines the nature, incidence, demographic distribution, sequelae and appropriate treatment of trauma in children's lives. After defining trauma, it explores how experiences such as parental or sibling death, serious illness or injury, familial alcoholism, emotional, physical and sexual abuse, divorce or parental abandonment, community violence and natural disasters affect children. Central to its aims is an examination of the long and short term consequences of such experiences, the factors that promote or impair the resilience of children and the signs psychologists should look for which suggest that a child is experiencing or has undergone such trauma. Finally, the course addresses the nature and efficacy of treatment of trauma and some of the ethical, legal and political difficulties a professional who suspects that a child has been traumatized should anticipate and prepare for. Class **4,** Credit **4**

0514-759 Research Methods 1
This course explores various types of research methods as well as important methodological issues and concepts. Methodologies studied include experimentation, quasi-experimentation, participant observation, archival methods, content analysis, surveys, interviews, and simulations. Methodological issues covered include philosophical paradigms, research ethics, reliability, threats to internal validity, external validity, demand characteristics, the volunteer subject problem, issues in sampling, and realism. Students will read original and contemporary works on research methodologies, as well as examples of such methodologies, and will write weekly summaries, applications, and criticisms. Course activities rely heavily on seminar-style discussions and presentations. (Matriculation in the school psychology program or permission of instructor) Class **4,** Credit **2**

0514-778 Applications of ASL at Work
This course includes linguistic features, cultural protocols and relevant vocabulary for students to function in a variety of settings where school psychologists may use American Sign Language such as testing, counseling and/or teaching. Prerequisite: ASL I, II, **III. Credit 2**

0514-799 Independent Study
A student may register for a graduate independent study project subject to the approval of the director of the student's graduate program, the faculty sponsor, the School Psychology graduate committee and the dean of the College of Liberal Arts. Because of the length of the approval process, students who desire to take independent study should make arrangements several weeks before the quarter begins. An independent study project enables the interested student and his or her faculty sponsor to coordinate their efforts on subjects and topics that range beyond the normal sequence of the graduate course selection. Credit variable

0514-810 Research Methods II
This course assists graduate students in the school psychology program in beginning their master's theses or projects. Students will write a thesis/project proposal and give a presentation of this proposal. The proposal will consist of an abstract, a preliminary introduction that includes a literature review, a proposed methods (for thesis students) or description of activities (project students) section, a proposed data analysis (thesis students) or product summary/outline (project students) section, a preliminary discussion section, a reference section, and appendices (if applicable). The proposal will be presented at the end of the term. Course activities will consist of library research, thesis/project planning, and writing under the (typically group) supervision of the instructor. Class **4,** Credit **2**

0514-811 Inferential Statistics II
This course will train students in understanding and using inferential statistical concepts. Special attention will be placed upon use of computer applications, conceptual understanding of statistical tests, proper selection of statistical tests, and proper interpretation and reporting of results. Topics include two-way ANOVA, repeated measures ANOVA, MANOVA, correlation, simple regression, reliability analysis, and non-parametric statistics. Class **4,** Credit **2**

0514-890 Thesis
Students will register for this course under the thesis option for the Advanced Graduate Certificate in School Psychology. The thesis option will be available to students only with the prior written approval of program faculty. Students must make clear their intent to enroll in the thesis option during the quarter prior to registration. Students will submit a proposal to a faculty member who agrees to serve as the student's Committee chair. The proposal will describe the basic research question to be investigated and how the student will gain access to subjects. Proposals will be reviewed by the program faculty who will give permission to register for thesis credit. **1 credit hour each for 3 quarters**

0514-891 Project
This course is used to fulfill the master's project requirements under the non-thesis option for the Advanced Graduate Certificate in School Psychology. The project may take the form of an original program designed to meet the needs of a specific school related population or a paper on some important or controversial topic. The candidate must obtain prior approval before registering for this course. A formal written paper and an oral presentation of the project are required. **1 credit hour each for 3 quarters**

0515-701 **Cultural Diversity in Education**
The aim of the course is to understand the historical and structural origins of the present schooling system in the United States. The functions of schools, from an ideological as well as technical viewpoint, will be analyzed. In addition, different forms of school organizations will be compared, as in the public vs. private dimensions. The functionalist theoretical approach will be presented as well as the conflict perspective to frame the discussion and analysis of opposing sociological system of thought. The role of education in promoting or inhibiting socio-economic mobility will also be analyzed. The course attempts to understand how role expectations are actually carried within the school system and how its different actors react to technical as well as value constraints. (See requirements for admission for prerequisites or receive permission of professor) **Class 4,** Credit **4**

Advanced Graduate Certificate in School Psychology and Deafness

0514-760 **Sign Language I**
This course provides an introduction to language and addresses the linguistic description of language and language learning features of American Sign Language (ASL). Topics include history of ASL, grammatical features of ASL, and an introduction to the various sign language systems. Offered during the summer 6 hrs/day, 5 days/week. Credit 6

0514-761 **Sign Language II**
This course expands the functions and grammar of ASL I as well as introduces a variety of new communicative functions which will allow for everyday interactions with Deaf people. Students will analyze ASL in its social/cultural context. This course is the second of a three-course sequence but may be taken separately. Prerequisite: ASL I or equivalent. **Class 3, Credit 3**

0514-762 **Introduction to Deaf Learner**
This course introduces more complex communicative functions and grammatical structures which allow for interactions with Deaf people. Students will analyze ASL in a linguistic context and be introduced to ASL literature. This course is the third of a three-course sequence but may be taken separately. Prerequisite: ASL **II** or equivalent. **Class 3, Credit 3**

0514-764 **Developmental Issues & Deaf Learners**
This course examines the development of language, cognitive and psychosocial skills in deaf and hard-of-hearing children. Current research in these areas will be critically reviewed and analyzed. Careful attention will be given to understanding the social-cultural contexts of the child and the implications for psychosocial, language and cognitive development and educational planning. The cultural, deficit, compensation and ecological perspectives on deaf and hard-of-hearing children's development will be compared and contrasted. The role of the school psychologist as a consultant on psychosocial, language, and cognitive developmental issues will be discussed. (Matriculation in the school psychology and deafness program or permission of the instructor.) **Class 4, Credit 4**

0514-766 **Psychological Assessment & Educational Planning**
This course will examine the assessment of the following areas of functioning for deaf and hard of hearing children and adolescents: communication, academic, cognitive, personality, and interpersonal. Assessment and educational planning for a student will be viewed from an ecological perspective including the family, the school, the community, the support services and the legal systems. Attention will be given to preparing and communicating psychological report data and developing individual educational plans. **Class 3 hrs/day, 5 days/wk for 6 weeks,** Credit **6**

0514-769 **Counseling & Consult Processes**
This course will concentrate on the development of counseling and consultation skills for the psychologist working with deaf and hard of hearing children and youth in the schools. Students will learn and practice basic skills, methods and techniques for providing remedial and preventive counseling with deaf and hard of hearing individuals. Counseling and consultation will be experienced within the context of the family, school, community, support services, legal and mental health systems. Special attention will be given to ethical and legal issues surrounding the provision of counseling and consultation services to meet the needs of deaf and hard of hearing individuals. **Class 3 hrs/day, 5 days/wk for 6 weeks,** Credit **6**

0514-777 **Internship School Psychology I**
Through direct, supervised 1,200-hour internship experience, the student will practice the various professional roles of a school psychologist in an educational setting. Competency in carrying out these tasks in an ethical and professional manner will be developed as preparation for employment. (Matriculation in the school psychology program plus satisfactory completion of **84** hours in graduate program and qualifying examination.) **Class 3, Credit 3/qtr**

0514-780 Sign Language Development
During the fall and winter quarters in the second year of the program, students are required to participate in sign language development courses/activities that are recommended by the ASL curriculum adviser and written up as independent study contracts. These courses and activities are designed on an individual basis according to the students' particular skill development needs. Students' progress is monitored throughout the quarters with feedback shared during regular meetings with the ASL curriculum adviser. Two credits per quarter are given upon successful completion of the individualized skill development plan. Credit 2

Public Policy

0521–700 Seminar: Readings in Public Policy
An in-depth inquiry into key contemporary public policy issues, with an emphasis on environmental policy and information and communications technology policy. (Matriculation in the public policy master's program or permission of the instructor.) Class **4,** Credit **4**

0521-701 Seminar: Advanced Theory & Methods in Policy Analysis
This course will cover the major theoretical and applied analytical methods and techniques in both quantitative and qualitative analysis. An emphasis will be placed on integrating empirical and normative concerns. (Data Analysis, Econometrics, Qualitative Data Analysis; matriculation in the public policy master's program or permission of the instructor) **Class 4, Credit 4**

0521-702 Seminar Evaluation Research
The focus of this course is on empirical evaluations of program outcomes. Students will explore the questions and methodologies associated with meeting programmatic outcomes, secondary or unanticipated effects, and an analysis of alternative means for achieving program outcomes. Critique of evaluation research methodologies will also be considered. (Data Analysis, Econometrics, Qualitative Data Analysis. Matriculation in the public policy master's program or permission of the instructor.) **Class 4, Credit 4**

0521-703 Thesis Research
The master's thesis in public policy requires the student to select a thesis topic, advisor and committee; prepare a written thesis proposal for approval by the faculty; present and defend the thesis before a thesis committee; and submit a bound copy of the thesis to the library and to the Program Chair. (Matriculation in the public policy master's program, satisfactory completion of Public Policy Analysis I—III, and satisfactory completion of a minimum of 16 graduate credits.) Class 0, Credit 8

Communication & Media Technology

0535-700 Film and Society
An inquiry concerning the relationship between motion pictures and society that will use historical, humanistic and social science research to achieve an understanding of movies as a social force, industry and art form. **Class 4, Credit 4** (offered occasionally)

0535-701 History of Media Technology & Industries
This course introduces students to the history of media technologies, the industries that evolved out of them, and the audiences that were constructed. The course includes, but is not limited to, print, broadcast, film, recording and digital media. Laws, regulations and ethics of communication media along with their effect on and relationships with people and culture will be discussed. Class **4,** Credit **4**

0535-702 Communication Theory & Audiences
This course focuses on theories of communication as they relate to technology. Theories based in both the humanities and in the social sciences that explain or predict the effects of communication technology on audiences will be presented. Opportunity for application of theory in field research is available. **Class 4,** Credit **4**

0535-703 Research Methods in Communication
An introduction to an overview of the methods and ethics of scholarly communication research including quantitative and qualitative approaches. The course focuses on methods of locating, critically analyzing and conducting communication research, and leads to the development of a research proposal suitable for a thesis or project. (0535-701,702) **Class 4, Credit 4**

0535-704 Communication Law & Ethics
This course focuses on issues presented by communication technologies to the practice of law and study of standards of ethics. Legal challenges presented by communications technologies are examined in the following contexts: intellectual property, technology rights, patents, privacy and information networks, access to information, defamation, indecency, obscenity and pornography. Special attention is paid to the difficulty of applying national laws to international media. (0535-701, 702) Class 4, Credit 4

0535-705 Electronic Communication & Society
This seminar is an intensive, advanced examination of the evolving forms and functions of computer-mediated communication as it intersects with public discourse and communicative behaviors. Grounded in rhetorical and media theory, but utilizing research from a variety of fields, the course will explore electronically-mediated communication in its many contexts and manifestations in an effort to understand how the technology influences the communication process. Positioned at the intersection of technology, identity and culture, the Internet exerts a wide and powerful influence on the communicative practices and possibilities of society in ways not yet understood. The range of contexts in which these forms of communication will be studied includes, but is not limited to, education, marketing, civic discourse, politics, popular culture, and movements for social change. (0535-701, 702) Class 4, Credit 4

0535-706 Crafting the Message
This course will focus on the creation of written and visual messages appropriate to a targeted audience and a specific medium including print, broadcast, interactive, digital, and on-line technologies. Case studies of effective and unsuccessful messages from advertising, politics, public service, education, entertainment, and development will be examined. Students will have the opportunity to create and execute a variety of messages using various writing styles and images and with varying purposes. (0535-701,702) Class 4, Credit 4

0535-707 International Media
Evaluation of media technology use in the international setting and in various countries and regions of the world. Major theories about the media, UNESCO communication developments, and governmental challenges and restrictions are considered. Comparative and cross-cultural studies of the uses and effects of media technologies within various countries and special focus on global implications of the World Wide Web and computer technologies on international cooperation, trade, and culture will be examined. A systems approach to the study of international media will structure the course. (0535-701, 702) Class 4, Credit 4

0535-708 Teaching & Training Technology
The ways we teach, train, and learn are increasingly assisted and influenced by various communications technologies. This course focuses on education and training strategies using various communication technologies with particular emphasis on developing teaching and training materials from a learner perspective. (0535-701,702) Class 4, Credit 4

0535-709 Public Relations & Advertising
A competency based study of the practices in public relations and advertising. Topics include identification of publics and selection of media, planning and evaluating campaigns, designing promotional materials, as well as employee, member, community and media relations. Special attention will be paid to online advertising, including the creation, measurement, accounting, and targeting of Internet advertisements, interstitials, the use of buttons, e-mail, sponsorships, interactive advertising, and consumer tracking. (0535-701,702) Class 4, Credit 4

0535-800 Communication Thesis/Project
The graduate thesis/project will be guided and approved by the student's Graduate Advisement Committee. Students may elect to conduct original research reported in a graduate thesis or to apply theory and research in an applied project. A minimum of 5 credits and no more than 9 credits can be earned as thesis/project credits.

College of Science

Ian Gatley, Interim Dean

The College of Science offers a unique complement of graduate programs with curricula designed with sufficient flexibility to prepare the graduate for direct entry into a career in the profession or for further study toward a more advanced graduate degree in a chosen discipline. The scheduling of courses allows the student to complete all requirements for each degree program on a full-time or part-time basis.

Whether the focus is on the foundations of matter, on applications of mathematics, on the role of the chemist in the health care environment, on the specialized properties of advanced materials or on the science and technology of advanced imaging systems, the College of Science graduate faculty join an outstanding group of students to furnish a valuable and integrated understanding of today's clinical, industrial and research problems.

PROGRAMS

MASTER OF SCIENCE DEGREES IN:

Chemistry
Clinical Chemistry
Color Science
Imaging Science
Industrial and Applied Mathematics
Materials Science and Engineering (offered jointly with the College of Engineering)

DOCTOR OF PHILOSOPHY DEGREE IN:

Imaging Science

Master of Science in Chemistry

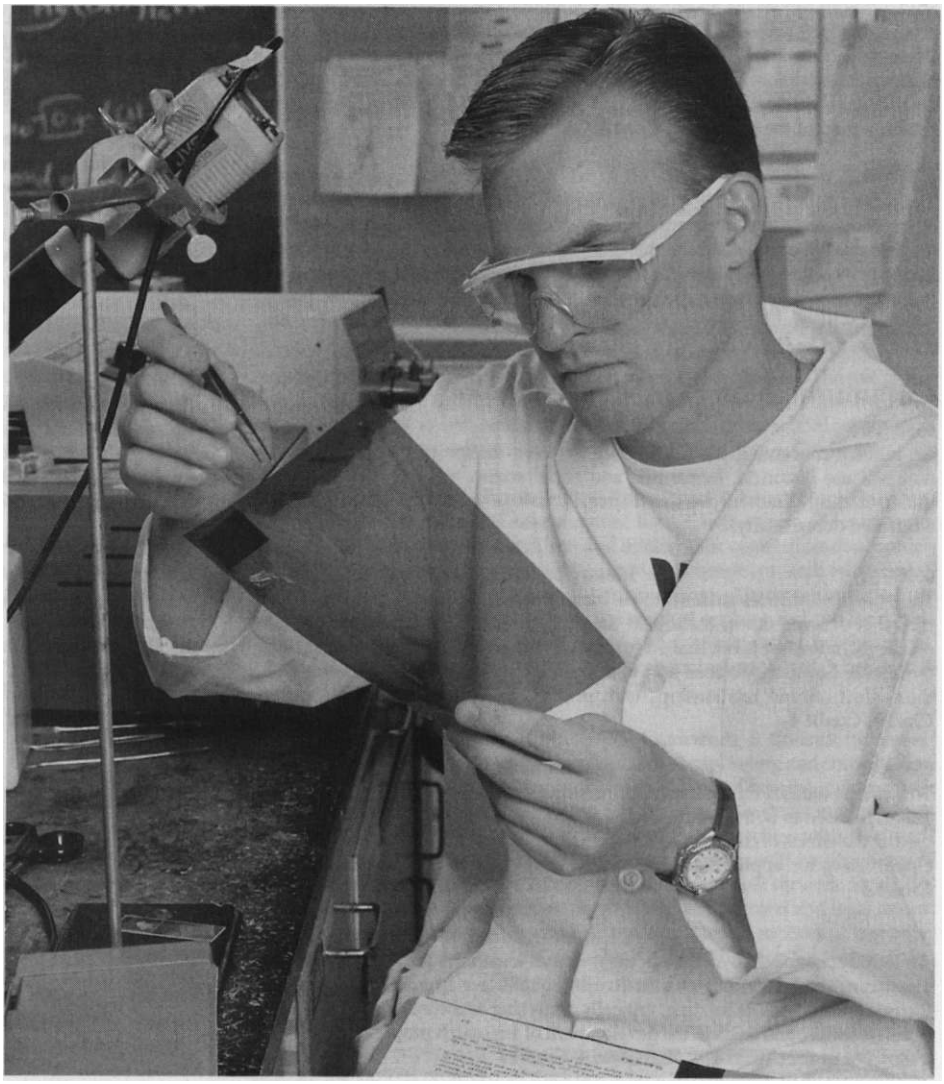
Terence C. Morrill, *Interim Department Head, Chemistry 716-475-2497*
fames Worman, *Chair, Chemistry Graduate Committee 716-475-2545*

The master of science degree in chemistry is offered on either a part-time or full-time basis. The program options are designed to fill the needs of both the practicing chemist in the greater Rochester industrial community and the full-time graduate student.

Objectives

The objectives of the program are, through course work and research experience, to increase both the breadth and depth of the graduate student's background and to provide an opportunity for the student to attack scientific problems on his or her own initiative with a minimum of supervision.

Various program options are available to cover the diverse needs of graduate chemists. Program concentrations in such important areas as polymer chemistry, microelectronics, materials science, biochemistry, and environmental chemistry are possible.



Graduate science programs seek to encourage the breadth and depth of students' educations while encouraging creative thinking.

Admission

Admission to the program will be granted to qualified graduates who are holders of a bachelor's degree in chemistry from an accredited college or university An applicant with a bachelor's degree in another scientific discipline and the equivalent of a full year's course in each of analytical chemistry organic chemistry, physical chemistry, physics and calculus will be considered for admission.

The admission decision will be based on: 1) college transcripts; 2) GRE scores (chemistry exam is recommended); and 3) letters of reference. It is strongly recommended that students visit RIT as a supplement to the normal application process.

An applicant with a bachelor's degree from an approved undergraduate school and the background necessary for specific courses is permitted to take graduate courses as a nonmatriculated student. Courses taken for credit can usually be applied toward the master's degree if the student is formally admitted to the graduate program at a later date. However, the number of credits that will be transferred to the degree program from courses taken at RIT as a nonmatriculated student will be limited to a maximum of nine credits.

Any applicant who wishes to register for a graduate course as a nonmatriculated student must obtain permission from the chair of the graduate program plus the course instructor.

English language requirement

All students who do not speak English as their primary language are required to submit TOEFL scores. All foreign students must take the Michigan Test, given by the RIT English Language Center. If a student's score is below standard, he or she must follow the recommendations of the center for additional course work. Successful completion of this work is a program requirement for the master of science degree in chemistry. This may mean that the student will need additional time and financial resources to complete the degree program.

Full-time graduate work

A number of teaching assistantships and tuition-remission scholarships are available to qualified students to undertake full-time graduate work that includes research experience. The department of chemistry has research and teaching oriented faculty as well as excellent equipment and facilities to enable full-time graduate students to carry on a program of independent study that will develop ability to attack scientific problems at the research level. The research can result in either a thesis or a project report.

Students enrolled in the program full time are expected to complete 45 credit hours of course work, including up to 16 credit hours of research leading to the submission of an independent research thesis. A full-time student normally takes six to nine graduate credits per quarter, including thesis work. Typically, all requirements are met within two years.

No more than eight credit hours of research are allowed for students working on a project report.

Part-time study

The department of chemistry encourages practicing chemists in the greater Rochester industrial community to pursue a program toward the master of science degree in chemistry without interrupting their employment. Consequently, most of the courses in the graduate program in chemistry are scheduled in the late afternoon or early evening.

Students employed full time normally take one course each quarter. Part-time students in the program are not required to complete a research thesis; the course work can be completed within four to five years.

Five-year combined BS/MS programs

The BS/MS program combines the BS chemistry, environmental chemistry option, biochemistry, and the BS polymer chemistry programs with the MS chemistry program and allows undergraduate chemistry majors to acquire an MS degree with only one extra year of study. Undergraduate majors are considered for entrance into the BS/MS combined program as early as their third year. Students in the combined program will be advised by the Chemistry Graduate Committee to take graduate-level electives so that they will receive both the BS and MS degrees after five years of full-time study.

External research credit

The department of chemistry recognizes that the in-plant experience of a number of chemists employed in local industry includes independent, creative research. This experience may be applied, to a maximum of 16 hours of research credit, towards the completion of the master of science degree in chemistry on either a full- or part-time basis.

Cooperative education option

The cooperative education option (1010-999) accommodates students at the master's level who have or are able to obtain industrial employment. Quarters of work can be interspersed with quarters of full-time academic work. If industrial employment permits research, up to 16 of the 45 required credits may be obtained through the external research credit option. If industrial employment does not permit research, research credits may be obtained within the department of chemistry.

Program

Each student, together with an adviser, will arrange a program best suited to the student's interests and needs. This program will be subject to the approval of the department head and the chair of the Graduate Committee.

A deliberate effort will be made to strengthen any areas of weakness indicated by the student's undergraduate records and the placement examinations. To qualify for the MS degree, a candidate must satisfy the following requirements:

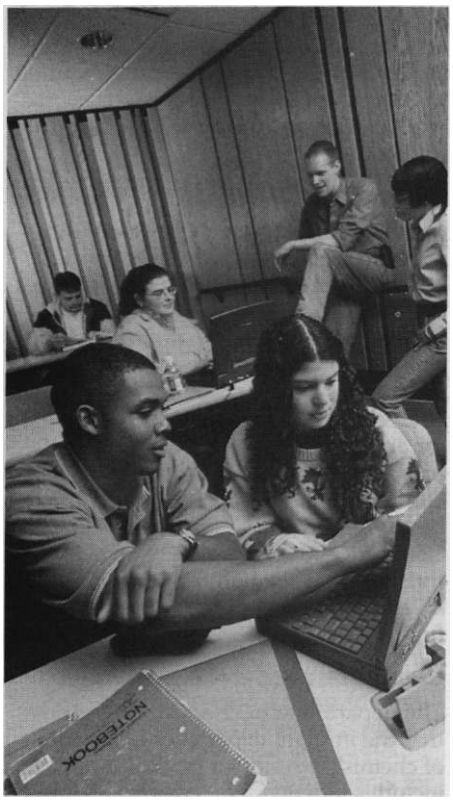
1. A minimum of 45 quarter credits beyond the bachelor's degree. Courses in chemistry will be chosen from 700- and 800-level numbers and should include one or more representing each of the three fields: analytical, organic

Schedule of Graduate Chemistry Courses

Some of the courses, designated Y1 or Y2, are offered every other year. The 2001-02 academic year is Y1.

See pages 120 to 121 for course descriptions.

Fall	Winter	Spring	Summer
1008-621	1008-621	1009-703	1010-870
1008-711	1008-711	1009-704	1010-879
1009-702	1009-702	1010-870	
1009-704	1009-703	1010-879	
1009-705	1010-870	1012-764	
1010-870	1010-879	1013-739 (Y1)	
1010-879	1012-765	1014-730	
1013-737	1013-730	1014-744 (Y2)	
1014-740 (Y1)	1013-736	1015-720 (Y2)	
1029-701	1014-741 (Y1)	1015-721 (Y2)	
1029-703	1014-742 (Y1)	1029-702	
1029-705 (Y2)	1014-743 (Y2)	1029-704 (Y2)	
	1014-747 (Y1)		



and physical. In addition a course in inorganic or biochemistry is required. A maximum of nine quarter credits may be taken in undergraduate-level courses.

Each student must select courses (subject to approval by the student's adviser and the graduate committee) that include the following core: 1008-621 and 1008-711; either 1013-737 or 1013-739; one of 1014-741,1014-743, or 1014-744. The inorganic core course is 1012-764. For biochemistry it is 1009-702. The core requirement is one course each in organic, physical and analytical chemistry and one course is recommended in either biochemistry or inorganic chemistry. As part of the required credits, each student must have one or two quarter credit hours in seminar 1010-870 and three to four quarter credit hours from outside of the department of chemistry.

2. The thesis option requires a minimum of nine quarter credit hours in research and submission of a satisfactory thesis.
3. Pass an oral thesis defense or comprehensive examination.

Additional information

More information may be obtained from the chair of the Graduate Committee, 716-475-2545, the department of chemistry, 716-475-2497, or the Web site, www.rit.edu/chemistry.

Master of Science in Clinical Chemistry

James C. Aumer, *Interim Director, Clinical Chemistry Program*
716-475-2526

The clinical chemistry program is designed for either full-time or part-time graduate study. Required courses are offered during the late afternoon or evening on a regular basis in order to accommodate the work schedules of part-time students.

Objectives

The program is designed to provide a focused educational experience for individuals preparing for careers in clinical chemistry. The design of the program provides technical and managerial proficiencies in either the diagnostic laboratory or a related industry.

Admission

Individuals holding a bachelor's degree in chemistry biology, medical technology, nuclear medicine technology, or a related field from an accredited college or university are invited to apply.

English language requirement

All students who do not speak English as their primary language are required, upon arrival at RIT, to take the Michigan Test, given by the RIT English Language Center. If a student's score is below standard, he or she must follow the recommendations of the center for additional course work. Successful completion of this work is a program requirement for the master of science degree in clinical chemistry. This may mean that the student will need additional time and financial resources to complete the degree program.

Financial support

A limited number of teaching assistantships, research assistantships, and tuition scholarships are available for graduate students. Detailed information is available from the office of the director.

Program

The master's program includes a core curriculum and electives which are chosen to reflect the student's background and career goals. A minimum of 50 quarter credits beyond the bachelor's degree is required. Required courses include Biochemistry, 1009-702; Biochemistry-Metabolism, 1009-703; Advanced Clinical Chemistry, 1023-820, 821, 822, 823; Organizational Behavior, 0102-740; Statistics and Quality Control, 1023-712; Survey of Physical Chemistry, 1014-742; Clinical Laboratory Computer Applications, 1023-722; Clinical Chemistry Research, 1023-877 or 879; Mechanisms of Disease, 1023-705.

All students are required to carry out and defend original research as part of the program requirements. Research is carried out under the direction of a faculty member and is reviewed and defended before a graduate committee appointed by the program director.

Students in the clinical chemistry program come from diverse educational backgrounds and have a variety of professional goals. The program focuses on the activities of the diagnostic clinical laboratory, developmental research in pathology and diagnostic testing as well as industrial activities related to clinical laboratory products and instruments.

Master of Science in Industrial and Applied Mathematics

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The ideas of applied mathematics pervade several areas of applications in a variety of businesses and industries and in government. Sophisticated mathematical tools are increasingly used to develop new models, modify existing ones, and analyze system performance. This includes applications of mathematics to problems in management science, biology, portfolio planning, facilities planning, control of dynamic systems, and design of composite materials. The goal is to find computable solutions to real-world problems arising from these types of situations.

The department of mathematics and statistics offers an interdisciplinary master of science degree program in industrial and applied mathematics. The program addresses the need for the education and training of people in the areas of mathematics that can effectively be used to solve problems encountered in business and industry.

Objective

The objective of the program is to provide the student with the capability to apply mathematical models and methods to study various problems that arise in industry and business. With the emphasis on computable, implementable solutions, the student uses mathematics to solve a variety of industrial and business-related problems. Since this is an interdisciplinary program, students have the opportunity to choose from a wide variety of courses across campus.

Admission requirements

The applicant should have a baccalaureate degree with a cumulative grade-point average of 3.0 or above out of 4.0 (or its equivalent) from an accredited institution. The degree could be in mathematics or any related field. The prerequisite courses are: Multivariable Calculus, Differential Equations, Matrix Theory, Probability, and Statistics. Knowledge of a programming language is also required.

A student may also be granted conditional admission and be required to complete "bridge" courses selected from among RIT's existing undergraduate courses, as prescribed by the student's adviser. Until the student completes these requirements, he or she is considered a nonmatriculated student. The graduate coordinator evaluates the student to determine eligibility for conditional and provisional admission.

English language requirement

To indicate proficiency in the language needed to handle university-level work, every applicant for whom English is not the native language is required to take the TOEFL and achieve a minimum score of 550. Those who cannot take the TOEFL will be required to take the Michigan Test of English Proficiency at RIT and obtain a score of 80 or higher. Although GRE scores are not required, submitting them enhances the chances of acceptance into the program.

Part-time study

The program is ideal for practicing professionals who are interested in applying mathematical methods in their work and in enhancing their career options. All courses are scheduled in the late afternoon or early evening hours. The graduate program may normally be completed in two years (six quarters) of part-time study.

Student's advisory committee

Upon admission to the program, the student chooses an adviser and forms an Advisory Committee whose responsibilities are to help the student formulate a concentration and select appropriate courses and to oversee the academic aspects of the student's program.

The program

The master's degree program in industrial and applied mathematics consists of 48 quarter credit hours of study. There are four "core courses" for a total of sixteen quarter credit hours. These courses are usually taken by the student in the first two quarters of the program and provide the student with a focus on some of the ideas of applied mathematics. Core courses are offered every year. The following are the core courses along with the quarters in which they are offered: 1016-725: Stochastic Processes (W); 1016-801: Numerical Linear Algebra (F); 1016-802: Methods of Applied Mathematics **I** (F); a fourth course, 0304-874: Numerical Analysis, is offered by the mechanical engineering department every winter.

The Bruce and Nora James Atrium of the Gosnell Building, which houses new and renovated science classrooms, laboratories and offices

The concentration and the corresponding course of study are formulated by the student in consultation with his or her Advisory Committee. The student completes a total of 24 quarter credit hours by taking a set of six specialized courses offered in the department of mathematics and statistics and other departments. Some of the possible concentrations are: operations research, communications networks, dynamical systems, and applied mathematics.

The program of study culminates in thesis or project work. The thesis option requires that the student present original ideas and solutions to a specific mathematical problem. The project option involves applying or adapting existing methodologies to solve a problem, or an expository paper on the methodology in a particular area. Both a proposal for the thesis or project work and the results must be presented and defended before the Advisory Committee.

Cooperative education option

The optional cooperative education (co-op) program enables the student to alternate periods in school with full-time, paid professional employment. Students may sign up for the co-op program after their first quarter.

Nonmatriculated students

A student with a bachelor's degree from an approved undergraduate school and with the background necessary for specific courses may take graduate courses as a nonmatriculated student with the permission of the graduate coordinator and the instructor. Courses taken for credit may usually be applied toward the master's degree if the student is formally admitted to the graduate program at a later date. However, the number of credits that will be transferred to the degree program from courses taken at RIT as a nonmatriculated student will be limited to a maximum of 12 quarter credits.

Materials Science and Engineering

Ian Gatley, Interim, *Director of the Center for Materials Science and Engineering*

The program, under the joint auspices of the colleges of Science and Engineering, offers graduate studies leading to the master of science degree in materials science and engineering with a variety of options designed to satisfy individual and industry needs in the rapidly growing field of materials.

RIT's science and engineering laboratories feature up-to-date equipment and technology, such as this differential scanning calorimeter used for thermal analysis of materials.

The objectives of the program are threefold:

- With the advent of whole new classes of materials and instruments in recent times, the traditional practice of empiricism in the search for and selection of materials is rapidly becoming obsolete. The program offers, therefore, a serious interdisciplinary learning experience in materials studies, crossing over the traditional boundaries of such classical disciplines as chemistry; physics; and electrical, mechanical, and microelectronic engineering.
- The program provides extensive experimental courses in diverse areas of materials-related studies.
- The program explores avenues for introducing greater harmony between industrial expansion and academic training.

Special features of the program

A special feature of the program is the offering of five required core courses. The core courses are specially designed to establish a common base of materials-oriented knowledge for students with baccalaureate degrees in chemistry, chemical engineering, electrical engineering, mechanical engineering, physics, and related disciplines; and consequently, to provide a new intellectual identity to those involved in the study of materials.

Second, there is an emphasis on experimental techniques in the program, with one required experimental course and additional optional experimental courses available. These are organized into appropriate units covering many aspects of analysis of materials. This aspect of the program should enhance student confidence when dealing with materials-related problems.

Finally, a large number of highly qualified scientists and engineers in the Rochester area are engaged in the research and development of materials. This reservoir of talent is utilized to ensure the breadth and quality of the program.

The overall thrust of the program is to establish a positive relationship between academia and industry by building a sound academic base in the field of materials.

Thesis option and the external research option

The inclusion of a research thesis as a formal part of the master of science degree program in materials science and engineering is optional. The research thesis option carries a minimum of nine and a maximum of 16 quarter credit hours, subject to review and approval of the project.

The external research option allows participants to continue their studies in their work environment, thus enhancing job satisfaction. In-plant work experience in materials-related areas may include independent study and creative research. This external research option may be applied, for a minimum of four and a maximum of eight quarter credit hours, toward the completion of the master of science degree.

Admission

The program is open to individuals with a bachelor's degree in chemistry, physics, chemical engineering, electrical engineering, mechanical engineering, or a related field from an accredited college or university. Any student who wishes to study at the graduate level must first be admitted to the program. However, an applicant may be permitted to take graduate courses as a non-matriculated student if he or she meets the general requirements mentioned above.

A person not meeting the general requirements may petition for admission to the program. In such cases, the necessary background courses will be taken at the undergraduate level. However, undergraduate credits that make up deficiencies may not be counted toward the master's degree.

To be considered for admission, it is necessary to file an application for admission to graduate study, accompanied by the appropriate transcripts of previous study and two letters of recommendation.

! English language requirement

. All applicants who do not speak English as their primary language are required to take both the TOEFL (Test of English as a Foreign Language) and the TWE
1 (Test of Written English) examinations. Minimum scores of 575 on the TOEFL and 4.0 on the TWE are required. In addition, all such students, upon arrival at RIT, are required to take the Michigan Test of English Language Proficiency, administered by the RIT English Language Center. Individuals scoring below an established minimum will be referred to the center for further evaluation and assistance. These students are required to follow the center's recommendations regarding language course work; this may require additional time and financial resources to complete the degree requirements. Successful completion of this course work is a requirement for the master of science degree in materials science and engineering.

Part-time study

Practicing scientists and engineers are encouraged to pursue the program on a part-time basis; therefore, all of the courses are offered in the early morning, late afternoon, or early evening. (This may not apply to courses offered off campus at selected industrial sites.)

Students employed full time in industry are normally limited to a maximum of two courses, or eight credit hours, each quarter. A student who wishes to register for more than eight credit hours while employed full time must obtain the permission of his or her adviser.

Financial aid

A limited number of teaching assistantships, research assistantships, and tuition scholarships are available for graduate students. Detailed information is available from the office of the program director.

Degree requirements

A minimum of 45 quarter credit hours, which includes five core courses (1028-701 through 1028-705) and the seminar course, 1028-890, are required for the completion of the program.

The remaining 24 quarter credit hours are completed either as a combination of the research thesis and elective courses, or as a combination of external research and elective courses, or as elective courses. The elective courses may be
1 selected from advanced courses offered
, by the Center for Materials Science and Engineering or, upon approval, from courses offered by other RIT graduate programs. Transfer credit may be
' awarded based on academic background
> beyond the bachelor's degree or credit by examination based on experience.

Curriculum

The core courses will be offered every year and the elective courses will be scheduled on a periodic basis.

Maximum limit on time

The required credits for the master's degree must be completed within seven years of the oldest credits applied toward the degree.

Chester F. Carlson Center for Imaging Science

The Chester F. Carlson Center for Imaging Science was established in 1985 for the interdisciplinary study of all aspects of imaging. The center offers BS, MS and Ph.D. degrees in imaging science and an MS degree in color science. It is located in the Chester F. Carlson building, which contains extensive laboratories supporting the center's teaching and research mission.

Master of Science in Color Science

Roy S. Berns, *Coordinator*
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Color science is broadly interdisciplinary, encompassing physics, chemistry, physiology, statistics, computer science and psychology. The curriculum leading to a master of science degree in color science educates students using a broad interdisciplinary approach. This is the only graduate program in the country devoted to this discipline, and it is designed for students whose undergraduate majors are in physics, chemistry, imaging science, computer science, electrical engineering, experimental psychology, physiology or any discipline pertaining to the quantitative description of color.

Graduates are in high demand and have accepted industrial positions in electronic imaging, color instrumentation, colorant formulation and basic and applied research. Companies include Hewlett Packard, Canon, Apple, Eastman Kodak, Xerox, International Paper, the Gemological Institute of America, Applied Science Fiction, and Polaroid.

The color science major provides graduate-level study in both theory and practical application. The program gives students a broad exposure to the field of color and affords them the unique opportunity of specializing in an area appropriate for their background and interest. This objective will be accomplished through the program's core courses, selection of electives and completion of a thesis or graduate project.

The degree program in color science revolves around the activities of the Munsell Color Science Laboratory within the Center for Imaging Science (http://www.cis.rit.edu/research/mcsl). The Munsell Laboratory is the preeminent academic laboratory in the country devoted to color science. Research is currently under way in color appearance and discrimination psychophysics, imaging device-independent calibration, color reproduction, high-accuracy spectrophotometry, spectroradiometry and multi-spectral image capture, synthesis and rendering, and reproduction. Since the inauguration of the program in 1984, three industrial conferences have been held drawing participants from around the world. Industrial seminars devoted to the quantitative specification of color are offered on a continuing basis. Students have received co-op and full-time positions through contacts made with the assistance of the Munsell Laboratory.

The program

All students must earn 45 credits as a graduate student, 36 of which must be taken at RIT, to earn the master of science degree. For full-time students, the program requires four to six quarters of study at the graduate level. Part-time students generally require two to four years of study at the graduate level. The curriculum is a combination of required courses in color science, elective courses appropriate for the candidate's background and either a research thesis or graduate project. Students must enroll in either the research-thesis or graduate project option at least one year before completion of required course work. Candidates who wish to enter the program but lack adequate preparation may have to take as many as 36 credits of foundation courses in mathematics, statistics, computer science and general science before matriculating with graduate status. Foundation courses can be completed in three quarters.

Core courses

All graduate students in the MS program are required to complete the following core courses:

		Credits
1050-701	Vision & Psychophysics	4
1050-702	Applied Colorimetiy	4
1050-721	Color Measurement Laboratory I	2
1050-703	Color Appearance	3
1050-722	Color Measurement Laboratory II	2
1050-813	Color Modeling	4
1050-801	Color Science Seminar	3

Elective courses

Appropriate electives should be selected to bring course work to 36 credit hours for the research thesis option or 41 credit hours for the graduate project option. Approval by the color science coordinator is required. (Some courses might require special permission for enrollment.)

The following is a partial list:

		Credits
0307-801 802	Design of Experiments I, II	3
0307-830 831	Multivariate Analysis I, II	3
0307-841 842	Regression Analysis I, II	3
0605-761	Fundamentals of Computer Graphics	4
1051-726	Programming for Scientists & Engineers	4
1051-728	Design & Fabrication of Solid State Cameras	4
1051-739	Principles of Solid State Imaging	4
1051-782	Introduction to Digital Image Processing	4
1051-790	Image Rendering	4
1051-816	Color Systems	4
2081-722	Ink & Substrates	4

Research thesis option

Students without research experience are encouraged to select the research thesis option (nine credits). The thesis is performed during the second year of study. Topics are chosen that complement the candidate's undergraduate education and career interests. The technical advisory board of the Munsell Color Science Laboratory, as well as the program coordinator, can aid in the selection of a thesis topic. Full-time students receiving full-time assistantships are required to perform a research thesis.

Graduate project option

Students with research experience may select the graduate project option (four credits). The project has the same intellectual level as a research thesis but is less lengthy. It might take the form of an experiment, demonstration, research project or critical review. The graduate project is normally performed during the last quarter of study. Part-time students often select this option.

A Typical Full-Time Schedule of Courses

FALL		Credits
1050-701	Vision & Psychophysics	4
1050-702	Applied Colorimetry	4
1050-721	Color Measurement Laboratory I	2
	Graduate Elective	
WINTER		
1050-703	Color Appearance	3
1050-722	Color Measurement Laboratory II	2
	Graduate Electives	

SPRING		
1050-813	Color Modeling	4
	Graduate Electives	
FALL		
1050-801	Color Science Seminar	3
1050-890	Thesis	3
	or	
1050-840	Color Science MS Project	4

Note: 12 credit hours per quarter is considered a full-time load. Remaining credits are given as equivalency credits for teaching and research assistantship activities.

Admission requirements

Prior to being admitted to the master of science degree program, applicants must satisfy the coordinator of the program that their previous education, ability and practical experience indicate a reasonable chance of success. Scientific reasoning, technical writing and oral communication skills are particularly important.

- Graduate application
- Earned baccalaureate degree
- Graduate record examination (GRE)
- Official undergraduate transcript
- Two professional recommendations
- An on-campus interview when possible
- GPA of 3.0 or higher
- Foundation course work of 3.0 or higher (if required)
- TOEFL score of at least 240 (computer based) or 575 (paper based) (international students)
- TSE-A score of at least 250 (international students)

Assistantships and scholarships

Scholarships and assistantships are available for qualified applicants. These include the Macbeth-Engel Fellowship, Grum Memorial Scholarship, Saltzman Memorial Scholarship, Munsell Color Science Laboratory Assistantship and research assistantships associated with ongoing grants and contracts. Most of these require 20 hours of work per week. Funding can consist of up to full tuition remission and a 12-month stipend. Students receiving fully funded assistantships tend to have undergraduate cumulative grade point averages of 3.5 and higher, GRE "quantitative" and "analytical" scores above 700 and "verbal" above 600. Applicants whose native language is not English have TOEFL scores above 250 (computer based) or 600 (paper based) and TSE-A scores above 250. Partial assistantships are also awarded. Applicants seeking financial assistance from the center must have all application documents submitted to the Admissions Office by February 15 for the next academic year.

The foundation program

The color science major is designed for the candidate with an undergraduate degree in a scientific or nonscientific discipline. Candidates with adequate undergraduate work in related sciences will start the program as matriculated graduate students.

Candidates without adequate undergraduate work in related sciences must take foundation courses prior to matriculation into the graduate program. Such students may be required to take as many as 36 credits in these subjects. A written agreement between the candidate and the program coordinator will identify the required foundation courses.

Foundation courses must be completed with an overall B average before a student can matriculate into the graduate program. A maximum of nine graduate-level credit hours may be taken prior to matriculation into the graduate program.

The foundation courses listed below are representative of those often required.
Calculus I, II, III
College Physics I, II, III
College Physics Lab I, II, III
C Programming
Elementary Statistics
Introduction to Psychology

Munsell Advisory Board

The Munsell Color Science Laboratory Advisory Board ensures that the research activities surrounding the degree program are relevant to current industrial needs. The board's members have expertise in color vision, color measuring instrumentation, psychophysics, computer colorant formulation, lighting, art and applied color technology. The Advisory Board is an excellent resource for students in the selection of both a thesis topic and future placement.

Master of Science in Imaging Science

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The objective of this program is to prepare men and women holding a bachelor's degree in science or engineering for positions in research in the imaging industry or in the application of various imaging modalities to problems in engineering and science. Formal course work includes consideration of the physics and chemistry of radiation-sensitive materials and processes, the applications of physical and geometrical optics to electro-optical systems, the mathematical evaluation of image forming systems and the statistics of experimental design and quality control. Technical electives at the graduate level may be selected from the courses offered in imaging science, color science, engineering, computer science, science and mathematics. Both thesis and project options are available. In general, full-time supported students are required to pursue the thesis option with the project option targeted at part-time students who can demonstrate that they have sufficient practical experience through their professional activities.

Faculty within the Center for Imaging Science supervise thesis research in areas of chemistry and physics of radiation-sensitive materials and processes, digital image processing, remote sensing, electrophotography, electro-optical instrumentation, medical diagnostic imaging, chemical imaging, color imaging systems and astronomy. Interdisciplinary efforts are possible with the colleges of Engineering and Science.

The degree requirements can be completed either on a full- or a part-time basis. An online version of the MS program is available in the areas of color science, remote sensing, and digital image processing. Interested students should consult the Web site (http://www.cis.rit.edu) or contact the graduate coordinator.

The program

Imaging science studies are available as a full- or part-time master's degree program. All students must earn 45 credits as a graduate student, 37 of which must be taken at RIT to earn the master of science degree.

The curriculum is a combination of required core courses in imaging science and elective courses appropriate for the candidate's background and interests. Six tracks (concentrations) have been established: Digital Imaging Processing, Medical Imaging, Electro-Optical Imaging Systems, Remote Sensing, Color Imaging and Hard Copy Materials and Processes. Additional tracks may be created for interested students. Students must enroll in either the research-thesis or graduate paper/project option at the beginning of their studies.

Candidates who wish to enter the program but lack adequate preparation may have to take bridge courses in mathematics, chemistry or physics before matriculating with graduate status.

All graduate students in the program are required to complete the following core courses:

1051-711, 712	Basic Principles of Imaging Science I, II
1051-716, 717	Linear Image Mathematics I, II

All non-imaging science courses must

be approved by the CIS master of science coordinator as acceptable for CIS credit.

Research thesis option

Full-time students who elect this option begin their thesis work during the first year of study. Part-time students may defer the beginning of their thesis work until their second or subsequent years. Full-time students receiving funding assistance are required to choose the research thesis option. Students who elect this option will take 36 credit hours of course work (including the core) and nine credit hours of thesis/research, three of which are associated with the graduate seminar course (1051-706, 707, 708).

The thesis is to be based on experimental evidence obtained by the candidate in an appropriate field as arranged between the candidate and his or her adviser. The minimum number of thesis credits required is nine. The thesis requirement may be fulfilled by experiments in Institute laboratories. In some cases, the requirement may be fulfilled by work done in other laboratories. An example might be the candidate's place of employment, under the following conditions:

1. The results must be fully publishable.
2. The candidate's adviser must be approved by the graduate coordinator.
3. The thesis must be based on the candidate's independent, original work, as it would be if the work were done in Institute laboratories.

Graduate paper/project option

Students with demonstrated practical or research experience approved by the graduate coordinator may choose the graduate project option (five credit hours) in addition to 40 hours of core and elective courses. This option takes the form of a systems course (a different course for each track) and an associated project/paper. The graduate paper is normally performed during the final quarter of study. Both part- and full-time students may choose this option with the approval of the graduate coordinator.

Admission

Admission will be granted to graduates of accredited degree-granting institutions whose undergraduate studies have included at least the following courses in the major areas of study: mathematics through calculus, including differential equations; a full-year calculus-based physics course; a full-year college-level course, with laboratory, in chemistry. It is assumed that students can write a common computer program.

Applicants must demonstrate to the Graduate Admissions Committee of the Center for Imaging Science that they have the capability to pursue graduate work successfully. Normally this will include an interview, the submission of a statement of purpose, presentation of undergraduate academic record, letters of evaluation from individuals familiar with the applicant's capabilities, and any other pertinent data furnished by the applicant. While previous high academic achievement does not guarantee admission, such achievement or other unusually persuasive evidence of professional promise is expected.

Applicants seeking financial assistance from the center must have all application documents submitted to the Admissions Office by February 15 for the next academic year. Those seeking funding from the center are also required to take the GRE. Students whose native language is not English must demonstrate proficiency in English, as evidenced, for example, by a TOEFL score of 600 (paper based) or 250 (computer based) or higher. Students whose native language is not English are advised to obtain as high a TOEFL score as possible if they wish to apply for a teaching or research assistantship. These candidates are also required to take the TSE-A test of spoken English, in order to be considered for financial assistantship.

Grades

The average of the grades for all courses taken at the Institute and credited toward a master's degree must be at least a "B" (3.0) grade point average. Research and thesis does not carry a letter grade and is not included in the average.

Doctor of Philosophy in Imaging Science

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The doctor of philosophy degree in imaging science signifies high achievement in scholarship and independent investigation in the diverse aspects of imaging science. Candidates for the Ph.D. degree must demonstrate proficiency by:

1. successfully completing course work, including a core curriculum, as defined by the student's plan of study;
2. passing a series of examinations;
3. completing an acceptable dissertation under supervision of the student's research adviser and Dissertation Committee.

The core curriculum includes courses that span and integrate a common body of knowledge essential to an understanding of imaging processes and applications. The core courses are:

		Credits
1051-706, 707, 708	Imaging Science Seminar	1
1051-711, 712	Basic Principles of Imaging Science	4
1051-713	Noise & Random Processes	4
1051-714	Information Theory for Imaging Systems	4
1051-716, 717	Linear Image Mathematics I, II	4
1051-721, 722,723	Imaging Lab **I, II,** III	1
1051-726	Programming for Scientists and Engineers	4

Admission

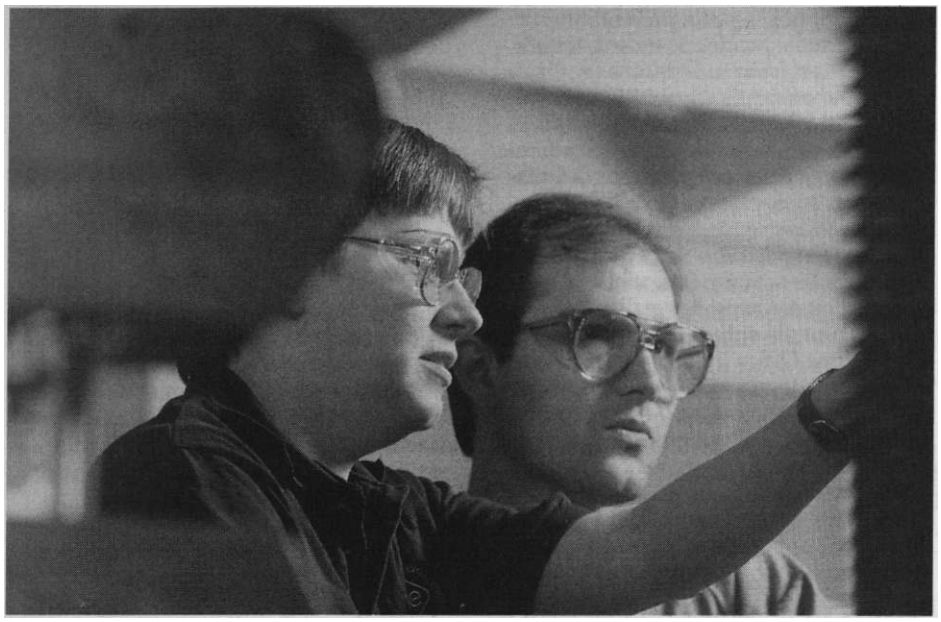
Because imaging science encompasses a wide variety of scientific disciplines, students with diverse backgrounds are accepted into the program. Undergraduate preparation leading to a bachelor of science degree in engineering, computer science, applied mathematics or one of the natural sciences is usually required, but exceptional students from other fields may be accepted. All students admitted to the Ph.D. program in imaging science must have completed courses in the following areas:

- Calculus and differential equations
- Probability and statistics
- Chemistry (one year)
- University physics (one year)
- Modern physics
- Computer language

Admissions decisions are made by a committee of the graduate faculty of the Center for Imaging Science. To be admitted, students must have a record of academic achievement from their undergraduate institutions, as indicated by official transcripts, must demonstrate proficiency on the Graduate Record Examination (GRE) and must request letters of recommendation from two people well qualified to judge their abilities for graduate study. Students for whom English is not the native language must also submit the results of the Test of English as a Foreign Language (TOEFL). Industrial and research experience are also considered in the decision to admit. Applicants seeking financial assistance from the center must have all application documents to the Admissions Office by February 15 for the next academic year.

Due to the variety of backgrounds of incoming students, it is recognized that some will not have the requisite preparation in all areas and will have to complete some undergraduate requirements during the course of their graduate study.

Students with a master of science degree in a related field (e.g., physics, chemistry or electrical and computer engineering) may be granted up to 36 quarter credits toward the Ph.D. degree in imaging science based on their earlier studies and after successful completion of the comprehensive examination. The required research credits may not be waived by experience or examination.



Comprehensive examination

All students must pass a written comprehensive examination. The examination is given each year prior to the Fall Quarter and is ordinarily taken after completing the core course of study (30 quarter credits); i.e., after the first year of study. The examination is administered by the graduate faculty. It consists of an assessment of mastery of the materials in the core disciplines and ability to construct solutions to significant problems. The student must successfully pass the comprehensive examination to advance to candidacy (two attempts are permitted).

By the time they take the comprehensive examination, all students must select a research adviser from the graduate faculty of the Center for Imaging Science.

Dissertation committee

After the student passes the comprehensive examination and upon recommendation of the director of the Center for Imaging Science, a Dissertation Committee of four members is appointed for the duration of the student's tenure in the program. One is appointed by the Provost's Office from the faculty within the Institute but outside the center and acts as the chair of the final dissertation defense. The committee must also include the student's research adviser and at least one other member of the imaging science graduate faculty. The fourth member may be affiliated with industry or another institution. Persons who are not members of the graduate faculty must be approved by the coordinator of the doctoral program.

The duties of the Dissertation Committee include:

1. reviewing the study plan and dissertation proposal;
2. preparing and administering the examination for admission to candidacy;
3. assisting in planning and coordinating the research;
4. supervising the writing of the dissertation;
5. conducting the final examination of the dissertation.

Study plan

The student and the research adviser develop a study plan that defines the course work to be completed, including the technical electives most relevant to the student's field of interest. The study plan must be filed with the doctoral coordinator of the Center for Imaging Science and must be approved by three members of the graduate faculty. The plan may be amended if the changes are approved by the student's advising committee.

Research proposal

The student and the research adviser select a research topic for the dissertation. The proposed research must be original and publishable. Although the topic may deal with any aspect of imaging, the research is usually concentrated in an area of current interest within the center. These areas include: silver halide imaging, remote sensing, digital image processing, color and visual perception, digital microlithography, astronomy, medical imaging, electro-optics and machine vision.

The student must make a formal proposal of the dissertation topic to the Dissertation Committee for approval.

Admission to candidacy

As soon as possible after acceptance of the research proposal, but not later than six months prior to defending the dissertation, the student must pass an examination to be admitted to candidacy for the doctoral degree. The examination is prepared and administered by the Dissertation Committee and may have oral and/or written sections at the committee's option. A typical examination may consist of oral responses to previously assigned written questions.

Course requirements

All students must complete a minimum of 72 credit hours of course work. The courses are defined by the student and the Dissertation Committee in the study plan and must include completion of the core sequences plus at least two three-quarter sequences in topical areas. Some examples of topical areas are: remote sensing, digital image processing, digital graphics, electro-optical imaging systems, medical imaging and microlithographic imaging technologies.

Students may take a maximum of 16 credits in other departments and must also complete 27 credits of research, 3 credits of which are associated with the graduate seminar course (1051-706, 707, 708) with a maximum of 9 credits per quarter.

Residency

All students in the program must spend at least three consecutive quarters (Summer Quarter excluded) as resident full-time students to be eligible to receive the Ph.D. A full-time academic load is defined as a minimum of nine academic credits per quarter or an equivalent amount of research as certified by the graduate coordinator.

Time limitations

All candidates for the Ph.D. must maintain continuous enrollment during the research phase of the program. Such enrollment is not limited by the maximum number of research credits that apply to the degree. Normally, full-time students complete the course of study for the doctorate in approximately three to four years. A total of seven years is allowed to complete the requirements after first attempting the comprehensive exam.

Final examination of the dissertation

The Dissertation Committee must submit a letter to the graduate coordinator requesting permission to administer the final examination of the dissertation. The letter must indicate that each member has received the dissertation and concurs with the request. The examination is scheduled by the graduate coordinator

but may not be held sooner than two weeks after permission has been granted.

The final examination of the dissertation is open to the public and is primarily a defense of the dissertation research. The examination consists of an oral presentation by the student, followed by questions from the audience. The Dissertation Committee may also elect to privately question the candidate following the presentation. The Dissertation Committee will immediately notify the candidate and the graduate coordinator of the result of the examination.

Graduate Faculty College of Science

Ian Gatley, BSc, University of London; Ph.D., California Institute of Technology—Interim Dean

Department of Biological Sciences

Larry Buckley, BA, University of Missouri; MS, Southern Illinois University at Edwardsville; Ph.D., Southern Illinois University at Carbondale—Assistant Professor, Biology

Mark E. **Deutschlander,** BS, State University of New York at Geneseo; Ph.D., Indiana University—Assistant Professor, Biology

Jean A. Douthwright, BA, Skidmore College; MS, Pennsylvania State University; MS, Ph.D., University of Rochester—Professor, Biology

Irene Evans, AB, University of Rochester; MS, Wesleyan University; Ph.D., University of Rochester—Associate Professor, Biology

G. Thomas Frederick, BS, MS, Ph.D., Ohio State University—Professor, Biology

David A. Lawlor, BA, University of Texas; MS, Ph.D., University of Texas Health Science Center at San Antonio—Assistant Professor, Biology

Jeffrey S. **Lodge,** BA, University of Delaware; Ph.D., University of Mississippi—Associate Professor, Biology

Douglas Merrill, BS, Ph.D., SUNY College of Environmental Science and Forestry, Syracuse University—Professor; Department Head, Biology

Robert H. Rothman, BA, Ph.D., University of California, Berkeley—Professor, Biology

Michael A. Savka, BSF, West Virginia University; MS, Ph.D., University of Illinois at Urbana-Champaign—Assistant Professor, Biology

Franz K. Seischab, BS, Cornell University; MS, SUNY College at Geneseo; Ph.D., SUNY College of Environmental Science and Forestry, Syracuse University—Professor, Biology

Gary R. Skuse, BA, University of Rochester; Ph.D., Syracuse University—Director, Bioinformatics

Hyla C. **Sweet,** BS, Union College; Ph.D., University of Texas at Austin—Assistant Professor, Biology

Nancy Wanek, BS, University of Wisconsin; Ph.D., University of California—Associate Professor, Biology

Department of Chemistry

B. Edward Cain, BA, Harpur College, SUNY Binghamton; Ph.D., Syracuse University—Professor, Inorganic Chemistry: chemical education, methodologies and adaptation for the handicapped student

Robert A. Clark, BS, Massachusetts Institute of Technology; Ph.D., University of Maryland—Professor and Director of the Center for Materials Science and Engineering: imaging science, physical organic chemistry, polymers

Paul A. Craig, BS, Oral Roberts University; Ph.D., University of Michigan—Associate Professor, Analytical Biochemistry

Thomas Gennett, BA, SUNY College at Potsdam; Ph.D., University of Vermont—Professor, Analytical Chemistry: electrochemistry, HPLC, ion implantation of electrode surfaces

Joseph P. Hornak, BS, Utica College of Syracuse University; MS, Purdue University; Ph.D., University of Notre Dame—Professor, Joint Appointment with Imaging Science, Physical Chemistry: magnetic resonance spectroscopies and imaging

Marvin L. Illingsworth, BS, Lafayette College; Ph.D., University of Massachusetts—Professor, Inorganic Chemistry: atomic oxygen resistant polymers, synthesis of eight-coordinate complexes and mixed ligand complexes

Andreas Langner, BS, Ph.D., SUNY at Buffalo—Professor, Physical Chemistry: polymer science, electro-optical properties of macromolecules, polymer characterization techniques

Massoud J. Miri, BS, MS, Ph.D., University of Hamburg—Assistant Professor, Polymer Chemistry: polymerization mechanisms, polymer properties, catalysis

Terence C. **Morrill,** BS, Syracuse University; MS, San Jose State University; Ph.D., University of Colorado—Professor and Department Head, Organic Chemistry: stereochemistry and mechanism of organic reactions, lanthanides, NMR spectrometry, organometallics

John P. Neenan, BS, Wayne State University; Ph.D., University of California, Santa Barbara—Professor, Biochemistry and Bio-organic Chemistry: design of active site-directed irreversible enzyme inhibitors

Christian G. Reinhardt, BS, Lafayette College; Ph.D., University of Rochester—Professor, Biophysical Chemistry: biological drug receptor recognition, binding and stereochemistry, quantitative structure-activity studies and biomolecular design

Gerald A. Takacs, BS, University of Alberta; Ph.D., University of Wisconsin—Professor, Physical Chemistry: chemical kinetics, atmospheric chemistry, plasma chemistry, and photochemistry

Laura Ellen Tubbs, BA, Hood College; Ph.D., University of Rochester—Professor, Physical Chemistry: accelerator-based ultrasensitive mass spectroscopy, natural radioisotope dating, aqueous polymer solutions

Kay G. Turner, BS, Bucknell University; Ph.D., Ohio State University—Professor, Synthetic Organic Chemistry: synthesis of natural products including fluorescent estradiol analogs; study of estrogen receptor mechanisms

James J. Worman, BS, Moravian College; MS, New Mexico Highlands University; Ph.D., University of Wyoming—Chair, Graduate Committee; Professor, Physical Organic Chemistry: environmental spectroscopy of small ring systems, naturally occurring biocumulative organics

Department of Allied Health Sciences

James C. Aumer, BS, MS, Michigan Technological University—Interim Program Director, Clinical Chemistry; Professor

Adjunct Faculty

Richard M. Bayer, BA, MS, Ph.D., Rutgers University—Rochester General Hospital, Adjunct Clinical Professor

Michael R. Bogovich, MS, Rochester Institute of Technology—Calibration Engineer, Clinical Products Division, Eastman Kodak Company

David R. Brown IV, BS, Rochester Institute of Technology—Lead Systems Analyst/Programmer, Eastman Kodak Company

Howard Harrison, Ph.D., Cornell University—Rochester General Hospital, Adjunct Clinical Associate Professor

Yasmin Kabir, BS, MS, Rochester Institute of Technology—Adjunct Instructor

Fred D. Lasky, Ph.D., SUNY at Buffalo-Senior Clinical Chemist, Clinical Products Division, Eastman Kodak Company

Daniel Montondo, BS, MS, Rochester Institute of Technology—Administrative Coordinator, Data Management, Department of Pathology and Laboratory Medicine, Rochester General Hospital

Jeanine Smith, BS, Alfred University; MS, Rochester Institute of Technology—Adjunct Instructor

Department of Mathematics and Statistics

William Basener, BA, Marist College; Ph.D., Boston University-—Assistant Professor

Maurino Bautista, BS, Ateneo de Manila University; MS, Ph.D., Purdue University—Associate Professor, Numerical Analysis, Applied Mathematics

Bernard Brooks, BS, University of Toronto; MS, Ph.D., University of Guelph—Assistant Professor

Patricia Clark, SB, SM, Massachusetts Institute of Technology; Ph.D., University of Rochester—Professor, Fluid Dynamics

Matthew Coppenbarger, BS, University of Arizona; MA, Ph.D., University of Rochester—Visiting Assistant Professor

Alejandro Engel, BS, Universidad de Chile; Ph.D., SUNY at Buffalo—Professor, Bio-Mathematics

David Farnsworth, BS, Union College; MA, Ph.D., University of Texas at Austin—Professor, Nonparametric Statistics

George Georgantas, AB, University of Rochester; AM, Washington University; Ph.D., SUNY at Buffalo—Professor, Abstract Algebra

Marvin Gruber, BS, Brooklyn College; MA, Johns Hopkins University; MS, Rochester Institute of Technology; MA, Ph.D., University of Rochester—Professor, Linear Models, Bayes Estimation, Reliability

Laxmi Gupta, BS, MS, Agra University, India; MS, Rochester Institute of Technology; Ph.D., SUNY at Buffalo—Professor, Algebraic Geometry

David Hart, BS, Syracuse University; MA, University of Rochester—Associate Professor, Algebra, Number Theory

Rebecca Hill, BS, Frostburg State College; MA, West Virginia University; MS, Rochester Institute of Technology—Professor, Analysis, Computer Science

Seshavadhani Kumar, BS, MS, University of Madras; Ph.D., University of Delaware—Associate Professor, Operations Research, Simulation

Carl V. Lutzer, BS, Michigan State University; MA, Ph.D., University of Kentucky—Assistant Professor, Mathematical Physics

Sophia Maggelakis, BS, MS, Ph.D., Old Dominion University—Professor, Bio-Mathematics

James Marengo, BA, MS, California State University; Ph.D., Colorado State University—Associate Professor, Statistics, Probability

Douglas Meadows, BS, Stanford University; MS, New York University; Ph.D., Stanford University—Professor, Topology, Computer Science

Mahmood Munir, BA, MS, Southern Illinois University; Ph.D., Monash University—Visiting Assistant Professor

Darren A. Narayan, BS, State University of New York at Binghamton, MS, Ph.D., Lehigh University—Assistant Professor, Graph Theory, Discrete Math

Edward Newburg, BS, Stanford University; MS, New York University; Ph.D., University of Illinois—Professor, Mathematical Modeling

Richard Orr, BS, John Carroll University; MS, Case Institute of Technology; MS, SUNY at Buffalo— Professor, Logic, Computability

John Paliouras, BS, Alfred University; MA, Ph.D., University of Illinois—Professor, Topological Dynamics

Michael Radin, BA, Rowan University; MS, Ph.D., University of Rhode Island—Assistant Professor

David Ross, BA, Columbia College; Ph.D., Couranr Institute of Mathematical Sciences—Associate Professor

Harry Schey, BS, Northwestern University; AM, Harvard University; Ph.D., University of Illinois—Professor, Statistics

Hossein Shahmohamad, BS, MA, California State University, Long Beach; Ph.D., University of Pittsburgh—Assistant Professor

Wanda Szpunar-Lojasiewicz, MS, Ph.D., University of Cracow—Associate Professor, Differential Equations, Function Analysis

Paul Wilson, BA, MA, University of Cincinnati; Ph.D., University of Illinois—Professor, Algebra

Elmer Young, BA, Amherst College; MS, Ph.D., Ohio State University—Associate Professor, Topology

Department of Physics

John D. Andersen, BS, SUNY at Buffalo; MA, Ph.D., University of Rochester—Associate Professor, Physics

Peter A. Cardegna, BS, Loyola College; Ph.D., Clemson University—Professor, Physics

Maria Sandalia Catalan, BSc, Ph.D., The University of Sussex—Assistant Professor, Physics

Shao-Hsuan Chiu, BS, Chun Yuan Christian University; MS, State University of New York at Binghamton; Ph.D., Purdue University—Visiting Assistant Professor, Physics

Tracy A. Davis, BA, BS, Wofford College; Ph.D., Clemson University—Associate Professor, Physics

Alan B. Entenberg, AB, Washington University; Ph.D., University of Rochester—Professor, Physics

Scott V. Franklin, BA, University of Chicago; Ph.D., University of Texas—Assistant Professor, Physics

Ronald E. Jodoin, BS, Worcester Polytechnic Institute; Ph.D., University of Rochester—Professor, Physics

James R. Kern, BS, Indiana University of Pennsylvania; MA, University of Indiana; Ph.D., Clemson University—Professor, Physics

Michael Kotlarchyk, BS, MS, Ph.D., Massachusetts Institute of Technology—Professor, Physics

Arthur Z. Kovacs, AB, Wabash College; Ph.D., Duke University—Professor, Physics

Vern W. Lindberg, BS, University of Alberta; MS, Ph.D., Case Western Reserve University—Associate Professor, Physics

Linda S. Meichle, BS, Massachusetts Institute of Technology; MS, Ph.D., University of Illinois—Assistant Professor, Physics

David L. Morabito, BS, MS, Rochester Institute of Technology; MA, University of Rochester; Ph.D., State University of New York at Buffalo—Visiting Assistant Professor, Physics

Ryne Raffaelle, BS, MS, Southern Illinois University; Ph.D., University of Missouri at Rolla—Associate Professor

Michael W. Richmond, BA, Princeton University; MA, Ph.D., University of California at Berkeley—Assistant Professor, Physics

John S. Shaw, BS, MS, Indiana University; Ph.D., SUNY at Albany—Professor, Physics

Anatoli A. Vankov, Diploma, Moscow State University; Ph.D., Institute of Atomic Energy—Visiting Assistant Professor, Physics

Jerome Wagner, BS, Case Institute of Technology; MS, Ph.D., University of Wisconsin—Professor, Physics

Anne G. Young, BA, Bryn Mawr; MS, Ph.D., Cornell University—Professor, Physics

Natalya A. Zimbovskaya, MA, Urals State University; Ph.D., Institute of Physics of Metals; D.Sc. University of Nizhni Novgorod—Visiting Assistant Professor, Physics

Materials Science and Engineering

College of Engineering and College of Science

John Andersen, BS, SUNY at Buffalo; MA, Ph.D., University of Rochester—Associate Professor, Physics: theoretical solid-state physics, transport phenomena, electron-phonon interactions, nonlinear phenomena, electronic properties of molecular crystals, experimental low-temperature physics, large scale computations, parallel processing

Jonathan S. Arney, BS, Wake Forest University; Ph.D., University of North Carolina at Chapel Hill—Associate Professor, Imaging Science: image microstructure and quality, diagnostic imaging for museum applications

Peter Cardegna, BS, Loyola College; Ph.D., Clemson University—Professor, Physics: superconductivity, low temperature physics, photographic materials

Robert A. Clark, BS, Massachusetts Institute of Technology; Ph.D., University of Maryland—Professor, Chemistry: plasma modification of organic polymers, polymer science, chemistry of microlithographic imaging systems, kinetics and thermodynamics of thermal and photochemical transformations of small hydrocarbon molecules

Tracy Davis, BA, BS, Wofford College; Ph.D., Clemson University—Associate Professor, Physics: experimental solid-state physics, optics, low temperature physics, computer models of chaotic systems

Alan B. Entenberg, AB, Washington University; Ph.D., University of Rochester—Professor, Physics: stress and adhesion in thin films; surface modification by glow discharge plasma and/or ion bombardment

Ian Gatley, BSc, University of London; Ph.D., California Institute of Technology—Interim Director, Professor, Imaging Science: Systems Integration

Thomas Gennett, BA, SUNY College at Potsdam; Ph.D., University of Vermont—Professor, Chemistry: electroanalytical chemistry, HPLC detectors, biosensors, ion-exchange partition coefficient

Surendra K. Gupta, B.Tech., India Institute of Technology; MS, University of Notre Dame; Ph.D., University of Rochester—Professor, Mechanical Engineering: dislocation theory, x-ray diffraction, sintering, numerical modeling, digital image analysis, computer-integrated manufacturing, micromechanics of heteroepitaxial structures, morphological filters in image processing of microstructures
Richard K. Hailstone, BS, Northern Illinois University; MS, Indiana University—Associate Professor, Imaging Science: silver halide materials and processing, imaging materials

Joseph P. Hornak, BS, Utica College of Syracuse University; MS, Purdue University; Ph.D., University of Notre Dame—Professor, Chemistry: physical chemistry, magnetic resonance spectroscopy and imaging
Marvin L. Illingsworth, BS, Lafayette College; Ph.D., University of Massachusetts—Professor, Chemistry: inorganic polymers, synthesis and characterization of coordination polymers, ferroelectric thin films, specialty materials

Michael A. Jackson, BS, MS, Ph.D., SUNY at Buffalo—Associate Professor, Microelectronic Engineering: microelectronic device design, fabrication, and test; material characterization techniques, surface analytical instrumentation; vacuum processing, including CVD, plasma, and ion beam techniques, micromachining, ferroelectric thin films, amorphous silicon and polysilicon film deposition and characterization

Ronald Jodoin, BS, Worcester Polytechnic Institute; Ph.D., University of Rochester-Professor, Physics: optical properties of photoreceptor materials, experimental physics, electronics, microcomputer interfacing
Bruce Kahn, SB, University of Chicago; Ph.D., University of Nebraska—Assistant Professor, Imaging & Photographic Technology

Michael Kotlarchyk, BS, MS, Ph.D., Massachusetts Institute of Technology—Professor, Physics: characterization of structure and phase transitions in surfactant systems (micelles, microemulsions, and liquid crystals) using scattering techniques; mass and surface fractals in condensed matter systems, theories of liquids; chaos in simple nonlinear physical systems
Santosh Kurinec, BS, MS, Ph.D., University of Delhi—Professor, Microelectronic Engineering: electronic materials, amorphous and semicrystalline materials, solid-state devices

Andreas Langner, BS, Ph.D., SUNY at Buffalo—Professor, Chemistry: physical chemistry, polymer chemistry, theoretical chemistry and chemical engineering, transient spectroscopy, charge and energy transfer, diffusion and flow in polymeric gels and blends
Vern Lindberg, BS, University of Alberta; MS, Ph.D., Case Western Reserve University—Associate Professor, Physics: deposition of metals onto polymeric substrates, effects of surface modification of polymer substrates on growth of PVD (physical vapor deposited) films, glow discharge and ion bombardment, stress in sputtered thin films, adhesion of PVD thin films, multilayer optical filters

Linda Meichle, BS, Massachusetts Institute of Technology; MS, Ph.D., University of Illinois—Assistant Professor, Physics: magnetic materials and magnetic measurements, calorimetry, bulk transport measurements, properties of materials at or near phase transitions, critical phenomena
Massoud Miri, BS, MS, Ph.D., University of Hamburg—Assistant Professor, Chemistry: polymerization mechanisms, polymer properties, catalysis

Ali Ogut, B.Ch.E., Hacettepe University, Turkey; MS, Ph.D., University of Maryland—Associate Professor, Mechanical Engineering: polymer processing, heat and mass transfer, rheology, transport phenomena
Philip D. Rack, BSc, Georgia Institute of Technology; Ph.D., University of Florida—Associate Professor, Microelectronic Engineering: luminescent materials, thin film processing, materials characterization, microlithography, and chemical mechanical polishing

Ryne P. Raffaelle, BS, MS, Southern Illinois University; Ph.D., University of Missouri at Rolla—Associate Professor, Physics
Sannasi Ramanan, BS, BE, M.Tech., Ph.D., Indian Institute of Technology—Associate Professor, Electrical Engineering: semiconductor materials, IC processing, epitaxial growth of semiconductors, quantum-well heterostructures, simulation and design of solid state devices

Bruce Smith, BS, MS, Ph.D., Rochester Institute of Technology—Professor, Microelectronic Engineering: 193 nm lithography, multilayer resist processing, attenuated phase shift mask materials
Robert Snyder, BS, Rochester Institute of Technology; P.E., Ph.D., Iowa State University—Professor, Mechanical Engineering: consulting work for attorneys—product liabilities, property damage, etc.; metallic alloys and materials, crystal structure, mechanical properties, materials testing
David A. Sumberg, BA, Utica College of Syracuse University; MS, Ph.D., Michigan State University—Associate Professor, Electrical Engineering: fiber optics and applications of fiber optics (polarization properties, microwave transmission on optical fiber, sensors, couplers); integrated optics (couplers, materials for integrated optics)
Gerald A. Takacs, BS, University of Alberta; Ph.D., University of Wisconsin—Professor, Chemistry: physical chemistry, chemical kinetics, photochemistry, atmospheric chemistry, plasma etching and modification of materials

I. R. Turkman, MS, Ph.D., Institut National des Sciences Appliquees—Associate Professor, Electrical and Microelectronic Engineering: susceptibility of microelectronic devices to damage from electrostatic discharges, CVD, sputtering, plasma-assisted etching processes

Jerome Wagner, BS, Case Institute of Technology; MS, Ph.D., University of Wisconsin—Professor, Physics: solid state physics, nuclear physics, medical physics, diagnostic nuclear medicine, defect properties in insulating materials, radiation-induced defects, color centers

Adjunct Faculty

John E. Carson, MS, Massachusetts Institute of Technology—Eastman Kodak Company, Rochester, N.Y.
Dennis H. Feduke, MS, P.E., Syracuse University—IBM, Endicott, N.Y.
George J. S. Gau, Ph.D., University of California, Berkeley—Eastman Kodak Company, Rochester, N.Y.
Mool C. **Gupta,** Ph.D., Washington State University—Eastman Kodak Company, Rochester, N.Y.
Henry J. Gysling, Ph.D., University of Delaware—Eastman Kodak Company, Rochester, N.Y.
J. Raymond Hensler, Ph.D., Pennsylvania State University—Director of Manufacturing Technology, Bausch and Lomb, Inc., Rochester, N.Y.
Merle N. Hirsh, Ph.D., The Johns Hopkins University—Plasma Resources
Robert Lord, MS, Syracuse University—Manager, IBM-Endicott, Endicott, N.Y.
Gerald F. Meyers, BS, University of Pittsburgh—Plant Metallurgist, Delco Products, General Motors Corporation, Rochester, N.Y.
J. William Sexton, BS, University of Rochester—Coordinator of Optics Contracts and New Opportunities Development, Eastman Kodak Company, Rochester, N.Y.
Tien-Kuei Su, Ph.D., University of Massachusetts—Supervisor, Mobil Chemical Corporation, Macedon, N.Y.
E. Wayne Turnblom, Ph.D., Columbia University—Manager, Materials Development and Manufacturing, Technical Operations, Graphics Imaging Systems Div., Eastman Kodak Company, Rochester, N.Y.
Edward G. **Williams,** MS, University of Rochester—Manager of Plastics Technology, Xerox Corporation, Rochester, N.Y.

Center for Imaging Science

Jonathan S. **Arney,** BS, Wake Forest University; Ph.D., University of North Carolina—Associate Professor
Roy S. **Berns,** BS, MS, University of California; Ph.D., Rensselaer Polytechnic University—Richard S. Hunter Professor.
Roger L. Easton, BS, Haverford College; MS, University of Maryland; MS, Ph.D., University of Arizona—Associate Professor
Mark D. Fairchild, BS, MS, Rochester Institute of Technology; Ph.D., University of Rochester—Director of the Munsell Color Science Laboratory; Associate Professor
Ian Gatley, BSc, University of London; Ph.D., California Institute of Technology—Director; Professor

Richard Hailstone, BS, Northern Illinois University; MS, Indiana University—Associate Professor
Elliott Horch, BS, University of Chicago; MS, Yale University; Ph.D., Stanford University—Assistant Professor
Joseph P. Hornak, BS, Utica College, MS, Purdue University; Ph.D., University of Notre Dame—Professor
Joel Kastner, BS, University of Maryland; MS, Ph.D., University of California—Associate Professor
Ethan D. Montag, BA, University of Pennsylvania; Ph.D., University of California—Assistant Professor

Zoran Ninkov, BS, University of Western Australia; MS, Monash University; Ph.D., University of British Columbia—Associate Professor
Noboru Ohta, BS, MS, Ph.D., Tokyo University—Xerox Professor
Jeff Pelz, BFA, MS, Rochester Institute of Technology; Ph.D., University of Rochester—Associate Professor
Navalgund Rao, MS, Banaras Hindu University; Ph.D., University of Minnesota—Associate Professor
Harvey E. Rhody, BSEE, University of Wisconsin; MSEE, University of Cincinnati; Ph.D., Syracuse University—Professor
John Schott, BS, Canisius College; MS, Ph.D., Syracuse University—Frederick and Anna B. Wiedman Professor
Anthony Vodacek, BS, University of Wisconsin; MS, Ph.D., Cornell University—Assistant Professor

Extended Graduate Faculty

Peter G. Anderson, BS, Ph.D., Massachusetts Institute of Technology—Professor, School of Computer Science
Sohail A. Dianat, BS, Aria-Mehr University, Iran; MS, Ph.D., George Washington University—Professor, Control Systems, Signal Processing
Lynn F. Fuller, BS, MS, Ph.D., SUNY Buffalo (Electrical Engineering)—Professor, Microelectronic Engineering
Roger S. Gaborski, BS, MS, State University of New York at Buffalo; Ph.D., University of Maryland—Associate Professor, Computer Science
Michael Kotlarchyk, BS, MS, Ph.D., Massachusetts Institute of Technology—Professor, Physics
Raghuveer Rao, BS, Mysore University, India; ME, Indian Institute of Science, Bangalore, India; Ph.D. University of Connecticut (Electrical Engineering)—Professor, Electrical Engineering
Andreas Savakis, BS, MS, Old Dominion University; Ph.D., North Carolina State University—Associate Professor, Digital Image Processing, Computer Vision
Bruce Smith, BS, MS, Ph.D., Rochester Institute of Technology—Professor, Microelectronic Engineering

Carlson Associates
Robert Maclntyre, BS, Boston University; MA, University of Rochester

Note: Prerequisites are within parentheses at the end of the course description.

Chemistry

1008-621 Advanced Instrumental Analysis Laboratory
A capstone course, requiring students to develop experimental protocols to accomplish assigned experiments involving advanced techniques in instrumental analysis. Library, literature and textbook research will be required. Upon agreement with the instructor, two to four major experimental techniques will be required. (Corequisite 1008-511 or -711) (1014-441,445) Lab 6, Credit 2 (F-X*, W)

1008-711 Advanced Instrumental Analysis
Theory, applications and limitations of selected instrumental methods in qualitative, quantitative and structural analysis. Possible topics include electrochemistry, surface analysis, NMR spectroscopy, mass spectroscopy, ICP, and other modern instrumentation. A term paper and oral presentation will be required based on an analytical technique agreed upon by instructor and student. (1014-441) Class 3, Credit 3 (F, W-X*)

1009-702 Biochemistry: Biomolecular Conformation & Dynamics
The first course in our graduate sequence in biochemistry. Molecular transport and enzymatic catalysis are related to the three-dimensional structures of biomolecules and the laws of thermodynamics. Also provides an introduction to membrane structure as preparation for the next course in the sequence, 1009-703 Biochemistry: Metabolism. Also offered in distance learning format. (Baccalaureate degree or permission of instructor) Class 3, Credit 3 (F-X*, W-X*)

1009-703 Biochemistry: Metabolism
Metabolic processes involved in energy consumption and production as well as the synthesis and degradation of biomolecules are discussed. Metabolic pathways are described in terms of thermodynamic principles, cellular localization and regulation mechanisms. Finally, the metabolic basis of several diseases is presented. Also offered in distance learning format. (Baccalaureate degree or permission of instructor) Class 3, Credit 3 (W, S-X*)

1009-704 Biochemistry: Nucleic Acids & Molecular Genetics
Nucleic acid structures, including the classical Watson-Crick model for DNA are introduced. The flow of genetic information by replication (DNA to DNA), transcription (DNA to RNA) and translation (RNA to protein) as well as gene expression and regulation in prokaryotes are discussed. The methodology of new techniques, such as DNA sequencing and recombinant DNA, and their role in medicine and forensics are presented. The genetic aspects of viruses and oncogenes are also reviewed. Also offered in distance learning format. (Baccalaureate degree or permission of instructor) Class 3, Credit 3 (F, S-X*)

1009-705 Biochemistry: Experimental Techniques
An introduction to the theory and practice of modern experimental biochemical laboratory techniques and concepts. The weekly one-hour lecture provides a theoretical framework for the various experimental techniques and includes a discussion of the properties of biomolecules and how those properties are exploited in the separation and characterization of the molecules. Practical laboratory techniques include the preparation of buffers, centrifugation, gel exclusion chromatography, electrophoretic methods, and UV/visible and fluorescence spectrophotometry as applied to the isolation and characterization of proteins and nucleic acids, the manipulation of genetic material in E. *coli* will also be examined. Sometimes offered in power-lab format. (Baccalaureate degree or permission of instructor) Class 1, Lab 6, Credit 3 (F)

1010-772 Special Topics
Advanced courses which are of current interest and/or logical continuations of the course already being offered. These courses are structured as ordinary courses and have specified prerequisites, contact hours and examination procedures. Recent courses taught as Special Topics include Nuclear Chemistry, Polymer Morphology, Advanced Chromatographic Methods and Applications of Computer Interfacing. Class variable, Credit variable

1010-870 Chemistry Seminar
Matriculated students are required to attend the weekly chemistry seminar series and to present a one-hour seminar on a topic in chemistry. Credit 1

1010-877 External Research
Industrial internship research. Credit 1-16

1010-879 Research & Thesis Guidance
Guidance hours and credits to be arranged. Chemical research in a field chosen by the candidate, subject to approval of the department head and adviser. Credit variable 1-16

1010-879-99 Continuation of Thesis
Credit 0 or 1

1010-899 Independent Study: Chemistry
Credit variable

1010-999 Chemistry Graduate Co-op
Cooperative work experience for MS chemistry students. Credit 0

1012-764 Inorganic Chemistry III: Physical Methods & Applications
Introduces the more sophisticated tools with which an inorganic chemist investigates inorganic materials. These physical methods, with the bond theories from 1012-563, are applied to inorganic reactions that exemplify the similarities and differences of the elements in each family of the periodic table. (1012-563 or permission of instructor) Class 4, Credit 4 (S)

1012-765 Preparative Inorganic Chemistry
The complexity of many inorganic "building blocks" requires a detailed understanding of inorganic theory, special handling precautions and special methods to investigate inorganic products. Different areas of the periodic table, new synthetic methods and new characterization techniques are examined. (1012-563 or permission of instructor) Lab 6, Credit 2 (W)

1013-730 Chemical Toxicology
Clinical and forensic aspects of abused drugs, including history, structure, classification, drug levels, metabolism and effects. Drug analysis methods: history, theory and practical applications of GLC, HPLC, GC/MS, UV spectrometry, TLC, IR, EIA, FPIA and stat tests. You are the drug chemist and the toxicologist in this multimedia experience. (College biology and chemistry, some biochemistry helpful or permission of instructor) Class 4, Credit 4 (W-X*)

1013-736 Spectrometric Identification of Organic Compounds
Theory and application of proton, carbon and 2-D nuclear magnetic resonance, infrared, mass spectrometry and ultraviolet spectra as applied to organic structure determination. (1013-433) Class 4, Credit 4 (W)

1013-737 Advanced Organic Chemistry
Advanced topics in organic synthesis, novel reagents and synthetic strategies such as retrosynthetic analysis are covered. In addition, enolate chemistry, organometallic chemistry, synthetic free-radical chemistry, protecting groups and combinatorial chemistry topics are covered in depth. Several classics in total synthesis are included with a strong emphasis on syntheses published in current chemical literature. (1013-433) Class 4, Credit 4 (F-X*)

1013-739 Advanced Organic Chemistry
Selected topics in physical organic chemistry including: techniques for elucidation of mechanism (kinetic, linear free, energy relationships, isotope effects), molecular orbital theory, electrocyclic reactions. (1013-433, 1014-443) Class 4, Credit 4 (offered alternate years; offered 2001-02) (S)

1013-832 Stereochemistry
Advanced treatment of steric relationships, conformational analysis and stereoisomerism in organic compounds. (1013-433) Class 4, Credit 4 (offered upon sufficient request)

1013-833 Heterocyclic Chemistry
A general treatment of heterocyclic chemistry. Syntheses and relative reactivities of heterocyclic compounds as demonstrated by their chemical reactions. (1013-433) Class 4, Credit 4 (offered upon sufficient request)

1014-730 Magnetic Resonance Imaging
An introduction to the principles of magnetic resonance imaging (MRI). The course covers spin physics, Fourier transforms, basic imaging principles, Fourier imaging, imaging hardware, imaging techniques, image processing, image artifacts, safety, and advanced imaging techniques. (1008-311,1014-442, Calculus) Class 4, Credit 4 (S-X*)

1014-740 Basics of Pulsed NMR
An introduction to the principles of pulsed nuclear magnetic resonance (NMR) spectroscopy. Lectures on instrumentation, pulse sequences, Fourier transforms and artifacts are presented. (1008-311) Class 1, Credit 1 (F)

X*: *course is offered at extended day hours (after 5 p.m.)*

1014-741 Advanced Chemical Thermodynamics
A study of the basic fundamentals of thermodynamics, including an introduction to statistical mechanics and their use in deriving the interrelationships of thermodynamic functions. Thermodynamic properties of gases are calculated based on spectroscopic data. Theory of solutions and phase equilibria are discussed. (1014-443,1016-306) **Class** 4, **Credit** 4 **(offered alternate years; offered 2001-02) (W-X*)**

1014-742 Survey of Physical Chemistry
A study of the fundamental principles of physical chemistry for clinical chemistry and biotechnology students. Kinetic-molecular theory, quantum mechanics, spectroscopy, thermodynamics and kinetics are presented in application to the life sciences. Not acceptable for BS in chemistry. **Class** 3, **Credit** 3 **(offered alternate years; offered 2001-02) (W-X*)**

1014-743 Advanced Chemical Kinetics
Methods of investigating the kinetics of chemical reactions and the theories used to interpret their results. Focus on homogeneous reactions in gas and liquid phases. Discussions of references from recent chemical literature. (1014-443) **Class** 4, **Credit** 4 **(offered alternate years; offered 2002-03) (W-X*)**

1014-744 Advanced Quantum Mechanics
Review of basic quantum theory and models. Variation and perturbation methods, atomic and molecular orbital theory, emphasis on relationship of spectroscopy and quantum chemistry. (1014-442) **Class** 4, **Credit** 4 **(offered alternate years; offered 2002-03) (S-X*)**

1014-747 Principles of Magnetic Resonance
A series of lectures designed to introduce the principles of magnetic resonance spectroscopies with emphasis on pulsed nuclear magnetic resonance (NMR) spectroscopy. Topics covered include classical and quantum mechanical theory, Fourier transform techniques, pulse sequences, instrumentation, instrumental techniques and modern applications such as 2-D NMR and solid-state NMR. (1014-443; 1014-648) **Class** 4, **Credit** 4 **(offered alternate years; offered 2001-02) (W-X*)**

1015-720 Environmental Chemistry
Environmental sources, reactions, transport, effects and fate of chemical species in air, soil, water and living systems are studied. (1014-443) **Class 3, Credit 3 (offered alternate years; next offering 2002-03) (S-X*)**

1015-721 Atmospheric Chemistry
The chemical composition of the Earth's atmosphere with emphasis on the role of the biosphere and the changes induced by human activity will be studied. Special emphasis will be placed on urban pollution, acid rain, stratospheric ozone depletion, and climate change. (1014-443) **Class 3, Credit 3 (offered alternate years; next offering 2002-03) (S)**

1029-701 Organic Chemistry of Polymers
Polymerization reactions that are used to prepare high molecular weight polymers and industrially important polymer chains, co-polymerization, graft polymer preparation and polymer degradation reactions are also considered. **(1013433) Class 4, Credit 4 (F-X*)**

1029-702 Polymer Chemistry: Chains & Solutions
Although most polymeric materials find utility as solids, polymer fabrication and characterization techniques are generally liquid-phase processes. This course is concerned with the fundamental physical chemistry of polymers in liquid solutions. Topics to be addressed include: polymerization kinetics and chain structure, molecular weight distributions and determination, polymer solution thermodynamics and transport phenomena, and solution phase transitions. The study of polymeric solids is the focus of 1029-703. (Baccalaureate degree in science or engineering, or permission of instructor) **Class 4, Credit 4 (S-X*)**

1029-703 Polymer Chemistry: Properties of Bulk Materials
This course is designed to give the student with a chemistry or materials science background a thorough grounding in the main concepts which describe bulk polymer structure, behavior and properties and to give the student practical tools to predict them. Basic to the understanding of polymer behavior is the fact that it is time-dependent. To emphasize this idea, the course is designed to build up to a study of the thermo-mechanical behavior of viscoelastic materials. (Baccalaureate degree in a science or engineering, or permission of instructor) Class **4,** Credit **4 (F-X*)**

1029-704 Polymer Characterization Laboratory
Many students in the Chemistry and Materials Science and Engineering graduate programs are involved in polymer research. This course gives these students an opportunity to acquire proficiency in using the tools of polymer characterization. Techniques for studying 1) molecular weight distributions, 2) spectroscopic analysis of chemical structure, 3) thermal stability, 4) morphology and phase transitions, and 5) mechanical properties will be introduced and mastered. Techniques may concentrate on particular research topics. (Baccalaureate degree in a science or engineering discipline, or permission of the instructor) **(offered alternate years; next offering 2002-03) (S)**

1029-705 Preparative Polymer Chemistry
Students will carry out about eight experiments. They will conduct in about half of those experiments step-growth polymerizations, and in the other half chain-addition polymerizations. Among the polymers produced will be polyvinyl alcohol gel, Nylon 6-10, Nylon 11, polystyrene, high density polyethylene, linear low density polyethylene, copolymer of styrene and methyl methacrylate and polyurethane. The more specific types of polymerizations and reactions introduced will be crosslinking of polymer, interfacial and bulk step-growth polymerizations, cyclopolymerizations, radical, ionic, and coordinative chain polymerizations. Instructors may add and/or delete polymer related experiments of their choice. The students in this course will also be primarily responsible to analyze the produced polymers and to use literature data to identify them. (1013-437) **Lab 6, Credit 2 (offered alternate years; next offering 2002-03) (F)**

Industrial & Applied Mathematics

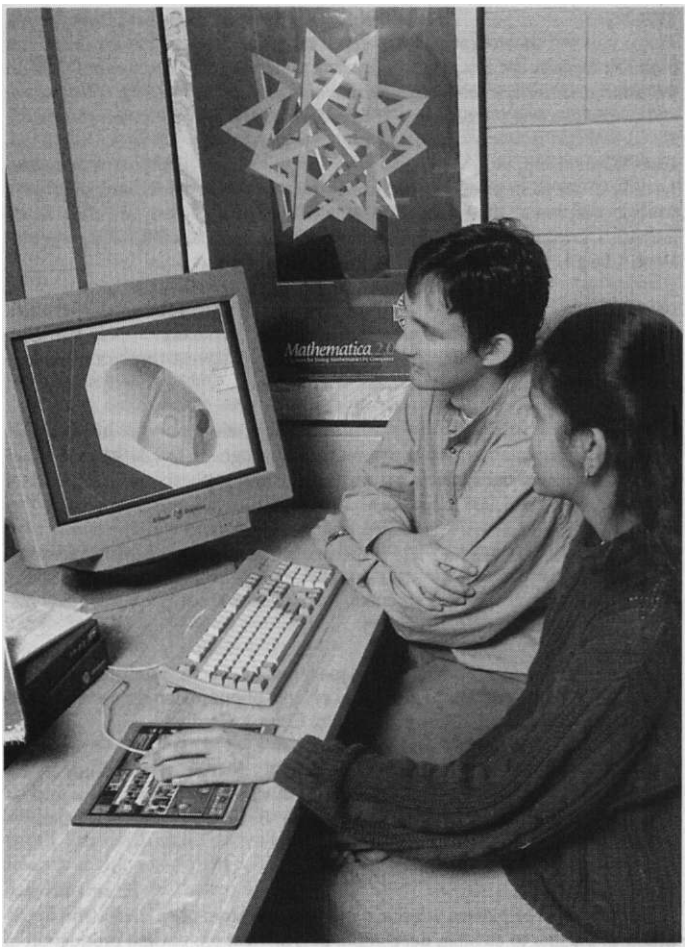
1016-725 Stochastic Processes
An introduction to stochastic processes. Important random processes that appear in various applications are studied. It covers basic properties and applications of Poisson processes and Markov processes as well as applications in renewal theory, queuing models, and optimal stopping. (Advanced Calculus, Probability, Matrix Algebra) **Class 4, Credit 4**

1016-801 Numerical Linear Algebra
An introduction to the theoretical concepts and computational issues in linear algebra. Topics include: vector spaces; linear transformations; linear functional; polynomials; canonical forms; eigen-values; diagonalization; decompositions; rational and Jordan forms; iterative techniques; factorization algorithms; special matrices. Computing projects, involving user-written programs and/or software packages, will be part of the course work. (Advanced Calculus, Matrix Algebra, knowledge of a programming language) **Class 4,** Credit **4**

1016-802 Methods of Applied Mathematics I
An introduction to some classical topics in mathematical analysis. Models arising in physics and engineering are introduced. Topics include: dimensional analysis and scaling; partial differential equations, classical techniques; Fourier series; integral transforms; orthogonal functions; wave phenomena in continuous systems. (Advanced Calculus, Differential Equations) Class **4,** Credit **4**

1016-803 Methods of Applied Mathematics II
This is a continuation of 1016-802 and deals with further applications of differential equations. Topics include: classification of partial differential equations; Laplace's equation; diffusion equations and their applications in physics and engineering. (1016-802) Class **4,** Credit **4**

1016-804 Numerical Methods for Stochastic Models
This course covers the algorithmic and numerical aspects of analyzing stochastic processes. Emphasis here is on computing the solutions to the systems represented by stochastic processes and identifying their probabilistic interpretations. Topics include: queuing models; examples from communications networks and manufacturing systems; reliability models; simulation; approximation methods. (1016-725,1016-801) **Class 4, Credit 4**



1016-859 Topics in Applied Mathematics
This course covers some topics that are not covered in the regular courses and are not offered in other departments. This course may be used to study other areas of applications in the student's concentration. A wide variety of topics may be offered. Some examples are: reliability models; biological models; calculus of variations; computational probability; and dynamical systems. (Consent of the adviser and the instructor) Class 4, Credit 4

1016-879 Thesis or Project Work
This is the capstone of the program in which the student works on a problem in applied mathematics under the guidance of the Advisory Committee. A formal written proposal of the problem to be studied must be presented before embarking on the project. A written report and an oral defense of the project/thesis are required at the completion of the work. This course may be repeated for a maximum of 12 quarter credit hours. (Consent of the adviser)

1016-899 Independent Study
A topic of special interest to the student and related to the student's area of concentration may be taken for independent study with the approval of the adviser and the instructor who will offer the course. The student submits a proposal for independent study to the Advisory Committee for consideration and approval. (Consent of the adviser and the instructor) Credit variable (maximum of 4 credits/quarter)

Clinical Chemistry

1023-705 Mechanisms of Disease
Mechanisms of cellular injury, the healing process, atherosclerotic heart disease, hypertension, infectious disease, and many other disease states are presented. Class 4, Credit 4 (offered alternate years) (S)

1023-712 Statistics & Quality Control
The principles of statistics as applied to biomedical research, manufacturing of reagents for the clinical laboratory, and as applied to the clinical laboratory analysis are studied. Using a problem-oriented approach to probability; normal values; analysis of variance; and quality control; as well as the relationship of these procedures to patient care are studied. Class 3, Credit 3 (offered alternate years) (S)

1023-722 Clinical Laboratory Computer Applications
Computerized office management and administrative techniques are discussed with emphasis on PCs. The basic concepts of data processing and spread sheets; design, evaluation, and the utilization of computer systems in both hospital and clinical laboratories; and the legal aspects of biomedical data processing are studied. Class 3, Credit 3 (offered alternate years) (S)

1023-820 Advanced Clinical Chemistry I
Electrolytes, acid-base physiology, renal function, trace metals, lipids, carbohydrate metabolism, enzymes, and various standard methods are covered, (permission of instructor) Class 4, Credit 4 (offered alternate years) (F)

1023-821 Advanced Clinical Chemistry II
A study of the concepts and applications of therapeutic drug monitoring, pharmacokinetics, toxicology, inherited disorders of metabolism, liver function tests, protein measurement, hepatitis, porphyrias, vitamins, pediatric clinical chemistry, geriatric clinical chemistry and gene probes. (Permission of instructor) Class 4, Credit 4 (offered alternate years) (W)

1023-822 Advanced Clinical Chemistry III
A survey of endocrinology and of the immunoassay methods used in performing endocrine assays. The endocrine systems covered include the thyroid, the adrenals, calcium metabolism, growth hormone, the human reproductive system and the fetal-placental unit. Class 4, Credit 4 (offered alternate years) (F)

1023-823 Advanced Clinical Chemistry IV
Introduces the student to the types of instrumentation and analytical methods commonly found in the clinical laboratory. Instrumentation and methods covered include UV-visible spectroscopy, immunoassay, GC-MS, TLC, fluorometry, atomic absorption spectroscopy, electrophoresis, osmometry, nephelometry and PCR techniques. The laboratory component serves to provide hands-on experience in these types of procedures and measurements. Class 3, Lab 3, Credit 4 (offered alternate years) (W)

1023-870 Clinical Chemistry Seminar
Credit 1

1023-872 Special Topics: Clinical Chemistry
In response to student and/or faculty interest, special courses that are of current interest and/or logical continuations of regular courses are presented. These courses are structured as ordinary courses with specified prerequisites, contact hours and examinations. Class variable, Credit variable (offered upon sufficient request)

1023-877 External Clinical Chemistry Research
Research carried out in a laboratory outside of the College of Science. Prior to the initiation of external research, a proposal from the student as well as a commitment of support and direction from the laboratory are evaluated. Credit variable

1023-879 Clinical Chemistry Research
Research carried out in the College of Science laboratories under the direction of RIT faculty members. The amount of credit awarded for such projects is determined after evaluation of a research proposal. Credit variable

1023-899 Clinical Chemistry: Independent Study
Individual projects or studies carried out under the direction of a faculty member. Study objectives and design are developed through faculty-student interaction with evaluation and credit to be awarded determined after review of a study proposal. Credit variable

1023-999 Clinical Chemistry Graduate Co-op
Cooperative work experience for MS clinical chemistry students. Credit 0

Materials Science and Engineering

1028-701 Introduction to Materials Science
The course provides an understanding of the relationship between structure and properties for development of new materials. Topics include atomic and crystal structure, crystalline defects, diffusion theories, strengthening mechanisms, ferrous alloys, cast irons, structure of ceramic and polymeric materials, and corrosion principles. (Graduate standing or permission of instructor) Class 4, Credit 4 (F)

1028-702 Introduction to Polymer Science
A study of the chemical nature of plastics detailing the relationships between polymerization conditions, structure and properties in both the solid and fluid states. (1028-701 or equivalent) Class 4, Credit 4 (W)

1028-703 Solid State Science
Survey of topics in the physics of solids. Included are crystal symmetry, structure and binding; mechanical, thermal and electrical properties of insulators, semiconductors and conductors, including band theory. (1028-704 or equivalent) Class 4, Credit 4 (W)

1028-704 Introduction to Theoretical Methods
Treatment of waves and fields; selected topics of interest in electrodynamics and fluid mechanics; statistical mechanics; Maxwell-Boltzmann, Bose Einstein and Fermi-Dirac distributions and their applications. (Graduate standing or permission of instructor) Class 4, Credit 4 (F)

1028-705 Introduction to Experimental Techniques
Introduction to laboratory equipment for hardness testing, impact testing, tensile testing, x-ray diffraction and thermal treatment of metallic materials. Experiments illustrating the characterization of high molecular weight organic polymers are conducted. (1028-701 and 702 or equivalents) Class variable, Lab variable, Credit 4 (S)

1028-706 Experimental Techniques: Thin Films
Production of thin films of metals and dielectrics by physical vapor deposition. Lectures cover vacuum systems, evaporation, sputtering, nucleation and growth of thin films, analysis and characterization of thin films, and application of thin films. Laboratories cover use of vacuum systems in evaporation and sputtering and some methods of characterizing the thin films thus produced. (Permission of instructor) Class variable, Lab variable, Credit 4

1028-707 Experimental Techniques: Microscopy & Spectroscopy
An in-depth look at various techniques used to characterize thin film materials. Lectures will cover resistivity measurements, ellipsometry, reflectance techniques, optical microscopy, electron microscopy, and scanning probe microscopy. The lab provides hands-on training in these techniques and is conducted in the cleanroom housed in the Center for Microelectronic Engineering. Students will be required to perform an in-depth study on a material of their choice using these techniques or to research an associated technique not covered in lecture. (Permission of instructor) Class variable, Lab variable, Credit 4

1028-708 Experimental Techniques
Provides an in-depth integrated approach to the analysis, investigation and development of materials, concentrating on specific types or classes. (1028-701 or equivalent) Class variable, Lab variable, Credit 4

1028-710 Materials Properties & Selection
Study of the principles of material behavior as applied to design. Application of materials according to these principles is stressed. Ferrous, nonferrous and nonmetallic materials are considered. (1028-701 or equivalent) Class 4, Credit 4

1028-714 Glass Science
Topics include the structure and properties of glass, applied areas such as glass melting and processing, and various technological applications of glass. (1028-701 or equivalent; 1028-704) Class 4, Credit 4

1028-717 Material Degradation: Corrosion
This course introduces the basic electrochemical nature of corrosion considers the various factors that influence the rate of corrosion in a variety of environments. Various means of controlling corrosion are considered. (1028-701 or equivalent) Class 4, Credit 4

1028-720 Organic Polymers
Meets the needs of students in the area of organic chemistry related to synthesis, polymerization mechanism, structures, stereochemistry of reactions of organic polymers and their industrial usage. (1028-702 or equivalent) Class 4, Credit 4

1028-721 Physical Chemistry of Polymers
A study of the theoretical and experimental methods available for designing plastics products and selecting appropriate materials, with special emphasis on the interrelationships between materials, product design, tooling construction and manufacturing producibility. (1028-702 or equivalent) Class 4, Credit 4

1028-722 Polymer Processing
A study of the basic principles and methods involved in the technology of processing polymeric materials, including treatments of heat transfer, mass transfer, mixing and shaping or molding of these materials. (1028-702 or equivalent) Class 4, Credit 4

1028-730 Optical Properties of Materials
Fundamentals of geometrical and physical optics, interaction of radiation with matter, dielectrics and thin films, introduction to electro-optic and acousto-optic effects. (1028-704 or equivalent) Class 4, Credit 4

1028-733 Magnetic Properties of Materials
Magnetostatics, creation and measurement of magnetic fields, galvano-magnetic and magneto-optic effects, magnetic materials, applications. (1028-701 and 704 or equivalents) Class 4, Credit 4

1028-734 Advanced Optics
Lasers: theory, types and construction; optics of metals; multilayer dielectrics; electro- and acousto-optic modulators and deflectors; optical detectors. (1028-730 or equivalent) Class 4, Credit 4

1028-736 Amorphous & Semicrystalline Materials
Electrical, thermal and optical properties of amorphous materials; model of conduction. (1028-701,703, 704 or equivalents) Class 4, Credit 4

1028-740 Nuclear Science & Engineering
Systemics of the atomic nuclei, radioactivity, nuclear reactions, fission, nuclear reactor principles, designs, materials and safety. (1028-701 and 704 or permission of instructor) Class 4, Credit 4

1028-760 Plasma Science
An introduction to plasma science; a study of the basic phenomena and application of plasma to etching, deposition, polymerization, plasma production of materials, analytical emission spectroscopy and atmospheric science. (1028-701 or equivalent) Class 4, Credit 4

1028-770 Physics & Chemistry of IC Processing
Study of the various processing steps used in integrated circuit fabrication technology with special emphasis on diffusion, thermal oxidation, ion implantation and plasma-assisted deposition and etching processes. Process modeling using SUPREM. (1028-703 or permission of instructor) Class 4, Credit 4

1028-800 Special Topics
In addition to in-depth study of any of the courses listed under Elective Courses, special topics may be selected from such areas as elastomers, organometallics, radiation damage, processing of materials, superconductivity, etc. (Permission of instructor) Class variable, Credit 4

1028-877 External Research
Research using equipment and facilities at a site other than RIT. Prior to enrollment in the course, a proposal from the student that includes a letter of support from the host facility is evaluated for determination of credit to be awarded upon successful completion of the project. A total of 8 quarter credit hours, with a maximum of 4 quarter credit hours per quarter, can be applied toward the MS degree. For matriculated MSE students employed full time by local companies. (Permission of program director) Credit variable

1028-879 Research & Thesis Guidance
A project involving research on a topic in materials science and engineering. An oral examination and written thesis are required. Credit variable

1028-890 Seminar
Required for completion of the program and involves a one-hour presentation on some topic in materials science in engineering. Class variable, Credit 1 (F, S)

1028-899 Independent Study
This course number should be used by students wishing to study a topic on an independent study basis. (Permission of instructor) Credit variable

Color Science

1050-701 Vision & Psychophysics
This course provides an overview of the human visual system and psychophysical techniques used to investigate it with an emphasis on applications to imaging. The first half of the course covers topics including threshold techniques, one- and multi-dimensional scaling techniques, and psychometric functions. The second half of the course includes discussions of the anatomy and physiology of the visual system and aspects of functional vision ranging from form and color perception to motion and depth perception. Class 4, Credit 4 (F)

1050-702 Applied Colorimetry
An introduction to the measurement and specification of color. The CIE system of colorimetry is presented with an emphasis on its practical application to common problems in quality control, reproduction and imaging. Topics include color perception, photometry, trichromatic theory, color matching mathematics, obtaining colorimetric data through measurement, color quality spaces, deriving industrial tolerances, and an introduction to device independent color. Class 4, Credit 4(F)

1050-703 Color Appearance
This course is for students who have an understanding of the applications of colorimetry. It presents the transition from the measurement of color patches and differences to the description and measurement of color appearance. This seminar course is based mainly on review and discussion of primary references. Topics include appearance terminology, appearance phenomena, viewing conditions, chromatic adaption and color appearance modeling. (1050-702) Class 3, Credit 3 (W)

1050-721 Color Measurement Lab I
An in-depth treatment of the instrumentation and standardization required for accurate, precise measurements of optical radiation. The optical properties of objects and radiation sources will be covered. Optical and electronic design of spectroradiometric and spectrophotometric instrumentation is discussed in detail. The use of standard reference materials for calibration and evaluation of instrumentation is explored. The laboratory is heavily stressed, with students fully analyzing the design and performance of various instruments. Class 1, Lab 3, Credit 2 (F)

1050-722 Color Measurement Lab II
Course stresses technical writing and scientific reasoning applied in a laboratory environment. Laboratories include: precision and accuracy analysis of color measuring instrumentation, measuring observer metamerism, color tolerance psychophysics, and building a colorimeter. (1050-701,1050-721) Class 1, Lab 3, Credit 2 (W)

1050-751 Special Topics
Advanced topics of current interest, varying from quarter to quarter, selected from the field of color science. Specific topics announced in advance. (Not offered every quarter. Consult the color science graduate program coordinator.) Credit variable

1050-752 Special Topics
Advanced topics of current interest, varying from quarter to quarter, selected from the field of color science. Specific topics announced in advance. (Not offered every quarter. Consult the color science graduate program coordinator.) Credit variable

1050-753 Special Topics
Advanced topics of current interest, varying from quarter to quarter, selected from the field of color science. Specific topics announced in advance. (Not offered every quarter. Consult the color science graduate program coordinator.) Credit variable

1050-799 Independent Study
An independent project in an area of color science not covered in the available courses. This project can be experimental research, literature review, or other appropriate work. This course requires a formal proposal and a faculty sponsor. Credit variable

1050-801 **Color Science Seminar**
A seminar course in which students will study the literature in particular areas of color science and present that material to the class. Topics will be based on student interest and current issues in the field. Available to color science MS students or by permission of the instructor. May be taken more than once for credit with permission of coordinator. (1050-701, 702,703,712) Class 3, Credit 3 (F)

1050-813 **Color Modeling**
This course explores mathematical techniques for predicting the relationships between user controls and spectral properties of coloration systems. These systems include computer-controlled CRT displays, digital cameras and scanners, halftone and continuous tone printers, and artistic materials. Accompanying laboratory stresses the use of nonlinear optimization and multivariate statistics to model colorant behavior, and technical writing. (1050-701, 721, 722) Class 4, Credit 4 (S)

1050-840 **Color Science: MS Project**
An independent project in an area of color science that serves as the major culminating experience for students in the Graduate Project Option of the color science MS program. This project can be an experiment, critical literature review, demonstration or other appropriate work. This course requires a formal proposal and faculty sponsor; a written technical report and oral presentation of the results. **Credit 4**

1050-890 Research & Thesis
Thesis based on experimental evidence obtained by the candidate in an appropriate topic as arranged between the candidate and the coordinator of the program. Credit 9 **(minimum for** MS)

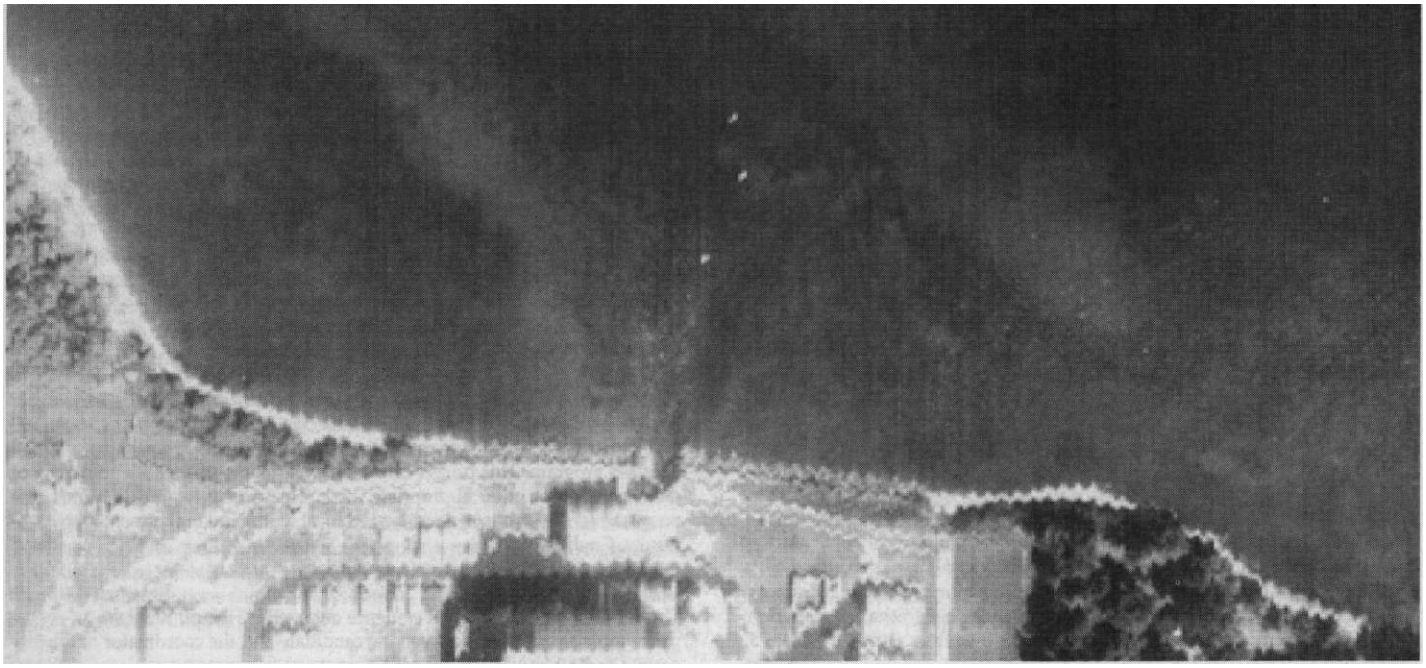
Imaging Science

1051-706, 707, 708 **Introduction to Imaging Science**
This course is focused on familiarizing students with research activities in the Carlson Center, research practices in the university, research environment and policies and procedures impacting graduate students. The course is coupled with the research seminar sponsored by the Center for Imaging Science (usually weekly presentations). The students are expected to attend and participate in the seminar as part of the course. The course will also address issues and practices associated with technical presentation and technical writing. Credits earned in this course apply to research requirements. **Class 1,** Credit **1 (F, W, S)**

1051-711 **Basic** Principles **of** Imaging **Science I**
This course provides the student with a basic understanding of the scientific principles associated with electromagnetic radiation propagation, image capture and formation, and image processing used to reproduce or display images. An end-to-end treatment of an imaging system shall be employed to illustrate the interrelationships among the concepts introduced throughout the course. System analyses include the use of modeling concepts and image quality metrics to demonstrate how the concepts developed in Linear Image Mathematics can be used in concert with concepts in this course to describe and assess a simple imaging system. Also offered online. (Credit or coregistration in 1051-716) Class 4, Credit 4(F)

1051-712 Basic Principles of Imaging Science II
This course continues the development of basic understanding of scientific principles associated with image capture, formation, and image processing used to reproduce or display images. An end-to-end treatment of an imaging system shall be employed to illustrate the interrelationships among the concepts introduced throughout the course. System analyses include the use of modeling concepts and image quality metrics to demonstrate how the concepts developed in Linear Image Mathematics can be used in concert with concepts in this course to describe and assess a simple imaging system. Also offered online. (Credit or coregistration in 1051-717) Class 4, Credit 4 (W)

1051-713 Noise & Random Processes
The purpose of this course is to develop an understanding and ability in modeling noise and random processes within the context of imaging systems. The focus will be on stationary random processes in both one dimension (time) and two dimensions (spatial). Power spectrum estimation will be developed and applied to signal characterization in the frequency domain. The effect of linear filtering will be modeled and applied to signal detection and maximization of SNR. The matched filter and the Wiener filter will be developed. Signal detection and amplification will be modeled, using noise figure and SNR as measures of system quality. At completion of the course, the student should have the ability to model signals and noise within. Class 4, Credit 4 (S)



RIT's airborne Modular Imaging Spectrometer Instrument (MISI) image ofGinna Nuclear Power Plant on Lake Ontario.

1051-714 Information Theory for Imaging Systems
This course develops a basic understanding of the efficient representation of information for storage and transmission. Classical concepts of information theory are developed and applied to image compression, storage and transmission. The intent is to develop a foundation for the efficient handling of image-based information in imaging systems. Credit 4 (offered alternate years, offered 2000-01) (S)

1051-716 Linear Image Math I
This course develops the mathematical methods required to describe continuous and discrete linear systems, with special emphasis on tasks required in the analysis or synthesis of imaging systems. The classification of systems as linear/nonlinear and shift variant/ invariant is discussed first, followed by development and use of the convolution integral. This is followed by a discussion of Fourier methods as applied to the analysis of linear systems, including the Fourier series and Fourier transform. Emphasis is placed on the physical meaning and interpretation of these transform methods. Image sampling and quantization is introduced and discrete convolution and Fourier transform is considered. Within the context of image analysis, imaging systems as a linear filter, image enhancement and information extraction and several basic image processing techniques are also introduced. Also offered online. Class 4, Credit 4 (F)

1051-717 Linear Image Math II
This course continues the development of mathematical methods required to describe continuous and discrete linear systems that was begun in 1051-716, with emphasis placed on the use of discrete models of imaging systems. The various types and effects of quantization are considered first, followed by discussions of common means to process sampled and quantized images. The use of linear models of imaging systems is considered, including he discussion of the valid limiting cases of optical imaging in coherent and incoherent light. The course concludes with discussions of various applications of the mathematical models. Also offered online. Class 4, Credit 4 (W)

1051-721 Imaging Laboratory I
This three quarter laboratory is designed to parallel the Basic Principles of Imaging Science I, II, and Noise and Random Processes core requirements. It provides hands-on experience with imaging materials and devices, digital imaging techniques, electro-optical devices, and other imaging modalities. It is intended to reinforce course work and provide the student exposure to, and facility with, a broad variety of instrumentation and analytical methods. In addition, statistical methods of data analysis will be introduced and utilized. Lab 3, Credit 1 (F)

1051-722 Imaging Laboratory II
This three quarter laboratory sequence is designed to parallel the Basic Principles of Imaging Science I, II, and Noise and Random Processes core requirements. It provides hands-on experience with imaging materials and devices, digital imaging techniques, electro-optical devices, and other imaging modalities. It is intended to reinforce course work and provide the student exposure to, and facility with, a broad variety of instrumentation and analytical methods. In addition, statistical methods of data analysis will be introduced and utilized. Lab 3, Credit 1 (W)

1051-723 Imaging Laboratory III
This three quarter laboratory sequence is designed to parallel the Basic Principles of Imaging Science I, II, and Noise and Random Processes core requirements. It provides hands-on experience with imaging materials and devices, digital imaging techniques, electro-optical devices, and other imaging modalities. It is intended to reinforce course work and provide the student exposure to, and facility with, a broad variety of instrumentation and analytical methods. In addition, statistical methods of data analysis will be introduced and utilized. Lab 3, Credit 1 (S)

1051-726 Programming for Scientists & Engineers
A course to prepare graduate students in science and engineering to use computers as required by their disciplines. Covers: the organization and programming of computers at various levels of abstraction (e.g. assembly, macros, high-level languages, libraries), advanced programming techniques, the design, implementation, and validation of large computer programs, modern programming practices, introduction to a programming environment and to a variety of programming languages. Programming projects will be required. Also offered online. Class 4, Credit 4 (W)

1051-728 Design & Fabrication of Solid State Cameras
The purpose of this course is to provide the student with hands-on experience in building a CCD camera. The course provides the basics of CCD operation including an overview, CCD clocking, analog output circuitry, cooling, and evaluation criteria. Class 1.5, Lab 7.5, Credit 4 (W)

1051-731 Principles of Chemical Imaging I
This course provides the student with a basic understanding of the principles of chemical imaging. The physical and chemical principles required for studying chemical imaging are reviewed. The phenomenon and mechanism of reciprocity law failure are illustrated. Emphasis is on relating the underlying principles of physics and chemistry to the metrics of system performance. Technologies to be covered include ink jet and thermal printing. Class 4, Credit 4 (offered alternate years) (F)

1051-732 Principles of Chemical Imaging II
A continuation of 1051-731 providing the student with a basic understanding of the principles of chemical imaging. Emphasis is on relating the underlying principles of physics and chemistry to the metrics of system performance. Chemical imaging technologies to be covered include electrophotographic, silver halide, and polymer. Spatial properties of chemical images are related to their underlying physics and chemistry. Class 4, Credit 4 (offered alternate years) (W)

1051-736 Geometrical Optics
This course leads to a thorough understanding of the geometrical properties of optical imaging systems. A method is developed of performing a first-order design of an optical system, applicable to uniform and gaussian beams. The following topics are included: paraxial optics of axisymmetric systems, Gaussian optics (cardinal points, pupils and stops, optical invariant), propagation of energy through lens systems, basic optical instruments and components, gradient index optics, finite raytracing, introduction to aberrations, geometrical optics of gaussian beams. Also offered online. Class 3, Lab 3, Credit 4 (F)

1051-737 Physical Optics
The wave properties of light and their application to imaging systems and metrology. Polarization, birefringence, interference and interferometers, spatial and temporal coherence, scalar diffraction theory are covered. (1051-717) Class 4, Credit 4 (W)

1051-738 Optical Image Formation
This course presents a unified view of the formation of images and image quality of an optical system from an applications viewpoint, but with a strict mathematical development. Topics covered are: geometrical and diffraction theory of aberrations, image quality criteria and MTF, MTF tolerance theory, image formation with coherent light. Throughout the course, the problem of image formation is treated also in its inverse form of designing an optical imaging system that satisfies a given set of specifications. (1051-737) Class 3, Lab 3, Credit 4 (S)

1051-739 Principles of Solid State Imaging
This course covers the basics of solid state physics, electrical engineering, linear systems and imaging needed to understand modern focal plane array design and use. The course emphasizes knowledge of the working of infrared arrays. (Optics, Linear Systems) Class 4, Credit 4 (F)

1051-749 Color Reproduction
This course presents the concepts required for an understanding of the relationships between mean-level input and output in various color imaging systems. Analog, digital, and hybrid color imaging systems will be covered. Special emphasis will be given to mean-level reproduction in photography, printing, and television. Also offered online. Class 4, Credit 4 (W)

1051-750 Hyperspectral Imaging & Synthetic Image Generation
This course will be divided into two parts. Half will focus on hyperspectral imaging. It will start with the physical and chemical phenomena that cause spectral signatures and trace spectral imaging through sensing by imaging spectrometers and analysis with specialized algorithms for handling spectrally rich data. The other half of the course will have more of a seminar flavor and will focus on Synthetic Image Generation (SIG). Several SIG models will be reviewed by the class and compared to the DIRSIG model which will be treated in detail as a point of reference for other models. A particular emphasis will be placed on the potential for using SIG to model the hyperspectral phenomena. (Permission of instructor) Class 4, Credit 4

1051-751 Special Topics: Imaging Science
Advanced topics of current interest, varying from quarter to quarter, selected from the field of imaging science. Specific topics announced in advance. (Not offered every quarter. Consult the imaging science graduate program coordinator.) Credit variable

1051-752 Special Topics: Imaging Science
Advanced topics of current interest, varying from quarter to quarter, selected from the field of imaging science. Specific topics announced in advanced. (Not offered every quarter. Consult the imaging science graduate program coordinator.) Credit variable

1051-753 Special Topics: Imaging Science
Advanced topics of current interest, varying from quarter to quarter, selected from the field of imaging science. Specific topics announced in advanced. (Not offered every quarter. Consult the imaging science graduate program coordinator.) Credit variable

1051-756 Introduction to Electrophotographic Materials & Processes
An introduction to materials and processes in electrophotography. Topics include an historical development of electrostatic and electrophotographic imaging, surface deformation imaging, and current topics in electrophotographic and related processes. Class 4, Credit 4 (F)

1051-757 Fundamentals of Electrophotography
This course describes the physical basis for field variation electrophotography, and the fundamentals of xerographic system design and analysis. Topics covered include calculation of development fields, the mathematical and physical basis for viscosity-controlled and adhesion-controlled development, the physical basis for charging and discharging photoconductors, and system optimization of the xerographic process. (1051-756) Class 4, Credit 4 (W)

1051-758 Electrophotographic Systems
Basic principles and techniques in engineering design and analysis of electrophotographic copiers, input scanners, raster output scanners, and other solid state electronic printing devices. Emphasis will be given to such topics as reliability, systems optimization, quality control, and print and copy quality. (1051-757) Class 4, Credit 4 (S)

1051-761 Principles of Remote Sensing Image Analysis
An introduction to radiometric concepts as they relate to remote sensing. The emphasis is on aerial and satellite imaging systems operating from 0.4 -20 um. After a brief review of the field, the basic radiometry concepts needed for remote sensing are introduced and a governing equation for radiance reaching the sensor is carefully derived. Class 4, Credit 4 (F)

1051-762 Remote Sensing & Image Analysis II
The problem of inverting recorded image data to surface reflectance or temperature values is treated using a variety of techniques, including the use of ground truth, "in scene" methods, and radiation propagation models. Multispectral digital image processing methods are introduced and their utility in various remote sensing applications considered. The potential for including multiple sources of data in image analysis is treated through consideration of multispectral image data fusion and the use of geographic information systems. (1051-761) Class 3, Lab 3, Credit 4 (W)

1051-765 Remote Sensing Systems
This course is designed to draw on the student's knowledge of linear system theory, digital image processing, and noise concepts and apply it to an end-to-end system in an area associated with remote sensing. Generalized concepts from these fields will be focused to show how they can be applied to solve remote sensing image analysis and systems design and evaluation problems. An overriding objective is on the application of theory to practice. Class 4, Credit 4 (S)

1051-771 Silver Halide Science I
A comprehensive study of the science of imaging with silver halide materials. Includes materials preparation and their physical and chemical properties, mechanisms and efficiency of image recording, and reciprocity law failure measurement and mechanisms. The course will focus on correlations between events at the atomic and molecular level and their manifestation at the macroscopic level. Class 4, Credit 4 (offered alternate years) (F)

1051-772 Silver Halide Science II
A continuation of the comprehensive study of the science of imaging with silver halide materials. Includes mechanisms and procedures of chemical sensitization, dopants, and spectral sensitization, and image detection and enhancement. This course will focus on correlations between events at the atomic and molecular level and their manifestation at the macroscopic level. Class 4, Credit 4 (offered alternate years) (W)

1051-773 Silver Halide Science III
A comprehensive study of the application of silver halides in imaging systems. The emphasis is on how the material properties of silver halides influence the properties of the imaging system such as sensitivity, reciprocity failure, curve shape, color and tone reproduction, granularity, sharpness, resolution, and processability. Class 4, Credit 4 (offered alternate years) (S)

1051-774 Vision & Psychophysics
This course provides an overview of the human visual system and psychophysical techniques used to investigate it with an emphasis on applications to imaging. The first half of the course covers topics including threshold techniques, one- and multi-dimensional scaling techniques, and psychometric functions. The second half of the course includes discussions of the anatomy and physiology of the visual system and aspects of functional vision ranging from form and color perception to motion and depth perception. Also offered online. Class 4, Credit 4(F)

1051-775 Applied Colorimetry
An introduction to the measurement and specification of color. The CIE system of colorimetry is presented with an emphasis on its practical application to common problems in quality control, reproduction, and imaging. Topics: color perception, photometry, trichromatic theory, color matching mathematics, obtaining colorimetric data through measurement, color quality spaces, deriving industrial tolerances, and an introduction to device independent color. Also offered online. Class 4, Credit 4(F)

1051-776 Color Modeling
This course explores mathematical techniques for predicting the relationships between user controls and spectral properties of coloration systems. These systems include computer-controlled CRT displays, digital cameras and scanners, halftone and continuous tone printers, and artistic materials. Accompanying laboratory stresses the use of nonlinear optimization and multivariate statistics to model colorant behavior, and technical writing. (1051-774, 1050-721, 722) Class 4, Credit 4 (S)

1051-779 Astronomical Instrumentation & Techniques
This course provides an in-depth look at various pieces of instrumentation used in many low light imaging applications with emphasis on astronomical requirements. Aspects of hardware, systems analysis, and performance calculation will be covered. Class 4, Credit 4 (offered occasionally) (S)

1051-782 Introduction to Digital Imaging
After a brief review of 2-dimensional signal processing, the course discusses the processing of images on a computer. It includes methods of contrast manipulation, image smoothing, and image sharpening using a variety of linear and nonlinear methods. Also discussed are methods of edge and line enhancement and detection, followed by techniques of image segmentation. The course concludes with a discussion of image degradation models and image restoration. (1051-717 or permission of instructor) Also offered online. Class 4, Credit 4 (F)

1051-784 Digital Image Processing: Spatial Pattern Recognition
This course develops a fundamental understanding of adaptive pattern recognition and a basic working knowledge of techniques that can be used in a broad range of applications. Inherent in adaptive pattern recognition is the ability of then system to learn by supervised or unsupervised training, or by competition within a changing environment. The effectiveness of the system depends upon it structure, adaptive properties and specifics of the application. Particular structures that are developed and analyzed include statistical PR, clustering systems, fuzzy clustering systems, multilayered perceptrons (with a variety of weight training algorithms), and associative memory systems. The goal is to gain both a fundamental and working knowledge of each kind of system and the ability to make a good system selection when faced with a real application design. Also offered online. Class 4, Credit 4 (W)

1051-790 Image Rendering
This course covers the fundamental principles of computer image synthesis with a focus on rendering techniques. Topics include geometric scene specification, shading (e.g., flat, Gouraud, Phong), and global illumination rendering (e.g., ray tracing, radiosity). Commercial software such as OpenGL and Radiance will be briefly described. Lastly, the design, advantages and limitations of modern computer graphics hardware are discussed. Students implement fundamental computer graphics techniques and produce images using IDL (or similar) environment. (Graduate status CIS or permission of instructor, 1051-726 or equivalent, Matrix Algebra) Class 4, Credit 4 (S)

1051-797 Principles of Computer Tomographic Imaging
Image reconstruction from projections is introduced as a mathematical problem. Technique for reconstruction via Fourier domain is explained using Fourier slice theorem. Simple and Filtered Backprojection and iterative methods are analyzed. Algorithms for various techniques are developed and artifacts and noise in discrete case are considered. Applications to several medical imaging modalities are outlined, with brief consideration of the physics of imaging involved in each case. Class 4, Credit 4 (S)

1051-799 Independent Study
An independent project in an area of imaging science not covered in the available courses. This project can be experimental research, literature review, or other appropriate work. This course requires a formal proposal and a faculty sponsor. Credit variable

1051-801 Advanced Optics Seminar I
This course covers several advanced aspects of optics and imaging that are not included in other regular course offerings. Topics vary every year. The course may be taken more than once. Student participation includes presentations to the class on agreed upon topics. Class 1, Credit 1

1051-802 Advanced Optics Seminar II
This course covers several advanced aspects of optics and imaging that are not included in other regular course offerings. Topics vary every year. This course may be taken more than once. Student participation includes presentations to the class on agreed upon topics. Class 1, Credit 1

1051-803 Advanced Optics Seminar III
This course covers several advanced aspects of optics and imaging that are not included in regular course offerings. Topics vary every year. The course may be taken more than once. Student participation includes presentations to the class on agreed upon topics. Class 1, Credit 1

1051-807 Hard Copy Systems
The focus is on concepts of "Imaging Systems" and system's Image Quality (IQ) metrics of concern in systems which are not discussed elsewhere in the curriculum. These will include concepts such as costs, reliability, and permanence. Two particular types of imaging systems will be covered in detail. The first, designated the "Internal Imaging System", focuses on strategies for the design and quality optimization of components internal to individual technologies. The second type of imaging system, designated the "External Imaging System", focuses on strategies for the design and quality optimization of components of an imaging chain. Class 4, Credit 4 (S)

1051-812 Medical Imaging Systems
This is an advanced graduate level course that describes existing medical imaging systems in terms familiar to imaging scientists and electrical engineers. These include impulse response, the transfer functions, and the signal to noise ratio. The course considers in detail, three different imaging modalities: Conventional projection X-Ray, CT, ultrasonic imaging, and magnetic resonance imaging. A complete system is examined piece by piece in terms of subsystems. Class 4, Credit 4 (S)

1051-816 Color Systems
This course builds on the theory and concepts presented in the Color Reproduction and Color Modeling courses to cover the key techniques utilized in device-independent color imaging systems. Topics covered include: device calibration and characterization (input, output, display), device profiles, multidimensional look-up table construction, inversion, and interpolation, gamut mapping, appearance matching, and color-management systems. Class 4, Credit 4 (S)

1051-840 MS Project Paper
The analysis and solution of Imaging Science Systems problems for students enrolled in Systems Capstone option. Credit 1

1051-890 Research & Thesis
Thesis (MS) or dissertation (Ph.D.) based on experimental data obtained by the candidate for an appropriate topic as arranged between the candidate and the research advisor. Credit 1-9 (MS); Credit 1-24 (Ph.D.)

National Technical Institute for the Deaf

T. Alan Hurwitz, Dean

The National Technical Institute for the Deaf is the world's largest technological college for deaf students. Among RIT's more than 14,000 full- and part-time students are more than 1,100 deaf students from the United States and other countries. Within NTID, students can choose from more than 23 fields of study to earn diplomas and associate degrees. Hearing students may pursue an associate degree in educational interpreting from NTID. Or students may choose from more than 200 technical and professional courses of study to pursue bachelor's or master's degrees through RIT's other seven colleges.

Master of Science Degree in Secondary Education of Students Who Are Deaf or Hard of Hearing

Gerald C. Bateman, Director, 716-475-6480 (voice/TTY)

The National Technical Institute for the Deaf offers a graduate program leading to the master of science degree in secondary education of students who are deaf or hard of hearing. The unique program prepares professionals to meet the national need for excellent teachers of secondary students who are deaf or hard of hearing. The program's purpose includes the preparation of teachers not only as effective practitioners but also as leaders in the profession.

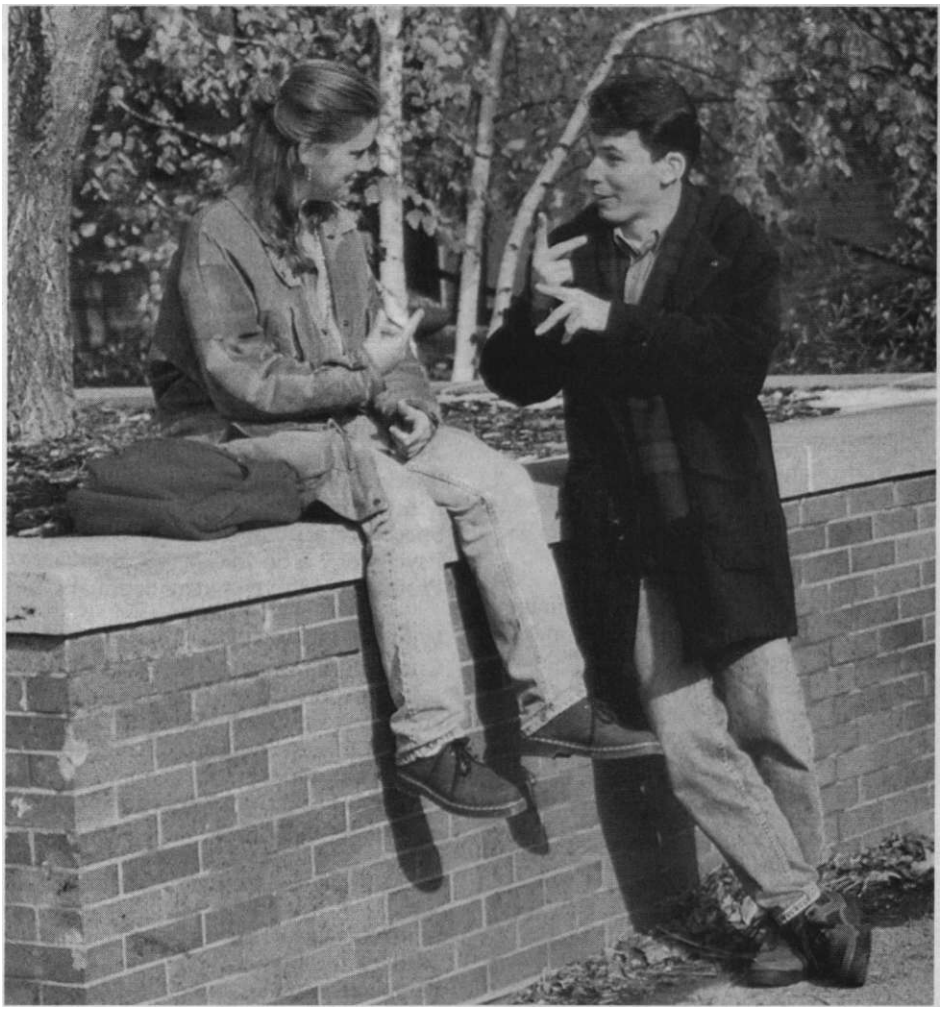
NTID is a logical home for this innovative program. Faculty members are international leaders in research and the art of teaching in the education of deaf people. A carefully designed system of faculty advisement is a prominent feature of this program. On-campus facilities, state-of-the-art technology and a well-established system of educational access services combine to make this a vital program for both deaf and hearing students who desire careers as professional educators of deaf students.

Graduates of teacher education programs at RIT have a 95 percent pass rate on the New York State Teacher Certification Examination.

Admission guidelines

Admission to the program is based on the following criteria:

- Successful completion of the baccalaureate degree at an accredited college or university
- Cumulative grade point average of 3.0 or above
- Either a score of 550 or better on the Test of English as a Foreign Language (TOEFL) or a score of 80 or better on the Michigan Test of English Proficiency (if English is not the applicant's first language)
- Prerequisite course work: a 36-semester-hour concentration of college-level credit in a secondary academic subject recognized for certification by New York State. Secondary academic subjects include English,



More than 1,100 deaf and hard-of-hearing students are enrolled at NTID.

PROGRAMS

MASTER OF SCIENCE

Secondary Education of Students Who Are Deaf or Hard of Hearing

mathematics, social studies or science.
Note: In science, at least 18 semester hours of the 36-semester-hour total must be in the specific science area (biology, chemistry, physics or earth science).

- Completion of the intensive summer sign language program at NTID or its equivalent from another college or university
- Evidence of professional commitment and potential for success in the program: letters of reference and an expository essay
- An individual interview

Costs

On the date of publication, the 2001-2002 tuition for students pursuing a master of science degree in secondary education of students who are deaf or hard of hearing is:

Domestic

- Full time (12-18 credit hours)—$2,236 per quarter
- Part time (11 credit hours or less)—$248 per credit hour

International

- Full time (12-18 credit hours)—$4,472 per quarter
- Part time (11 credit hours or less)—$496 per credit hour

Course number and title		Credits
0835-711	Contemporary Issues in Education	4
0835-712	Curriculum Content & Methods of Instruction	4
0507-701	History of American Educational Thought & Practice	4
0835-790	Foundations of Educational Research	4
0515-701	Cultural Diversity in Education	4
0886-199	American Sign Language I	4
0886-200	American Sign Language II	4
0835-721	Structure of American Sign Language	4
0835-724	English Language Development	4
0835-701	Psychology & Sociology of Adolescence	4
0835-722	Audition & Spoken Language: Applications in Education	4
0835-723	Language Acquisition & Variation	4
0835-820	Perspectives on Teaching Deaf & Hard-of-Hearing Students	2
0835-702	Deaf Students: Educational & Cultural Diversity	4
0835-705	Political/Legal Environment	4
0835-713	Assessment	4
0835-860	Student Teaching I	10
0835-861	Student Teaching II	10
0835-880	Master's Project Seminar	2
0835-890	Master's Project	8
0835-898	Special Topics Professional Development Seminars	Variable Credit 0
	Total Credits	92

The courtyard outside the Lyndon Baines Johnson Building is a popular place to enjoy the sunshine between classes.

Proposed plan of study

First Year

FALL QUARTER
Contemporary Issues in Education
American Sign Language I
Special Topics: Introduction to Language & Communication
Special Topics: Educational Audiology
Psychology & Sociology of Adolescence
Professional Development Seminars

WINTER QUARTER
Curriculum Content & Methods of Instruction
American Sign Language II
Special Topics: Spoken Language in the Educational Context
History of American Educational Thought & Practice
Language Acquisition & Variation
Professional Development Seminars

SPRING QUARTER
Student Teaching I
Perspectives on Teaching Deaf & Hard-of-Hearing Students

Second Year

FALL QUARTER
Assessment
Foundations of Educational Research
English Language Development
Deaf Students: Educational & Cultural Diversity
Professional Development Seminars

WINTER QUARTER
Master's Project Seminar
Student Teaching II

SPRING QUARTER
Master's Project
Political/Legal Environment
Cultural Diversity in Education
Structure of American Sign Language
Professional Development Seminars

Degree requirements

Course work will require a minimum of seven quarters. Students must take a minimum of 94 quarter credits in areas related to deaf studies and education, including 20 credit hours of student teaching. A cumulative GPA of at least 3.0 must be maintained. Before graduation, students must demonstrate proficiency in sign language at the Intermediate Plus level rating of the Sign Communication Proficiency Interview (SCPI).

Graduate Faculty National Technical Institute for the Deaf

John A. Albertini, BA, Drew University; MS, Ph.D., Georgetown University—Professor
Baldev Kaur Khalsa, BA, M.Ed., Western Maryland College—Assistant Professor
Gerald C. Bateman, BS, MS, SUNY College at Geneseo; Ed.D., University of Rochester—Associate Professor; Director, MSSE
Joseph Bochner, BA, CUNY Queens College; MA, Ph.D., University of Wisconsin—Associate Professor
Paula Brown, BA, University of Missouri, Columbia; MA, Kent State University; MS, Ph.D., University of Rochester—Associate Professor
Karen Christie, BS, M.Ed., Lewis and Clark College; Ph.D., University of Pittsburgh—Assistant Professor
Kathleen E. Crandall, BA, MA, California State University at Fresno; Ph.D., Northwestern University—Associate Professor
Patricia A. **DeCaro,** BA, Earlham College; MS, SUNY College at Brockport
Judy C. Egelston-Dodd, BS, MS, SUNY Albany; Ed.D., SUNY Buffalo—Professor
Susan Fischer, AB, Radcliffe College; Ph**.D.,** Massachusetts Institute of Technology—Professor
Susan Foster, BA, Northwestern University; BS, University of Maine; M.Ed., Bridgewater State College; Ph.D., Syracuse University—Professor
T. **Alan Hurwitz,** BS, Washington University; MS, St. Louis University; Ed.D., University of Rochester—Dean, NTID; Professor
Ronald Kelly, BS, M.Ed., Ph.D., University of Nebraska at Lincoln—Associate Professor
Peter A. Lalley, BS, Siena College; MS, Catholic University of America; Ph.D., SUNY Buffalo—Professor; Director, Center for Baccalaureate and Graduate Studies
Harry G. **Lang,** BS, Bethany College; MS, Rochester Institute of Technology; Ed.D., University of Rochester—Professor
Jeffrey E. Porter, B.Ed., M.Ed., University of Virginia; Ph.D., Washington University—Associate Professor
Marvin C. Sachs, BS, MA, Ed**.D.,** University of Rochester—Associate Professor
J. Matt Searls, BA, MA, Gallaudet University; Ph**.D.,** American University—Assistant Professor

NTID's master of science degree in education of students who are deaf or hard of hearing prepares graduates to teach in both schools for the deaf and public high schools.

Nora Shannon, BS, Nazareth College; MS, Canisius College—Coordinator of Student Teaching, MSSE; Assistant Professor
Donald G. Sims, BA, University of Colorado; MS, Ph.D., University of Pittsburgh—Associate Professor
Michael S. Stinson, BA, University of California at Berkeley; MA, Ph.D., University of Michigan—Professor

Note: Prerequisites are within parentheses at the end of the course description.

Secondary Education of Students Who Are Deaf or Hard of Hearing

0835-701 Psychology & Sociology of Adolescence
The purpose of this course is to examine the psychological and social development of adolescents. The ways that family, school and community affect the adolescent's development, including effects on cognitive processes, identity formation and peer relationships, are considered. Psychological and sociological perspectives on the adolescent experience in general are used to provide a framework for understanding the development of deaf adolescents. Educational implications of the theories and research presented are discussed. Credit 4

0835-702 Deaf Students: Educational and Cultural Diversity
This course introduces the concepts underlying cultural anthropology and uses a cross-cultural approach to examine issues that include transmission and preservation of culture, cultural change and transformation, concepts of marginality, and majority and minority cultures. Deaf culture is examined and compared with other cultures, using comparative studies and cultural constructs such as norms, values and beliefs. The relationship between education and culture is discussed, and the nature of this relationship with respect to Deaf culture is studied. Credit 4

0835-705 Political/Legal Environment
The relationship of the goals and processes of deaf education to those of special education and education in general is explored. The course provides a detailed examination of historical and current demographic, economic, political, legal and social trends that affect the education of deaf and hard-of-hearing students. Current federal and state legislation affecting students with disabilities is analyzed and critiqued. Credit 4

0835-711 Contemporary Issues in Education
The purpose of this course is to introduce and discuss the issues and problems related to education in general. The approach is survey in nature as certain topics are covered in more depth in subsequent courses. The topics may include (but are not limited to) the following: the impact of society on education, current trends and issues in education (such as bilingual/bicultural education), inclusion, the purposes of education, empowerment of students, learning theories, governance and curriculum, and history of the education of deaf students. Classroom observations in schools serving deaf and hard-of-hearing students are required. Credit 4

0835-712 Curriculum Content & Methods of Instruction
Note: There are actually four discipline-specific courses here, designated by section: 01 (English), 02 (Mathematics), 03 (Science) and 04 (Social Studies). Students will take only the section focusing on the content area in which they will be certified. Descriptions of all four sections follow.

Section 01 English
This course examines issues and methods related to teaching English at the secondary level to students who are deaf or hard of hearing. Students investigate and analyze current approaches to curriculum, instruction and materials in the area of English instruction through readings, observations and seminars. Students design content area projects to demonstrate a variety of methodological philosophies. (Contemporary Issues in Education) Credit 4

Section 02 Mathematics
This course examines issues and methods related to teaching mathematics at the secondary level to students who are deaf or hard of hearing. Current instructional methods, curriculum and professional resources in mathematics are studied through seminars, readings, special projects, observations and work with content-area specialists and teachers in secondary-level mathematics courses. (Contemporary Issues in Education) Credit 4

Section 03 Science
This course examines issues and methods in teaching secondary level science to deaf and hard-of-hearing students, including the selection, modification, and use of curriculum materials in science. Discussions will be concerned with instructional strategies, classroom management, cognitive development, testing and evaluation, lab report writing and theories of science teaching. Students will be required to observe teachers in secondary level science courses. (Contemporary Issues in Education) Credit 4

Section 04 Social Studies
This course examines issues and methods related to teaching social studies at the secondary level to students who are deaf or hard of hearing. Through seminars, readings, special projects, and work with content area specialists/teachers, current instructional methods, curriculum and professional resources in social studies are examined. Students will be required to observe teachers of secondary level social studies courses at public schools, residential schools for deaf students or in mainstream programs. (Contemporary Issues in Education) Credit 4

0835-713 Assessment
This course addresses assessment as a process involving the choice and interpretation of assessment measures to diagnose the need for and aid in planning for services, referrals and placement of secondary students who are deaf and hard of hearing, including students with other secondary disabilities. The respective roles of the classroom teacher, school psychologist, parents and support service providers are addressed. Assessment and educational planning for a student are viewed from an ecological perspective, including the family, the school, the community, the support services and the legal systems. This course also addresses the development and interpretation of assessment measures of learning through teacher-made, criterion-referenced, curriculum-based and norm-referenced methods. Credit 4

0835-721 Structure of American Sign Language
This course concentrates on the linguistic structures of American Sign Language (ASL). Students examine all levels of structure from phonology (sublexical) through morphology and syntax to semantics and discourse. ASL structures will be elucidated through comparison and contrast with English and other spoken languages or dialects, as well as with other sign languages. ASL literacy, language variation and code switching in the deaf population are also examined. Credit 4

0835-722 Audiology & Spoken Language: Applications in Education
This course focuses on the ways individuals comprehend and produce spoken English. It provides a functional understanding of auditory physiology, speech perception and deafness, hearing aids and other assistive listening devices. Procedures for audiological and speech/language assessment are examined with their implications for auditory training, speechreading and speech/language instruction. Models of collaboration among teachers, speech/language pathologists and audiologists to enhance students' communication using spoken English are discussed and observed. (Prerequisite or taken concurrently: Psycholinguistics and Sociolinguistics of Deafness) Credit 4

0835-723 Language Acquisition & Variation
This course is designed to familiarize students with the processes involved in learning English with a focus on reading and writing. The course concentrates on those aspects of English language development that pertain to teaching deaf and hard-of-hearing students in grades 7 to 12. Students investigate deaf learners' attainments in reading and writing, patterns of English language performance observed in deaf learners, relationships between spoken and written English performance, bilingual/bicultural issues related to English learning and use, second language teaching strategies, and reading and literacy questions. (0835-721, Structure of ASL) Credit 4

0835-724 English Language Development
This course is designed to familiarize students with the processes involved in learning English with a focus on reading and writing. The course concentrates on those aspects of English language development that pertain to teaching deaf and hard-of-hearing students in grades 7 to 12. Students investigate deaf learners' attainments in reading and writing, patterns of English language performance observed in deaf learners, relationships between spoken and written English performance, bilingual/bicultural issues related to English learning and use, second language teaching strategies, and reading and literacy questions. (Psycholinguistics and Sociolinguistics of Deafness) Credit 4

0835-790 Foundations of Educational Research
This course is an introduction to research and inquiry in education. Perspectives on and issues related to research in the education of people who are deaf and hard of hearing are examined. Students are introduced to the research process, including design, theoretical perspectives, methods of data collection, validity/reliability, data analysis and interpretation. Students leave this course with a preliminary proposal for the master's thesis or project. Credit 4

0835-820 Perspectives on Teaching Deaf & Hard-of-Hearing Students
This course reviews fundamental principles of teaching and learning in light of the recently completed student teaching assignment. Students analyze examples of theoretical applications in teaching this class and from viewing videotapes of their actual lessons used during the student teaching experience. Students propose a plan for change and skill development. (Student Teaching I) Credit 2

0835-860 Student Teaching I
This first practicum consists of 10 weeks (250 hours) of teaching and observation. Student teachers are placed with cooperating teachers in residential schools for the deaf. Students develop lesson and unit plans and teach in the content area in which they plan to receive New York State certification. (Contemporary Issues in Education, Curriculum Content and Methods of Instruction, Psychology and Sociology of Adolescence, Structure of ASL, Psycholinguistics and Sociolinguistics of Deafness, and Audiology and Spoken Language in Education) Credit 10

0835-861 Student Teaching II
This is an eight-week practicum done in conjunction with an itinerant or resource room cooperating teacher at the middle or secondary level in a mainstream setting with students who are deaf or hard of hearing. Students develop and deliver support for instruction, participate in student assessment, and, where appropriate, prepare lesson plans and teach to specific IEP objectives. (Student Teaching I, Assessment, Perspectives on Teaching Deaf and Hard of Hearing Students) Credit 10

0835-880 Master's Project Seminar
Students finalize their thesis/project proposal and begin research and development. Students also finalize the selection of their thesis/project adviser. Format for the seminar is full group meetings in the early part of December followed by individual or small group consultation with thesis/project advisers. (Foundations of Educational Research) Credit 2

0835-890 Master's Project
This is the capstone experience of the master's degree program. Students must submit an acceptable project proposal in order to enroll. Project development, presentation, and/or reporting or research and the preparation of the written thesis are completed in this course. Credit 8

0835-898 Special Topics
Special topics courses will be developed based on student interest and demand as well as faculty interest and availability. They may include electives in speech, audiology and comparative linguistics, among others. Credit variable

0886-199 American Sign Language I
Designed for students who have no previous knowledge of American Sign Language. ASL I includes the linguistic features, cultural protocols and core vocabulary for students to function in basic ASL conversations that include ASL grammar for asking and answering questions while introducing oneself; exchanging personal information; talking about family, friends and surroundings; and discussing activities. Classroom and lab activities include practicing conversations and videotaping. (SIPI/LCBQ:1) (Humanities) Class 4, Credit 4 (F, W, S)

0886-200 American Sign Language II
This course focuses on continued development of conversational fluency in ASL. Students learn to accurately recognize and produce ASL with appropriate nonmanual behaviors and grammatical features. (American Sign Language I) Credit 3

0507-701 History of American Educational Thought & Practice
A historical analysis of change and continuity in American educational history from colonial through contemporary America. Special emphasis on the leading historiographical aspects of American educational history and on enabling the student to acquire mastery of the relevant bibliography. Lectures, seminars and readings offer comprehensive coverage of the salient intellectual themes and a chronological structure to mark the significant educational developments in particular periods-e.g., the Progressive Era, the 1920s and '30s and post-World War II changes. Course structure: lectures, seminars, readings from multiple paperbacks and class handouts, essay exams and critique. Credit 4

0515-701 Cultural Diversity in Education
This course is designed to lay the foundation for the introduction of a broad multicultural perspective in education. Such perspective will include the examination of cultural differences of various ethnic groups and the role schools play in addressing the questions of interpretation, ability groupings, home environments, equality of opportunity and equality of outcome. Also analyzed are ways in which the school may act as a cultural transmitter and the teacher as cultural mediator. Different forms of school organizations will be compared, as in the public vs. private dimension. The functionalist theoretical approach will be presented, as well as the conflict perspective, to frame the discussion and analysis of opposing sociological systems of thought. The course attempts to understand how role expectations are actually carried within the school system and how its different actors react to technical as well as value constraints. Credit 4

Professional Development Seminars
Variety of topics: second-year students present research topics and ideas to all program faculty and students; child abuse and substance abuse; the code of ethics for interpreters; using educational support personnel effectively; identifying and using community resources. No credit

Online Learning and Executive Education

Online Learning

Rochester Institute of Technology is a recognized leader in delivery of online asynchronous education. Since the late 1980s, RIT has been experimenting with online education delivery, and in 1991, RIT began offering full degrees through distance delivery.

RIT offers eight full graduate degrees and three graduate certificates, all of which can be earned without ever coming to campus. Including graduate and undergraduate courses, RIT offers more than 300 courses online annually. Students are encouraged to select and apply to their chosen academic program, but may enroll in courses prior to matriculation into a program.

All courses are taught using Internet and Web-based technologies. Students must have full Internet access, a computer, VCR and monitor, and a telephone to participate in courses. Not all courses use the same technologies; some will take advantage of toll-free phone conferences; while others use text-based chat; others utilize CD-ROMs; some have Web-based simulations, and some require additional software to complete course requirements. All courses use asynchronous Internet/Web-based tools for the fundamental class structure.

Students have full access to customer and technical support through toll-free phone numbers and e-mail. Online learners also have full access to the library and library services. Other online services include registration, access to student records, bookstore orders, and academic advising. Registration can also be accomplished through touchtone phone and fax. Upcoming quarterly schedules can be found on the Web at http://online.rit.edu. Once registered, students receive orientation information, including access to registered student pages at http://learn.rit.edu. Online learning offers most students the flexibility to learn on their own time, when and where it best meets their needs.

All courses offered online meet the same rigorous objectives set for traditional classroom experiences. Faculty who teach online courses often teach the same class in a traditional format.

However, just as each professor establishes the learning outcomes for a traditional course, their individual styles will be present in the online classroom. Most classes establish either a weekly schedule for learning activities or a project-based learning approach where deliverables are due after certain learning outcomes are accomplished. These may include team-based projects, required asynchronous discussion, or computer programs. Most classes also include various readings either from textbooks or electronic reserves. Students interact online with other students to exchange ideas and collaborate much like they would face-to-face.

RIT online learning serves students throughout the United States and in some 40 different countries. Those living near Rochester can choose to take both online and traditional courses as a way of increasing flexibility and remaining on target to complete a degree.

For more information, contact:
RIT Online Learning
91 Lomb Memorial Drive
Rochester, NY 14623-5603
http://online.rit.edu
1-800-call RIT

Online Graduate Programs:

Master's Degrees

- Applied Statistics (page 62)
- Cross-Disciplinary Professional Studies (page 20)
- Environmental Health and Safety Management (page 7)
- Graphic Arts Publishing (page 89)
- Health Systems Administration (page 19)
- Imaging Science (**Page** 114)
- Information Technology (page 10)
- Microelectronics Manufacturing Engineering (page 60)
- Software Development and Management (page 9)

Advanced Certificates

- Health Systems (see page 20)
- Health Systems Finance (see page 20)
- Statistical Quality (see page 62)

Executive Education

RIT offers a number of graduate degree programs designed specifically for working professionals looking for a flexible option to complete a graduate degree. These programs are targeted to working professionals and offer non-traditional and time-shortened options for degree completion.

The College of Applied Science and Technology offers five Executive Leader graduate programs that allow career professionals to pursue a master's degree with minimal interruption. By combining summer sessions, distance learning, independent study, and credit for selected work experience and significant professional accomplishments. Executive Leader programs allow students to earn a degree in about 15 months. These accelerated MS degree programs are developed for practicing mid-level managers and for executives who hold a bachelor's degree and a minimum of five years experience in the field. Programs include:

- **(MS) Hospitality-Tourism Management** **(see page 13)**
- **(MS) Human Resource Development** (see page 16)
- **(MS) Instructional Technology** (see page 17)
- **(MS) Packaging Science** (see page 12)
- **(MS) Service Management** (see page 15)

Our College of Business Executive Programs are designed to meet the needs of emerging executives—especially technical and functional specialists interested in improving their organization's customer satisfaction, product quality, and organizational productivity. The following options are available:

- **(EMBA) Executive Master of Business Administration**

  A general management program for executives with extensive work experience. This program can be completed on alternating weekends in a two-year time frame (see page 43).

- **(MS) Master of Science in Manufacturing Management & Leadership**

  A joint program with the College of Engineering that focuses on the cross-functionality of business and manufacturing in the manufacturing environment. Students attend part time and complete the program in two years (see page 44).

- **(MS) Master of Science in Product Development**

  A joint program with the College of Engineering that focuses on the management processes of bringing new products to market. Classes are held one day per week over a two-year time frame (see page 45).

Admission

Decisions on graduate selection are made by the college offering the program. Correspondence between the student and the Institute will be conducted through the Office of Graduate Enrollment Services, according to the following policies and procedures:

1. Inquiries about, and applications for, graduate study are directed to the Office of Graduate Enrollment Services, Rochester Institute of Technology, Bausch & Lomb Center, 58 Lomb Memorial Drive, Rochester, New York, 14623-5604.
2. The Office of Graduate Enrollment Services will acknowledge the inquiry or application, instructing the student as to the information required for admission by the school or department to which he or she is applying.
3. Once a student has made formal application, the Office of Graduate Enrollment Services will prepare an applicant file for him or her. All correspondence and admission data will be collected by the Office of Graduate Enrollment Services and placed in the applicant's file. The file will include an RIT application, previous college records, applicable test scores, two letters of recommendation and other documents that may support admission of the candidate.
4. When all relevant admission data has been received, the applicant's file will be sent to the appropriate school or department for action.
5. When the school or department has made a decision on the application, this decision and the applicant's file will be returned to the Office of Graduate Enrollment Services.
6. The Office of Graduate Enrollment Services will notify the student of the admission decision.
7. Academic departments may informally advise nonmatriculated students, but no formal program of study can be approved prior to matriculation.
8. The formal program of study will be approved by the dean's designee (department head, coordinator or program director, etc.). This program must be followed by all students applying for admission or readmission.
9. The basic entry requirements for master's degree candidates include the completion of a four year baccalaureate degree and whatever other evidence of the applicant's potential to successfully complete graduate studies may be required by the particular college. Rare exceptions to the baccalaureate requirement can be made in the case of candidates who have demonstrated unusual competence in their field of specialization. For these exceptions the recommendation of the department chairperson or director and the approval of the appropriate dean and the Graduate Council are required.

   International applicants must demonstrate English language proficiency as part of the admission process. This is normally accomplished through submission of test scores from the Test of English as a Foreign Language (TOEFL). Minimum TOEFL scores vary by program. Most programs require a TOEFL score of 550 or higher. Upon arrival at RIT, students with English as a second language may be required to take the Michigan Test. Depending on the results, a student may have to enroll in English instruction, which will result in additional tuition cost.

   In certain cases graduate students may be admitted prior to, but conditional on, completion of the baccalaureate degree. Applicants will not be considered for admission prior to the start of the final year of undergraduate study. The student must present a final transcript covering all undergraduate study within one quarter after first registering for a graduate program.

   Graduate applicants who do not fully satisfy all admission criteria as to grades, test scores or their credentials, but do show sufficient promise to qualify for a trial period of graduate study, may be admitted on probation to the Institute. Such students must achieve a 3.0 ("B") program cumulative grade point average by the end of their first 12 quarter credit hours of graduate study. Those students who do not meet this criterion will be suspended. Responsibility for specific requirements and maintenance of the students' appropriate status rests with the student's academic department in consultation with the Office of Graduate Enrollment Services and the Registrar.
10. Evaluation of transfer credit (see p. 140) is made by the academic school or department in question (and the College of Liberal Arts).
11. RIT will admit and hire men and women; veterans; persons with disabilities; and individuals of any race, creed, religion, color, national or ethnic origin, sexual orientation, age or marital status in compliance with all appropriate legislation.

New York State immunization requirement

New York State Public Law 2165 requires that all matriculated students enrolled for six or more quarter credit hours in a term and born after January 1,1957, must provide RIT Student Health Center with proof that they have received the appropriate immunizations against measles, rubella and mumps. Immunization requirements include: two measles vaccinations at least one month apart with a live virus after January 1,1968, and after the first birthday and one vaccination each against mumps and rubella after January 1,1969, and after the first birthday. Additional information concerning the necessary documentation and where it must be sent is included with the student's acceptance packet or available from the Student Health Center.

Readmission

If a student has become inactive (has not completed a course in four quarters) or has withdrawn from RIT, Institute policy requires that the student reapply for admission as follows:

1. Students who left a graduate program with a GPA of 3.0 or better (in good standing) and will return to the program within two years of the time their last course was completed, will be readmitted to the program upon reapplication.
2. Students who left the program with a GPA of 3.0 or better and return to the program more than two years after the last course was completed must meet current admission standards upon reapplication. The program of study shall be subject to review and will be rewritten. Previous waiver and/or transfer credit may be lost and program deficiencies may need to be made up.
3. Students who leave a program with a GPA below 3.0 must meet current admission standards upon reapplication. Readmission will be based on all information, including previous graduate level work. Program requirements in effect at the time of reapplication will apply. Previous waiver and/or transfer credit may be lost and program deficiencies may need to be made up.

Expenses and Financial Aid

Costs and Payment Procedures

The Institute reserves the right to change its tuition and fees without prior notice. Nonmatriculated students are charged graduate rates for graduate courses.

Graduate costs are listed in the table on this page. In addition, any graduate student carrying more than 18 credit hours of study will be charged the full-time tuition rate plus $587/credit hour for each hour of study exceeding 18.

Room and board for full-time students for 2001-2002 will be $1,057 per quarter for a standard meal plan and $1,365 for a double occupancy room in the RIT Inn and Conference Center. A variety of housing options and meal plans are available, and costs may vary according to options selected.

An estimated cost for books and supplies ranges from approximately $500 to $2,500 per year per student. For part-time students, books and supplies will depend on the number of courses taken and may cost approximately $300 to $450 per year.

Graduate Costs

Tuition	Per Quarter	Per Year—3 Quarters
Full-time (12-18 Credit hours)	$6,976	$20,928
Part-time (11 Credit hours or less)	$587/credit hour	$587/credit hour
Student Activities Fee	$54	$162

Charges for tuition, fees, and room and board are computed on a quarterly basis; bills are mailed approximately four weeks prior to the beginning of each quarter. Payments sent by mail should be made by check, payable to Rochester Institute of Technology. Due dates for the 2001-2002 school year are as follows:

Fall Quarter—Aug. 22, 2001
Winter Quarter—Nov. 27, 2001
Spring Quarter—March 6, 2002
Summer Quarter—May 29, 2002

Students who have not participated in the early registration process for the quarter will be expected to pay the quarterly charges (tuition, fees, room and board) at the time of registration. They may pay these charges in a single payment or by the partial payment plan. Partial payments are due twice a quarter: 50 percent (plus a $25 partial payment processing fee) at the time of registration and the remaining 50 percent by the mid-quarter bill due date. A late payment fee will be assessed if the balance is not paid by the due date.

If you have questions concerning payment options, please contact Ms. Kathy Cole, RIT Bursar's Office, 716-475-2756.

IL.

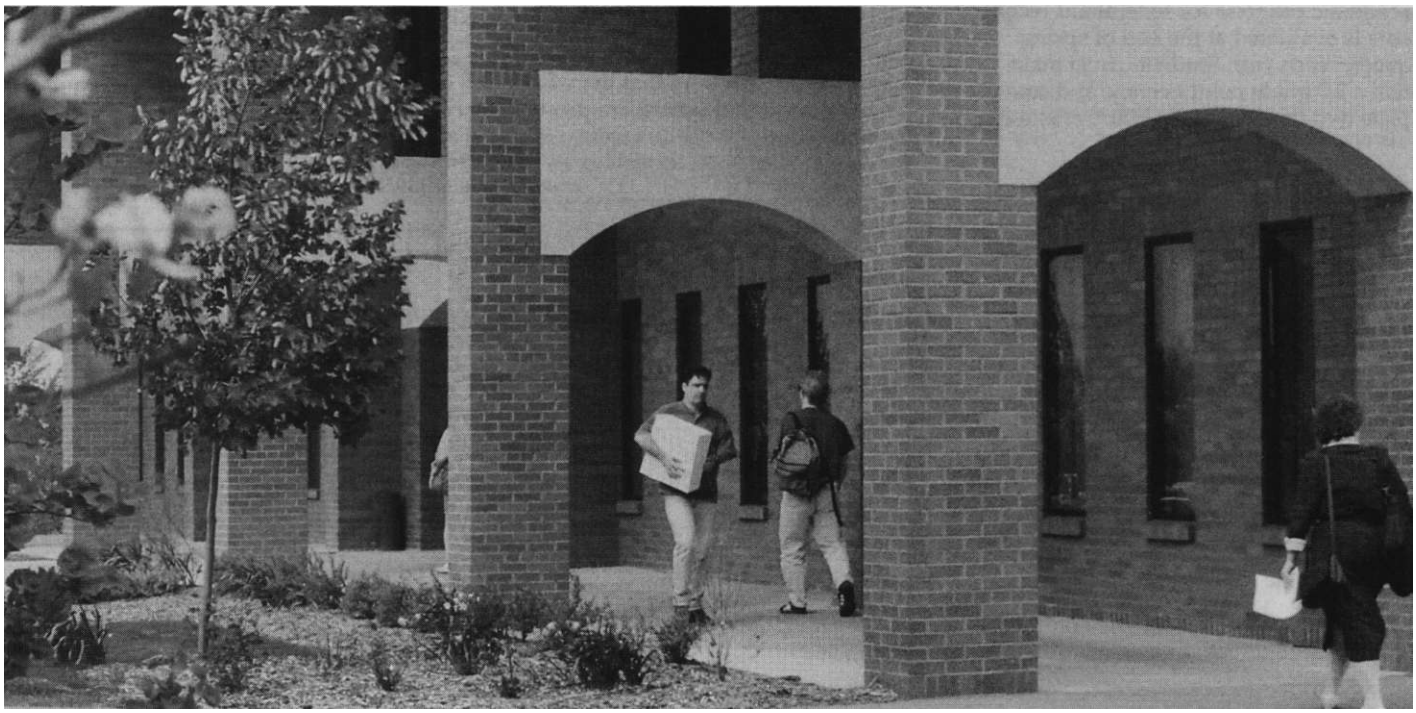
RIT Payment Options

OPTION	WHO IS ELIGIBLE	TERMS
Quarterly payment	All students	Payment in full by billing due date. Payments received after each billing due date are subject to a late payment fee.
Deferred payment plan	All students	$25 participation fee. Bill must be paid in full from prior quarter. 50% of net "out of pocket" quarterly balance due with registration. A deferred payment agreement form must be completed and submitted to the Bursar's Office on or before the start of classes. Remaining 50% due by mid-quarter bill due date. Payments received after billing due date will be assessed a late payment fee.
Monthly payment plan	Matriculated day students (full and part time)	Interest free. Account must be paid in full from prior school year. Student must submit enrollment and housing plans for upcoming academic year by May 15. Projected net annual amount due is divided into 10 monthly installments. First monthly payment due July 1 prior to school year. The minimum annual amount must be $1,000 ($100 per month). Students must be registered for a minimum of two quarters during the academic year. Applications cannot be accepted after the first day of fall quarter classes.
Company deferred payment plan	All students who have official verification of employer's tuition reimbursement practice	Account must be paid in full from prior quarter. Official verification form must be submitted quarterly in lieu of payment. Full payment for the quarter is due by mid-quarter bill due date (regardless of whether the employer has reimbursed the student). Payment received after the billing due date will be assessed a late payment fee.
Veteran payment option	All veterans who are certified for VA educational benefits by the RIT Veteran Enrollment Services Office	Account must be paid in full from prior quarter. An authorized veteran deferment form must be submitted in lieu of payment. The student pays monthly in accordance with his or her scheduled VA benefit checks.
MasterCard / Visa payment option	All students	

PAYMENT PROCEDURES

Payment should be made by check payable to Rochester Institute of Technology. Late payment fees will be assessed as follows on accounts that are past due as of each billing due date. Since there are two billings per quarter, there is a potential that two late fees (total maximum of $150) may be assessed as well.

Past Due Amount	**Late Payment Fee**
$100 through $500	$25
$500 through $1,000	$50
Over $1,000	$75



Financial Aid

Rochester Institute of Technology is interested in seeing that all students qualified for graduate study at RIT find the financial resources needed to assist with their educational expenses. The information provided here is an overview of the sources of assistance available. Please contact the offices listed for additional information.

Scholarships and assistantships are available in most graduate departments. In addition, some departments offer externally funded stipends from corporate or governmental sources. Please contact the appropriate department chairperson or the Office of Graduate Enrollment Services at 716-475-2229 for additional information.

While students can apply for these awards before matriculation, they can be awarded only to matriculated students. These awards are generally given to full-time students, but exceptions are made for qualified part-time students.

Additional sources of financial assistance include the New York State Tuition Assistance Program and various work-study and student loan programs. Please refer to the accompanying chart for details.

It should be noted that international graduate students can accept pay for work related to their program of instruction (co-op, internships, etc.). They cannot accept remuneration for jobs not related to their course work.

All federal assistance programs require submission of the Free Application for Federal Student Assistance (FAFSA). The FAFSA is available from the Office of Financial Aid, 716-475-2186. Satisfactory academic progress for federal aid recipients is evaluated at the end of spring quarter each year. Students must maintain a 2.0 grade point average and complete two-thirds of credit hours attempted each year. Federal aid eligibility is exhausted after attempting 150 percent of the number of credit hours required for the degree or certificate. In addition, loan eligibility for students with full-time equivalent status is normally limited to a maximum of four quarters.

Students receiving New York Tuition Assistance Program benefits must meet credit hour and grade point average requirements based on the number of TAP payments received at the graduate level at RIT. Course completion is defined as meeting course requirements and receiving a letter grade of A, B, C, D or F. Complete state student aid academic requirements are listed here.

Refund Policies

Advance deposits are nonrefundable. The acceptable reasons for a withdrawal with refund during the quarter are:

For a full refund

1. Active military service: A student called to active military service during the first eight weeks of the term may receive a full tuition refund. If called after the eighth week, he or she may elect to complete the course by malting special arrangements with both the instructor and department or to withdraw and receive a full tuition refund. If the student withdraws, he or she will have to repeat the course at a later date.
2. Academic reasons: Students sometimes register before grades for the previous quarter are available. If such a student later finds that he or she is subject to academic suspension or has failed prerequisites, the student will be given a full refund upon withdrawal. It remains the student's responsibility to contact his or her department to assure that the withdrawal form and refund are properly processed.
3. If students drop a course(s) during the Official Drop Period (first six days of classes during that specific quarter), they may contact the Bursar's Office for a 100% refund for the courses dropped. Courses dropped after the Official Drop Period will not result in any tuition refund.

For a partial tuition refund

A student must officially withdraw from all courses or take a leave of absence from the Institute in order to be eligible for a partial tuition refund. Students must complete a leave of absence or withdrawal form, which can be initiated with their academic department.

A partial refund will be made during a quarter if withdrawal/leave of absence is necessitated for one of the following reasons:

1. Illness, certified by the attending physician, causing excessive absence from classes.
2. Withdrawal for academic or disciplinary reasons at the request of the Institute during a quarter.
3. Transfer by employer, making class attendance impossible.
4. Withdrawal for academic or personal reasons at the request of the student, approved by the student's adviser or department representative, the Institute Coordinator for Academic Advising and the Bursar.

Students withdrawing from the Institute must complete a withdrawal form to initiate the refund process. Refunds will be made according to the following schedule.

During the first week of classes—100% tuition reduction
During the second week of classes—70% tuition reduction
During the third week of classes—60% tuition reduction
During the fourth week of classes—50% tuition reduction
During the fifth week of classes—25% tuition reduction

Any student who intentionally defrauds or attempts to defraud the Institute of tuition, fees or other charges or who gives false information in order to obtain financial aid is subject to legal liability, prosecution and Institute disciplinary action.

Standard of Satisfactory Progress for the Purpose of Determining Eligibility for State Student Aid

Graduate Degree—Quarter System

Before being certified for this payment	1st	2nd	3rd	4th	5th	6th
A student must have accrued at least this many credits	0	12	24	36	48	60
With at least this cumulative grade point average	0	2.00	2.50	2.70	2.80	2.90

Graduate Student Financial Assistance Summary, 2001–2002*

PROGRAM	ELIGIBILITY	AMOUNT	WHERE TO APPLY
Grants! Scholarships			
Graduate Assistantships	Varies based on academic excellence	Varies	Contact your academic department at RIT for additional information.
Graduate Scholarships	Varies based on academic excellence	Varies	Apply for scholarship by checking the appropriate box on the Admissions application packet. Contact your academic department at RIT for additional information.
New York State Tuition Assistance Program (TAP)	Matriculated graduate students attending full time who meet New York State residency and income requirements	"Based on net taxable income. Awards range from $75 to $550.	Applicants must file the Free Application for Federal Student Aid (FAFSA) and the application form provided by N.Y. State.
Bureau of Indian Affairs Higher Education Program Fellowships	Full-time students recognized by Secretary of the Interior as members of an Indian tribe and demonstrating financial need	Varies	Contact American Indian Graduate Center, 4520 Montgomery Blvd. NE, Albuquerque, NM 87109, for application information.
AAHANA Graduate Scholarship	Awarded to African American, Hispanic American and Native American full-time matriculated graduate students demonstrating financial need and academic achievement	Up to $1500 per academic year	File FAFSA by March 15.
Loans			
Federal Direct Subsidized Loan	Students attending at least half time (6 credit hours) and who meet the financial eligibility requirements established by the federal government	Maximum loan is $8,500 per year. Aggregate total cannot exceed $65,500 for undergraduate and graduate work.	Applicants must file the Free Application for Federal Student Aid (FAFSA).
Federal Direct Unsubsidized Loan	All graduate students attending at least half time. Loans cannot exceed cost of education minus other financial aid.	Maximum loan is $10,000 per year. Aggregate limit is $73,000, including undergraduate loans.	Applicants must file the FAFSA.
Federal Perkins Loan	Full-time students who meet financial need requirements established by the federal government	Typically $1,000-$2,200 Limited funding is available for this program. Aggregate limit is $30,000, including undergraduate loans.	File FAFSA by March 15.
Private Lender Loans	Students may apply; subject to normal credit review guidelines. Variable interest rates	Up to the cost of education less other financial aid; subject to lender review	Information and applications are available from the Office of Financial Aid, 56 Lomb Memorial Drive, Rochester, N.Y. 14623-5604.
Work			
Federal College Work-Study Program	Students who meet financial need requirements as established by the federal government	Varies depending on hours and wage rate	File FAFSA by March 15.
Institutional Employment	Full-time students	Varies depending on hours and wage rate	Student Employment Office at RIT

* *Information is accurate as of August 2001. Additional information covering federal financial aid programs is provided in U.S. Department of Education Student Guide. Contact RIT Financial Aid Office to request a copy.*

** *TAP award amounts are dependent upon action in the New York State budget.*

Sixth and subsequent weeks—
No tuition reduction

Note: Nonattendance does not constitute an official withdrawal.

A student is not "officially withdrawn" until he or she receives the student's copy of the withdrawal form. The date on which a withdrawal form is properly completed shall be the date of "official withdrawal" used to determine the refundable amount. If a student drops his or her course load from full-time (12 or more credits) to part-time (less than 12 credits) status during the Official Drop Period, he or she may contact the Bursar for a refund based on the difference between the full-time tuition payments and the total per-credit-charge for the part-time load.

No refund will be made for classes dropped after the Official Drop Period unless the student is officially withdrawing from the Institute.

Room and board

To complete a withdrawal from RIT, a resident student or a nonresident student on a meal plan must check out with Residence Life located in Grace Watson Hall and/or the Food Service Administrative Office, A520 Union. Refunds, when granted, are from the date of official check-out.

1. RIT Inn and Conference Center
   a. During the first week of classes—90% of unused room charge
   b. During the second week of classes—75% of unused room charge
   c. During the third week of classes—60% of unused room charge
   d. During the fourth week of classes—50% of unused room charge
   e. Fifth and subsequent weeks—no refund
2. Board
   a. During the first four weeks—75% of unused board charge
   b. After the first four weeks—50% of the unused board charge
   c. During the last two weeks of classes—no refund

Appeals process

An official appeals process exists for those who feel that individual circumstances warrant exceptions from published policy. The initial inquiry in this process should be made to Richard B. Schonblom, Bursar.

Financial Aid Refund Policy

Return of Federal funds

In accordance with Federal regulations, the Office of Financial Aid calculates quarterly Federal aid eligibility for students who withdraw, drop out, are suspended, or take a leave of absence prior to completing 60 percent of a quarter. "Withdrawal date" is defined as the actual date the student initiated the withdrawal process, or the student's last date of recorded attendance, or the midpoint of the quarter for a student who leaves without notifying the institution. Recalculation is based on the percent of earned aid using the following formula: number of days completed up to the withdrawal date/total days in the quarter. Aid returned to Federal programs is then equal to (100 percent minus the percentage earned) multiplied by the amount of Federal aid disbursed.

Funds are returned to the Federal government in the following sequence: Federal Direct Unsubsidized Loans, Federal Direct Subsidized Loans, Federal Parent Loans, Federal Perkins loans, Federal Pell grants, Federal SEOG, other Federal aid.

Late disbursement

If the student is otherwise eligible, the first disbursement of Federal Direct Subsidized Loan or Federal Direct Unsubsidized Loan proceeds is allowed up to 90 days after the student has ceased to be enrolled. Subsequent disbursements are not allowed.

State scholarships

Regulations vary. Any adjustments are done in accordance with the specific requirements of the sponsoring state.

Privately funded grants and scholarships

In the absence of specific instructions from the sponsor, 100 percent of the quarterly award will be credited to the student's account.

RIT grants and scholarships

If a credit balance remains after all federal, state and private adjustments, a percentage of the remaining credit balance is returned to the RIT scholarship account according to the following formula, where

A = Scholarship amount
B = Scholarship plus student payments
C = Percent returned to scholarship program
D = Remaining credit balance

$$A = \frac{C \times D}{B}$$

Registration and Degree Requirements

A graduate degree at RIT may be obtained in more than 50 programs ranging from business administration to imaging science. (Please refer to page 3 for a complete listing of graduate programs of study.)

Upon completion of the stipulated requirements, a student's academic department certifies him or her for a degree. After commencement, a statement verifying that a degree has been awarded will be posted to the transcript. Degrees for fall graduates are mailed early in winter quarter; for winter graduates, in spring; for spring graduates, in the summer; and for summer graduates, in the fall.

Registration

1. Student should complete the registration and payment process in accordance with Institute registration/billing procedures as indicated in the quarterly schedule of courses.
2. It is the responsibility of the student to advise the Registrar of any change of address.
3. RIT identification cards are required for students to use many campus facilities—e.g., the library, Student Life Center—and services, such as the meal plan and check payments at the bookstore. Identification cards are available at the Registrar's Office.
4. Students are expected to pursue their degree without a substantial break. Failure to enroll (register) for four successive academic terms can result in the loss of matriculated status. (In the case of nonregistration, the department should inform the Registrar as to whether the student should be put on nonmatriculated status or withdrawn from the program.)
5. RIT considers graduate-level students to be "full time" in every academic quarter in which they are enrolled for at least 12 credit hours. With approval of the department chair and associate provost for academic programs, additional "equivalent" credit can be granted for such activities as thesis work, teaching assistantships and internships.

Matriculation

Matriculated graduate students are those who have applied and been formally accepted into a graduate program through the Office of Graduate Enrollment Services. Such students may register for graduate-level courses (700 to 800) that fit their home department-approved programs. When registering for graduate courses outside the home department, the approval of the department offering the course may also be necessary.

Nonmatriculated students will be allowed to take graduate courses on a space-available basis with the department's approval and with the knowledge that the course work completed while a nonmatriculated student will not necessarily apply to any given academic program.

Matriculated and nonmatriculated graduate students may register for undergraduate-level courses with the understanding that these courses may not always apply to RIT graduate programs. In certain cases, where educationally sound programs will result, appropriate undergraduate courses as approved by the faculty adviser and by the department may be included in a master's program. However, not more than nine undergraduate quarter credit hours (600-level or below) may be applied toward the 45-quarter-credit minimum (12 undergraduate hours for those programs requiring 48 or more quarter credit hours). Where undergraduate work is allowed, it must be well planned and closely controlled. In the vast majority of cases, most, if not all, course work will be at the graduate (700 to 800) level.

Degree Requirements

Credit requirements

The minimum credit requirement for a master's degree is 45 quarter (or 30 semester) credit hours. At least 36 of these quarter credit hours must be earned at the graduate level and in residence at the Institute.

Transfer credit

A maximum of nine quarter credit hours in a 45-credit-hour program or 12 quarter credit hours in a 48- or more credit-hour program may be awarded as transfer credit from other institutions. A request for transfer credit must be made at the time of application for graduate student status. Only a course with a grade of B (3.0) or better may be transferred.

Transfer credits are not calculated in the student's grade point average but will count toward overall credit requirements for the degree. Transfer credits do not count in the satisfaction of residency requirements.

A graduate student who wishes to take courses at another institution and transfer them to his or her degree work at the Institute must obtain prior permission from the appropriate departmental officer or dean.

Thesis requirements

Included as part of the total credit-hour requirement may be a research, dissertation, thesis or project requirement as specified by each department. Some departments have other requirements in place of a thesis. The amount of credit the student is to receive must be determined by the time of registration for that quarter.

For the purpose of verifying credit, an end-of-quarter grade of R should be submitted for each registration of research and thesis/project/dissertation guidance by the student's faculty adviser. Before the degree can be awarded, the acceptance of the thesis/project/dissertation/project must be recorded on the student's permanent record.

Students should also note the following continuation of thesis/project/dissertation policy.

Continuation of thesis/project/dissertation*

Once work has begun on a thesis, project or dissertation, it is seen as a continuous process until all requirements are completed. If a thesis, project or dissertation is required, or such an option is elected, and if the student has completed all other requirements for the degree, the student must register for the Continuation of Thesis/Project/Dissertation course each quarter (including summer quarter). This course costs the equivalent of one quarter credit hour, although it earns no credit.

1. Registration for the Continuation of Thesis/Project/Dissertation course preserves student access to the usual RIT services; e.g., Wallace Library, academic computing and faculty and administrative support. With payment of appropriate user fees, access to the Student Life Center and Student Health Center is also preserved.
2. If circumstances beyond students' control preclude them from making satisfactory progress on their thesis/project/dissertation, they should consider taking a leave of absence and should discuss such a leave in advance with their adviser and/or department head. The dean's signature of approval is required on the Leave of Absence or Institute Withdrawal form, a copy of which also must be sent to the associate provost for academic programs.

* *The dissertation is required only of Ph.D. students.*

If students do not register for the Continuation of Thesis/Project/Dissertation course, or take an approved leave of absence, their departments may elect to remove them from the program.

3. The length of time to complete a thesis/project/dissertation is at the discretion of the department. Be sure to read, however, point 1 under "Summary of requirements for master's degree" on this page.

Candidacy for an advanced degree

A graduate student must be a candidate for an advanced degree for at least one quarter prior to receipt of the degree.

The position of the Graduate Council is that a student is a candidate for the master's degree when he or she has been formally admitted to the Institute as a graduate student.

Summary experience

The Graduate Council regards some form of integrative experience as necessary for graduate students. Such requirements as the comprehensive examination, a project, the oral examination of the thesis and a summary conference are appropriate examples, provided they are designed to help the student integrate the separate parts of his or her total educational experience. The nature of the experience will be determined by the individual college or department.

Overlapping credit for second degree

At the discretion of the Graduate Committee in the specific degree area, nine to 12 previous master's quarter credit hours can normally be applied toward satisfying requirements for a second master's degree. The use of a given course in two different programs can be allowed only if the course that was used for credit toward the first degree is a required course for the second degree. The course must be used in both programs within five years; i.e., no more than five years between time used for the first degree and applied again toward the second degree.

In no case shall less than the minimum 36 quarter credit hours of residency be accepted for the second degree. If duplication of courses causes a student to go below the 36-hour limit in the second degree program, he or she would be exempted from these courses but required to replace the credit hours with departmentally approved courses. An RIT student will not be admitted through the Graduate Enrollment Services Office to the second degree program until the first program has been completed.

Financial standing

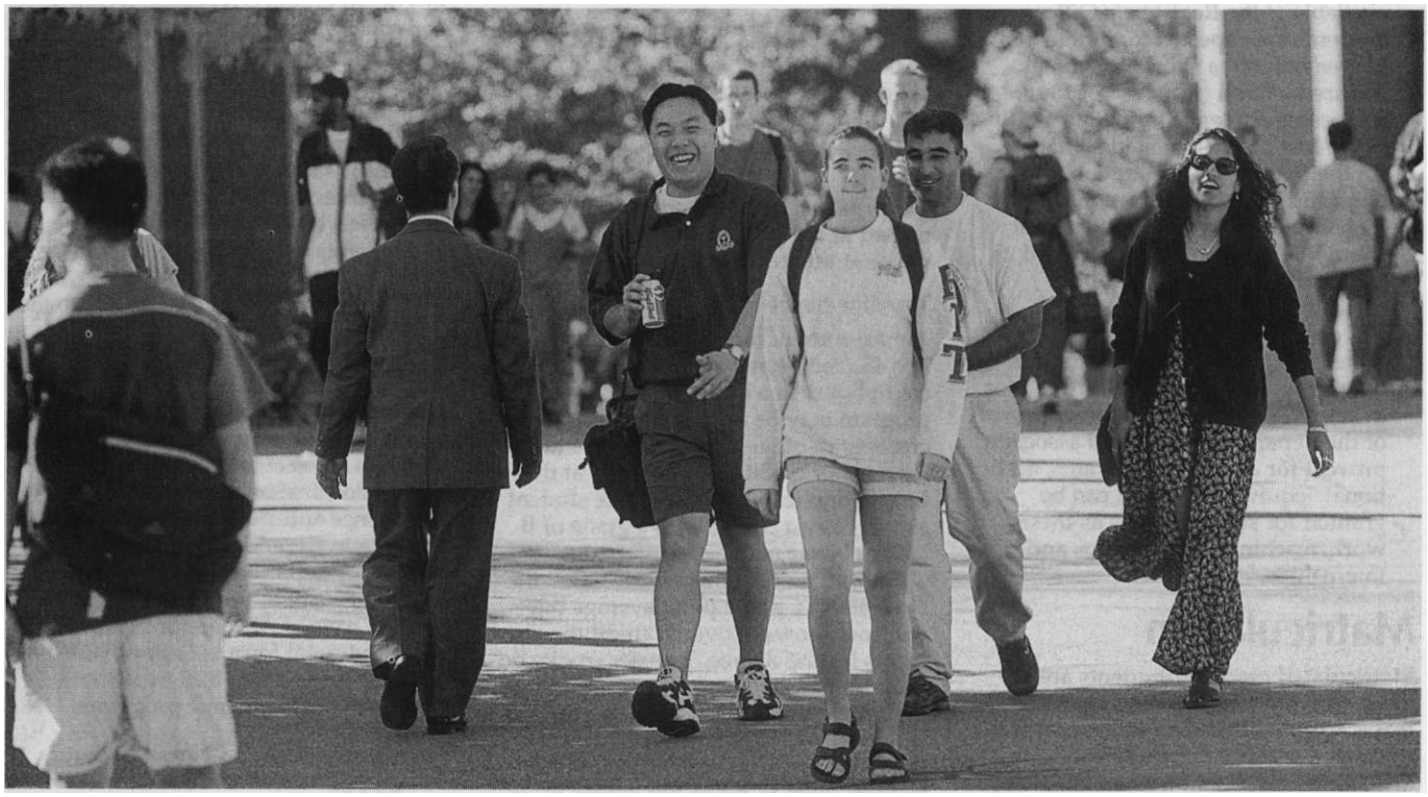
Tuition and fees paid to the Institute cover approximately 60 to 70 percent of the actual expense of a student's education. The rest of the cost is borne by the Institute through income on its endowment, gifts from alumni and friends and grants from business and industry.

Students, former students and graduates are in good financial standing when their account is paid in full in the Bursar's Office. Any student whose account is not paid in full will not receive transcripts, degrees or recommendations from the Institute.

The Institute reserves the right to change its tuition and fees without prior notice.

Summary of requirements for master's degree

1. Successfully complete all required courses of the Institute and the college. These requirements should be met within seven years of the date of the oldest course counted toward the student's program. Extension of this rule may be granted through petition to the Graduate Council.
2. Complete a minimum of 45 quarter credit hours for the master's degree. At least 36 quarter credit hours of graduate-level course work and research (courses numbered 700 and above) must be earned in residence at the Institute.
3. Achieve a program cumulative grade point average of 3.0 (B) or better.



4. Complete a thesis/project/dissertation or other appropriate research or comparable professional achievement at the discretion of the degree granting program.
5. Pay in full, or satisfactorily adjust, all financial obligations to the Institute.

Note: The dean and departmental faculty can be petitioned, in extraordinary circumstances, to review and judge the cases of individual students who believe the spirit of the above requirements have been met yet fall short of the particular requirement. If the petition is accepted and approved by the faculty, dean, and provost and vice president for academic affairs, a signed copy will be sent to the registrar for inclusion in the student's permanent record.

Definition of grades

Grades representing the students' progress in each of the courses for which they are registered are given on a grade report form at the end of each quarter of attendance. The letter grades are as follows:

A Excellent
B Good
C Satisfactory

D and F grades do not count toward the fulfillment of program requirements for a master's degree.

The grades of all courses attempted by graduate students will count in the calculation of the cumulative grade point average. This program cumulative grade point average shall average 3.0 (B) as a graduation requirement. The dean of the college or his designee must approve all applications for graduate courses a student wishes to repeat.

Quality points

Each course has a credit-hour value based on the number of hours per week in class, laboratory or studio and the amount of outside work expected of each student. Each letter grade yields quality points per credit hour as follows:

A 4 quality points
B 3 quality points
C 2 quality points
D 1 quality point

F grades count as 0 in computing the grade point average (GPA). The GPA is computed by the following formula:

$$\text{GPA} = \frac{\text{total quality points earned}}{\text{total quality hours}}$$

There are other evaluations of course work that do not affect GPA calculations. Only I and R (as described below) can be assigned by individual faculty members at the end of a quarter.

Registered (R)—a permanent grade indicating that a student has registered for a given course but has yet to meet the total requirements of the course or has continuing requirements to be met. The grade is given in graduate thesis/project/dissertation work.

Completion of this work will be noted by having the approved/accepted thesis/project/dissertation title, as received by the registrar from the department, posted to the student's academic record. Full tuition is charged for these courses. "R" graded courses are allowed in the calculation of the residency requirement for graduate programs.

Incomplete (I)—this notation is given when the professor observes conditions beyond the control of the student such that the student is not able to complete course requirements in the given quarter. This is a temporary grade that reverts to an F if the registrar has not received a change of grade directive from the professor by the end of the second succeeding quarter (including summer terms). Full tuition is charged.

Withdrawn (W)—will be assigned in courses from which a student withdraws through the end of the sixth week of classes or if a student withdraws from all courses in a given quarter.

Audit (Z)—indicates a student has audited the course. The student need not take exams, and full tuition will be charged. A student can change from credit to audit or from audit to credit status for a course only during the first six days of classes. Audited courses do not count toward the residency requirement, do not get included in GPA calculations and do not count toward degree requirements.

Credit by examination (X)—assigned for the successful completion of various external or Institute examinations provided such examinations cover or parallel the objectives and content of the indicated course. Credit must be assigned in advance for any credit received through registration for the indicated courses. "X" graded courses do not count toward the residency requirement. A maximum of 12 quarter credit hours is allowed for graduate courses.

Exceptions to the maximum transfer credit or credit-by-exam for graduate programs can be granted by the associate provost for academic programs in unusual circumstances upon appeal from the dean of the college involved.

Waived—Waived courses are those courses eliminated from the list of requirements that a student must take to graduate. For graduate students, required courses may be waived because of previously completed academic work, but in no case shall the resulting graduate program requirements be reduced below 45 quarter credit hours.

In addition, waiver credit for graduate courses can be applied only toward required, not elective, courses. The process of waiving courses and thereby reducing graduate program requirements is not to be confused with the process of exempting certain requirements that are then replaced by an equal number of credit hours in the specified program.

Changing grades—once a grade has been reported by a faculty member, it is not within the right of any person to change this unless an actual error has been made in computing or recording it. If an error has been made, the faculty member must complete the appropriate form. The completed form must be approved by the head of the department in which the faculty member teaches. When approved, the form is then sent to the registrar. There is, however, an appeal procedure for disputed grades through the Academic Conduct Committee of the college in which the course is offered. A final appeal can be sent to the Institute Hearing and Appeals Board.

Academic probation and suspension

Any matriculated graduate student whose program cumulative GPA falls below a 3.0 after 12 quarter credit hours will be placed on probation and counseled by the departmental adviser concerning continuation in the graduate program.

Those students placed on probation must raise their program cumulative GPA to the 3.0 level within 12 quarter credit hours or be suspended from the graduate program.

Should it be necessary to suspend a graduate student for academic reasons, the student may apply for readmission to the dean of the college or his designee upon demonstration of adequate reason for readmission.

Student Services

RIT offers a number of services for graduate students. The services described in the following pages are among the most frequently used.

Wallace Library

Wallace Library is a high-technology, multimedia resource center. It is a particular boon to busy graduate students, who find that its vast information resources are as close as their computers. The library's on-line menu provides access to a wide selection of up-to-date electronic resources in Web-based and text formats.

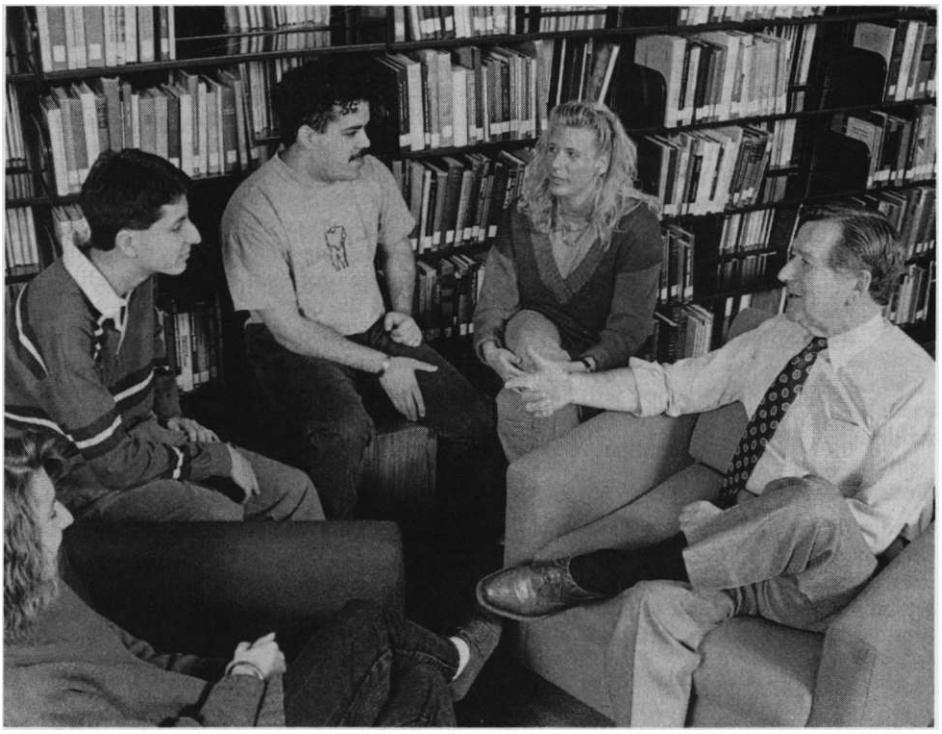
Users can access Wallace's catalog, search electronic databases and surf the Internet. The staff offers hands-on instructional sessions for using various electronic and Internet resources. Specialized class instruction can be scheduled upon request. Reference librarians are available during the week and on weekends to provide individual assistance at the reference desk. In-depth research assistance is available by appointment.

Both videotapes and DVDs can be checked out at the circulation desk. E-books, audio books, and wireless laptop computers are also available. The VAX Internet Area (VIA) provides access to graphic interface workstations, image scanning and a host of interactive CD-ROM titles. Interlibrary loan services and in-house book requests are accessed through the on-line catalog. The Center for the Visually Impaired houses an Arkenstone Reader and contains periodicals in Braille. Individual carrels and small-group rooms provide more than 1,000 study spaces.

Student artwork and photographs are exhibited in gallery areas. Outstanding student work is purchased and displayed permanently.

A unique entity within Wallace Library, the Cary Library, contains more than 14,000 volumes of rare books illustrating fine printing and other materials detailing the history of printing, book design and illustration, papermaking and other aspects of the graphic arts.

The Rochester Regional Library Council's Access program allows graduate students to obtain a library card that offers access to other area libraries, including those of the University of Rochester and the State University of New York colleges at Geneseo and Brockport.



Wallace Library offers extensive print and multimedia resources.

The latest enhancement to the library is the cafe. Java Wally's opened its doors in early 2001. Serving a wide range of beverages and treats, it has quickly become a popular gathering place for the RIT community.

The library is open more than 100 hours per week, with extended hours before and during finals. For library hours, call 475-2046 (voice); for the reference desk, call 475-2563 (voice/TTY) or 475-2564 (voice). You can e-mail the library at 610wmlref@rit.edu (RITVAX). The circulation desk can be reached at 475-2562 (voice) and 475-2962 (TTY).

Information and Technology Services

Computing services at RIT are provided by Information Systems and Computing. ITS manages a large VMSCluster (networked Digital VAX and Alpha computers), several UNIX clusters (Digital Alpha computers), a campus-wide network, dial-in access and an IBM mainframe for administrative computing. Distributed Support Services manages many computer labs. Detailed information on the systems that ITS manages and supports may be obtained from the HelpDesk. Some of the more popular features of the RIT computer facilities and network include electronic mail (used extensively by students, faculty and staff), SIS (Student Information System) and access to the Internet/World Wide Web. Many faculty have incorporated these features into their curricula, resulting in innovative and interesting courses not available elsewhere.

The use of computing systems managed by ITS is guided by the RIT Code of Conduct for Computer Use. Computer accounts are issued to students, staff and faculty so that they may perform activities supporting educational goals and internal RIT functions. Students can obtain an account at the HelpDesk or at the reference desk in the library by showing their RIT ID card. Computer account request forms may be available in campus departments or can be obtained by contacting the HelpDesk. ITS provides consulting services, seminars, problem solving and general information to users of enterprise server systems, minicomputers and microcomputers. Contact Client Support Services through the HelpDesk.

The Distributed Support Services group operates labs and smart classrooms (in cooperation with the Educational Technology Center) that are available to students for general computing use and to faculty for reserved class work. Assistants are available to

help people use the hardware and software available in the labs.

Students are urged to contact ITS staff for advice on hardware, software and networking in order to help ensure an efficient and effective campus-wide computing environment.

ITS HelpDesk

The HelpDesk is located in room 1113 in the Gannett Building. Hours for fall, winter and spring quarters:

- Mon. through Thurs.—8 a.m. to 8 p.m.;
- Fri.— 8 a.m. to 5 p.m.; and
- Sun.—noon to 8 p.m.
- Saturdays—closed

Hours for summer quarter, holidays and quarter breaks:

- Mon. through Thurs.—8 a.m. to 6 p.m.
- Fri.—8 a.m. to 5 p.m.
- Weekends—closed

Telephone: 475-4357 or 475-2810 (TTY)

Electronic media:

- E-mail: services@rit.edu
- RITMenu: ASK system
- World Wide Web: http://www.rit.edu/its

Cooperative Education and Career Services

The Office of Cooperative Education and Career Services supports the Institute's commitment to preparing students for "the making of a living and the living of a life."

Since 1912, RIT has developed one of the country's strongest co-op programs. RIT's cooperative program is the fourth oldest in the world and one of the largest. For those who desire more experience in their field, co-op is an option in several graduate programs. A co-op opportunity often leads directly to a permanent position upon graduation. Students also may find permanent positions through RIT's on-campus recruitment program or job listing service.

RIT students and alumni find the services of the Office of Cooperative Education and Career Services helpful in the job search. Individual career counseling, job search skills sessions, job listings, a resource library and on-campus interviewing provide a steady linkage between campus and the workplace.

Students entering the graduate program are encouraged to meet with their program coordinators early to begin developing their career plans. The Co-op and Career Services Office hosts frequent orientation sessions to inform students of the many services offered.

Educational Technology Center

The Educational Technology Center provides proactive service and leadership to enhance and support the educational environment at RIT. Services include media production, classroom equipment support, distance learning and the Media Resource Center. The last includes materials such as videotapes, films and audio tapes placed on reserve by faculty members for student use. There are 7,000 media items in collection and 20 viewing/listening carrels. The MRC also houses an extensive art slide library.

ETC staff members assist faculty and students in finding and preparing media for classroom presentations, club meetings or personal use. The photo and graphic design services of ETC are helpful in preparing presentations and lectures. A broad array of media technology, from projectors to teleconferencing equipment, is available for instructional support and other campus events.

ETC offices and the Media Resource Center are located on the lower level of Wallace Library. More than 60 students work in ETC, assisting with video production, photography, graphic design and office support. Individuals are invited to drop in and explore these resources. The offices are open fall through spring quarters from 8 a.m. to 10 p.m., Monday through Thursday; 8 a.m. to 5 p.m., Friday and 11 a.m. to 5 p.m. on Sunday. Hours are subject to change during break weeks and summer quarter.

Counseling Center

The RIT Counseling Center is located on the second floor of the August Center in the Hale-Andrews Student Life Center. The center offers a variety of services to hearing, deaf, and hard of hearing RIT graduate students. These include:

- Personal/Psychological Counseling
- Career Counseling
- Career Resource Center
- Discover (Computer-Assisted Career Guidance)
- Testing
- Consultation
- Referral Services

Counseling Center hours are 8:30 a.m. to 4:30 p.m., Mon. through Fri. For more information about counseling services, call 475-2261 (voice/TTY or 475-6897 TTY. Check out our Web site at http://www.rit.edu/~361www/.

Campus Ministry

RIT has long recognized the importance of spiritual growth in the development of the whole person. The Center for Campus Ministry was founded to nurture this aspect of life on campus. Members of various faith traditions work together to serve the spiritual, ethical, and personal needs of our students, faculty, and staff. A variety of services—including Christian, Muslim, Buddhist, Jewish, and Hindu—are offered. Services are also provided for deaf and hard-of-hearing individuals. The Kilian J. and Caroline F. Schmitt Interfaith Center is located on the east side of the Student Alumni Union. It houses the ministers' offices, chapels, and meeting rooms. Visit the Web page at www.rit.edu/~320www/ or call 716-475-2135 for more information.

Learning Development Center

The Learning Development Center provides individual and group instruction in efficient reading, study procedures, mathematics and writing skills. These services are available at no additional charge during regular LDC scheduled hours to all graduate students at the Institute and may be scheduled at the center, located on the second floor, north end, of the administration building.

For more information about Learning Development Center services, call 475-6682.

Student Health Center

The Student Health Center provides primary medical care on an outpatient basis. The staff includes physicians, nurse practitioners, registered nurses, health educators and an interpreter for the deaf. All services, including allergy, psychiatric and gynecological services, are available by appointment. Health education programs are provided also. The center is located on the walkway linking the academic and residential areas of campus. Students are seen by appointment, Mon. through Thurs., 8:30 a.m. to 7 p.m., and Fri., 8:30 a.m. to 4:30 p.m. Only emergencies are seen during the last half hour of each shift. Hours are subject to change and are posted.

The Institute requires students to maintain health insurance coverage, which they may purchase on their own or through RIT while enrolled.

The quarterly student health fee is mandatory for all full-time undergraduate students. Other students may pay either the quarterly fee or a fee for service. Some laboratory work ordered through the center is not covered by this fee; there is a nominal charge for this service. Prescription medicines may be purchased from local pharmacies or, for some prescriptions, from the center. The health fee does not include prescription medications.

Medical records are confidential. Information will not be released without

the student's written consent. Exceptions to this rule are made only when required by the public health laws of New York State.

Questions about the Student Health Center or health insurance should be directed to the office, at 475-2255.

RIT Ambulance

RIT Ambulance is a New York State-certified volunteer ambulance service that serves the campus community, including its adjoining apartment complexes. The organization, an auxiliary of the Student Health Center, is governed by RIT students and is staffed by emergency medical technicians. Twenty-four-hour ambulance service is available seven days a week. If, for some reason, the RIT ambulance is not available, there may be a charge for services provided by another corps.

For *emergency* assistance and/or transport, the RIT ambulance can be dispatched through Campus Safety at 475-3333 (voice) or 475-6654 (TTY).

Emergencies, Escort Service

In case of emergency, call the Institute's 24-hour emergency number, 475-3333/6654 (TTY). For routine security services, call 475-2853/6654 (TTY), which is staffed 24 hours a day.

Campus Safety strongly encourages students to use the escort service, available seven days a week. The Mobile Escort Service is available seven days a week, 11:30 p.m. to 3:45 a.m., on a timed basis. Call 475-2853/6654 (TTY), or use the blue-light courtesy call boxes located throughout the campus.

Additional information about Campus Safety services, security procedures and crime statistics can be found in the Campus Safety report, which can be obtained by calling 716-475-7799. Our services are also explained on RIT's Web site at www.rit.edu/~206www.

Identification Cards, Vehicle Registration

You will need an RIT identification card to use any campus facility. You should obtain your identification card at the time of your first registration.

For further information, call the ID office, 475-2821 (voice/TTY).

All vehicles operated on campus must be registered with Campus Safety, and stickers must be properly displayed on the inside glass on the driver's side of the vehicle as far to the rear as possible. Institute fines are imposed for operators violating parking and traffic regulations. Fines are payable at the Bursar's Office in the George Eastman Building.

Campus Stores

RIT operates two campus stores. The main store, Campus Connections, is located on the west side of the Student Alumni Union. It consists of two selling floors and is divided into 11 departments selling everything from clothing to textbooks to computers. Normal store hours are Monday through Thursday, 8:30 a.m. to 8 p.m.; Friday, 8:30 a.m. to 4:30 p.m.; and on Saturday, 11 a.m. to 4 p.m. For current information about hours and special sales, call 716-475-6033.

Campus Connections accepts cash, checks, MasterCard, VISA and RIT flexible debit cards for payment. Certain students may have arrangements with a government agency to pay for some of their books and supplies; this is handled at our service counter on the first floor. Visit our Web page at finweb.rit.edu/bookstore.

The Candy Counter in the Student Alumni Union lobby sells candy, tobacco products, health and beauty aids, daily newspapers, snack items, beverages and ice cream. The Candy Counter accepts cash, checks, MasterCard, Visa, and RIT food and flexible debit cards.

Residence Life

Serving approximately 6,000 students, RIT's campus housing offers many living options to meet the diverse needs, interests and backgrounds of RIT students.

RIT Inn and Conference Center

The RIT Inn and Conference Center offers students fully furnished double rooms with private baths. Included in each room is a TV with cable service, phone with free local service, data access, and air conditioning. Students have access to a heated indoor/outdoor pool, sauna, whirlpool, an exercise room and a laundry room. Full shuttle service to campus is also available to students. Students with cars will receive a commuter parking pass that will provide access to convenient parking on campus.

Apartment Housing

Five apartment complexes and nearly 1,000 apartment and townhouse units distinguish RIT's apartment community as one of the largest university-operated apartment programs in the country. The five complexes—Colony Manor, Perkins Green, Racquet Club, Riverknoll and University Commons at Riverknoll—differ in layout and design. Apartments range in size from one-, two- and four-bedroom units; townhouses have two or three bedrooms.

Although the majority of apartment residents are undergraduates, a mixture of graduate and undergraduate and single and married students can be found in each apartment complex. Apartment contracts run from September through August, although, with proper notification, students may terminate their contracts at the end of the quarter. Security deposits are not required, and summer storage is available to returning residents. A modified meal plan is also available to apartment residents through RIT's Food Service Department. University apartment housing is available to graduate students on a space-available basis. For further information on RIT Apartment Housing, contact the Center for Residence Life, Rochester Institute of Technology, 63 Lomb Memorial Drive, Rochester, NY 14623-5603 or call 475-2572 (voice) or 475-2113 (TTY).

The Housing Connection

A service of the Center for Residence Life, The Housing Connection office is designed to meet the general housing needs of the RIT community. The center provides free referrals for students looking for Institute or off-campus accommodations in the Rochester area. In addition, The Housing Connection office offers the only on-campus clearinghouse for apartment residents in need of additional roommates, providing a continually updated listing of available roommates and their specific interests.

Located at 305-D Perkins Green, The Housing Connection provides free maps, information pamphlets and telephones for users of the service. A trained staff member will assist you in your search for housing or roommates. For more information, stop in or call 475-2575.

International Student Services

With several programs receiving worldwide recognition, RIT enrolls approximately 1,000 full-time international students from more than 85 countries.

The International Student Program is located in the Center for Student Transition and Support and serves as a resource for all deaf and hearing international students on visas as well as for members of the campus community seeking cross-cultural help. The staff advises students on immigration issues, helps them adjust to academic and cultural expectations in the United States, and provides cross-cultural programs. In addition, the office coordinates off-campus hospitality through the Rochester International Friendship Council.

International student clubs on campus offer social activities throughout the

year. Campus housing options include International House, a special-interest residence hall floor offering a community experience for both international and U.S. students, like those in the international business program.

The International Student Program offers orientation each quarter. In the fall, the PAL (Peer Adviser Leader) program matches up returning students with new students on a one-to-one basis to help with their adjustment to RIT and the United States.

The office is located on the mezzanine of the Student Alumni Union. For more information, call 475-6943 (voice/TTY); 475-6876 (voice); 475-5540 (TTY), coordinator for deaf international students.

The English Language Center

Students whose native language is not English can find assistance at the English Language Center. Writing, grammar, vocabulary, conversation and reading courses are offered at several levels each quarter. Courses are also available in Presentation Skills, Computer Word Processing, Pronunciation, Business Communication and TOEFL Preparation, among others.

Students also may enroll in a full-time intensive English to Speakers of Other Languages (ESOL) program. In addition, students may receive individualized instruction tailored to meet their needs. Tuition is charged for the services of the English Language Center.

International students may find employment at the English Language Center, where they can teach their native language and culture or do translations.

The office is located on the first floor (north end) of the George Eastman Building, room 1301. For more information, call 475-6684.

English Language Testing

The minimum TOEFL requirement for most graduate programs at RIT is 550. Upon arrival at RIT, students with English as a second language may be required to take a battery of English tests, including the Michigan Test of English Language Proficiency. Depending on the results, the student may have to enroll in English instruction at an additional cost.

A score of 80 or higher on the Michigan Test, plus satisfactory scores in writing and speaking, are required for university-level work. Students with scores below 80 or who do not demonstrate proficiency in writing, listening and speaking may be advised to take English at RIT's English Language Center.

The tests are given in the George Eastman Building before registration each quarter or at another time by appointment. Students who have paid enrollment deposits will receive information on testing dates from the Center for Student Transition and Support.

There is no cost for the test to RIT students who have already been accepted. Their spouses also may take the test free of charge. Others pay a $50 fee. For more information, call 475-6684.

Margaret's House—Child Care Programs

Margaret's House is a New York State-licensed and nationally accredited child care center offering all-day, quality care and education for children eight weeks to eight years of age, including a district-approved full-day kindergarten, after school, vacation and summer programs. It is open to children of RIT students, faculty, staff and members of the local community. Margaret's House is located on campus and is open year round.

- Infant and toddler programs: eight weeks to 36 months
- Preschool programs: three- and four-year-olds
- Full-day kindergarten /after-school programs: five- to eight-year-olds

Call 475-5176 (voice/TTY) or e-mail rxdhcc@rit.edu.

Kids on Campus programs

Kids on Campus provides a variety of academic and recreational summer programs to students entering first grade through high school.

- "Lil' Kids on Campus is a full-day program for children entering grades 1 through 4; July through August
- Kids on Campus is a full-day program for children entering grades 5 through 8; July
- Kaleidoscope is a full-day program of independent academic workshops for high school students; all summer

For information and registration material, contact Susan Kurtz, 475-5987; sfkldc@rit.edu.

Veteran Services

Courses and programs at the Institute are approved for the education of veterans under the Veterans Readjustment Benefits Act, the Rehabilitation Acts and the War Orphans Act.

To receive benefits, an eligible veteran or dependent must submit an application for the VA "Certificate of Eligibility." This application must be sent to the VA Regional Office in Buffalo, N.Y., well in advance of the beginning of the starting quarter. These applications are available at local VA offices or on campus from the Office of Part-time Enrollment Services.

To ensure a smooth transition and successful academic program completion, start your benefits paperwork early. For benefits assistance or information, call 475-6641.

Standards for Student Conduct

The RIT community intends that campus life will provide opportunities for students to exercise individual responsibility and places high priority on self-regulation by its members. All members of the community are responsible for encouraging positive behavior by others, as well as preventing or correcting conduct by others that is detrimental to RIT's educational mission and values.

As an educational community, RIT strives for a campus environment that is free from coercive or exploitative behavior by its members. Moreover, it sets high standards that challenge students to develop values that enhance their lives professionally and that will enable them to contribute constructively to society.

RIT enjoys a diversity of backgrounds, lifestyles and personal value systems among those who compose the academic community. Students, however, are expected to observe and respect the policies and standards of the Institute and the right of individuals to hold values that differ from their own and those expressed by RIT.

Students are encouraged to review the *Student Rights and Responsibilities Handbook* for information regarding campus policies and expectations of student conduct.

Students must recognize that they are members of the local, state and federal communities and that they are obliged to live in accord with the law without special privilege because of their status as students or temporary residents.

Commission for Promoting Pluralism

The Commission for Promoting Pluralism was established to formulate a plan of action that would address seriously and deliberately the subject of pluralism and community building in every part of the university. Its evolution is the result of an identified need for RIT constituents to deepen their respect and appreciation for all people in the RIT community and beyond. This institutional focus attempts:

- to proactively identify and eliminate barriers that restrict equality throughout the RIT community,
- to develop and implement programs that promote commitment to equality and justice in campus-wide activities and
- to develop and nurture a support system that increases participation by all members of the RIT community.

RIT Terminology

Academic probation—**A** formal warning from your college dean that you are in danger of being suspended or dismissed from RIT because your grade point average (GPA) has fallen below 3.00 (B average). (See page 142 for a more complete description.)

Accredited—An academic program, school or university that has been reviewed by an appropriate educational association and meets its standards of quality in academics and services is accredited. RIT is accredited by the Middle States Association of Colleges and Schools, and several of its academic departments and programs have achieved additional accreditation by national associations within their discipline.

Audit—Attending a course without receiving an evaluation grade (such as A, **B,** etc.) or receiving credit. To audit a course, you must formally register for it and have the permission of the department. Audited courses may not be used to fulfill degree requirements, although the course and an audit grade of Z will appear on your official transcript.

Cooperative education (co-op)—The opportunity to work in a full-time, paid position related to your field of study. Co-op is a formal component of many RIT programs. Co-op experiences are divided into "blocks" of one quarter each and do not carry credit. They should be carefully coordinated with the help of your adviser, the Office of Cooperative Education and Career Services and your employer. Registration is required.

Credit by exam or experience—Academic credit awarded based on evaluation of a comprehensive examination, interview or record review.

Credit hour—The numerical value assigned to courses, internships and other educational experiences. RIT follows a quarterly academic calendar, so its base measure is the quarter credit hour, which generally equals two-thirds of a semester hour.

Curriculum—The set of courses that, when finished successfully, can qualify a student for an academic degree. The curricula for all of RIT's degree programs have been registered with the New York State Education Department.

Discipline—A distinct academic area of study. At RIT, most programs are interdisciplinary, or include course work from a variety of areas of study.

Distance learning—A means of earning a certificate or degree off campus through methods such as cable TV broadcasts and videotapes of lectures; teleconferences; computer conferences; and on-line computer services such as electronic blackboards, picture phones and electronic mail. These technologies enable RIT's distance-learning students to follow the same quarter system of study as on-campus students.

Drop/add—Formally changing the set of courses in which you are enrolled in any quarter by adding or removing yourself from an official class list for a course. You may add or drop a course until the end of the sixth class day of a quarter, as specified on the academic calendar. If you do not officially submit a drop/add form for a course, you may receive a failing grade for a course you have stopped attending or not receive credit for a course you have begun attending.

Dual degree program—A program combining the course curricula from a bachelor's degree program and a master's degree program. This produces a streamlined curriculum that allows selected students to earn both a bachelor's and master's degree at the same time.

Full-time student—A student registered for at least 12 quarter credit hours of course work per quarter (excluding audits and credits by exam or experience) or registered for a cooperative education work block during the quarter.

Good standing—A student eligible to enroll in courses (not suspended) as verified by the Office of the Registrar. Certain financial aid programs have specific "standards of progress" by which students are determined to be in "good standing" and therefore eligible for aid.

Graduate-level course—a course designed for postbaccalaureate students and in support of one of RIT's many master's or doctorate degree programs (700-level and higher).

Half-time student—A student registered for six to 11 credit hours during a quarter.

Internships/field instruction—An experiential learning program in which students are placed into a public or private agency to work with professionals in their field of study. The student is eligible for academic credit for the work and is supervised and supported by a mentor while in the position.

Lower-division course—An undergraduate course typically taken during the first or second years of study (100- to 300-level).

Matriculated—A student who has been formally accepted into an academic program and begun a course of study. You must be matriculated in order to receive degrees or other formal awards from RIT.

New York State Immunization Certification—New York State Public Law 2165 Qune 1989) requires RIT to either verify that students have been immunized according to state health law (see page 134 for specifics) or deny them access to RIT facilities. For more information, contact the RIT Student Health Center.

Part-time student—A student registered for at least one course during a quarter, excluding audits and credits by exam/experience.

Residency—Term for the minimum number of credit hours a student must earn at RIT to be eligible for academic certification and completion of degree requirements. The residency requirement ensures that RIT faculty have sufficient opportunity to evaluate your academic abilities.

Suspension—Dismissal from RIT for either academic or disciplinary reasons, which bars a student from enrolling in any RIT courses while the suspension is in effect. If you are suspended for academic reasons, you must usually wait for at least a year before applying for readmission (see page 142). If you are suspended as a result of action by the judicial and appeals processes, you may not be readmitted until the dismissal is formally waived by the assistant to the vice president for Student Affairs/Judicial Affairs.

Upper-division course—An undergraduate course usually taken during the last two to three years of study (400- to 600-level courses).

Withdrawal from a course—Removal of a student from the official enrollment list of a class for a given quarter after the six-day drop/add deadline. You may withdraw from a course at any time through the sixth week of the quarter (time frames are adjusted for sessions of fewer than 10 weeks). After the end of the sixth week, you may withdraw only with written approval of the course instructor and chairperson of your department of study. In either case, the course remains on your record with a grade of "W," and you are still financially responsible for the course tuition.

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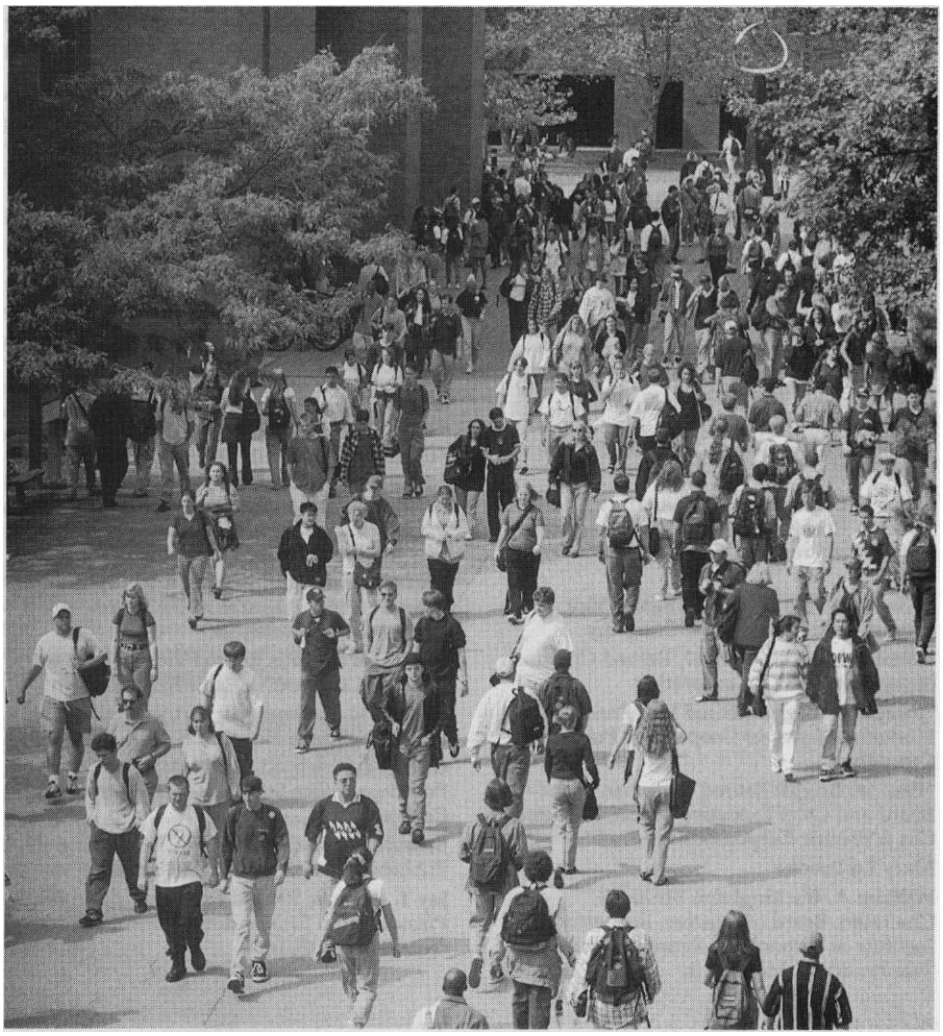

Course Number Index

RIT course numbering: Throughout this bulletin and in registration materials that are published quarterly, courses are generally referred to by their seven-digit registration number. The first two digits refer to the college offering the course. The third and fourth digits identify the discipline within the college. The final three digits are unique to each course and identify whether the course is noncredit (less than 099); lower division (100-399); upper division (400-699); or graduate-level (700 and above).

College of Business

*0101 Accounting
* 0102 Management/Technology
Management/International Business
*0103 Economics
•0104 Finance
"0105 Marketing
*0106 Decision Sciences/Production & Operations Management
*0112 Management Information Systems

College of Engineering

*0301 Electrical Engineering
0302 General Engineering
"0303 Industrial & Manufacturing Engineering
*0304 Mechanical Engineering
*0305 Microelectronic Engineering
"0306 Computer Engineering
*0307 Quality & Applied Statistics
3010 Software Engineering

College of Liberal Arts

0501 Criminal Justice
0502 Language
0503 Foreign Languages
•0504 Literature & Film
'0505 Fine Arts
*0507 History
0508 Science, Technology & Society
"0509 Philosophy
0510 Anthropology
0511 Economics
0513 Political Science
*0514 Psychology
"0515 Sociology
0516 Social Work
0520 Interdisciplinary—Liberal Arts
0535 Professional & Technical Communication

College of Applied Science and Technology

0601 Computer Programming
*0607 Packaging Science
0608 Civil Engineering Technology
0609 Electrical Engineering Technology
*0610 Mechanical Engineering Technology
0614 Telecommunications Engineering Technology
"0617 Manufacturing Engineering Technology
0618 Computer Engineering Technology
0620 Nutrition Management
0621 Food Management
0622 Hotel & Resort Management
0623 Travel Management
*0624 Hospitality/Tourism Management
*0625 Service Management
*0626 Human Resource Development
*0627 Instructional Technology
"0630 Environmental Management Technology
*0633 Safety Technology
*0635 Health Systems Administration
0680 Accounting & Business Systems
0681 Business & Management
0682 International Business
0684 Quality Management
0686 Humanities & Social Science
*0688 Technical Communications
0690 Deaf Studies
0692 Math & Science
0694 Emergency Management
*0699 Cross-Disciplinary Professional Studies

National Technical Institute for the Deaf

0801 Accounting Technology
0804 Business Technology/ Administrative Support Technology
0805 Applied Computer Technology
0806 Interdisciplinary Studies
0812 Computer Integrated Machining Technology
0813 Computer Integrated Machining Technology
0820 Healthcare Billing & Coding Technology
0825 Art & Computer Design
0827 Ophthalmic/Optical Finishing Technology
"0835 Graduate Secondary Education
0853 Prebaccalaureate Studies
0860 Speech & Language
0875 ASL/English Interpretation
0878 Digital Imaging & Publishing Technology
0879 Laboratory Science Technology
0880 Communication Studies
0880 Humanities
0881 Performing Arts
0882 Social Science
0883 English
0884 Mathematics
0885 Science
0886 American Sign Language
0890 Computer Aided Drafting Technology

College of Science

1001 Biology
1004 General Biology
1005 Field Biology
* 1008 Analytical Chemistry
*1009 Biochemistry
* 1010 Chemistry
1011 General Chemistry
* 1012 Inorganic Chemistry
"1013 Organic Chemistry
* 1014 Physical Chemistry
* 1015 Environmental Chemistry
* 1016 Mathematics
1017 Physics
1019 Technology Mathematics
* 1023 Clinical Chemistry
1024 Medical Technology
1025 Nuclear Medicine Technology
1026 Allied Health Sciences—General
1027 Biomedical Computing
* 1028 Materials Science & Engineering
* 1029 Polymer Chemistry
1030 Diagnostic Medical Sonography
1032 Physician Assistant
* 1050 Color Science
* 1051 Imaging Science

English Language Center

1701 English Language Center

Learning Development Center

1710 Learning Dev. Ctr.—Technical

College of Imaging Arts and Sciences

* 2001 Interdisciplinary Imaging Arts
*2010 Graphic Design
*2011 Art Education
2012 Fine & Applied Arts & Crafts
2013 Foundation Courses
*2014 Computer Graphics Design
2015 Interior Design
"2019 Illustration
*2020 Medical Illustration
*2021 Fine Arts Studio
*2035 Industrial Design
*2037 Graduate Studies
2039 Art History
*2040 Ceramics & Ceramic Sculpture
"2041 Glass
*2042 Metalcrafts & Jewelry
*2043 Textiles
*2044 Woodworking & Furniture Design
2060 Fine Art Photo
2061 Biomedical Photo
•2065 Film & Animation
*2066 Graduate Photography
2067 Illustration Photography
2068 Imaging Systems Management
2076 Imaging & Photo Technology
*2080 Printing Management
*2081 Printing Technology

Interdisciplinary

3001 Digital Media
3010 Software Engineering

College of Computing and Information Sciences

*4002 Information Technology—Software
4003 Computer Science
*4004 Information Technology—IT/IMD
*4005 Graduate Computer Science

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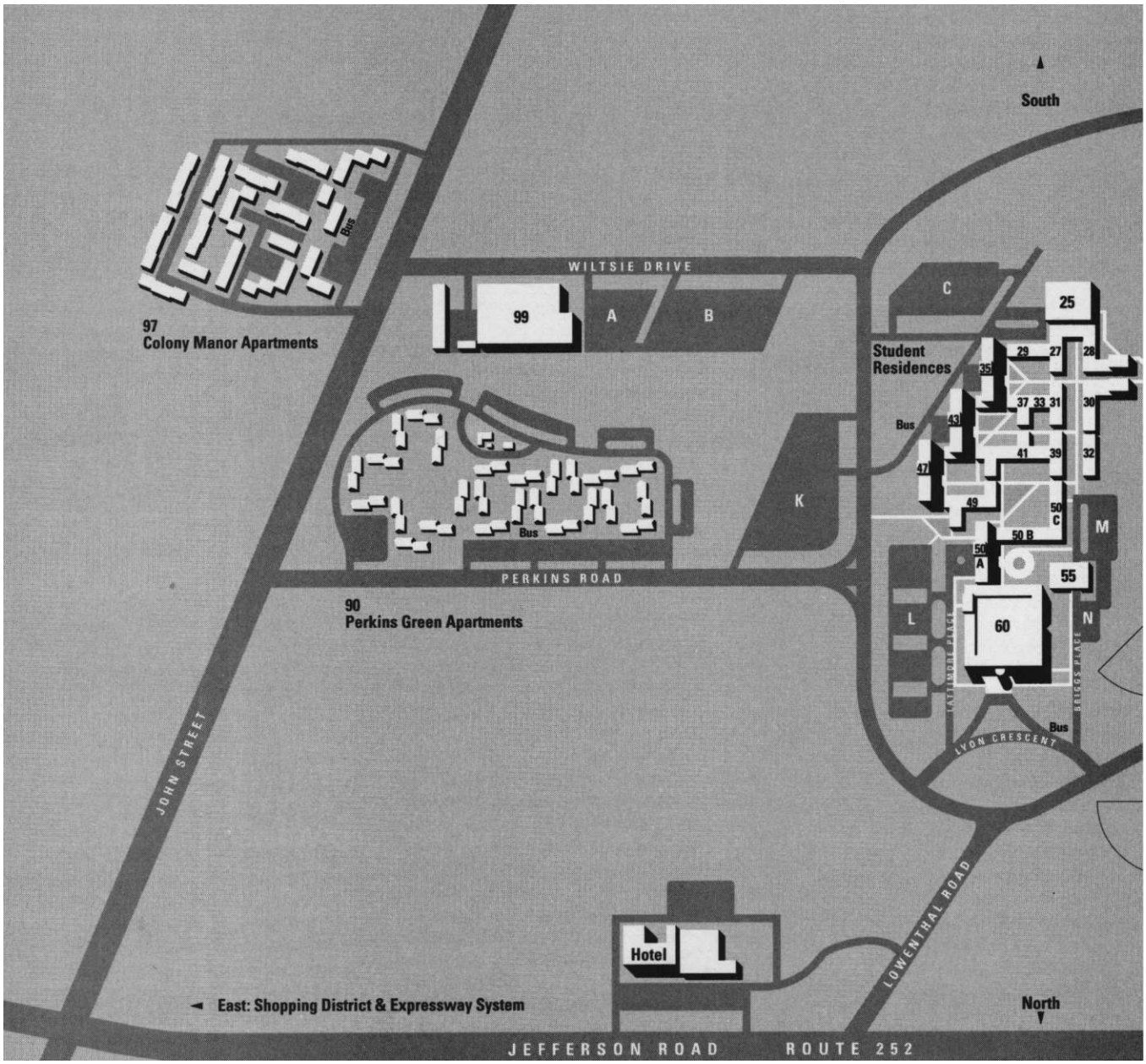


Student Residences

20 **Riverknoll Apartments**

90 **Perkins Green Apartments**

97 **Colony Manor Apartments**

27 **Francis Baker Hall**
29 **Francis Baker Hall**

28 **Fraternity & Sorority Housing**
30 **Fraternity & Sorority Housing**
32 **Fraternity & Sorority Housing**

31 **Eugene Colby Hall A, B**
33 **Eugene Colby Hall C, D, E**
37 **Eugene Colby Hall F, G**

35 **Kate Gleason Hall**

39 **Helen Fish Hall A, B**
41 **Helen Fish Hall C, D, E, F**

43 **Nathaniel Rochester Hall**
47 **Sol Heumann Hall**
49 **Carleton Gibson Hall**

50A **Mark Ellingson Hall**
SOB **Peter Peterson Hall**
50C **Alexander Graham Bell Halt**
Margaret's House:
Early Childhood Programs
University Commons

George Eastman Building
Academic:
College of Applied Science & Technology:
Hospitality & Service Management
Environmental Management
Center for Multidisciplinary Studies
B. Golisano Thomas College of
Computing and Information Services
College of Liberal Arts:
Behavioral Sciences
(Psychology, School Psychology,
Social Work)
Professional & Technical Communication
English Language Center
Learning Development Center
NTID Social Work Support Dept.
Administrative:
Office of the President, Academic Affairs, Academic Senate Office, Bursar, Commission for Promoting Pluralism, Development, Finance & Administration, Human Resources, Information & Technology Services, Institutional Research, Office of the Provost, Registrar, Special Services Program, University News Services, University Publications

Frank Ritter Ice Arena

3 **George H. Clark Gymnasium**
Edith Woodward Pool,
Intercollegiate Athletics

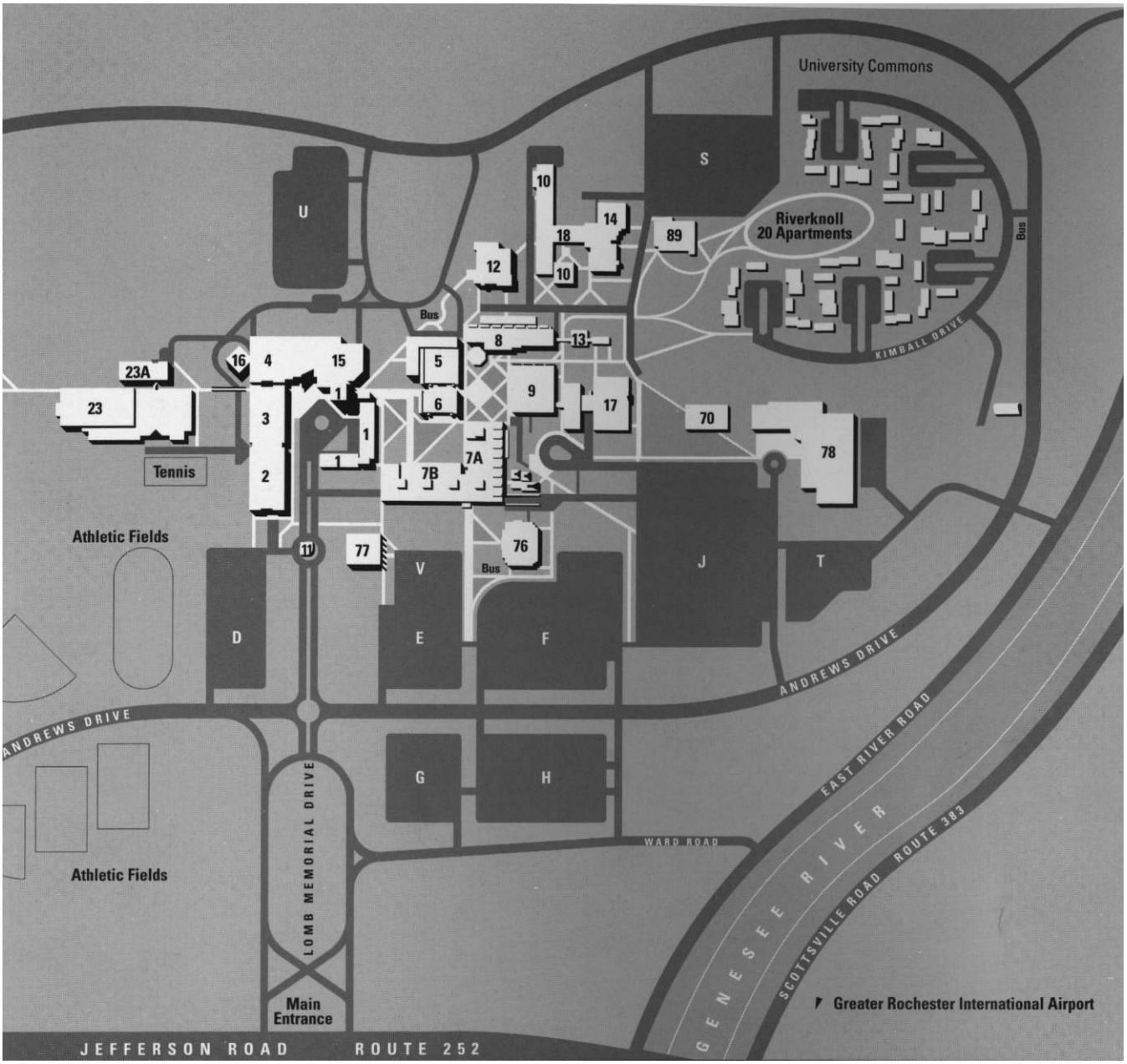
4 **Student Alumni Union**
1829 Room, Alumni Room, Cafeteria, Campus Life, Candy Counter (tickets for public events), Center for Student Transition & Support, Clark Meeting Rooms, Credit Union, Fireside Lounge, Ingle Auditorium, Off–Campus & Apartment Student Association, Ombuds Office, RITskeller, Staff Council Office, Student Conduct, Student Government, Student Affairs Office

5 **Wallace Library**
Archives & Special Collections, Cary Collection, Educational Technology Center, Java Wally's

6 **Liberal Arts Building**
College of Liberal Arts:
RIT Exploration Program
Criminal justice
Economics
Humanities
Social Sciences
NTID Liberal Arts Support Dept.

7A **lames E. Booth Building**
Academic:
College of Imaging Arts & Sciences:
Bevier Gallery
School of Art,
School of Design,
School for American Crafts
NTID:
Applied Art & Computer Graphics
Electronic Publishing & Printing Technology
Imaging Arts & Sciences Support Dept.
Webb Auditorium
Administrative:
Systems Development

7B **Frank E. Gannett Building**
Academic:
College of Imaging Arts & Sciences:
School of Film & Animation
School of Photographic Arts & Sciences
SPAS Photo Gallery
School of Printing Management & Sciences
Administrative:
ITS HelpDesk, Client Support Services;
ITS Distributed Support Services



8 Gosnell Building
College of Science:
Allied Health Sciences
Biological Sciences, Chemistry,
Mathematics & Statistics, Physics,
Center for Materials Science & Engineering
Van Peursen Auditorium
NTID Science Support Dept.

9 James E. Gleason Building
Kate Gleason College of Engineering:
Electrical Engineering
Mechanical Engineering
Software Engineering (CAST)
NTID Engineering Support Dept.

10 Lewis P. Ross Building
Academic:
Computer Science (CCIS)
Administrative:
ITS Data Center Operations

11 Information Center

12 Max Lowenthal Building
College of Business:
Accounting
Finance,
International Business,
Management,
Management Information Systems,
Marketing
Photo Marketing Mgmt.
NTID Business & Computer Science Support Dept

13 Gosnell Annex
Public Policy (Libera! Arts)

14 Hugh L. Carey Building
John D. Hromi Center for
Quality & Applied Statistics
NTID:
Baccalaureate & Graduate Programs,
Business Occupations & Applied
Computer Technologies Programs,
Department of Interpreting Services

15 Campus Connections Bookstore

16 Kilian). & Caroline F. Schmitt Interfaith Center
Campus Ministry

17 Center for Microelectronic &
Computer Engineering

18 Link Building

23 Hale-Andrews Student Life Center
Gordon Administration & Activity Wing,,
Bruce Proper Fitness Room,
Center for Physical Education & Recreation,
Robert James Spinney Gymnasium

23A August Center
Sylvio O. Conte Counseling Center:
Counseling Center
Higher Ed. Opportunity Program (HEOP)
Student Health Center

25 Grace Watson Hall
Campus Safety, Center for Residence Life,
Residence Dining Hall (Grade's),
U.S. Post Office

55 Hettie L. Shumway Commons
International Center for Hearing &
Speech Research,
Residence Dining Hall (The Commons)

60 Lyndon Baines Johnson Building
Academic:
National Technical Institute for the Deaf (NTID):
Technical, Humanities,
Social Sciences Programs
Administrative:
NTID Administration,
NTID Admissions Office
Panara Theatre,
Research Programs,
Switzer Gallery

70 College of Applied Science & Tech. (CAST):
Civil Engineering Technology
Computer Engineering Technology
Electrical Engineering Technology
Mechanical & Manufacturing Eng. Tech.
Telecommunications Engineering Tech.

B. Thomas Golisano College of Computing
and Information Science:
Information Technology

76 Chester F. Carlson
Center for Imaging Science

77 Bausch & Lomb Center
Undergraduate Admissions, Part-time
Enrollment Services, Cooperative Education
& Career Services, Financial Aid, Office of
Vice President for Enrollment Management
and Career Services, Graduate Enrollment
Services, Government and Community
Affairs, Nathaniel Rochester Society,
Secretary of the Institute

78 Center for Integrated
Manufacturing Studies
Associate Provost for Outreach Programs,
Corporate Education & Training, Industrial
& Manufacturing Engineering, Packaging
Science, Manufacturing Technology,
Remanufacturing & Resource Recovery

89 Crossroads Building
Alumni Relations, Crossroads Cafe and
Market, The Hub

99 Facilities Management
Campus Safety Transportation, Design &
Construction, Mail & Reprographic Services,
Operations Center, Purchasing, Receiving,
Shipping, Telecommunications