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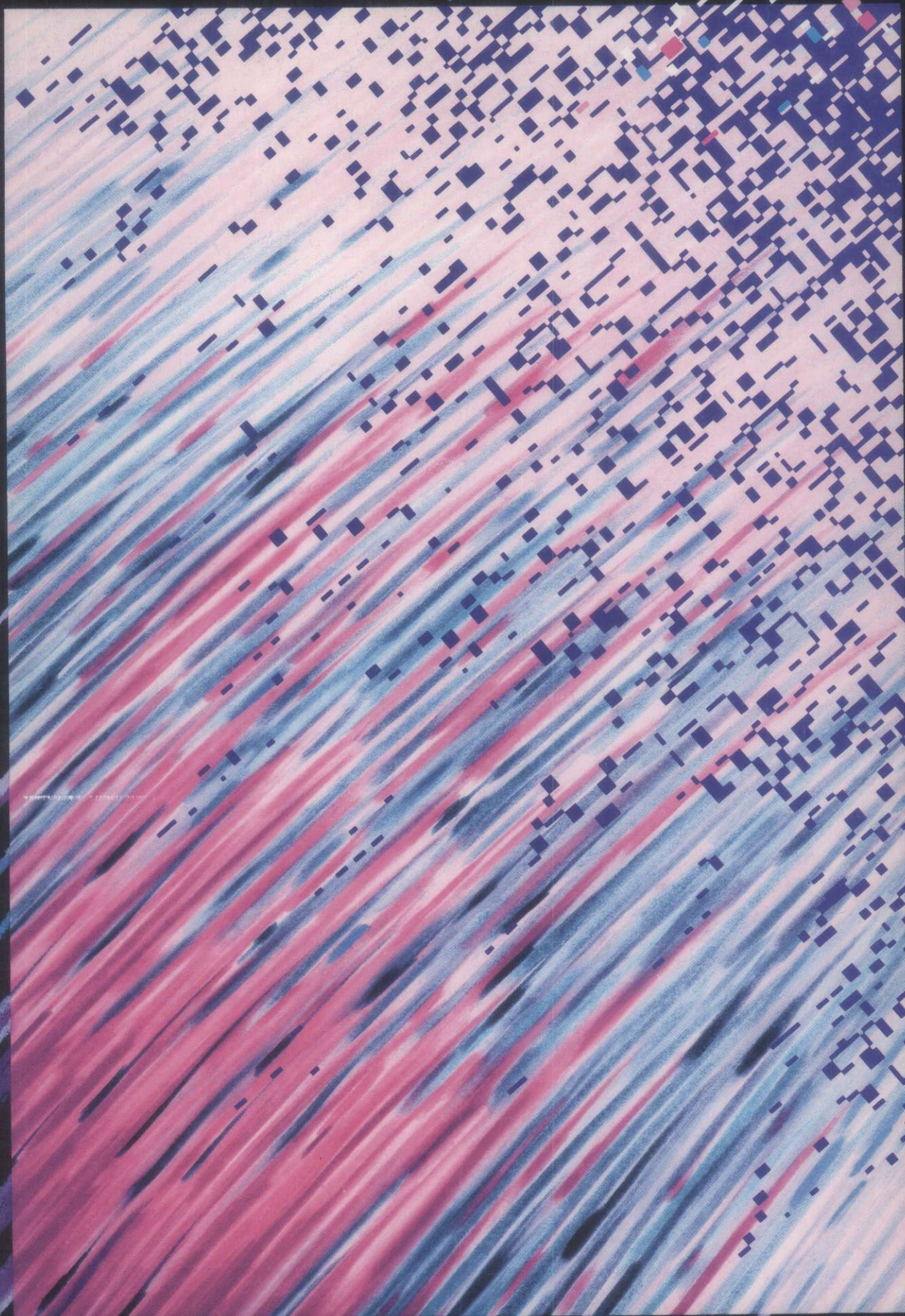
GRADUATE STUDY · 88-89

Rochester Institute of Technology Calendar 1988-89

	No Classes	Classes Begin Day Colleges	Exam Week	Last Day of Quarter
Fall Quarter	Nov. 17-27	Sept. 1	Nov. 11-15	Nov. 16
Winter Quarter	Dec. 20-Jan. 3 Feb. 26-Mar. 5	Nov. 29	Feb.22-25	Feb. 25
Spring Quarter	May 21-28	March 7	May 16-19	May 20
Summer Quarter	July 4	May 30	Aug. 10-12	Aug. 15

Cover design *by RIT Communications*

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 admits and hires men and women, veterans and disabled individuals of any race, color, national or ethnic origin, or marital status, in compliance with all appropriate legislation, including the Age Discrimination Act. The compliance officer is James Papero.

Contents

RIT

About RIT

Founded in 1829, Rochester Institute of Technology has been a pioneer in career-oriented and cooperative work-study higher education. RIT includes a modern 1,300-acre campus and the RIT City Center in downtown Rochester. The nonsectarian, coeducational, independent Institute prepares students for technical and professional careers in a changing world.

RIT consists of nine colleges: Applied Science and Technology, Business, Continuing Education, Engineering, Fine and Applied Arts, Graphic Arts and Photography, Liberal Arts, Science, and the federally funded National Technical Institute for the Deaf.

Graduate Education at RIT

About 29 years ago, Rochester Institute of Technology expanded its educational responsibilities to include graduate curricula, the first being in the area of fine arts. Encouragement from a variety of professional sources plus student demand caused the Institute to initiate programs in the arts and crafts leading to the master of fine arts degree. Shortly thereafter, RIT appointed a Graduate Council and petitioned for a charter to give the Institute authority to grant the master of science degree. The function of the Council on Graduate Studies was "to define the essential character of a graduate study at the Institute, to establish policies and procedures for the administration of graduate study, and to provide for a con-

tinuous review of graduate programs."

By 1963 student interest and industrial and business requirements caused the College of Science to develop a master's program in chemistry. This program was designed to provide opportunities for significant research, additional acquisition of knowledge in appropriate areas of chemistry, and study in allied areas such as physics and mathematics.

Within a year, the Institute received requests from the armed forces and many industrial employers for a graduate program in photographic science. The new curriculum, in contrast to offerings at European universities, was concerned principally with the application of photography to problems of science and engineering.

By 1965 national and local surveys suggested another area of responsibility for RIT. Considerable need was indicated for sophisticated statisticians, particularly individuals who could undertake the complex task of collecting, analyzing, and interpreting data necessary for industrial planning. Accordingly, the College of Continuing Education created a Department of Statistics and began to offer work leading to a master of science degree in applied and mathematical statistics.

By 1968 important unmet demands for graduate training in business administration were apparent in the Rochester area and beyond. In view of this considerable need, the College of Business developed a master of business administration program which encompassed all of the management and business areas common to middle and upper-middle management. The new curriculum was also designed to provide a balance between the behavioral and quantitative aspects of business management.

Later in 1968, in addition to the two-year MFA program, the College of Fine and Applied Arts developed a program in art education leading to the master of science in teaching degree. The program was specifically designed for secondary school teachers of fine and applied arts who wished to improve their understanding and skills and earn certification.

The need for additional people with technological training in the graphic arts became apparent from the numerous requests RIT received for a graduate program in printing. As a result, the School of Printing Management and Sciences introduced a graduate program in January, 1969 leading to the MS degree.

Recent additions to the list of graduate degree programs now available include the MS in School Psychology, the MS in Hospitality-Tourism and the MS in both Graphic Arts Publishing and Graphic Arts Systems.

The Department of Instructional Technology has developed an MS degree program for those engaged in teaching or directing multi-media communications. This combines and builds upon the several communication/graphics/visual disciplines long associated with RIT. In addition, the College of Applied Science and Technology now offers an MS in computer science through its School of Computer Science and Technology. The Department of Pack-aging Science also started its master of science degree program in the spring of 1983 in response to demand from industry for people with graduate education in packaging. RIT is one of only four schools in the country to offer an MS degree in packaging.

RIT has also initiated an MS interdisciplinary program involving science and engineering in the area of materials science. In addition, our College of Fine and Applied Arts began an MS offering in medical illustration in 1981-82 and inaugurated its MFA program in computer graphics design in the fall of 1984. Beyond this, the new manufacturing engineering option within the ME was approved for the fall of 1985. More recendy, RIT has added new programs in software development and computer engineering

Through these programs, the Institute has exhibited a continuous concern for the emerging needs of the business, industrial and scholarly communities. It will consider additional graduate programs as these requirements become evident.

Accreditation
The Institute is chartered by the legislature of the State of New York and accredited by the Middle States Association of Colleges and Secondary Schools. In addition to institutional accreditation, curricula in some of the colleges are accredited by appropriate professional accreditation bodies. Specific mention of these is included in the college descriptions, where applicable.

Graduate Programs of Study

	Graduate Degrees Offered	Programs Available in	HEGIS* Code	For More information See Page

College of Applied Science andTechnology	Master of Science	Computer Science
		Instructional Technology
		Packaging Science
		Hospitality-Tourism
		Software Development
		   and Management
		Advanced Certificate in Applied
		   Computer Studies
			0701
			0699
			4999
			0510.10
			
			0799
			
			0701
				19

College of Business	Master of Business Administration	Business Options Listed on pages 42-43	0506	39

College of Continuing Education	Master of Science	Applied and Mathematical Statistics
		   Cooperative Program
		     Summer Program
		Career and Human Resource Development
			1702
			
			0826
				51

College of Engineering	Master of Science Master of Engineering	Computer Engineering Electrical Engineering Mechanical Engineering Materials Science and Engineering** Computer Engineering Engineering (CE, EE, ME, IE)	0999 0909 0910 0915 0999 0901	63

College of Fine and Applied Arts	Master of Fine Arts
	   or
	Master of Science
	  for Teachers
	
	Master of Fine Arts
	
	Master of Science for Teachers
		Ceramics and Ceramic Sculpture
		Graphic Design
		Industrial & Interior Design
		Glass
		Metalcrafts and Jewelry
		Painting
		Printmaking
		Weaving and Textile Design
		Woodworking and Furniture Design
		
		Medical Illustration
		Computer Graphics Design
		
		Art Education
			1009
			1009
			1009
			1009
			1009
			1002
			1002
			1009
			1009
			
			1299
			1009
			
			0831
				82

College of Graphic Arts and Photography	Master of Science
	
	Advanced Certificate
	
	Master of Fine Arts
		Printing Technology
		Graphic Arts Publishing
		Graphic Arts Systems
		Color Science, Appearance,
		   and Technology
		Imaging and
		   Photographic Science
		
		Electronic and Optical Storage
		   Applications
		Photography
			0699
			0699
			0699
			
			1099
			
			1011
			
			0699
			1011
				89

College of Liberal Arts	Master of Science	School Psychology	0826.02	113
College of Science	Master of Science	Chemistry Clinical Chemistry Materials Science and Engineering**	1905 1223 0195	120
National Technical Institute for the Deaf	None	Educational Specialists for the Deaf		132

Enrollment in other than registered or otherwise approved programs may jeopardize a student's eligibility for certain student aid awards. All the above programs are registered according to the indicated HEGIS* code.

Higher Education General Information Survey
**Joint program of Colleges of Engineering and Science

Philosophy of Graduate Education at RIT

Graduate education has been part of the mission of the Rochester Institute of Technology since the first graduate program in Fine and Applied Arts was begun in 1958. During the ensuing years, student demand has led to the emergence of more than 35 graduate programs in such diverse areas as fine arts, business, engineering and imaging science and photography. These offerings have drawn on the total resources of the Institute and have received wide acceptance.

From its beginnings as the Mechanics Institute, RIT has stressed both "earning a living and living a life." Its offerings have also emphasized the amalgam of formal education and experience, and have included a definitive commitment to career development in a context of social responsibility. In particular, RIT's graduate thrust has been oriented in the direction of technology and business, as well as the aesthetic content of the fine arts, photography, and printing.

RIT's graduate programs stress the applications of specialized knowledge that enable students to use their professional knowledge and skills to attain personal and career goals. Further, their graduate accomplishments at the Institute are basic to continuing lifelong learning, career development and personal satisfaction. In certain areas, the MS or MFA is the terminal degree in the field, while in others it provides the base for work at a higher level.

Another fundamental objective of graduate education at RIT is that it be characterized both by effective teaching and quality scholarship. Out of these concerns have risen selective research projects that aid the education of students and provide continuing opportunities for professional growth. At RIT many of our research projects—including projects in engineering, graphic arts, and imaging science—are under the umbrella of the RIT Research Corporation. These projects bring industry experts to campus to interact with faculty and graduate students, give graduate students the opportunity to assist with research projects and keep faculty members up to date on current industry practices. In addition, through the Research Corporation, graduate students utilize special libraries and research facilities as they study in their fields.

Graduate programs at RIT help students understand the conceptual structure and organization of knowledge of their chosen programs. Such an understanding is a necessity if our graduates are to cope with the accumulation of knowledge and technological change in the professions. These programs provide the educational base for additional learning, and offer access into and mobility within one or more professional areas. Through their education, RIT's graduate learners become equipped with the knowledge, skills, and attitudes to stay abreast in their professional fields.

Graduate study should help students to mature as perceptive problem-solvers who will emerge as professional and community leaders. It also should provide a strong base for independent study and experimental learning. Above all, graduate education should help students become skillful and incisive professionals who perceive the human purposes that underscore all learning.

Admission

Decisions on graduate selection rest within the college offering the program. Correspondence between the student and the Institute will be conducted through the Admissions Office, according to the following procedures:

1. Inquiries about, and applications for, graduate study are directed to the Director of Admissions, Rochester Institute of Technology, One Lomb Memorial Drive, P.O. Box 9887, Rochester, New York, 14623-0887.
2. The Admissions Office 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 Admissions Office will prepare an applicant file for him or her. All correspondence and admission data will be collected by the Admissions Office, and placed in the applicant's file. The applicant's file will include an RIT application, previous college or secondary school records, applicable test scores, recommendations (if required) 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 Admissions Office.
6. The Admissions Office will notify the student of the admission decision.
7. Academic departments may informally advise non-matriculated students, but no formal program of study can be approved prior to matriculation.
8. The formal program will be laid out by the dean's designee (department head, coordinator or program director, etc.) and is the one that must be followed by all students applying for admission or readmission.

Readmission
If a student has become inactive (has not completed a course in four quarters) or has withdrawn from RIT, Institute policy requires the student to reapply for admission. Readmission applications are handled according to the following policy:
1. Students who left the 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.

4. In addition, each college will have the responsibility, upon readmission, of determining which previous courses, if any, will be applicable toward the degree.

5. In all cases, students must complete the program within seven years of the date of the oldest course counted toward their program. This does not apply to prerequisites, Bridge Program courses in computer science, Foundation courses or similar requirements in other departments. This policy took effect on September 1,1984.

6. The basic entry requirements for master's degree candidates include the completion of a baccalaureate degree and whatever other evidence of the applicant's potential to successfully complete graduate studies may be required by the particular college. Rare exception 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 are required.

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 their final year of undergraduate study. The student must present a final transcript 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 other 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 student's appropriate status rests with the department in consultation with the Admissions Office and the Registrar.

Evaluation of transfer credit (see p. 13) is made by the academic school or department in question and the College of Liberal Arts. For students applying to the College of Continuing Education, transfer credit will be evaluated within that college.

7. RIT admits and hires men and women, veterans and disabled individuals of any race, color, national or ethnic origin, or marital status, in compliance with all appropriate legislation, including the Age Discrimination Act The compliance officer is James Papero.

Graduate programs specialized and diverse


RIT President M. Richard Rose

"RIT has a national and international reputation in a great many of our programs, particularly in imaging, graphic arts, photography and the fine and applied arts," says President M. Richard Rose.

In addition, Dr. Rose says, "Being ranked as one of the nation's leading comprehensive universities by such publications as *U.S. News & World Report* and others is a reflection on the Institute's dedication to providing the nation's finest career and professional education. Our long-range vision for RIT is that of a great non-traditional university with contemporary programs that command national respect."

In his discussions with students, Rose says, "Graduate students have described RIT programs as professional, high-quality, goal-oriented with fast-paced applications, a rigorous, energetic yet flexible curriculum. They have also found the faculty to be outstanding and the facilities to be almost without peer. These comments echo our own evaluation of RIT as a dynamic and progressive university that has always been willing to take those extra steps necessary to maintain relevant career and professional programs.

"In many ways, RIT also symbolizes much of what we find so desirable about our community, particularly through its attractive blend of tradition, culture, innovation, business and education.
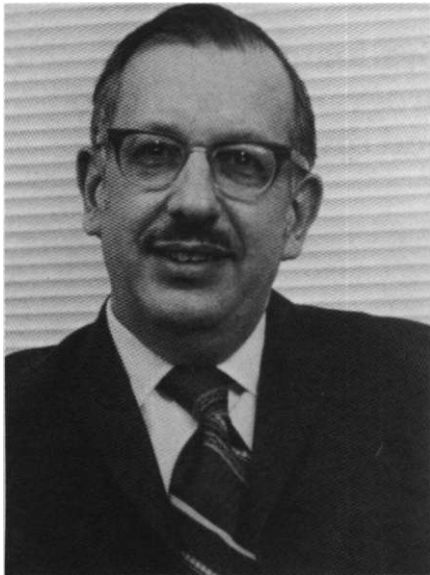
Dr. Paul Bernstein

"In the final analysis each student's future is our first priority. We hope they share our pride in an institution that provides access to the future with graduate programs that are both satisfying and rewarding."
"RIT is a highly specialized institution, and our graduate program is a reflection of that," says Dr. Paul Bernstein.

"The hallmark of our overall graduate program is the diversity and quality of the individual programs," he says.

Bernstein is dean of Graduate Studies. He received his bachelor's and master's degrees in education from Temple University, and his Ph.D. in history from the University of Pennsylvania. He has been at RIT since 1966.

"Each of our graduate programs is built as a freestanding unit," he says. "As such, they are designed to fill a specific need in a given field of study.

"As a need developed in a specialized field and RIT felt it could satisfy that need, a program followed," he says.

"Good examples of that are the Hospitality-Tourism, MBA and Imaging Science programs. We perceived a real need for people in these areas from our discussions with business and industrial leaders, and then proceeded to develop these interdisciplinary offerings with their encouragement"

Costs

On the date of publication, the tuition for graduate students pursuing a master's degree is:
Full-time (12-18 credit hours)—$3206/quarter
Part-time (11 credit hours or less)—$272/credit horn-
Master of Science (CCE)—
Internship*—$150/credit hour

In addition, any graduate student carrying over 18 credit hours of study will be charged the full-time tuition rate plus $272/credit hour for each hour of study exceeding 18.

Room and board for full-time students for 1988-89 will be $1,380. An estimated cost for books and supplies ranges from approximately $700-$1,200 per year per student. For part-time students, books and supplies will depend on the number of courses taken and may cost approximately $200-$400.

All full-time graduate students are required to pay a Student Activities Fee of $25 per quarter.

Tuition and fee payments are due on the following dates:
Fall Quarter, August 18,1988;
Winter Quarter, November 16,1988;
Spring Quarter, February 15,1989;
Summer Quarter, May 10,1989.
These due dates are firm. If payment is not received by the date stated, the student must appear at the registration day for the quarter desired. (See calendar on page 2.) A late payment fee will be charged to all student accounts that become past due.

The Institute reserves the right to change its prices without prior notice. Nonmatriculated students are charged graduate rates for graduate courses.

*Applied only to the internship portion of the master of engineering degree in the College of Engineering, the industrial research option of the MS degree in the Department of Chemistry and the External Research Option in the MS in Clinical Chemistry in the Department of Clinical Sciences. It also applies to the MS degree in career and human resource development in the College of Applied Science and Technology.

note: Matriculated graduate students enrolled in CCE or Day College undergraduate courses will be charged the Day College graduate tuition rate.

12-Month Payment Plan

For the 1988-89 academic year RIT offers a 12-month payment plan, which combines the elements of a prepayment/deferred payment plan. For further information about the plan, contact the Bursar's Office at (716) 475-6059.

Refund Policies

Advance deposits are non-refundable. The acceptable reasons for the 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 may elect to complete the course by making special arrangements with both his instructor and department, or to withdraw and receive a full tuition refund. If he withdraws, he 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 or take a leave of absence from the Institute in order to be eligible for a partial tuition refund.

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 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 advisor 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—90% 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

Fifth and subsequent weeks—No tuition reduction

Note: Non-attendance 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 differential 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.

Fees
Fees are not refundable.

Continuation of Thesis Policies
Basic Policy
In those programs where a thesis is required, if a student has completed his/her thesis course work but has not finished the thesis itself, it is the responsibility of the student to register for all quarters except the Summer Quarter for a Continuation of Thesis course. Although the Continuation of Thesis course carries no quarter credit hours, the Continuation of Thesis tuition is the equivalent of one graduate quarter hour. Departments may offer graduate students a one quarter extension of time before the Continuation of Thesis tuition is levied. No Continuation of Thesis registrations should be processed for either the quarter in which the Continuation of Thesis is waived, or the Summer quarters.

1. All new and readmitted students matriculated into a graduate program after September 1, 1987, will be subject to this new Continuation of Thesis policy.
2. Once work has begun on a thesis, it is seen as a continuous process until all requirements are completed. It is the student's responsibility to register each quarter (except for the Summer Quarter and a quarter that may be waived by the department) for a Continuation of Thesis course if the student has completed the departmental thesis course work but not the thesis itself.
3. The Continuation of Thesis course will be a new offering to accommodate this policy.
4. If the student does not register for the Continuation of Thesis course, his/her department may either: waive, for one quarter only, the need to register for Continuation of Thesis; or remove the student from the program.
5. The length of time to complete a thesis is at the discretion of the department. However, the thesis and all other graduation requirements must be completed within the seven-year period after matriculation.

Registration procedures
1. The 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. Once the student has completed the registration procedure, his/her ID card will be validated. The validated ID card will allow the student to use Institute facilities.
4. If the student fails to register, it is assumed that the student has left the program and that readmission policies will apply if the student wishes to be readmitted to the program. (In the case of non-registration, the department should inform the Registrar as to whether the student should be put on non-matriculated status or withdrawn from the program.)

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. Unresolved matters will be referred for further action to William J. Welch, Controller.

Room and board
To complete a withdrawal from RIT, a resident student or a non-resident student on a meal plan must check out with Housing and/or Food Service. Refunds, when granted, are from the date of official check-out

Partial refund schedule:
1. Room
   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

Financial aid
Scholarships and assistantships are available in most graduate departments. In addition, some departments have externally funded stipends from corporate or governmental sources. Please contact the appropriate department chairperson or dean, or call Dian Miller in the Graduate Studies office at (716) 475-2337.

While students can apply for the above awards before matriculation, they can be awarded only to matriculated students. These awards are generally awarded to full-time students, but exceptions are made for qualified part-time students.

In addition, there is funding available for minority applicants.

Tuition Assistance Program
New York State residents who show ability to pursue a full-time program may receive awards from $100 to $1,200 as matriculated graduate students.

Graduate degree programs
A master's degree at RIT may be obtained in over 35 programs ranging from business administration to imaging science. (Please refer to page 7 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. A statement of requirement completion will be listed on the transcript in the appropriate term. 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 and summer graduates in the summer; and for summer graduates, in the fall.

The Steps Toward Earning Your Degree

Graduate registration

Matriculated graduate students are those who have applied and been formally accepted into a graduate program through the Office of Admissions. Such students may register for graduate level courses (700-800) that fit their home department approved programs. When registering for graduate courses outside the home department which are in the normally approved program, the approval of the department offering the course is also necessary.

Non-matriculated (undergraduate or graduate) 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 non-matriculated student will not apply to any given baccalaureate or master's program.

Matriculated and non-matriculated graduate students may register for undergraduate level courses with the understanding that these courses may not always apply to an RIT master's program. In certain cases, where educationally sound programs will result, appropriate undergraduate courses as approved by the faculty advisor and by the department may be included in a master's program. However, no 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 (700-800) level.

Credit requirements

The minimum credit requirement for a master's degree is 45 quarter (or 30 semester) credit hours. Students should refer to the section covering the college in which they will enroll to earn the credit hour requirements. At least 36 of these quarter credit hours must be earned at the graduate level in residence at the Institute.

External master's degree programs allow for varying amounts of acceptable graduate transfer credits. Thus, the residency requirement may be decreased, if approved by the Graduate Council and vice president for academic affairs. Other exceptions pertaining to a group of students must be approved by the Graduate Council.
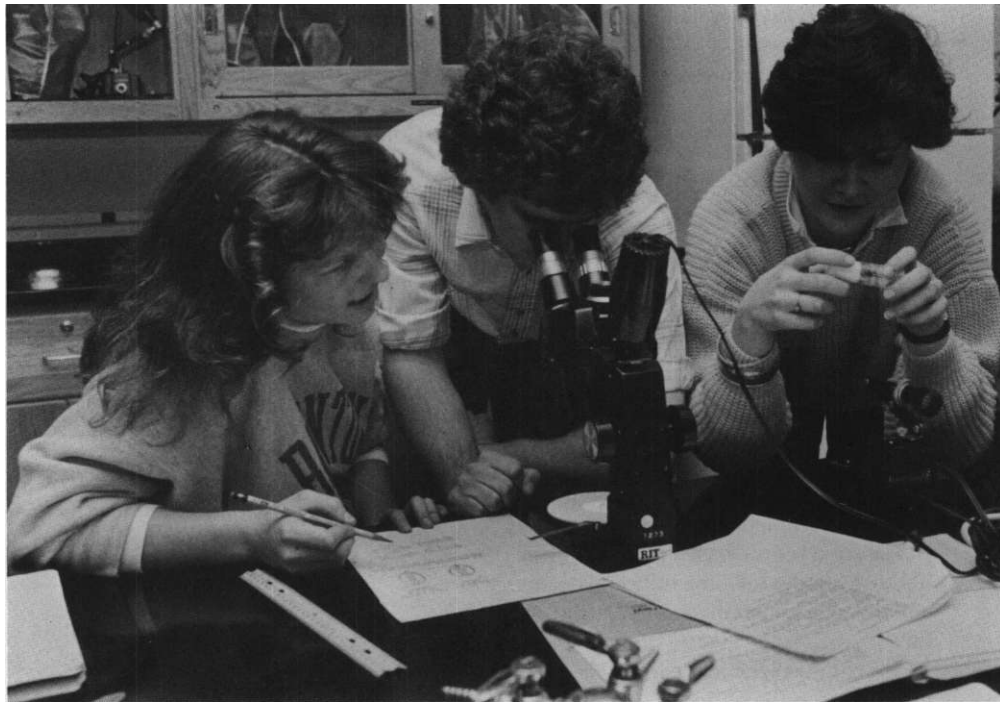
Transfer credit

A maximum of nine quarter credit hours in a 45 credit hour program or 12 quarter credit hours in a 48 credit hour program or more 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 (GPA) 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 work at another institution and transfer it 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 and thesis 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 for research and thesis guidance in any given quarter must be determined by the time of registration for that quarter, recorded on the student's card, and verified on the course list.

For the purpose of verifying credit, an end-of-quarter grade of R should be submitted for each registration of research and thesis guidance by the student's faculty advisor. Before the degree can be awarded, the acceptance of the thesis must be recorded on the student's permanent record.

Students should also note the new continuation of Thesis Policy that becomes effective September 1,1987 (see page 11).

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

A student not formally admitted as a graduate student of the Institute (regardless of the number of graduate credits earned) is a non-matriculated student and not a candidate for an advanced degree. Such a student cannot be a candidate until formally admitted to the Institute as a graduate student There is no guarantee that any credits in graduate courses earned as a non-matriculated student will apply toward an advanced degree.

Summary experience

The Graduate Council regards some form of integrative experience as necessary for candidates of advanced degrees. Such requirements as the comprehensive examination, 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, 9-12 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 first degree and applied again toward 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 Admissions Office to the second degree program until the first program has been completed.

Financial standing

Tuition and fees paid to the Institute cover approximately 60-70 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 other 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 prices 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. Extensions 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 700-800) 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 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.

Michigan Test of English Language Proficiency

All entering students, whose native language is not English, are required to take the Michigan Test of English Language Proficiency. A score of 80 or higher is required to indicate the proficiency needed to handle university-level work. Students with scores below 80 will be referred to the English Language Center at RIT for further evaluation and assistance.

The test is given at RIT's English Language Center in the George Eastman Memorial Bldg. (475-2321) at the beginning of each quarter prior to registration. In addition, the test also can be taken during each quarter by appointment. Rhona Genzel, director, English Language Center, can be contacted at 475-6684 for further information. Students who have paid deposits will receive information on exact testing dates from Mary Ann Campbell, assistant director, International Student Affairs, who can be contacted at 475-6876.

There is no cost for the test to RIT students who have already been accepted, or their spouses. All others must pay a $30 fee.

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 program cumulative grade point average. This program cumulative grade point average shall average 3.0 ("B") as a graduate 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

E and F grades count as 0 in computing the grade point average (GPA). The GPA is computed by the following formula:

$$\frac{\text{total quality points earned}}{\text{total quality hours}}$$

There are other evaluations of course work that do not affect GPA calculations. Only I, W 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 work.

Completion of this work will be noted by having the approved/accepted thesis 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 grade 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" form from the professor by the end of the second succeeding quarter. Full tuition is charged.

Withdrawn (W)—will be assigned in courses from which a student withdraws after the second week and before the ninth 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 6 days of classes. Audited courses do not count toward the residency requirement.

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 of any credit received through registration for the indicated course. 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 Dean of Graduate Studies 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 towards 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, thus retaining the total 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, plus the head of the department enrolling the student. When approved by both of these individuals, the form is then sent to the registrar. There is, however, an appeal procedure for disputed grades through the Academic Grievance Committee of the college in which the course was 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 advisor 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.

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.

Student Services

The Wallace Memorial Library

Wallace Memorial Library is a high-technology, multimedia resource center with a collection of over 500,000 items. Included in the holdings are 5,400 subscriptions, 2,300 theses, 230,000 microforms, 5,000 cassettes, tapes and records, and over 200,000 books. Access to the collection is provided through an online computer catalog on site or by remote access. Services include interlibrary loans, computerized literature searching of commercial data bases, class instruction, individual taped tours and access to the Archives and Special Collections Room.

The library also contains a special collection of materials on the deaf to serve the National Technical Institute for the Deaf. Supplementing the main library is the Graduate Chemistry Library in the College of Science.

The Media Resource Center located just inside the library entrance on the main level contains a variety of audiovisual equipment and non-print media for individual use. In addition, the center contains more than 70,000 slides. Preview facilities and study carrels are also provided.

The Audiovisual Service Department houses a collection of nearly 400 films and provides materials, equipment, and assistance for classroom instruction. Approximately 3,500 films are shown in classrooms each year.

The library is open over 100 hours a week with extended hours before finals.

Reference librarians are available during the week and on weekends to provide individual assistance, and a special instruction librarian offers service for the hearing-impaired and disabled. The Center for the Visually-impaired houses a Kurzweil Reading Machine and other aids.

For additional information call (716) 475-2562, or 610WMLREF (RITVAX).

Information Systems and Computing

Information Systems and Computing (ISC) provides computing services on VAX/VMS and VAX/ULTRIX (UNIX) systems and various microcomputers at no cost to students regardless of their majors. Many RIT colleges also have computing facilities available to students in their programs.
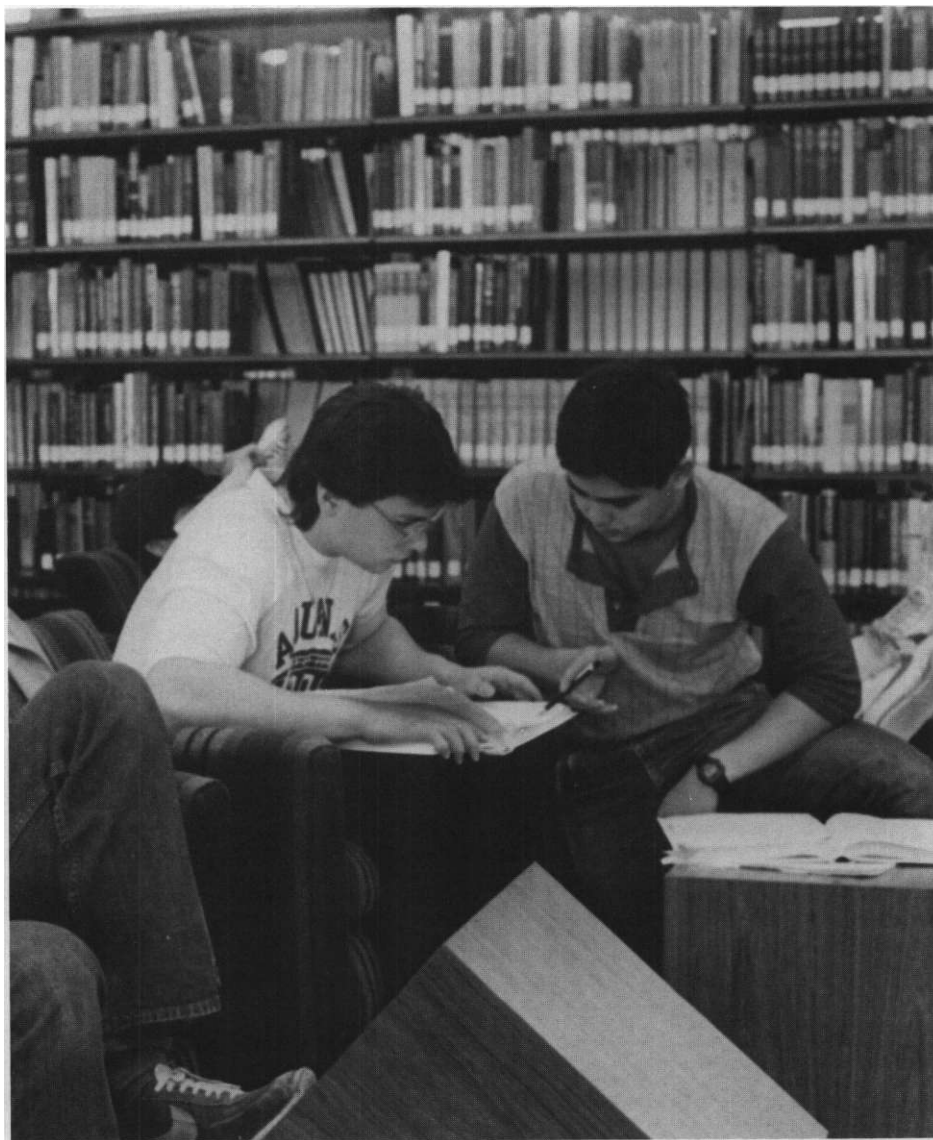
A VAX/VMS computer account is available to each registered student whether or not specific computer use is required in the student's program. The account remains active as long as the student is registered and in good standing. ISC publishes the *Computer Use Code of Conduit,* which provides guidelines on the use of computers at RIT.

Computer accounts and the files stored in those accounts are the property of RIT. ISC and departments that student accounts are associated with have the right to review and delete accounts and files. Normally accounts are deleted only if the student leaves RIT. ISC will take action against people who abuse the privilege of using RIT's computers.

Central computer systems can be accessed via telephone or terminals in the User Computing Centers (UCC) located in the James E. Gleason Memorial Building (9), Max Lowenthal Memorial Building (12), Microelectronics/Computer Engineering Building (17), Lewis R Ross Memorial Building (10), and the Grace Watson Hall (25).

UCC and Microcomputer Lab employees assist students using the computer systems. Professional software specialists in the Academic Computing and User Services Department also are available for consultation or presentation of free seminars. Documentation is available in the UCCs and labs, and can be purchased from ISC User Services or Campus Connections' Textbook Department The monthly *ISC Newsletter,* and on-line HELP, INFO and NEWS also provide information on using ISC systems.

Questions and comments regarding ISC services and policies can be made to Academic Computing and User Services staff in the Ross Memorial Building, room A291, or by calling (716) 475-6929. VAX/VMS computer accounts can be obtained from that office. Questions regarding use of computing facilities provided by RIT colleges should be made to the specific college.
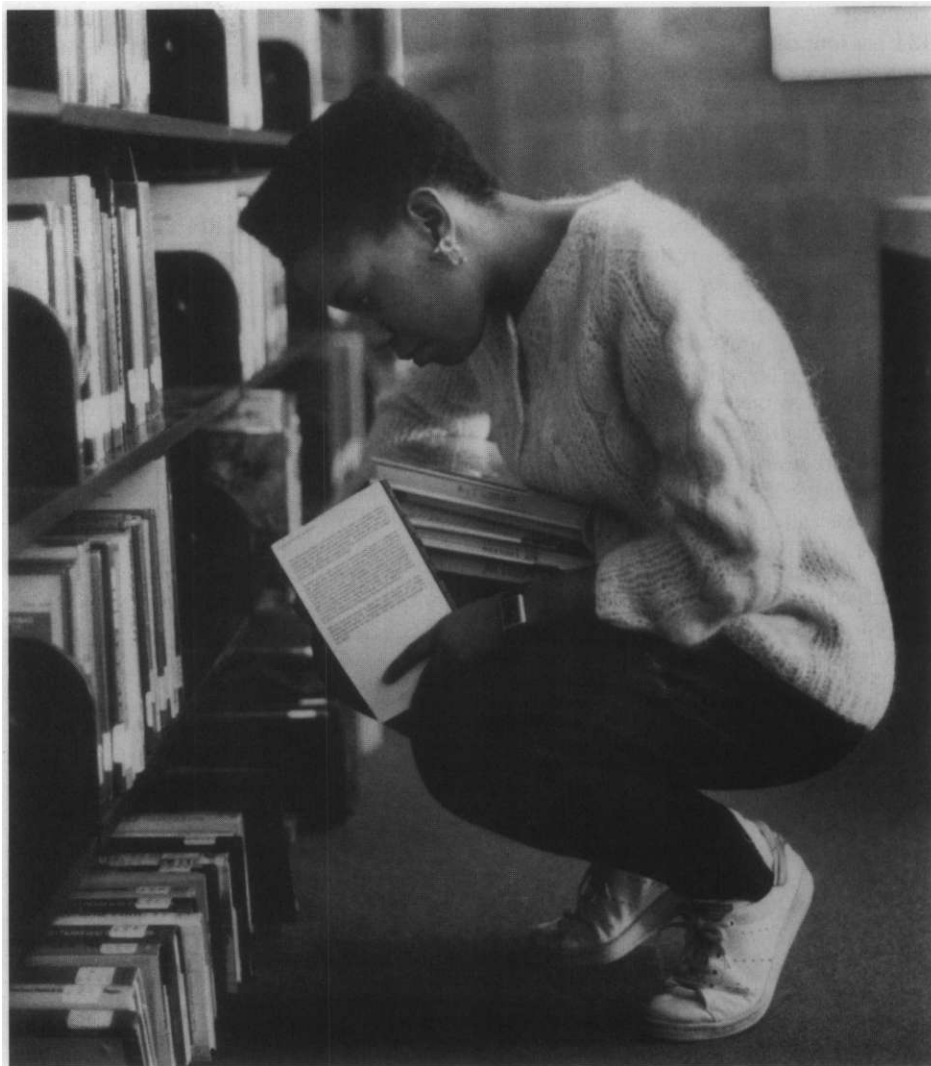
Counseling Center

The Counseling Center, located in Grace Watson Hall, offers a variety of services to RIT graduate students. These services include:

    Personal/Psychological Counseling
    Alcohol Counseling & Referral Services
    Career Counseling
    Career Resource Center
    SIGI (System of Interactive Guidance
        and Information)
    Testing
    Developmental Programs and Groups
    Consultation
    Victims Assistance Program
    Referral Services

Counseling Center hours are 8 a.m.-5 p.m., Monday, Tuesday, Thursday; 8 a.m.-8 p.m., Wednesday; and 8:30 a.m.-4:30 p.m., Friday. For more information about Counseling Center services, call (716) 475-2261.

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 the day to all graduate students of the Institute and may be scheduled at the center, located on the second floor, north end, of the administration building.

Child care

RIT's Horton Child Care Center offers preschool and kindergarten programs for the children of students, faculty, and staff. For complete information, call (716) 475-5948.

Housing

RIT has four campus apartment complexes on the campus for both married and single students. You should apply through the Office of Apartment Life, Rochester Institute of Technology, P.O. Box 9887, Rochester, N.Y. 14623. This should be done at your earliest convenience.

The residence halls are designed and programmed primarily for undergraduate students. Due to increased enrollment and the number of returning students living in the halls, they have been filled beyond capacity for the past several years. Entering students are frequently tripled.

There are several large apartment complexes within a short distance of the campus. Please call the Apartment Life office at (716) 475-6920 for information.

Identification cards

You will need an RIT identification card to use any campus facility.

You should apply for your identification card at the time of your first registration.

For further information, call the ID office at 475-2125.

Automobile registration

Those students having automobiles on campus must register these vehicles with Campus Safety at the time they first register for classes, or upon bringing the automobile onto campus for the first time.

Enrollment of veterans

Courses and programs at the Institute are approved for the education of veterans under the Veterans Readjustment Benefits Act, the Rehabilitation Acts, and 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 your local VA office or on campus from the Veterans Affairs Office.

Visit the Veterans Affairs Office and complete the necessary forms to ensure your benefits will arrive on time for the beginning of school.

Students who have been receiving benefit payments at other institutions or while participating in a different program and wish to transfer into one of RIT's many programs will be required to complete and submit a "Request for Change of Program or School" form.

To ensure a smooth transition and successful academic program completion at RIT, start your benefits paper work early. For benefits assistance or information, call the Veterans Affairs Office at 475-6641.

Emergencies; Escort Service

In case of emergency (fire, injury) the Institute's 24-hour emergency number 475-3333, should be called. For routine security services, 475-2853, which is staffed 24 hours a day, should be contacted.

Office of Cooperative Education and Placement

The Office of Cooperative Education and Placement 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 largest and strongest co-op programs. In fact, RIT's program is the fourth oldest and fifth largest cooperative education program in the world. Many co-op positions lead directly to permanent positions upon graduation. Other students find permanent positions through RIT's outstanding on-campus recruitment program, bringing employers and students together in a professional environment for interviewing.

Graduates, co-op students and alumni find the services of the Office of Cooperative Education and Placement helpfiil in the job search. Individual career counseling, group skills sessions, reference/credential services, job listings, a resource library, and on-campus interviewing provide a steady linkage between campus and the workplace. All students approaching graduation are encouraged to attend one of many orientation sessions and register for use of services during the important job-search period. Graduate students often seek their counselors early in the graduate program. Employers seeking qualified graduates with an advanced degree contact the office for job listings and interviews with graduate students. The Office of Cooperative Education and Placement is committed to linking RIT students to career experiences and to career entry upon graduation.

Student Health Service

Student Health Service provides primary level medical care on an outpatient basis. The staff includes physicians; medical nurse practitioners; registered nurses; and an interpreter for the deaf. Some specialties-psychiatry, gynecology—are available on campus by appointment In addition, Student Health Service provides health education programs.

Student Health Service is located on the second floor of the George Eastman Memorial Building. Students are seen on a walk-in basis (Monday through Friday, 8:30 a.m. to 4:00 p.m.; to 4:30 p.m. for emergencies). Appointments for follow-up treatment are arranged when necessary. A registered nurse is on duty in Nathaniel Rochester Hall in the evening (4:30-11 p.m.). On Saturday and Sunday a medical provider is available from 10 a.m. to 3:30 p.m. (to 4 p.m. for emergencies) in Nathaniel Rochester Hall.

For emergency transportation, the RIT Ambulance is available. The unit can be reached through Campus Safety at 475-3333.

Payment of a quarterly Student Health Service fee is mandatory for all full-time undergraduate students. All other students may pay either the quarterly fee or on a fee-for-service basis. Some laboratory work ordered through Student Health Service is not covered by this fee; there is a nominal charge for this service. The health fee does not include prescription medications.

The Institute **requires** students to maintain health insurance coverage as long as they are enrolled at RIT. Students may obtain coverage either through RIT or their own insurer.

Questions about Student Health Service or health insurance should be directed to the office (475-2255).

Health records: Medical records are confidential. Information will not be released without the written consent of the student. Exceptions to this rule are made only when required by the public health laws of New York State.

Institutional and civil authority

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.

College of Applied Science and Technology

**Wiley R. McKinzie,** Acting Dean

Graduate education in any discipline requires commitment of both the student and the institution involved. The graduate-level academic areas within the College of Applied Science and Technology represent RIT's commitment to curricular innovation, program flexibility, and academic rigor. The College of Applied Science and Technology is composed of five academic units: the School of Computer Science, the School of Food, Hotel, and Tourism Management, the Department of Packaging Science, the Department of Instructional Technology, and the School of Engineering Technology. Graduate degree programs are offered in each of these areas except for the School of Engineering Technology. The graduate programs in these areas are recognized as being academic leaders in the state, national, and international education communities. Graduates are employed or highly sought after by their respective industry and business groups.

Individuals entering computer science have a number of degree options from which to choose. The newest of these is an MS degree program in software development and management Also new is an MS degree in hospitality-tourism management and a graduate-level certificate program in applied computer studies. The program in instructional technology answers the growing demand for professional systems-oriented training design and development experts. The master's program in packaging science exists in response to identified demand from the industry for people with graduate education in packaging science.

The following graduate programs are currently offered in the College of Applied Science and Technology.

Master of science degree in computer science

Graduates of computer science, science, engineering, or business programs who wish to pursue advanced technical and theoretical studies in the field, for purposes of employment or further graduate study at the doctoral level, will find this curriculum offers the opportunity to tailor a program that will satisfy their goals. Both day and evening courses are available.
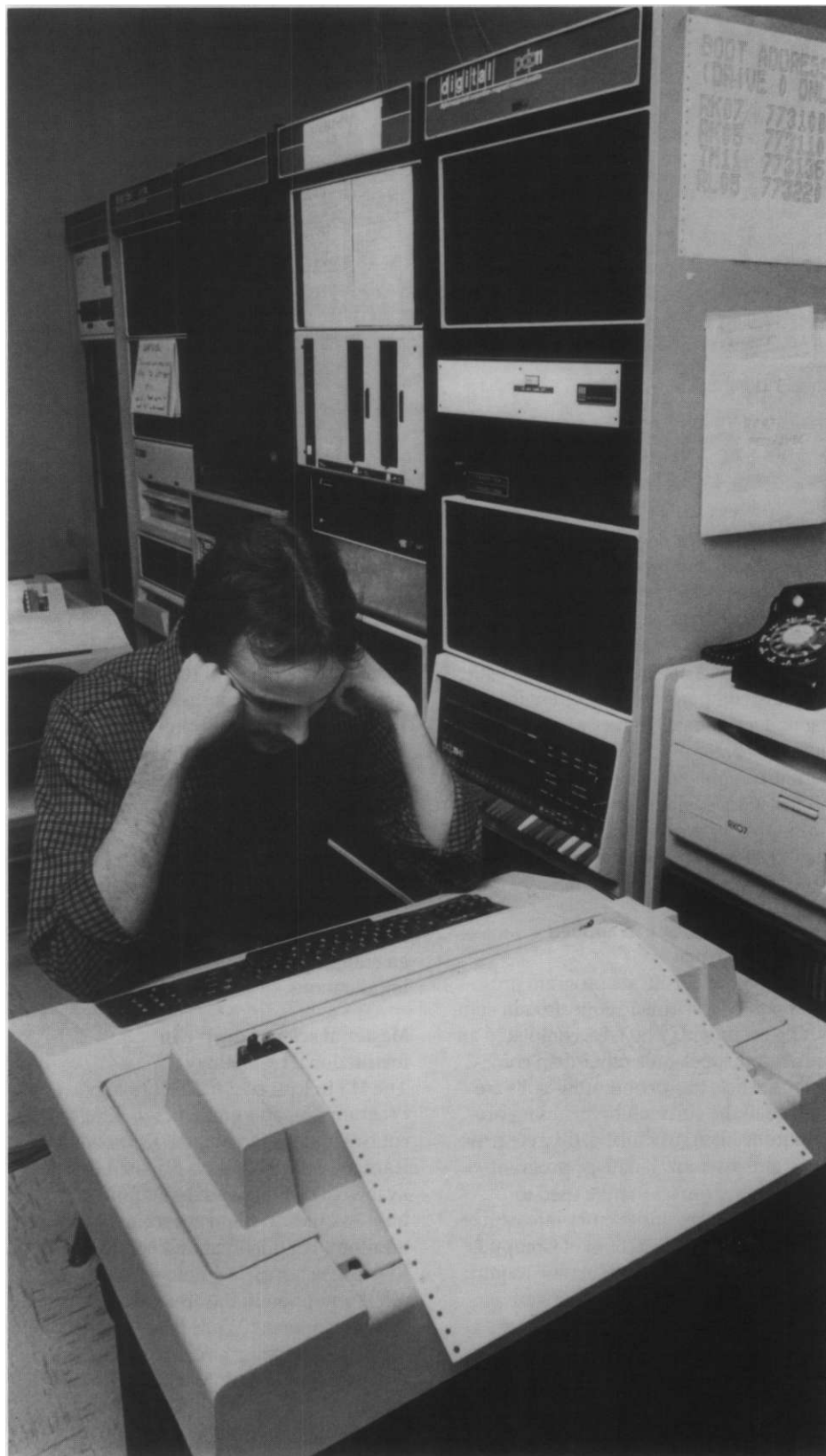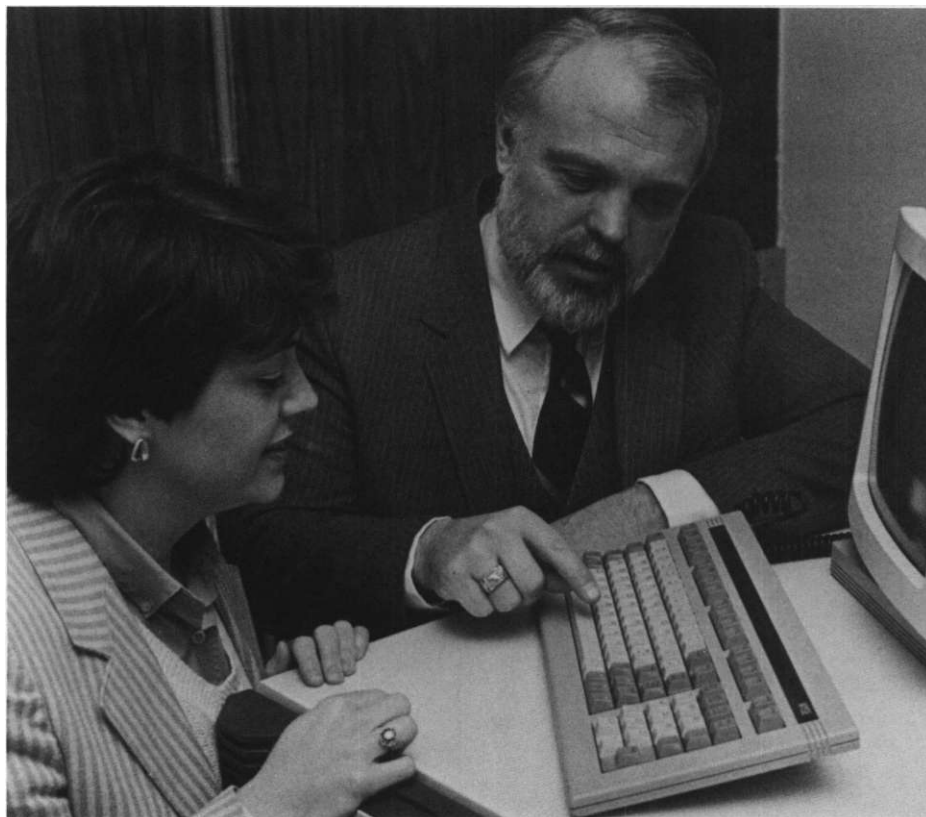
Master of science degree in software development and management

This graduate degree program prepares students to manage software development projects within a corporate environment The program is oriented to students with business, computer science, or engineering undergraduate degrees who wish to pursue a career in software development Software engineering methodology and project management are major elements within the curriculum. Courses are scheduled to allow both full- and part-time students to enroll in the program.

Advanced certificate in applied computer science

This advanced certificate program provides post-baccalaureate education in computing to students who have completed an undergraduate degree other than computer science. Basic computing skills are covered in the curriculum including programming, data structuring, discrete structures, and assembly language programming. These courses may be used to accomplish prerequisite entry into degree programs within the School of Computer Science, as well as completing the requirements for the certificate. Courses are scheduled to allow part-time students to complete the requirements in one calendar year.

Master of science degree in hospitality-tourism management

The MS in hospitality-tourism management is by design multidisciplinary, in part because its program offerings demand a constant integration of theory and practice. It recognizes that successful professionals in the hospitality-tourism industry must have at their command an extensive and variable set of techniques and strategies to accomplish managerial fact finding, decision making and interpersonal communications. It also acknowledges that successful professionals need intellectual abilities, which allow them to familiarize themselves quickly and thoroughly with an endless procession of new and changing situations.

Master of science degree in instructional technology

The MS in Instructional Technology Program prepares graduates to develop courses and training materials for adult learners. The program is oriented primarily toward training and development in business, industry, and governmental organizations. For qualified individuals, the RIT Instructional Technology Program offers an option in the area of training and development. While based strongly in theories of learning and instruction, the program is pragmatic and offers training in specific job-related skills. The program may be taken as a full- or part-time stu-

dent Most courses are offered in the evening hours to enable all those employed during the day to pursue degree work.

Master of science degree in packaging science

This graduate program is a natural extension of the undergraduate curriculum, and is one of only a very few graduate curricula in the U.S. Students completing undergraduate studies may continue the study of packaging at a more intensive level, and those who are already working in industry can use the program to enhance career development or allow for concentrated study in an area of interest There is enough flexibility in curriculum requirements to tailor programs to suit individual need. Courses are generally offered late in the day so that people presently employed full-time may pursue the degree.

School of Computer Science

Wiley R. McKinzie, Director, School of Computer Science
Peter G. Anderson, Chairman, Graduate Computer Science Department
Guy Johnson, Chairman, Applied Computer Studies Department
Evelyn Rozanski, Chairperson, Undergraduate Computer Science Department

The School of Computer Science offers several graduate programs leading to advanced certificates and degrees in the computing field. This includes the master of science degree in computer science, the master of science degree in software development and management, and the advanced certificate in applied computer studies. Graduate courses are given at times of the day convenient to both part-time and full-time graduate students: late afternoon, evening, early morning, etc. Students may begin their course work in any one of the four quarters at RIT. Depending on individual preparation, a full-time student can complete the course work for the computer science degree in as little as one calendar year and complete the thesis or project in one more quarter. The software development and management degree requires slightly more time and completion of a project requirement The advanced certificate may easily

be accomplished in one calendar year by a part-time student.

The master of science in computer science degree program prepares students for a wide variety of computer-related careers in business, industry, and academia. Graduates are prepared to work in computer system software design, specification, applications, and education.

The master of science in software development and management prepares students for management positions in the software development industry. Students become proficient in the practices, methodologies, and problems in the software development process.

The advanced certificate is intended for students who have a background in some discipline other than computer science and wish to become proficient in programming and computing skills. The courses that make up the requirements for this certificate may serve as entry requirements for the other degree programs. Alternatively these courses will provide the student with skills that are increasingly important in many career paths in high-technology industry.

These programs are particularly suited to individuals who have a strong undergraduate background in a quantitative field in which computers are applied, such as engineering, science and business.

Computer facilities

Supplementing the computing resources provided by Information Systems and Computing, as listed in the Student Services section of this catalog, the School of Computer Science and Technology provides extensive facilities for students and faculty. The hardware associated with these facilities represents current distributed processing technology, including an Ethernet coupling:

- two VAX-11/780 systems
- five Motorola 68000-based microcomputers (the operating systems laboratory)
- seven Apollo DN3000 workstations with one file server
- forty SUN 3/50 workstations with three file servers
- nine SUN 3/60 color workstations with one file server
- six SUN 2/120 workstations
- 12 Apple Macintosh systems
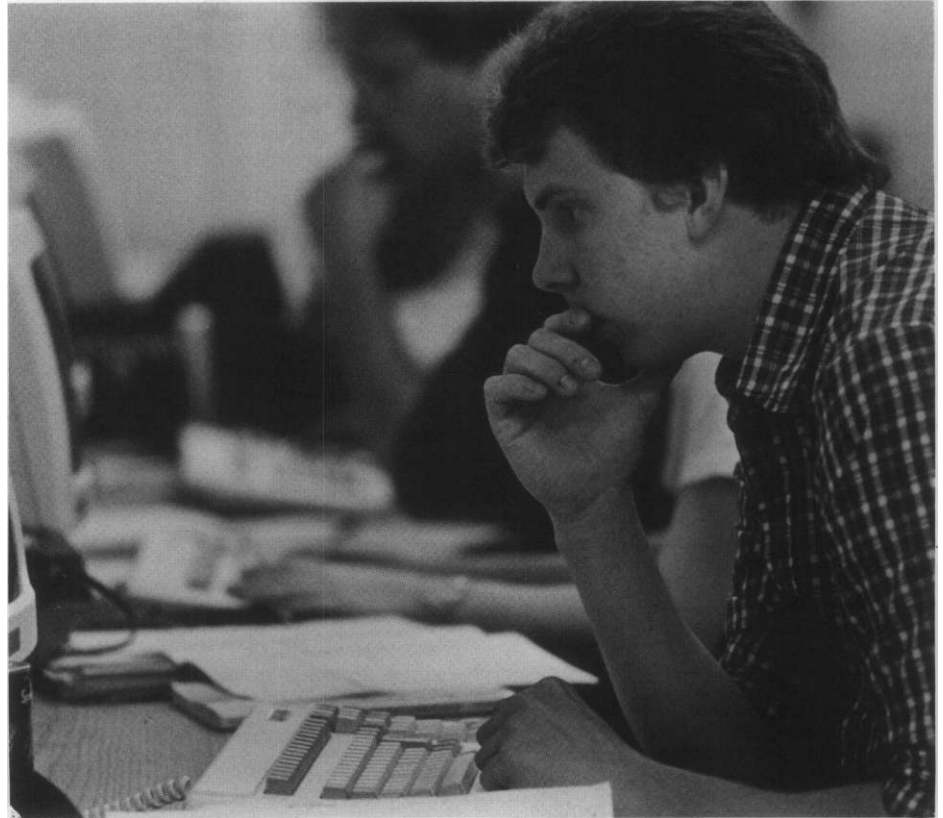
Most of our computers operate under the UNIX (UNIX is a trademark of Bell Labs) operating system. There are over 60 CRT terminals (half supporting color graphics) accessing the larger systems.

A digital logic laboratory is equipped with single-board microcomputers supporting courses, individual student projects, and theses.

A laboratory devoted exclusively to graduate computer science students has the following equipment:

- four AT&T 3B2/400 computers running AT&T System V UNIX. They each support 5-10 users, contain 140 Mbytes of file storage and 4 Mbytes of memory.
- an AT&T 3B2/600 computer running AT&T System V UNIX. This system supports 25 users, with 12MB RAM and over 800MB disk storage.
- a network of 13 Xerox 8010 workstations running (a) the Pilot operating system and the Xerox Development Environment, (b) the ViewPoint word processing system, and (c) the Interlisp-D Common Lisp, and LOOPS artificial intelligence environment. There also are networked services providing large amounts of file storage, laser printers, mail, and remote communications of various kinds.

- 35 AT&T 3B1 UNIX PCs running AT&T System V UNIX, each with a built-in modem, 2MB RAM, and 40 or 67MB hard disk. These are integrated with the other systems to serve as student and faculty workstations.
- a Pyramid Technologies 90X computer running both AT&T System V and Berkeley 4.2 UNIX with 64 ports, 11MB of main memory, and over 800 Mbytes of disk space.

Ethernet, Starlan, and ISN are 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, and course work.

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

Master of Science in Computer Science

Entrance 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).

Applicants from foreign universities should submit Graduate Record Exam (GRE) scores. (GRE scores can also be considered for applicants whose undergraduate grade-point average is lower than 3.0.) Applicants whose native language is other than English should take the TOEFL examination; a score of at least 535 is required. Applicants with a lower TOEFL may be admitted conditionally and will take a prescribed program in English along with a reduced program course load.

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 meet these prerequisites and 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 Structures

Computing
Experience with a modern high-level language (e.g., Pascal, Ada, Modula, Algol)
Data structures programming
Assembly language programming
Basic software design methodology
Elementary computer architecture and digital logic
Elementary systems programming

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 advisor.

Mathematics
Calculus SMAM-251, 252, and 253
Statistics SMAM-351, EIEI-715, or BBUQ-781
Discrete Structures ICSA-705 or SMAM-265

Computing
Introductory Programming ICSA-700
Algorithms and Data Structures ICSA-703
Assembly Language ICSA-704
Advanced Programming ICSA-707
Computer Organization and Programming ICSA-708

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. The Bridge Program courses are not part of the 48 credits required for the master's degree, and their grades are not included in a student's graduate grade-point average.

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, concentration, and a thesis or project (total of 48 credits).

The computer science core consists of six courses:
ICSG-700 Foundations of Computing Theory
ICSG-710 Programming Language Theory
ICSG-720 Computer Architecture
ICSG-730 Operating Systems, I
ICSG-740 Data Communications & Networks, I
ICSG-750 Artificial Intelligence
Students who elect the thesis option take three electives (12 credits); project students take two electives. Electives provide breadth of experience in computer science and applications areas. Students who wish to include courses from departments outside computer science need prior approval of their graduate advisor. Refer to the Graduate Catalog course descriptions in the computer science, engineering, and business sections for possible elective courses.

Concentration sequences are available in the six areas represented by the "core" courses. A student will usually form a concentration by taking the second course in the chosen area and the remaining credits in seminars. (Other concentrations are possible and may be designed with the student's advisor.)

Thesis-option students take one eight-credit concentration; project-option students take both an eight-credit and six-credit concentration sequence.

Students' programs of study must be designed in cooperation with a graduate advisor.

The master's thesis or project

A thesis is the capstone of each graduate program. Before registering for ICSG-890 (thesis) or ICSG-891 (project) a student must submit an acceptable proposal to the computer science graduate faculty.

Financial aid

Scholarships and graduate assistantships are available in the School of Computer Science. Information may be obtained from:

Graduate Studies Chairman
School of Computer Science
Rochester Institute of Technology
One Lomb Memorial Drive
P.O. Box 9887
Rochester, New York 14623-0887

Master of Science in Software Development and Management

Entrance 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).

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

In addition, there is a certain minimal background required of all students wishing to enter the master's program. If an applicant is lacking in some way, Bridge Program courses are provided to allow students to meet these prerequisites and 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 areas that constitute the required minimal background are:

Mathematics
Discrete Structures
Statistics
Computing
Experience with a modern high-level language (e.g., Pascal, Ada, Modula, Algol)
Data structures programming
Elementary computer architecture and digital logic
Business
Accounting
Organizational Behavior

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 advisor.

Mathematics
Statistics BBUQ-781
Discrete Structures ICSA-705

Computing
Introductory Programming ICSA-700
Data Structures ICSA-703
Computer Hardware Fundamentals ICSA-709
Business
Accounting BBUA-703
Organizational Behavior BBUB-740

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. The Bridge Program courses are not part of the 56 credits required for the master's degree, and their grades are not included in a student's graduate grade-point average.

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 Graduate Studies Handbook for more details.)

The curriculum
The graduate program of study consists of 56 credits comprising the Management Foundation, Computing Foundation, Software Engineering Block, and Software Engineering Project.

The Management Foundation consists of three courses: BBUQ-744 Project Management and two management concentration selections.

The management concentration consists of a student selection of two courses from the following areas of the graduate business curriculum: management, economics, marketing, or decision sciences.

The Computing Foundation consists of three courses:
ICSA-720 Principles of Data Management
ICSA-725 Principles of Distributed Systems
ICSA-820 Software Engineering Concepts

The Software Engineering Block consists of four required courses and two electives:
ICSA-821 Analysis and Design Techniques
ICSA-823 Program Design and Implementation
ICSA-830 Software Project Management
ICSA-835 Program Testing and Reliability
Two electives

One elective must be taken from selections within the School of Computer Science, and the other must be selected from either the College of Business or the School of Computer Science.

The Software Engineering Project consists of two courses:
ICSA-894 Software Project Laboratory
ICSA-895 Software Engineering Project
Students' programs of study must be designed in cooperation with a graduate advisor.

Financial aid
Scholarships and graduate assistantships are available in the School of Computer Science. Information may be obtained from:
Chairman, Applied Computer Studies
School of Computer Science
Rochester Institute of Technology
One Lomb Memorial Drive
P.O. Box 9887
Rochester, New York 14623

Advanced Certificate in Applied Computer Studies

Entrance 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).

Applicants should submit two professional recommendations.

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

The curriculum
The graduate program of study consists of 28 credits comprising the Programming Skills Block, Computer Hardware Block, Math Skills Block, and Advanced Elective.

The Programming Skills block consists of four courses:
ICSA-700 Computer Programming and Problem Solving
ICSA-703 Algorithms and Data Structures
ICSA-704 Assembly Language Programming
ICSA-707 Advanced Programming
The Computer Hardware Block consists of one course:
ICSA-708 Computer Organization and Programming
The Mathematics Skills Block consists of one course:
ICSA-705 Discrete Computational Structures
The Elective Block consists of one course:
Elective selected from any graduate curriculum within the School of Computer Science.

Students' programs of study must be designed in cooperation with a graduate advisor.

Financial aid
Scholarships and graduate assistantships are available in the School of Computer Science. Information may be obtained from:
Chairman, Applied Computer Studies
School of Computer Science
Rochester Institute of Technology
One Lomb Memorial Drive
P.O. Box 9887
Rochester, New York 14623

Department of Instructional Technology

Clint Wallington, Director

At RIT, instructional technology is synonymous with developing training courses for business and industry. Although a few graduates choose to enter higher education or health training, the vast majority hold jobs in business, industry, or in larger organizations in the public sector. While their training responsibilities vary from place to place, most start by designing courses—some lengthy, some only a lesson or two to fit into a day-long seminar.

At RIT, instructional technology means an orientation toward training where the bulk of the instructional load is carried by a highly structured set of lessons based on materials. While the instructional technology program does have courses in computer-assisted instruction and interactive training, the type of training drives the selection of media, not vice-versa.

At RIT, instructional technology also means "people skills." Good instructional developers must have good interpersonal communications skills, and the instructional technology program has required courses in interpersonal communications and group dynamics—not theory-only courses, but process courses.

At RIT, there are also certain things that instructional technology is *not*. The RIT instructional technology program is not a traditional teacher education nor a curriculum methods program. The reason is simple. While certain learning principles are constant in any setting, their application in business and industry training is often quite different from their use in elementary and secondary education.

Because trainers in the private sector are not frequently called on to actually produce audiovisual shows, the RIT program is not a media production or a library-media program. Moreover, the program is not oriented toward research. It is designed to train trainers and course developers, not theorists.

In short, the program prepares people to develop courses to train adult learners in technical, professional, and managerial skills. While the program is rooted in the theories of adult learning and instructional development, it still has a strong practical component that makes the graduate a contributing member of a training and development team the first day on the job.

The program

The instructional technology program is a 48 (quarter) hour program. About half of the courses are required core courses. Qualified students may also elect to take an option in training and development.

The training and development option is for the graduate planning to enter the training field either in the private sector (business and industry) or larger organizations (social or governmental agencies) in the public sector. The training and development option requires that the student's elective courses be in areas that strengthen the skills sought by future employers. Currently, there is a widespread and expanding need for training specialists, especially instructional developers, in the private sector, and RIT currently has internship agreements (for qualified students) with at least three major corporations.

Admission requirements

Admission decisions for the instructional technology program are based on a review of the baccalaureate degree and any other course work, including grades; scores from the Graduate Record Examination or Miller Analogies Test; letters of reference from academic advisors or major professors and from supervisors or managers; and a personal statement of work goals and how the degree can contribute to those goals.

Nonmatriculated students with a baccalaureate degree may, with special permission, take 2 courses or 8 hours of course work (whichever comes first) from a list of selected courses. 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 any questions about the program, job prospects, or the relation of the degree to any personal goals, the student should contact the department director for an individual interview. Application forms are available from the RIT Admissions Office or the Instructional Technology Department.

Financial assistance

In addition to the assistance available through the RIT Financial Aid Office (716/475-2186) or the Dean of Graduate Studies (716/475-6523), the Instructional Technology Department often has departmental assistantships. The number and kind vary from year to year. For more information and assistantship applications, contact the department (716/475-2892).

Degree requirements

The degree requires the completion of a minimum of 48 quarter hours at the graduate level. Of the 48 hours, 29 are in 9 core courses required for all students. In addition, all students are required to complete an instructional development project that can serve as part of a portfolio for prospective employers. The degree may be completed in four consecutive quarters if the student starts in the fall quarter. However, the majority of students attend part time and take from two to four years to complete the degree work. A student *must* complete the degree within five years of matriculation. Almost all courses are offered in the evenings so that students may work in the daytime as they take courses.

Of the 19 hours of electives, students are relatively free to choose what they feel best meets their needs. The other restrictions are:

- all courses must be graduate level courses;
- a maximum of 9 quarter hours (not counted toward another degree) may be transferred from another college or university;
- a maximum of 12 hours may be taken outside the Instructional Technology Department;
- a maximum of 6 hours may be taken in projects or internship courses (ICIT-722, 840, and 850);
- a student may take a maximum of 14 hours of any combination of the above.

Each student has an academic advisor to help develop a plan of study. 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 ICIT-700, 735, 755, 756, 770 within the first 20 hours of course work. For specific questions, the student should see his/her academic advisor.

Required Core Courses	Credits
ICIT-700 Introduction to Instructional Technology	2
ICIT-735 Psychology of Learning and Teaching	4
ICIT-750 Instructional Development I	4
ICIT-751 Instructional Development II	4
ICIT-753 Group Dynamics	4
ICIT-755 Criterion Referenced Instruction and Technical Training I	3
ICIT-756 Criterion Referenced Instruction and Technical Training II	3
ICIT-770 Interpersonal Communications	2
ICIT-749 Strategy, Technology, and Futuring in Human Resource Development	3
Total Required Core	29

Training and Development Option
(10 hours)

ICIT-721 Evaluation of Training and Instruction	4
ICIT-736 Interviewing, Counseling, and Coaching in Training OR	3
ICIT-757 Techniques of Work Analysis	3
ICIT-758 Developing Instructional Modules	3

School of Food, Hotel and Tourism Management

George T. Alley, Director

The MS in hospitality-tourism management provides the industry with trained professionals who can step into numerous mid-level management and training director positions. The major orientation of the program is focused on training and supervision functions within the corporate setting, as well as those found at post-secondary academic institutions.

The curriculum

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 is a combination of required core courses in addition to required professional concentration courses in one of four specialized areas. It also contains elective courses appropriate for the candidate's background and interests, and *either* a research thesis or a graduate project.

Admission requirements

Prior to admission to the master of science degree program, applicants must satisfy the director 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, and will be required to take the Graduate Record Examination (GRE) or the Miller's Analogy Test (MAT). The complete list of admission requirements are:

- Graduate application
- Earned baccalaureate degree
- Graduate Record Exam *or* Miller's Analogy 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, if applicant has superior recommendations; high GRE or MAT scores; 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 (international students).

Program requirements

Students who already are qualified for one or more required courses may substitute other course work with the permission of the director 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 director of the program. The student may choose elective courses with the approval of the director of the program.

The core graduate courses are broad in their orientation, and provide a basic understanding of the complexities of services management, as well as insights into the relevant fact finding and managerial strategies used in the hospitality-tourism industry. The required core courses are:

ISMM-750 The Hospitality-Tourism Industry: A Systems Approach
ISMM-760 Research Methods and Application in the Hospitality-Tourism Industry
ISMM-770 Employee Relations and Training in Service Industries
BBUA-703 Accounting Concepts for Managers

The student also must declare a professional concentration. There are four professional concentrations (options) available. Each professional concentration consists of an integrated series of three courses, which focus upon specific issues within each professional field.

Foodservice/Restaurant Management Option:
ISMM-822 Computerized Systems for Food Service
ISMM-842 Food and Beverage Marketing Strategies
ISMM-862 Product Development and Problem Solving in Food Service

Hotel/Resort Management Option:
ISMM-824 Organizational Strategies of Hospitality Firms
ISMM-844 Hospitality Resource Management
ISMM-864 Problem Analysis and Decision Making in the Service Economies

Travel and Tourism Management Option:
ISMM-826 Tourism Policy Analysis
ISMM-846 Travel Marketing Systems
ISMM-866 Tourism Planning and Travel Product Development

Meeting Planning/Conference Management:
ISMM-828 Meeting Planning Management
ISMM-848 Convention and Exhibition Management
ISMM-868 Legal Issues and 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 the School of Food, Hotel and Tourism Management, the College of Business, and the Department of Instructional Technology. However, students are cautioned to observe course prerequisites in their selections. The following courses are offered as illustrations of the course offerings available as potential electives.

College of Business (Students must be matriculated into program)
BBUB-740 Organizational Behavior
BBUB-748 Employee and Labor Relations
BBUB-750 Human Resource Management
BBUB-756 Conflict Management and Negotiation Skills
BBUB-757 Interpersonal Skills for Managers
BBUB-761 Marketing Concepts
BBUB-763 Consumer Behavior
BBUB-765 Sales Management
BBUB-766 International Marketing
BBUB-767 Marketing Communications

Department of Instructional Technology
(Students must be matriculated into program)
ICIT-721 Evaluation of Training and Instruction
ICIT-735 Psychology of Learning and Teaching
ICIT-736 Interviewing, Counseling, and Coaching in Training
ICIT-757 Techniques of Work Analysis
ICIT-770 Interpersonal Communications
Of the 11 to 17 hours of electives, students are relatively free to select courses that they feel best meet their needs. The only limitations are:

- All courses must be graduate-level courses
- 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 be chosen which 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 thesis topic which has current hospitality-tourism industry relevance.

Projects are by nature of an applied research genre, reflecting the student's ability to utilize professional modelling 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.

Financial aid
Scholarships and graduate assistantships are available in the School of Food, Hotel, and Tourism Management Information may be obtained from:
Graduate Studies Chairman
School of Food, Hotel, and Tourism Management
Rochester Institute of Technology
One Lomb Memorial Drive
P.O. Box 9887
Rochester, New York 14623-0887

Master of science in hospitality-tourism management
The MS in hospitality-tourism management has as its primary mission the preparation of trained professionals to step into numerous mid-level management and training positions. The focus of its academic program includes several distinct fields of study: food service/restaurant management hotel/resort management travel/tourism management, and meeting planning/conference management By encompassing these areas within a single academic unit graduates understand the context of service management, as well as how to manage and train for its delivery.

Course offerings are generally scheduled late in the day as well as during the summer months to facilitate part-time students.

Department of Packaging Science

David L. Olsson, Director

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.

Requirements
Students entering the program will have a graduate academic advisor appointed and will develop their programs of study in consultation with their advisor. 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, by selecting one or more from the following list of undergraduate courses: Packaging Principles, Materials I, Materials II, Rigid Containers, Flexible Containers, Production Systems, Packaging for Distribution, Packaging for Marketing, and/or Shock and Vibration. 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 CTAM-712, and having completed a course in a programming language. Lacking this background, applicants will be required to take CTAM-711 and CTAM-712, and/or ICSA-205, or equivalent course work to remedy a background deficiency.

Application for admission for graduate study in packaging will be made through the RIT Office of Admissions. Final acceptance of the candidate for graduate study will be determined by the Department of Packaging Science. All applicants must (1) have earned a B (3.0) average grade in their final two years of undergraduate degree work, (2) submit transcripts of undergraduate work to the RIT Office of Admissions, and (3) 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.

The curriculum
The curriculum is comprised of three components identified as (1) packaging core courses, (2) research, and (3) 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 IPKG-701, Research Methods, and any four of the following:
IPKG-721 Packaging Administration
IPKG-731 Advanced Packaging
      Economics
IPKG-742 Distribution Systems
IPKG-750 Graduate Seminar
IPKG-752 The Legal Environment

IPKG-763 Packaging for End-Use
IPKG-770 Advanced Computer
      Applications
IPKG-783 Packaging Dynamics
IPKG-799 Advanced Packaging Design

Research
Students in the master's program will be required to prepare and defend a 12-credit thesis which has been completed under the supervision of their advisor. They may also elect to take up to 8 credits of independent study credit, but this may NOT be used as credit towards the 20 credits of packaging core course work.
IPKG-798 Independent Study
  1-4 credits, maximum of 8 credits; does not count as "core"
IPKG-890 Graduate Thesis
  12 credits; required. The type of research done and the area of study will be agreed upon by the student and the advisor before enrolling for graduate thesis credits.

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 advisor, 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.

Graduate Faculty College of Applied Science and Technology

Wiley R. McKinzie, MS, SUNY at Buffalo —School of Computer Science, Director, Professor, Acting Dean

William Stratton, Ph.D., SUNY at Buffalo—Associate Dean, Associate Professor

David L. Olsson, Ph.D., Michigan State University—Department of Packaging Science, Director, Professor

George T. Alley, MS, Rutgers University-School of Food, Hotel, and Tourism Management, Director, Professor

Clinton J. Wallington, Ph.D., University of Southern California—Department of Instructional Technology, Director, Professor

School of Computer Science

Wiley R. McKinzie, MS, SUNY at Buffalo —Director, School of Computer Science, Professor

Graduate Computer Science Department

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

John A. Biles, MS, University of Kansas— Assistant Professor

James Heliotis, Ph.D., University of Rochester—Assistant Professor

Andrew Kitchen, Ph.D., University of Rochester—Associate Professor

Donald L. Kreher, Ph.D., University of Nebraska—Assistant Professor

Peter Lutz, Ph.D., SUNY at Buffalo-Associate Professor

Stanislaw Radziszowski, Ph.D., University of Warsaw—Assistant Professor

Applied Computer Studies Department

Guy Johnson, MS, Syracuse University-Chairman, Professor

Chris Comte, MS, Rochester Institute of Technology—Assistant Professor

Gordon Goodman, MS, Rochester Institute of Technology—(Assistant Professor)

James Hammerton, MBA, New York University—Assistant Professor

Daryl Johnson, MS, Rochester Institute of Technology—(Instructor)
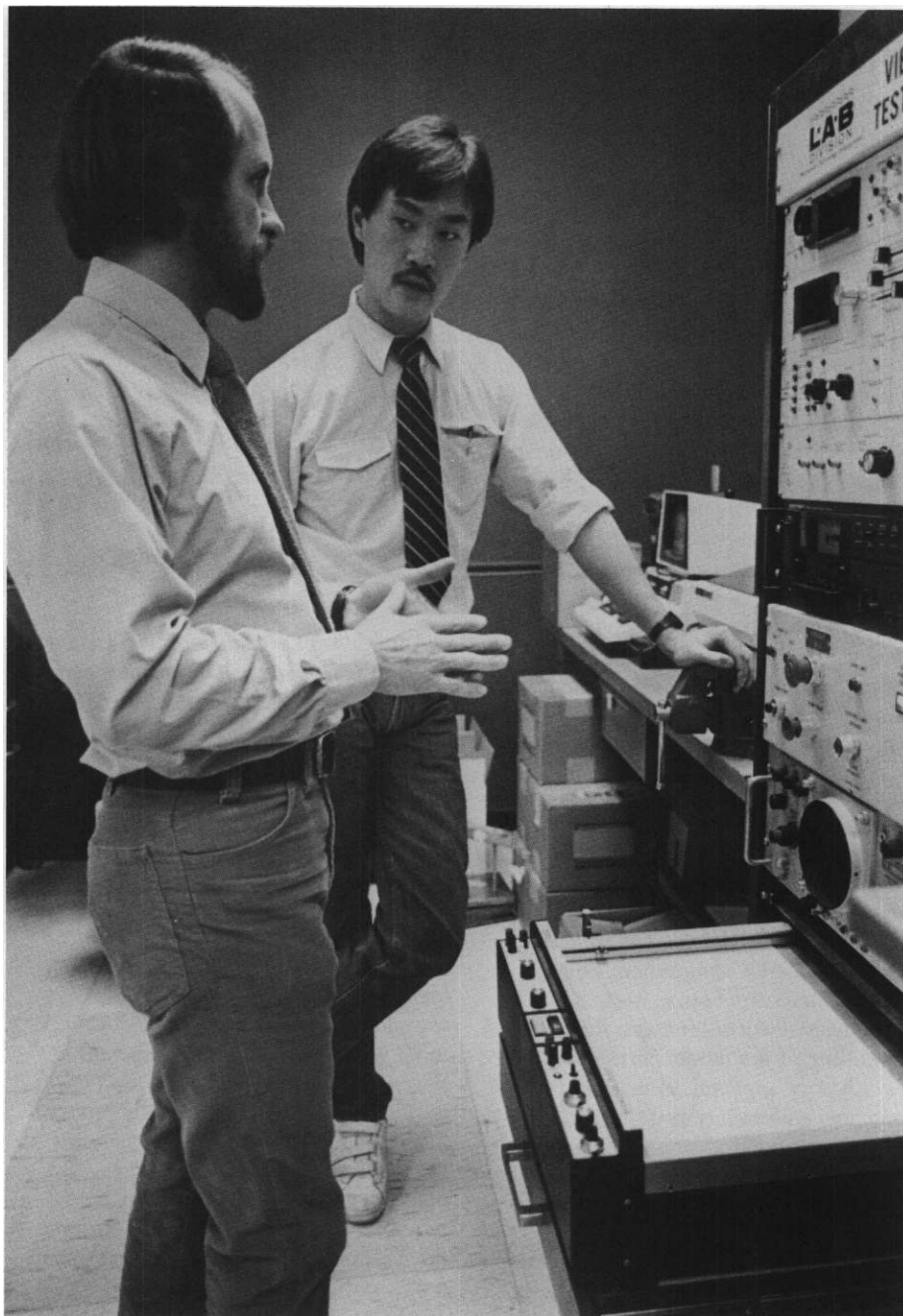
Alan Kaminsky, MS, University of Michigan—Assistant Professor

Stephen Kurtz, MS, Rochester Institute of Technology—Assistant Professor

Jeffrey Lasky, MBA, City University of New York—Associate Professor

William Stratton, Ph.D., SUNY at Buffalo-Associate Dean, Associate Professor

Undergraduate Computer Science Department

Evelyn P. Rozanski, MS, Syracuse University—Chairperson, Professor

Rodger Baker, MS, University of Rochester—Associate Professor

Warren Carithers, MS, University of Kansas—Assistant Professor

Lawrence Coon, Ph.D., Ohio State University—Associate Professor

Roy Czernikowski, Ph.D., Rensselaer Polytechnic Institute—Computer Engineering, Department Head, Professor

Henry Etlinger, MS, Syracuse University-Associate Professor

Fereydoun Kazemian, Ph.D., Kansas State University—Visiting Assistant Professor

Michael J. Lutz, MS, SUNY at Buffalo-Associate Professor

Rayno Niemi, Ph.D., Rensselaer Polytechnic Institute—Associate Professor

Kenneth Reek, MS, Rochester Institute of Technology—Associate Professor

Margaret Reek, MS, Rochester Institute of Technology—Assistant Professor

Nan Schaller, MS, Union College-Assistant Professor

Walter A. Wolf, Ph.D., Brandeis University—Assistant Professor

Adjunct Faculty—
School of Computer Science

Vishwas Abhyankar, Ph.D., University of Rochester

Frank Bernhart, Ph.D., Kansas State University

James R. Carbin, MS, Rensselaer Polytechnic Institute

Charles Fung, MS, Rochester Institute of Technology

Teiji Furugori, Ph.D., University of Buffalo

Steve Gooding, MSEE, Clarkson College

John D. Hanson, MS, Rochester Institute of Technology

James Hillenbrand, Ph.D., University of Michigan

Larry Hoffman, Ph.D., Iowa State University

Eugene Johnson, MS, Rochester Institute of Technology

Burton Kaliski, Ph.D., Massachusetts Institute of Technology

Narayan Kulkarni, MS, Rochester Institute of Technology

Edith Lawson, MS, Rochester Institute of Technology

Ralph Longobardi, Ph.D., Syracuse University

Bruce Lyon, MS, Rochester Institute of Technology

Walter Maurer, MS, Rochester Institute of Technology

Richard Orr, MS, SUNY at Buffalo

Paul Rulli, MS, University of Rochester

Mary K. Russell, MS, Rochester Institute of Technology

Werner Schenk, MBA, University of Rochester

Daniel Sorrentino, MS, Rochester Institute of Technology

Thomas J. Tatakis, BS, SUNY Potsdam

Jacqueline Vandellon, MS, Rochester Institute of Technology

George Zion, MS, Rochester Institute of Technology

School of Food, Hotel, and Tourism Management

George Alley, MS, Rutgers University-Director, School of Food, Hotel and Tourism Management; Professor

James Burke, Ph.D., University of Minnesota—Associate Professor

Barbara Cerio, R.D., MS, SUNY Buffalo-Assistant Professor

Francis M. Domoy, MA, SUNY at Buffalo; Ph.D. Michigan State University-Professor

Richard Marecki, Ph.D,, SUNY Buffalo-Associate Professor

Warren Sackler, MA, New York University—Assistant Professor

Edward Steffens, MBA, Rochester Institute of Technology—Assistant Professor

Edward B. Stockham, Ph.D., University of Pennsylvania—Assistant Director

Janet Clay White, R.D., MS, Cornell University—Assistant Professor

Carol Whitlock, R.D., Ph.D., University of Massachusetts—Associate Professor

Department of Instructional Technology

Clinton J. Wallington, Ph.D., University of Southern California—Professor

Michael A. Yacci, MS, Rochester Institute of Technology—Lecturer

Thomas H. Zigon, MS, Rochester Institute of Technology—Instructor

Adjunct Faculty

Gladys Abraham, MS, SUC Brockport

Andrew Dougherty, MBA, Bradley University—Distinguished Lecturer

Paul Kazmierski, Ph.D., Syracuse University

Albro C. Wilson, MS, Rochester Institute of Technology

Carl Winkelbauer, M.Ed., University of Rochester

Department of Packaging Science

David L. Olsson, Ph.D., Michigan State University—Director, Professor

A. Ray Chapman, MBA, Rochester Institute of Technology—Assistant Professor

Daniel L. Goodwin, Ph.D., Michigan State University—Associate Professor

Deanna M. Jacobs, MS, Rochester Institute of Technology—Instructor

Karen L. Proctor, MBA, Rochester Institute of Technology—Assistant Professor

Fritz J. Yambrach, MBA, Utah State University—Assistant Professor

School of Computer Science

Undergraduate Computer Science students may take 700 and 800 level courses only by consent of the School Director and the consent of the instructor.

Graduate students must obtain the consent of a graduate advisor in order to enroll in graduate courses not listed in their own program of study.

Applied Computer Studies

ICSA-700   **Computer Programming and Problem Solving**

Registration #0602-700

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 Pascal or Ada, 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. (Pre-calculus)

Credit 4

ICSA-701   **Programming I**

Registration #0602-701

Fundamentals of computer programming and problem solving using a modern software development environment and a structured programming language (Pascal or ADA). Introduction to and use of an interactive editor and file system. Applications in business, science, mathematics, engineering, education, systems programming, and graphics will be covered. Techniques will be introduced for data representation and structuring, sorting, and searching. Programming projects will be required. (Computer literacy, pre-calculus; discrete math, is a corequisite.)

Credit 8

ICSA-702   **Programming II**

Registration #0602-702

The concept of computer programming at various levels of application. At a lower level is a macro assembly language. At a higher level, a new language—APL, Snobol, etc. Combining program segments in a known high-level language. Modern programming practices, tools and techniques from the point of view of the software life-cycle: specification, design and prototyping, coding and verification, integration, and maintenance. A study of a programming language (e.g., ADA) and a software engineering environment (e.g., Unix) that supports these programming practices. Programming projects will be required. (ICSA-701 or equivalent)

Credit 8

ICSA-703   **Algorithims and Data Structures**

Registration #0602-703

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. (Programming proficiency in some high-level structured programming language, discrete mathematics)

Credit 4

ICSA-704   **Assembly Language Programming**

Registration #0602-704

Introductory computer architecture (von Neumann machine): addressing methods—direct, indirect, immediate, absolute, indexing, base register, etc.; operations-machine instructions, directives or pseudo-operations, and macros; representing program paradigms in assembler language—decisions, loops, subroutines, arrays, links, etc; assembly language program design techniques; macro definitions and use; libraries. Programming projects will be required. (ICSA-700, 701 or a programming proficiency in some high-level language.)

Credit 4

ICSA-705   **Discrete Computational Structures**

Registration #0602-705

The fundamental concepts of discrete mathematics which are necessary for understanding the mathematical foundations of computer science. Topics include: structures defined on countable sets elementary symbolic logic, patterns of mathematical proof, vectors and matrices, graphs and networks, combinatorics, formal languages, abstract mathematical systems. The relevance of the chosen topics to Computer Science and the applications of computers to these topics are stressed. (College algebra, computer literacy)

Credit 4

ICSA-706   **General-Purpose Software I**

Registration #0602-706

In this course students will be introduced to computers and problem solving by learning to use general-purpose application software. Students will use a variety of general-purpose software tools such as a spreadsheet, data base package, outline and word processors, and graphics software to complete a series of required projects. Emphasis is on using software for personal productivity and to enhance effectiveness and communication. Required projects will utilize packages individually and in an integrated fashion. (Graduate standing)

Class 4, Credit 4

ICSA-707   **Advanced Programming**

Registration #0602-707

An introductory course in the life-cycle issues of large and single/multi-programmer programs. Structured and modular programming, data abstraction and information hiding. The Chief programmer concept. 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 languages such as ADA). Programming projects will be required. (ICSA-703)

Credit 4

ICSA-708   **Computer Organization and Programming**

Registration #0602-708

An introduction to the basic concepts and terminology of hardware and software systems. Basic hardware is elementary circuit design-gates, Boolean algebra, simple combinational circuits (adders, decoders, multiplexers) and simple sequential circuits (various flip-flops, registers, serial adders, counters). The Operating System as the major software providing a "virtual" interface-virtual memory (paging, segmentation, etc.), file systems, multiprogramming, traps and interrupts, etc. The intent of this course is to prepare the student for future courses in computer architecture and operating systems. Programming projects will be required. (ICSA-703, 704)

Credit 4

ICSA-709   **Fundamentals of Computer Hardware**

Registration #0602-709

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 a survey of commercially available computers. (ICSA-700, 703)

Class 4, Credit 4

ICSA-720   **Principles of Data Management**

Registration #0602-720

Introduction to topics in analysis and design of data representations. This includes external data structuring for sorting and searching applications, file structures: Sequential, Indexed, Random, and Inverted, and data base concepts: views, architectures, normalization, and data manipulation. Programming projects will be required. (ICSA-700, 703, 709)

Class 4, Credit 4

ICSA-725   **Principles of Distributed Systems**

Registration #0602-725

Introduction to data communications, transmission, terminal handling, fundamentals of networking, high-level protocols, local networks. Issues in control of distributed systems. Communicating sequential processes, concurrency, redundancy, reliability (ICSA-700, 703)

Class 4, Credit 4

ICSA-820   **Software Engineering Concepts**

Registration #0602-820

An introduction to the field of software engineering. The overview encompasses analysis and design methodologies and techniques, programming design languages, software project management principles, and quality assurance and control. (ICSA-700, 703, 709, BBUQ-740, 781, BBUA-703)

Class 4, Credit 4

ICSA-821   **Analysis and Design Techniques**

Registration #0602-821

An examination of current methodology and techniques in systems analysis and design. Methodologies covered include those of Yourdon, Warnier, and Jackson. Students will be required to demonstrate a practical mastery of a combination of several of the techniques that are presented. Application areas will include traditional information systems, distributed systems, and real-time systems. (ICSA-720, 725, 820)

Class 4, Credit 4

ICSA-823   **Program Design and Implementation**

Registration #0602-823

Presents techniques for developing, expressing and implementing program and systems designs. Emphasis is placed on the use of formal tools in the production of correct and reliable programs. Application areas will include traditional information systems, distributed systems and real-time systems. An introduction to formal proofs of program correctness is included. Course work is expressed in a program design language and implemented in a modern programming language such as ADA, MODULA-2 or MESA as part of a team effort. Programming projects will be required. (ICSA-821)

Class 4, Credit 4

ICSA-830   **Software Project Management**

Registration #0602-830

An examination of the organizational, managerial and technical aspects of software development. Examines the use of models and software metrics in the following areas: cost estimation and manpower allocation, evaluation of alternative designs, implementation measures, and test management. Other topics include: configuration management, reviews, and inspections, management and control of the maintenance process. (BBUQ-744)

Class 4, Credit 4

ICSA-835   **Program Testing and Reliability**

Registration #0602-835

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. (ICSA-820)

Class 4, Credit 4

ICSA-894   **Software Project Laboratory**

Registration #0602-894

Within a controlled laboratory environment small student teams work on a never-ending software development project. Emphasis is placed on the use of good software engineering practice to achieve product continuity and integrity. Students will make presentations of results. (ICSA-823, 830, 835)

Class 2, Lab 4, Credit 4

ICSA-895   **Software Engineering Project**

Registration #0602-895

Under faculty supervision, student teams participate in an industry-sponsored software development project. The project will apply the knowledge and technology mastered in all previous software engineering course work and laboratories. (ICSA-823, 830, 835)

Class 4, Credit 4

ICSA-899   **Independent Study**

Registration #0602-899

Faculty directed study of appropriate topics to a tutorial basis. This course may be used by a graduate student to study particular applications of computers that are not covered in depth in other courses. (Permission of instructor)

Credit 2-4

Graduate Computer Science

Undergraduate Computer Science students may take 700 and 800 level courses only by consent of the school director and the consent of the instructor.

Graduate students must obtain the consent of a graduate advisor in order to enroll in graduate courses not listed in their own program of study.

ICSG-700   **Foundations of Computing Theory**

Registration #0605-700

Review of discrete mathematics with emphasis on graph theory and proof techniques. A study of computer programs in the abstract, including program flow graphs, program transformations, the structuring theorem, abstract automata, and formal languages. An overview of computability and algorithmic complexity. (ICSA-705, 703)

Credit 4

ICSG-701   **Computability**

Registration #0605-701

Computability is the heart of theoretical computer science, for it is The theory which attempts to formalize the notion of computation. Topics include computation by while-programs, Turing machines, recursive function theory, Symbol-Manipulation Systems, program methodology, the limitation of the concept of effective computability. (ICSG-700)

Credit 4

ICSG-702   **Computational Complexity**

Registration #0605-702

This course is concerned with the mathematical analysis of computer algorithms. Topics include matrix operations, combinatorial algorithms, integer and polynomial arithmetic, NP-completeness, and lower bounds on algorithms involving arithmetic operations. (ICSG-700)

Credit 4

ICSG-703   **Coding Theory**

Registration #0605-703

The study of error-correcting codes and their application to reliable communication of digitally encoded information. Topics include cyclic codes, hamming codes, quadratic residue codes, B.C.H. codes, designs and codes, weight distributions. (ICSG-700)

Credit 4

ICSG-709   **Topics in Computer Science Theory**

Registration #0605-709

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; the Fast Fourier Transform; combinatorial optimization. Programming projects will be required. (Permission of the instructor)

Credit variable 1-4

ICSG-710   **Programming Language Theory**

Registration #0605-710

An introduction to several important programming languages and the basic concepts of language design and specification. Topics will include data and control structures, subprogram sequencing and control, and parameter passing. Languages elected will include examples of string processing, applicative, systems programming, and concurrent languages. Programming projects will be required. (ICSA-702 or equivalent)
Credit 4

ICSG-711   **Compiler Construction**

Registration #0605-711

The structure of language translators, lexical and syntactic analysis, storage allocation and management, code generation, optimization, error recovery. Programming projects will be required. (ICSG-700, 710)
Credit 4

ICSG-712   **Theory of Parsing**

Registration #0605-712

Application of theoretical concepts developed in formal language and automata theory to the design of programming languages and their processors, syntactic and semantic notation for specifying programming languages, theoretical properties of some grammars, general parsing, non-backtrack parsing, and limited backtrack parsing algorithms. (ICSG-700)
Credit 4

ICSG-719   **Topics in Programming Languages**

Registration #0605-719

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. (Permission of the instructor)
Credit variable 1-4

ICSG-720   **Computer Architecture**

Registration #0605-720

Review of classical computer architectures, the design of operation codes and addressing modes, data formats, and their implementations. Analysis of internal and external bus structures. Architectural features to support virtual storage and page-replacement policies, high-level language features, and operating systems. Speed-up techniques. Future directions. Programming projects will be required. (ICSA-708)

Credit 4

ICSG-721   **Microprocessors and Microcomputers**

Registration #0605-721

A study of microprocessors, microcomputers, and microcomputer applications. Topics to be covered include microprocessor architecture, microcomputer organization and buses, parallel serial interface techniques, analog interfacing, interrupts, and development trends in microprocessors. Emphasis will be on the use of microprocessors and small microcomputers. Single board microcomputer systems are used in laboratory projects to explore hardware and software design issues, as well as memory design and I/O interface techniques. Programming projects will be required. (ICSG-720)
Credit 4

ICSG-729   **Topics in Computer Architecture**

Registration #0605-729

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)
Credit variable 1-4

ICSG-730   **Operating Systems I**

Registration #0605-730

An introduction to solving problems using cooperating parallel processes and to the concepts of operating systems design. Emphasis will be on the use of operating systems from the programmer's point of view and on the design of operating systems from a conceptual rather than an implementation-oriented point of view. The student will be required to construct software systems of parallel processes and study how an operating system supports such parallelism. Also, the student will become conversant in the issues facing the operating system designer and will be able to evaluate trade-offs inherent in the design process. Programming projects will be required. (ICSA-708)
Credit 4

ICSG-731   **Operating Systems II**

Registration #0605-731

Operating Systems II is a laboratory practice course designed to provide the student with practical experience in implementing many of the notions discussed in Operating Systems I. The class, with the instructor serving primarily as a technical advisor, designs the kernel of a small operating system in class in the first two to three weeks. This kernel is module tested and downloaded to a stand-alone processor and test run until it is debugged. Then students form into groups of three to five persons and choose a project to pursue which involves implementing additional features of the operating system. Typical projects are: file systems, memory management, scheduling, and inter-process communications. Programming projects will be required. (ICSG-730)
Credit 4

ICSG-739   **Topics in Operating Systems**

Registration #0605-739

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, security, operating systems performance, software environments. Programming projects will be required. (Permission of the instructor)
Credit variable 1-4

ICSG-740   **Data Communications and Networks I**

Registration #0605-740

Fundamentals of data communication, including terminal communication and computer-to-computer communication. Emphasis in the first course will include the theoretical basis for data communication, terminal handling, data transmission and multiplexing, error detection and correction, as well as an introduction to the hierarchical model for computer networks; an introduction to graph theory and the topological design of networks, queueing theory and delay analysis; the fundamental protocols for computer communication. (Statistics, ICSA-708)
Credit 4

ICSG-741   **Data Communication and Networks II**

Registration #0605-741

A second course in computer communication and networks. Emphasis is on higher level protocols and local networks. Included are design and analysis of communication protocols, routing algorithms, satellite and local networks; higher level protocols and the application of computer networks. (ICSG-720, 730, 740)

Credit 4

ICSG-749   **Topics in Data Communications**

Registration #0605-749

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)

Credit variable 1-4

ICSG-750   **Introduction to Artificial Intelligence**

Registration #0605-750

The theory and techniques underlying the development of "intelligent" computer software. Emphasis will be placed on programming techniques and languages used in artificial intelligence research. Students will be required to design and implement programs that use these techniques to build game players, theorem provers, natural language understanding systems or other rudimentary artificial intelligence projects. Programming projects will be required. (ICSA-707, 708)

Credit 4

ICSG-751   **Knowledge-Based Systems**

Registration #0605-751

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 or expert system building tools in a Lisp or Prolog environment. Programming projects will be required. (ICSG-750)

Credit 4

ICSG-759   **Topics in Artificial Intelligence**

Registration #0605-759

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, robotics. Programming projects will be required. (Permission of the instructor)

Credit variable 1-4

ICSG-761   **Fundamentals of Computer Graphics**

Registration #0605-761

Topics include basic concepts, 2-D transformations, windowing, clipping, interactive and raster graphics, 3-D transformations and perspective, hidden line and surface techniques, graphical software packages and graphics systems. Programming projects will be required. (ICSA-703)

Credit 4

ICSG-769   **Topics in Computer Graphics**

Registration #0605-769

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: animation techniques and packages; modeling of solids, including shading, perspective, hidden line and surface removal; three-dimensional graphics software packages; algorithms and heuristics; special purpose computer hardware for graphics. Programming projects will be required. (Permission of the instructor)

Credit variable 1-4

ICSG-771   **Data Base Systems**

Registration #0605-771

The storage and processing of formatted data using data base management systems. Topics include: objectives of data base management; file and indexing structures; data base system architectures; normalization theory; data base machines and distributed data bases. Several existing and experimental systems will be studied. (ICSA-703, 708)

Credit 4

ICSG-772   **Data Base System Implementation**

Registration #0605-772

An examination of the technical issues related to the implementation of shared access data bases. Topics include concurrency control, transaction processing, reliability and recovery. Extensions to the distributed processing environment are also covered. Programming projects will be required. (ICSG-771)

Credit 4

ICSG-773   **Information Storage and Retrieval**

Registration #0605-773

A study of contemporary approaches to the storage and retrieval of unformatted test with emphasis on document data bases. Topics include: traditional approaches to indexing and retrieval; text analysis and automatic indexing, clustering algorithms; the SMART system; the extended Boolean logic model; pattern matching algorithms; and videotex. (ICSA-707)

Credit 4

ICSG-781   **Software Engineering**

Registration #0605-781

The software engineering methodologies and technologies useful for developing quality, cost-effective and schedule-meeting software. The course focuses on the engineering of programming systems products, with emphasis on quantitative models. Topics include: current problems in software development; Halstead's software science; complexity metrics; specification and design metrics; cost estimation models; growth dynamics; software reliability models; and models of program testing. (ICSA-708, ICSG-710)

Credit 4

ICSG-782   **Software Engineering Laboratory**

Registration #0605-782

A projects course in applied software engineering with emphasis on the use of software-based engineering tools. Available tools include Higher Order Software's specification and code generation system and Stanford University's WEB, an integrated programming and documentation system. Students work in small teams on software development projects. Programming projects will be required. (ICSG-781)

Credit 4

ICSG-783   **On-Line Information Systems Design**

Registration #0605-783

The structured analysis, design, and implementation of on-line information systems are discussed. Topics include data and algorithm structuring, measures of software complexity, software behavior modeling, and packaging. System development and project management are also highlighted. (ICSA-707, 708)

Credit 4

ICSG-791   **Simulation & Modeling I**

Registration #0605-791

Computer simulation techniques are examined. Topics include abstract properties of simulations modeling, analysis of a simulation run, and statistics. A general purpose simulation language will be taught. Programming projects will be required. (ICSA-703, Statistics)

Credit 4

ICSG-799   **Topics in Simulation & Modeling**

Registration #0605-799

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: continuous systems simulation; applications to world population models, operating systems; programming languages that support simulation and procedural applications (e.g., Simscript, Simula, SLAM, ADA). Programming projects will be required. (Permission of the instructor)

Credit variable 1-4

ICSG-829   **System Programming Seminar**

Registration #0605-829

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. Students will be guided through the construction of large software projects. Programming projects will be required. (Permission of the instructor)

Credit variable 1-4

ICSG-890   **MS Thesis**

Registration #0605-890

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 14

ICSG-891   **MS Project**

Registration #0605-891

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 2

ICSG-892   **Thesis Preparation**

Registration #0605-892

Preparation for the master's thesis. (36 credits of graduate study)

Credit 3

ICSG-898   **Independent Study**

Registration #0605-898

Faculty directed study of appropriate topics on a tutorial basis. This course will generally be used to enable an individual to study computer science topics in greater depth and more detail. (Faculty approval)

Credit variable 1-4

ICSG-899   **Seminar**

Registration #0605-899

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

Packaging Science

All Department of Packaging Science graduate courses are offered at least biennially. Research courses are offered on demand, in consultation with the instructor.

IPKG-701   **Research Methods in Packaging**

Registration #0607-701

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

IPKG-721   **Packaging Administration**

Registration #0607-721

Study of the role of packaging operations in the corporate enterprise. Positioning of the package 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

IPKG-731   **Advanced Packaging Economics**

Registration #0607-731

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

IPKG-742   **Distribution Systems**

Registration #0607-742

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 is considered. Case study or individual research appropriate to student's interest.

Credit 4

IPKG-750   **Graduate Seminar**

Registration #0607-750

Course concentrates on topic of current interest, depending on instructor, quarter offered, and mix of students. Content to be announced prior to registration dates.

Credit 4

IPKG-752   **The Legal Environment**

Registration #0607-752

An intensive study of federal, state, and local regulation that affects packaging. Individualized study and research on an interest basis.

Credit 4

IPKG-763   **Packaging for End Use**

Registration #0607-763

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

IPKG-770   **Advanced Computer Applications**

Registration #0607-770

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

IPKG-783   **Packaging Dynamics**

Registration #0607-783

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

IPKG-798   **Independent Study**

Registration #0607-798

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 variable (may be taken for a maximum of 8 credits)

IPKG-799   **Advanced Package Design**

Registration #0607-799

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 variable 1-4

IPKG-890   **Graduate Thesis**

Registration #0607-890

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 is required. (Consent of department)

Credit variable (maximum of 12)

Department of Instructional Technology

All courses are offered on demand with sufficient enrollment

ICIT-700   **Introduction to Instructional Technology**

Registration #0613-700

An overview of the basic elements of instructional technology including: technology and its application to instruction; instructional development; past, present, and future trends in instructional technology; and instructional objectives. The course is a mix of self-instructional modules and seminars. (Required for graduation.)

Credit 2

ICIT-705   **Sources of Information in Instructional Technology**

Registration #0613-705

Students develop general search techniques and strategies for finding information, evaluating it, and establishing a reference file. Sources of print material include journals and periodicals related to instructional technology, books, research reports and conference proceedings, catalogues and commercial information, and automated information systems. Interpreting recent copyright changes is also covered. Actual search problems are given and an information search project is required.

Credit 3

ICIT-710   **Programed Instruction**

Registration #0613-710

Students review principles and techniques of preparing programed instruction; then design, produce and validate their own programed instruction materials; includes research and development related to programed instruction and sources of programed materials.

Credit 4

ICIT-712   **Computer-Assisted Instruction (CAI-1)**

Registration #0613-712

Students learn the use of the computer for instruction (computer-assisted instruction) and then produce their own computer-assisted instruction programs. Students review research and computer-assisted instruction, various hardware and software configurations, programming languages, and sources of already developed computer-assisted courses. The course covers some methods of course and lesson development. Project required. (ICIT-755 or with permission of department)

Credit 4

ICIT-713   **Advanced Computer-Assisted Instruction (CAI-2)**

Registration #0613-713

The student develops complex and sophisticated instructional sequences which incorporate advanced CAI programming techniques; enters the sequences 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. (ICIT-712) Two projects required.
Credit 4

ICIT-714   **Computer-Based Interactive Instructional Systems (CAI-3)**

Registration #0613-714

Students plan and produce segments of a computer-based, highly interactive course which also utilizes a pictorial display medium, preferably video. The student must enter all computer elements and produce the scripts and directions for noncomputer segments, as well as preparing all technical and user-documentation. The course incorporates the principles of ICIT-712 (CAI-1) and ICIT-713 (CAI-2). Major project required. (ICIT-712, 713, 750, 755, 756, media design skills) Offered as production facilities available.
Credit 4

ICIT-715   **Instructional Television**

Registration #0613-715

Explores the various uses of television as an instructional medium, e.g., individualized instruction, instruction of mass audiences, stand-alone instruction, integrated instruction. Students must produce at least one television program. Surveys the hardware, technology and software of television.

Credit 4 (offered on demand)

ICIT-720   **Research in Instructional Technology**

Registration #0613-720

Examines the fundamentals of educational research: hypothesis stating, designs, statistical procedures, reporting techniques, and types of research. Specifically examines the research in instruction. Students learn to critique research articles and develop evaluation plans.

Credit 4

ICIT-721   **Evaluation of Training and Instruction**

Registration #0613-721

A course to train students in the development and application of testing methods used in measuring performance, principally cognitive and psychomotor skills, as well as methods to determine overall course effectiveness. Covers methods for both formative and summative evaluation, test construction, and means of validating instructional materials and instructional systems.
Credit 4

ICIT-722   **Research Project**

Registration #0613-722

A variable credit course which allows a student to conduct a research project based on the student's interest and with the advice and consent of a faculty member. A formal research proposal must be submitted before registering for this course (guidelines available from the department). (ICIT-750, 751, and 720 or 721)

Credit variable 1-3

ICIT-735   **Psychology of Learning and Teaching**

Registration #0613-735

Relates various theories of learning to actual teaching and training. Students review learning principles and apply them to practical instructional situations. Emphasis is on behavioral approach to developing instruction and training. (Required for graduation.)
Credit 4

ICIT-736   **Interviewing, Counseling, and Coaching in Training**

Registration #0613-736

The course distinguishes between counseling, coaching, and training, stressing task-related interpersonal and cognitive skills such as working with a subject matter expert or job counseling. Includes methods of interaction to maintain communications and to shape behavior. (ICIT-735, 770 or concurrently)
Credit 3

ICIT-745   **Instructional Facility Design**

Registration #0613-745

Designed to enable the instructional developer to assist and participate in the design of spaces and related facilities for effective learning. Specific topics include acoustics, lighting, ventilation, electric circuits, planning for electronic distribution systems, equipment specifications, spatial relationships, together with architectural engineering and contracting procedures.

Credit 4 (offered on demand)

ICIT-749

Seminar in Strategy, Technology, and Futuring in Human Resource Development

Registration #0613-749

Training and development, especially in business and industry, and human resource development exist within the larger context of national and global economics. Trends in business directly affect the development of human resources into an effective work force. This closing seminar examines future directions as they relate to—and may have an impact upon—training and human resource development in various sectors of the economy. After reviewing past, current, and projected economic and societal trends, seminar participants are required to analyze and project various possible developments in an area of their own interest. (Required for graduation.) (Prerequisites or corequisites: all core courses and 40 hours of course work.)
Credit 3

ICIT-750   **Instructional Development I**

Registration #0613-750

Covers the concepts and principles underlying the development 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. A limited instructional development project is part of the course. (Required for graduation.) (Note: ICIT-700 must be taken before or simultaneously with ICIT-750; must be taken before 22 hours of program are completed; ICIT-735 and ICIT-755 are prerequisites.)
Credit 4

ICIT-751   **Instructional Development II**

Registration #0613-751

A continuation of Instructional Development I (ICIT-750) in which instructional development principles are applied in an actual project selected by the student. More sophisticated means of development, evaluation, and revision are included along with strategies for media selection and development. Literature of the field is also covered. (Required for graduation.) (ICIT-750)
Credit 4

ICIT-752   **Instructional Development III**

Registration #0613-752

Stresses the difference between personnel/faculty development, instructional/ program development, and curriculum/organizational development and how the instructional developer or trainer becomes an agent for change. Examines the methods of disseminating and promoting the adoption of innovative methods of materials. Students research special problems related to selected areas of instructional development (ICIT-750, 751)

Credit 4 (offered only on demand)

ICIT-753   **Group Dynamics**

Registration #0613-753

Almost without exception, an instructional designer works as part of an instructional development team. This course helps instructional developers plan, conduct, and evaluate various group processes—especially in relation to course development. Each course participant will review appropriate functions, advantages, and disadvantages of different group dynamic procedures and interventions and will demonstrate appropriate "attending," listening, group guiding, problem-solving and decision-making skills needed to plan and to moderate task-oriented small group meetings. (Required for graduation.)

ICIT-755   **Criterion Referenced Instruction and Technical Training I**

Registration #0613-755

A two-course sequence which 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. The course is largely self-paced and self-instructional and the student must complete a project in the technical training area. (Required for graduation.)
Credit 3

ICIT-756   **Criterion Referenced Instruction and Technical Training II**

Registration #0613-756

A two-course sequence which 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. The course is largely self-paced and self-instructional and the student must complete a project in the technical training area. (Required for graduation.)

Credit 3

ICIT-757   **Techniques of Work Analysis**

Registration #0613-757

Students learn a variety of job analysis and task analysis techniques based on Functional Job Analysis. Data gathered from analyses is cast into various formats for job restructuring, writing job descriptions, establishing task and job hierarchies, and developing training programs. Students learn to develop job inventories and checklists for gathering task information for a number of interrelated purposes.

Credit 3

ICIT-758   **Developing Instructional Modules**

Registration #0613-758

The course is designed to follow ICIT-756 to give the student extended 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 revision procedures. Students must have already selected a content area and developed objectives, a course plan, and criterion tests. (ICIT-755, ICIT-756)
Credit 3

ICIT-759   **Technical Writing for Instructional Developers**

Registration #0613-759

This course introduces instructional developers to the process of writing technical manuals and reports. Includes an overview of the production process, content and audience analysis, information layout. Two major writing projects and other exercises required. (Writing skills and experience, ICIT-700, 755, 756, 758)
Credit 3

ICIT-762   **Management & Budgeting in Instructional Technology**

Registration #0613-762

Applies basic theories of management to areas of instructional technology and to management of personnel of those areas. Examines the organizational structure of instructional development units. Covers budgeting and actual financing for services and projects.
Credit 4

ICIT-765   **Individual Learning Styles Analysis**

Registration #0613-765

Examines the ways different individuals learn and relates instructional strategies to learning styles. Covers cognitive style mapping, aptitude treatment interaction, application of norm and criterion referenced tests as each relates to individual learning style. (ICIT-735)
Credit 4

ICIT-770   **Interpersonal Communications**

Registration #0613-770

Instructional development requires that instructional technologists be able to work well with people. Participants in the course are taught to be sensitive to others as well as to examine their own feelings in a group situation. (Required for graduation.)
Credit 2

[CIT-772 **Group Development and Organizational Change**

Registration #0613-772

Similar in format to ICIT-770, the course extends the concept and practice of interpersonal communications to the area of work- and task-oriented team-building and organizational change. The course stresses actual personal inter-action in a training laboratory environment while including some of the theoretical aspects of causing work-oriented, personal and organizational change. (Offered on demand.) (ICIT-750,751, 757,770,753, and permission of department)

Credit 3

ICIT-840 **Internship**

Registration #0613-840

Special opportunities may occur for students to obtain work experience in a job or environment similar or coincident with their career objectives. In fact, students are encouraged to locate such opportunities. This course recognizes this experience. A proposal (guidelines available from the department) must be approved by the department prior to registering for this course. (ICIT-750, 751 plus 20 hours of course work)

Credit variable (**1**-3)

ICIT-850 **Independent Study**

Registration #0613-850

An opportunity for a student to explore, with a faculty advisor, an area of interest to the student. A proposal (guidelines available from the department) must be approved by the department prior to registering for this course. (ICIT-750, 751 plus 20 hours of course work)

Credit variable (1-3)

School of Food, Hotel, and Tourism Management

The Hospitality-Tourism Industry:
ISMM-750 **A Systems Approach**

Registration #0624-750

General systems theory is used to examine the major components of the hospitality-tourism industry. The interactions and interdependencies of these components are discussed with reference to the properties of open systems. Students will become acquainted with systems in terms of a philosophy, a theory and a procedure for decision making and evaluation.

Credit 4

Research Methods and Applications
ISMM-760 **in the Hospitality-Tourism Industry**

Registration #0624-760

A survey of research methods that are especially applicable to the hospitality-tourism industry. Emphasis on utilization of primary data collection and its application to specific forecasting and modelling techniques used within the industry.

Credit 4

Employee Relations and
ISMM-770 **Training in Service Industries**

Registration #0624-770

An overview and examination of various supervisory/managerial skills. Self-description of the student's management style is conducted using the Lafferty Level I: Life Style Inventory. These are matched to those needed within the hospitality-tourism industry. Students will prepare presentations that are staff development/training oriented and targeted at employee, supervisory, mid-level, and key management personnel.

Credit 4

ISMM-822 **Computerized Systems for Food Service**

Registration #0624-822

Survey of computer information systems for planning and control in food service and restaurant operations. Various software and hardware packages are explored in relation to planning and control functions. These include: presale, point-of-sale (production, service and check handling) and postsale (post costing, check statement, menu adjustments, accounting, etc.).

Credit 4

ISMM-824 **Organizational Strategies of Hospitality Firms**

Registration #0624-824

An analysis of the organizational structure, operational procedures, corporate policies, financial growth, and related factors in specific hospitality firms. Traces the evolution of various selected companies to reveal individual growth strategies.

Credit 4

ISMM-826 **Tourism Policy Analysis**

Registration #0624-826

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. Local, state, national and international examples are included.

Credit 4

ISMM-828 **Meeting Planning Management**

Registration #0624-828

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 under-taken. Negotiations skills are examined.

Credit 4

ISMM-842 **Food and Beverage Marketing Strategies**

Registration #0624-842

Market segmentation; methods in marketing research; creating a menu, environment, 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 projects.

Credit 4

ISMM-844 **Hospitality Resource Management**

Registration #0624-844

This course is designed to analyze the inputs associated with the development of hospitality firms. Labor markets, financial instruments, tourism in-frastructures, real estate markets, and educational support systems will be assessed in order to determine the development of hospitality firms.

Credit 4

ISMM-846 **Travel Marketing Systems**

Registration #0624-846

Travel marketing systems includes the identification of markets, product pric-ing 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

ISMM-848   **Convention and Exhibition Management**

Registration #0624-848

The organization and operation of exhibit/convention space is examined from the meeting planner's perspective. Emphasis is given to the 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

Product Development and
ISMM-862   **Problem Solving in Food Service**

Registration #0624-862

Evaluation of food ingredient interactions and quality standards of food products by sensory (taste) panels and objective measures. Creation of new food products or special dietary products; evaluation of new food ingredients or preparation methods; comparison of time and/or labor-saving products/ methods. Emphasis on practical applications, experimental design and communicating the results both orally and in writing.

Credit 4

Problem Analysis and Decision
ISMM-864   **Making in the Service Economies**

Registration #0624-864

Specific hospitality-tourism industry and enterprise problems are analyzed using various problem-solving frameworks. The student will structure individual problems and design an appropriate analytical and decision-making framework for each.

Credit 4

Tourism Planning and
ISMM-866   **Travel Product Development**

Registration #0624-866

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

ISMM-868   **Legal Issues and Evaluation of Events**

Registration #0624-868

An examination of the instruments used to confirm meeting arrangements. Focus is placed on informal instruments (letter of agreement) and formal documentation (contract). A survey of legal decisions impacting the liability of the planner and its 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

ISMM-880   **Seminar Current Issues**

Registration #0624-880

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**

ISMM-890   **Practicum in Hospitality-Tourism Training**

Registration #0624-890

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 *prior* to enrolling in the course.

Credit variable 1-6

ISMM-896   **Graduate Project**

Registration #0624-896

This course number is used to fulfill the graduate paper requirements 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 variable 1-3

ISMM-898   **Thesis**

Registration #0624-898

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 variable 2-9

ISMM-899   **Independent Study**

Registration #0624-899

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 *prior* to registering for this course. The independent study must seek to answer questions outside the scope of regular course work.

Credit variable 1-6

College of Business

Dr. Walter F. McCanna, Dean
Dr. William Mihal, Chairman

The College of Business offers the master of business administration, or MBA, with concentrations in corporate accounting, public accounting, finance, marketing, management and personnel/human resources. The program is balanced in several respects. Both the quantitative and qualitative sides of management are included. Both the applied dimension of managing real problems in actual companies, and the theoretical underpinnings of decision-making strategies are integral parts of the MBA program. And last, the student is considered as a whole person... attention is paid to both personal growth and achievement and to developing the professional skills necessary for intelligent management in today's business community.

The strength of the MBA program comes from several sources. Faculty are nationally recognized. Applied research and writing bring recognition from both academic and business centers, while consulting activities link the faculty firmly to the business community.

Another part of RIT's strength is the long-standing institutional commitment to technological leadership and career development. A cooperative education experience at the graduate level, an assessment center, special courses and seminars, develop the interpersonal skills and career objectives of students. Cooperative education is a tradition at RIT, and the MBA program provides opportunities for students to alternate quarters spent in class and quarters spent at full-time work.

Finally, students themselves bring a unique mix of talents and experiences to the MBA program. A group of full-time students works closely with faculty on a variety of academic and research projects. And a group of part-time students brings information, insights, and ideas to the classroom from their collective work experience. At last count, more than 200 different work organizations were represented by students in the MBA program.

A synergy flows from the combination of a carefully planned program, outstanding faculty, and talented and experienced students. Many graduates of the MBA program have gone on to positions of leadership in a number of large corporations, and many have done well as entrepreneurs developing their own business enterprises.

Master of Business Administration

The purpose of the MBA program is to enhance the depth and breadth of general management capabilities of the student. This is accomplished by providing the student with a basic core of coursework in the disciplines of management, economics, statistics, management science, and information systems. Functionally oriented courses include accounting, finance, marketing and operations. These are followed by advanced courses, some of which are directed toward an area of concentration, while the remainder are chosen in elective areas designed to provide breadth to the student's program.

The MBA program requires 80 quarter credit hours (20 courses) and is designed so that a student will progress through the program in a logical sequence while allowing some program flexibility. Those students with previous course work in business may be eligible for the waiver of specified foundation courses thereby reducing the length of their program.
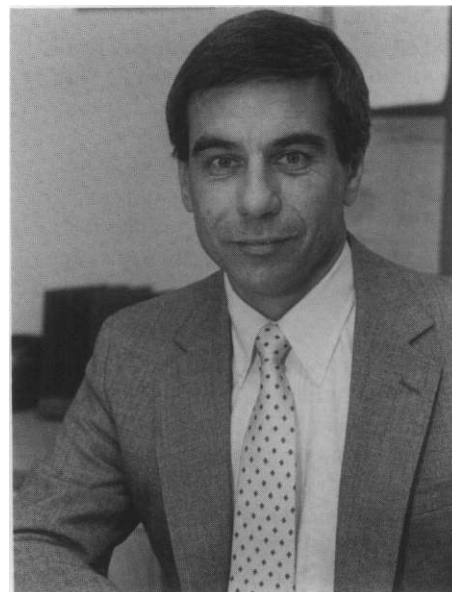
Dr. William Mihal

Students entering the program have widely varied academic backgrounds. To assure that all students are adequately prepared in the areas of mathematics and statistics, diagnostic tests are administered to all new students. Those students who need review in these areas will be required to successfully complete preparatory course work in algebra, calculus and statistics during their first quarter of study.

Students are able to take course concentrations in: corporate accounting, public accounting, finance, marketing, management and personnel/human resources.

The MBA with the public accounting concentration provides students with general management skills and prepares them for public accounting careers. Graduates of this program meet the educational requirements for either the Uniform Certified Public Accounting Examination or the Certificate in Management Accounting Examination.

General Information and Procedures

Facilities

The College of Business is housed in the Max Lowenthal Memorial Building on RIT's suburban Rochester campus. Facilities include a fully staffed Learning Support Center, extensive time-sharing computer terminals on line with RIT's computer system, two microcomputer labs, state of the art software support and an up-to-date collection of business texts, periodicals and reference services in the Wallace Memorial Library.

Admission

RIT operates on a quarter system calendar, thus students may apply for entry into the MBA program in the fall, winter, spring or summer. However, applicants planning full-time study are strongly urged to begin their studies in the fall quarter. Completed applications for admission should be on file in the Office of Admissions five weeks prior to registration day for the upcoming academic quarter to ensure adequate time for consideration by the Graduate Review Committee.

Admission to the MBA program will be granted to graduates of accredited baccalaureate degree programs who, in the opinion of the Graduate Review Committee of the College of Business, have demonstrated their potential to successfully complete graduate business studies through their achievements in their undergraduate program and through the results of the Graduate Management Admission Test.

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.

Students who have been accepted in a program are allowed to defer enrollment (admission) for one year. If a student wishes to defer enrollment beyond one year, credentials will be reevaluated on the basis of current admission standards.

Prerequisite skills

It is not necessary for students to have completed any undergraduate course work in business to be admitted to, or succeed in, the graduate business program. It is necessary, however, for students to possess a working knowledge of algebra, elementary calculus and introductory statistics to undertake graduate business courses. The mathematics skills of all entering students are assessed prior to the first day of classes by means of diagnostic exams. Students who need further preparation will be required to successfully complete either self-instructional modules or formal review courses in mathematics and statistics during their first quarter of study.

Foreign students

International applicants also are eligible to apply on a rolling admissions basis. For many, the fall quarter is a recommended start-up time as the majority of full-time MBA students commence their studies in the fall. Applicants from foreign countries, where a degree or diploma is granted by an institution not holding accreditation, may be admitted provided their study and performance approximates the standards of an accredited bachelor's degree and an ability to meet graduate standards is indicated. International applicants must take and submit the results from the Graduate Management Admission Test. In addition, the TOEFL score (minimum 550) must be submitted by applicants with limited or no experience in an academic program in the United States.

Procedures

To be considered for admission it is necessary to file an application and submit transcripts of all previous undergraduate and graduate work, and results of the Graduate Management Admission Test. Information on the test may be obtained from the College of Business or by writing to the Graduate Management Admission Test, Educational Testing Service, Box 966, Princeton, NJ., 08540. The test is usually given four times a year in convenient locations, including RIT.
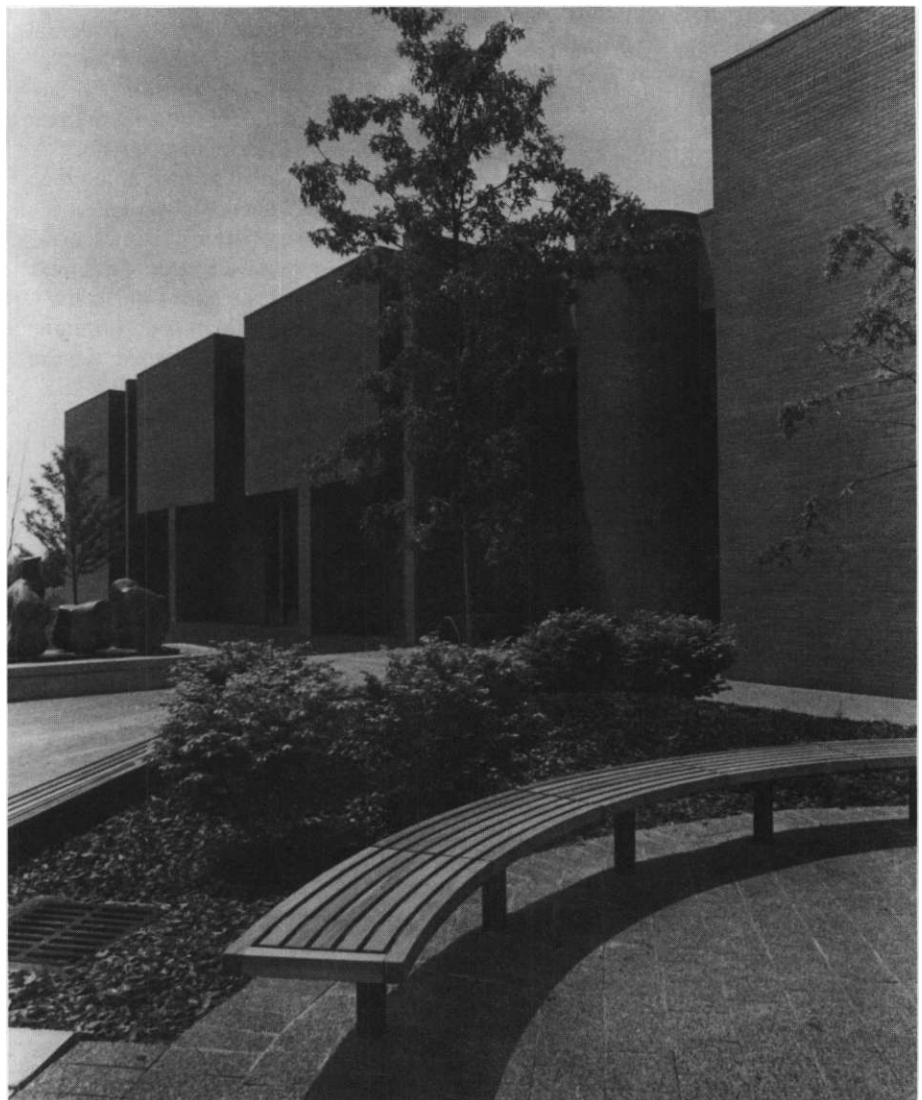
Orientation

All new students are required to attend an evening orientation session prior to enrolling in courses. At the same time, the mathematics/statistics diagnostic tests are administered. Students are given information regarding course selection, career planning, program planning and academic advising during the orientation. Student handbooks and registration materials are distributed at this time. A more extended Saturday orientation introduces students to the library, the computer system, and the many recreational facilities available at RIT.

Non-matriculated students

Students may apply to take a limited number of courses on a non-matriculated basis. If these courses are passed with an acceptable grade, and if the student later matriculates, these credits may be applied to the student's degree program. The regular admissions process should be followed by non-matriculated students who wish to be admitted to the MBA program.

Students may find it convenient to begin MBA courses on a non-matriculated basis while they are waiting for their GMAT scores to be reported.

Financial aid

Several forms of financial support are available to U.S. and International graduate students. For highly qualified full-time students, full research assistantships supplemented by stipend support are available. Such exceptional candidates may expect 100% tuition remission and a quarterly stipend to help cover books, housing, food and other cost-of-living expenses. For many promising full-time candidates, partial research assistantships are available. Typically, such awards cover 50% of a student's tuition costs. Last year, 68% of the full-time students received some form of assistantship support. All assistants work with faculty on research projects, thus enhancing their education, and in turn receive full or partial tuition remission. Interested individuals should write to the Graduate Business Programs Office, requesting consideration for an assistantship and indicating the quarter or quarters in which they desire aid.

While assistantships are limited to full-time students, scholarships are available to promising full-time and part-time graduate students. Scholarships are administered through the dean of graduate studies, Dr. Paul Bernstein, who should be contacted by interested prospective students.

Other forms of financial aid such as fellowships, loans and grants should be investigated through the Graduate Business Office and the director of financial aid in the Office of Financial Aid.

Placement service

Students seeking employment after graduation should register with RIT's Center for Cooperative Education and Career Services approximately one year prior to graduation. This lead time will enable the student to take full advantage of resume preparation aid and offers the opportunity to interview with a wide variety of local and national firms as they visit the campus.

Credit hour requirement

Credit hour requirements vary depending on the particular program and a student's prior academic achievements. Normally, 80 quarter credit hours are required in the master of business administration program. Each course carries four quarter credit hours. In certain cases, total credit hour requirements may be reduced by the use of waiver credit and/or transfer credit. Students have the responsibility of applying for transfer credit and waiver credit.

Waiver Policy

For applicants who demonstrated a high likelihood of success as indicated from their GMAT scores and undergraduate record, up to eight foundation courses may be waived. In order to waive a foundation course, such students must have recently completed undergraduate course work in the relevant discipline and obtained good to excellent grades.

Applicants who do not satisfy the above requirements may still be granted waiver credit for a foundation course, provided they successfully complete an examination in the subject.

Transfer credit

A maximum of 12 quarter credit hours may be awarded as transfer credit from other graduate programs provided the courses in question carry a grade of "B" or better. Any questions concerning waiver or transfer credit should be referred to the Graduate Business Programs Office.

Academic standards

The average of the grades for all courses taken in the College of Business and credited toward the master's degree must be at least a "B" (3.0). Transfer credits from other colleges or institutions, waiver credits, or undergraduate course credits are not counted in the grade point computation. The policy on probation and suspension is explained in the section "Steps Toward Degree" (page 12) in this Bulletin. Students are urged to pay careful attention to that policy.

Program scheduling

Classes are scheduled weekday mornings and afternoons and weekday evenings. Classes meet once a week, 11 times during the quarter, for sessions of 3 ½ hours. Full-time students may take the 15 required classes in the daytime while choosing their electives from the evening offerings. Generally full-time students complete the program in six quarters, or one and a half years. However, if students elect to go on a co-op completion of the program may take two full years. In addition to full-time study, all graduate programs are available on a part-time basis. Course requirements, faculty, and admission procedures correspond to the full-time program. A feasible course load for the part-time student is one to two courses per quarter, permitting program completion in approximately three to four years.

Program completion requirement

Institute policy requires that a graduate program be completed within seven years of the student's initial registration.

The co-op program

Cooperative education affords graduate students the opportunity to gain work experience with an organization. Co-ops are paid positions lasting 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 final, written report analyzing the company and the experience. Graduate students must apply for the co-op program early in their graduate studies. Students accepted into the co-op program will be eligible to interview with organizations once they complete the foundation courses in the MBA program. RIT will attempt to provide co-ops for qualified students but is unable to guarantee that all students will be placed.

Master of Business Administration Curriculum

The following sequence is recommended. Students who find it necessary to vary this sequence should seek counseling from the Graduate Office.

Quarter 1
BBUA-703 Accounting Concepts for Managers
BBUB-740 Organizational Behavior
BBUQ-781 Introduction to Statistics

Quarter 2
BBUQ-782 Applied Statistical Analysis
BBUE-711 Microeconomics
BBUB-741 Organization & Management

Quarter 3
BBUF-721 Financial Management I
BBUM-761 Marketing Concepts
BBUQ-780 Management Science Elective

Quarter 4
Elective(s)
BBUF-722 Financial Management II
BBUQ-743 Operations Management

Quarter 5
Elective(s)
BBUE-712 Macroeconomics
BBUB-745 Business and Public Policy

Quarter 6
Elective(s)
BBUQ-790 Information Systems
BBUB-759 Policy and Strategy

Course offerings

Information concerning courses to be offered in a given quarter will be available through the Graduate Business Programs Office. The Institute reserves the right to make any necessary changes in course schedules or instructors, including the right to cancel courses, without prior notice. Day and evening courses meet once a week. The Institute 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.

Master of Business Administration (MBA) Curriculum

Foundation Courses: Required courses which provide a depth and breadth of knowledge in business concepts, tools and functions.

Course Number and Title	Credit Hours
*BBUA-703 Accounting Concepts for Managers	4
*BBUB-740 Organizational Behavior	4
*BBUQ-780 Management Science	4
*BBUQ-781 Introduction to Statistics	4
*BBUE-711 Microeconomics	4
*BBUF-721 Financial Management I	4
*BBUM-761 Marketing Concepts	4
*BBUQ-743 Operations Management	4
*BBUQ-790 Information Systems	4
BBUE-712 Macroeconomics	4
BBUQ-782 Applied Statistical Analysis	4
BBUB-741 Organization & Management	4
BBUF-722 Financial Management II	4
*BBUB-745 Business & Public Policy	4
BBUB-759 Policy and Strategy	4
Total hours-foundation courses	60

*Can be waived, reducing the number of courses required to graduate (no more than eight courses may be waived)

Concentration courses: Concentrations are offered in public and corporate accounting, finance, marketing, management, and personnel/human resources. Concentration courses are on the following page.

Free elective courses: Free electives must be taken in discipline areas outside of a student's concentration. Students may choose no more than one free elective from economics, quantitative methods, finance and management and no more than two free electives from accounting, marketing, computers/information systems, production/operations management, personnel/human resources,

and the social, legal, political environment of business. Graduate level courses from other Institute colleges also may be taken with prior approval of the chairman of Graduate Business Programs.

Concentration hours (8)	
and free elective hours (12)	20
Total hours	80*

'public accounting totals   96

CORPORATE ACCOUNTING CONCENTRATION

Course Number and Tide	
BBUA-704 Accounting Theory I	4
BBUA-705 Accounting Theory II	4
BBUA-706 Cost Accounting	4
Two free electives	8
Total Credits	20

Suggested free electives:
BBUF-723 Theory of Finance
Approved computer information systems courses

PUBLIC ACCOUNTING CONCENTRATION

Course Number and Title	
BBUA-704 Accounting Theory I	4
BBUA-705 Accounting Theory E	4
BBUA-706 Cost Accounting	4
BBUA-707 Advanced Accounting	4
BBUA-708 Auditing	4
BBUA-709 Basic Tax Accounting	4
BBUA-810 Advanced Tax Accounting	4
BBUA-730 Business Law I	4
BBUA-731 Business Law II	4
Total Credits	36

This concentration meets the educational requirements for the Uniform Certified Public Accounting Examination and the Certificate in Management Accounting Examination.

FINANCE CONCENTRATION

Course Number and Tide	
BBUF-723 Theory of Finance	4
One course from Group A	4
Three free electives	12
Total Credits	20

Group A
BBUF-724 Problems in Finance
BBUF-725 Securities & Investment Analysis
BBUF-726 Capital Markets
BBUF-729 Seminar in Finance

Suggested free electives:
BBUE-713 Advanced Microeconomics
BBUE-714 Advanced Macroeconomics
BBUA-706 Cost Accounting
BBUA-709 Basic Tax Accounting
Approved statistics, computer/ information systems courses

MARKETING CONCENTRATION

Course Number and Title	
BBUM-762 Advanced Marketing Management	4
Two courses from Group A	8
Two free electives	8
Total Credits	20

Group A
BBUM-763 Consumer Behavior
BBUM-764 Marketing Logistics
BBUM-765 Sales Management
BBUM-766 International Marketing
BBUM-767 Marketing Communications
BBUM-769 Seminar in Marketing

Suggested free electives:
BBUB-770 Business Research Methods

MANAGEMENT CONCENTRATION

Course Number and Tide	
Two courses from Group A	8
Three free electives	12
Total Credits	20

Group A
BBUB-742 Technology Management
BBUB-760 Comparative Management
BBUB-753 Small Business Administration
BBUB-756 Conflict Management and Negotiating Skills
BBUB-757 Management & Leadership
BBUB-758 Seminar in Management

PERSONNEL/HUMAN RESOURCES CONCENTRATION

Course Number and Tide	
BBUB-748 Employee & Labor Relations	4
BBUB-750 Human Resource Management	4
One course from Group A	4
Two free electives	8
Total Credits	20

Group A
BBUB-746 Management & Career Development
BBUB-758 Seminar in Personnel/Human Resource Management

Graduate Faculty College of Business

Walter F. McCanna, Ph.D., University of Wisconsin-Madison—Dean; Professor, Management

Thomas E. Comte, Ph.D., University of Missouri; MBA, Columbia—Associate Dean; Associate Professor, Management

William L. Mihal, Ph.D., University of Rochester; MS, Clarkson—Chairman, Graduate Business Programs; Associate Professor, Management

Department of Management

Robert Pearse, Ph.D., University of Chicago—Distinguished Lecturer and Chairman

Management Faculty

Robert J. Barbato, Ph.D., Michigan State—Associate Professor, Management

Janet C. Barnard, Ed.D. University of Rochester—Assistant Professor, Management

Andrew J. DuBrin, Ph.D., Michigan State; MS, Purdue—Professor, Management

David T. Methe, Ph.D., University of California at Irvine: MPA, Syracuse University—Assistant Professor, Management

William A. Nowlin, Ph.D., SUNY Buffalo; MPA SUNY Brockport—Assistant Professor, Management

Karen Paul, Ph.D., Emory University—Associate Professor, Management

Donald O. Wilson, Ph.D. in progress, University of California, Irvine; MPA, University of Southern California—Assistant Professor, Management

Department of Decision Sciences

George A.Johnson, DBA, MBA, Indiana University—Professor and Chairman

Decision Science Faculty

Terry L. Dennis, Ph.D,, MSIA, Purdue-Associate Professor

Bernard J. Isselhardt, Ph.D., University of Iowa—Assistant Professor

Daniel A. Joseph, Ph.D., SUNY Buffalo; MBA McMaster—Assistant Professor

A. Erhan Mergen, Ph.D., Union College-Assistant Professor

Thomas F. Pray, Ph.D., Rensselaer Polytechnic Institute—Associate Professor

William J. Stevenson, Ph.D., MBA, Syracuse University—Associate Professor

Thomas A. Williams, Ph.D., Rensselaer Polytechnic Institute—Professor

Department of Marketing

Eugene F. Fram, Ed.D., SUNY at Buffalo-Professor and Chairman

Marketing Faculty

Dean C. **Siewers,** Ph.D., North Carolina-Chapel Hill; MBA, Duke University-Assistant Professor, Marketing

Patricia A. Sorce, Ph.D., MS, University of Massachusetts—Assistant Professor, Marketing

Philip R. Tyler, DBA, MBA, Michigan State—Associate Professor, Marketing

Stanley M. Widrick, Ph.D., Syracuse University; MBA, SUNY at Buffalo—Associate Professor, Marketing

Julian E. Yudelson, Ph.D., Northwestern; MBA, Emory—Associate Professor, Retailing/Marketing

Department of Accounting

Bruce Oliver, Ph.D., University of Washington; MBA, University of Cincinnati-Professor, and Chairman

Accounting Faculty

Kenneth D. Gartrell, DBA in progress, MS, BA, Kent State University; CPA—Assistant Professor

Francis E. Kearns, Ph.D., MBA, SUNY Buffalo; B.D., Harvard University; CPA-Assistant Professor

Jose A. Rullan, MS, Rochester Institute of Technology; CPA—Instructor

Daniel D. Tessoni, Ph.D. Syracuse University; MS, Clarkson; CPA—Assistant Professor

Joanne H. Turner, Ph.D., University of Minnesota—Assistant Professor

Department of Finance and Economics

John S. Zdanowicz, Ph.D., MBA, Michigan State—Associate Professor and Chairman

Finance and Economics Faculty

Donald R. Chambers, Ph.D., University of North Carolina-Chapel Hill—Associate Professor, Finance

James C. Galloway, Ph.D., University of Virginia; MBA, Pennsylvania—Assistant Professor, Finance

Steven C. Gold, Ph.D., SUNY at Binghamton—Assistant Professor, Economics

John A. Helmuth H, Ph.D., South Carolina—Assistant Professor, Economics

Special Appointments

Edward C. Mclrvine, Ph.D., Cornell University; BS, University of Minnesota—Professor

M. Richard Rose, Ph.D., University of Pittsburg; MS, Westminster College; BS, Slippery Rock—Professor

Accounting

BBUA-703   **Accounting Concepts for Managers**

Registration #0101-703

An introduction to financial and managerial accounting concepts, with particular emphasis placed on their use for managerial decision making. Topics covered will include: financial statements, transaction analysis, measuring economic values, responsibility accounting, budgeting, decentralized and divisional performance measurement.
Credit 4

BBUA-704   **Accounting Theory I**

Registration #0101-704

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

Credit 4

BBUA-705   **Accounting Theory n**

Registration #0101-705

Continuation of Accounting Theory I with emphasis on liabilities, equity, long-term debt and special reporting problems. Included is the Statement of Cash Flows, pensions, leases, and accounting for changes in the price level. (BBUA-704)

Credit 4

BBUA-706   **Cost Accounting**

Registration #0101-706

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 distribution and control. (BBUA-703)
Credit 4

BBUA-707   **Advanced Accounting and Theory**

Registration #0101-707

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. (BBUA-705)
Credit 4

BBUA-708   **Auditing**

Registration #0101-708

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. (BBUA-705)

Credit 4

BBUA-709   **Basic Taxation Accounting**

Registration #0101-709

Study of federal income taxation of individuals, partnerships and corporations. Problems of the S Corporation and corporate accumulations are examined. Income tax and accounting concepts affecting revenues and deductions are compared, including concepts of gross income, basis, recognition of gain and loss, capital asset transactions, exemptions, deductions and credits. (BBUA-703)
Credit 4

BBUA-810   **Advanced Taxation Accounting**

Registration #0101-810

A study of federal income taxation as it relates to corporate and partnership tax planning particularly in reorganization, merger, and liquidation. Problem areas in property transactions including non-taxable exchanges and valuation will be explored. Family tax planning including the use of trusts, and other income shifting devices in the environment of estate and gift taxes is examined. Emphasis will be on the need for tax planning in the complex business or personal situation. (BBUA-709 or equivalent)
Credit 4

Management

BBUB-740   **Organizational Behavior**

Registration #0102-740

The importance of human behavior in reaching organizational goals. Course emphasis: managing individual and interpersonal relations; group and intergroup dynamics; leadership, communication and motivation skills in managing organizational performance and change.
Credit 4

BBUB-741   **Organization and Management**

Registration #0102-741

A study of organizations as systems, including their subsystems and interrelationships with other organizations and the external environment. Focus is placed on the role of managers as those responsible for understanding and integrating the needs of the organization, its members, and its external environment. Major topics studied include organization structure and design, organizational effectiveness, organizational change, organizational analysis, and bureaucracy.
Credit 4

BBUB-742   **Technology Management**

Registration #0102-742

This course examines the technological innovation process in organizations and the factors, both internal and external, that influence the rate, timing, and success of industrial innovations. Technological innovation is examined as a strategic tool to be used in confronting competition and also as a strategic challenge facing managers. This course is designed for the graduate student who is now or in the future will be working in a technology-intensive organization. (BBUB-740)
Credit 4

BBUB-753   **Entrepreneurial Field Studies**

Registration #0102-753

Students enrolled in this course are provided the opportunity to serve as consultants to a specific small business firm within this geographic area. Under an arrangement with the Small Business Administration, and working under the supervision of a senior faculty member, teams of students provide management consulting about a variety of problems to small businesses. As a practicum this course does not have regularly scheduled class hours. Instead students confer with their faculty member on an as-needed basis. (BBUA-703, BBUF-721, BBUM-761)
Credit 4

BBUB-756   **Conflict Management and Negotiating Skills for Managers**

Registration #0102-756

A study of current theories and techniques related to constructive management of organizational conflicts and negotiations. Current theories on interpersonal, group and intergroup conflict management are reviewed. (BBUB-740)
Credit 4

BBUB-757   **Management & Leadership**

Registration #0102-757

Manager oriented skills related to the 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. (BBUB-740)

Credit 4

BBUB-758   **Seminar in Management**

Registration #0102-758

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, money and motivation, organization development, conflict resolution, comparative management, and small business information systems. The course topic for a specific quarter will be announced prior to the course offering. Although a seminar, the course may include some lectures and examinations. (BBUB-740, varies with instructor)
Credit 4

BBUB-759   **Policy and Strategy**

Registration #0102-759

Also referred to as business strategy and policy, this course provides experience in combining theory and practice gained in other course work. This integrative exposure is achieved by solving complex and interrelated business policy problems that cut across the functional areas of marketing, production, finance, and personnel. This course is aimed at the formulation and implementation of business policy as viewed by top management. The case method and computer simulation are used extensively. Since this is a capstone course, the workload is considerably above average. (All other required courses)
Credit 4

BBUB-760   **Comparative Management**

Registration #0102-760

An analysis of business behavior and organization in Western Europe, the Pacific Basin, and the U.S. with particular emphasis on values, authority, individual and group relations, labor management ties, and organizational structure. In addition, leadership styles, risk tolerance, and motivational techniques will be studied. In all cases, the differential effect of culture on management will be carefully appraised. (BBUB-740)
Credit 4

BBUB-768   **Advanced Seminar in Management**

Registration #0102-768

Study and discussion of strategic issues in management for the advanced student. Seminar topics have included the successful entrepreneurial organization, and takeover management. (BBUB-740 or BBUB-741, BBUF-721,722, and BBUM-761)
Credit 4

BBUB-770   **Research Methods**

Registration #0102-770

This course concerns the development, presentation, and use of research in managerial decision-making. Included are the processes by which meaningful research problems are generated, identification of the relevant literature, operationalizing the research design, and interpretation of findings. Students typically work in small groups to execute a research project in one of the functional areas of management for the profit or not-for-profit sector. (BBUQ-782)
Credit 4

BBUB-771   **Research Option**

Registration #0102-771

A practicum permitting the student to confront a real management problem. Requirements include steps from design to completed management report. (To be developed with selected faculty)
Credit 4

BBUB-799   **Independent Study**

Registration #0102-799

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 career objectives and availability of faculty will be included in the review and considerations for acceptance. (Permission of instructor and Graduate Department)
Credit 1-4

Personnel/Human Resources

BBUB-746   **Management and Career Development**

Registration #0102-746

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. Student is required to develop a career plan (career pathing). 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. (BBUB-740)
Credit 4

BBUB-748   **Employee and Labor Relations**

Registration #0102-748

A study of labor-management relations as they influence managerial decision making in both union and nonunion organizations. Topics may include collective bargaining, conflicts and agreements between labor and management, sharing of productivity gains between labor and management, and contemporary issues. An analysis is made of how market forces, labor unions, employee associations and labor law influence employee compensation. Employee and labor relations are studied in both private and public sector firms. (BBUB-740, BBUE-711)

Credit 4

BBUB-750   **Human Resource Management**

Registration #0102-750

A study of personnel systems or the methods of human resource management in organizations. The major personnel topics studied include organizational staffing (selection and recruitment), training and development, compensation, equal employment opportunity, human resource forecasting, and performance appraisal. (BBUB-740, BBUQ-782)

Credit 4

Social and Political Environment of Business

BBUA-730   **Business Law I**

Registration #0101-730

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

BBUA-731   **Business LawH**

Registration #0101-731

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. Wills, trusts, and estates, liability of accountants, and international law are also discussed. (BBUA-730)

Credit 4

BBUB-745   **Business and Public Policy**

Registration #0102-745

Legal issues in areas such as consumer protection, environmental law, occupational safety and health, employment discrimination, labor management relations, antitrust policies, and industrial policy. Ethical, economic, political, legal and cross-cultural perspectives are considered.

Credit 4

BBUB-751   **Legal Environment of Business**

Registration #0102-751

An introduction to legal principles and their relationship to business practices. Business ethics and the environmental impact of the federal administrative agencies are stressed. Among the agencies considered will be the EPA, EEOC, FDA, OSHA, FTC and the NLRB. (BBUA-703, BBUB-740)

Credit 4

Economics

BBUE-711   **Microeconomics**

Registration #0103-711

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 are fundamentals to management and to understanding the role of a firm in an economy.

Credit 4

BBUE-712   **Macroeconomics**

Registration #0103-712

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. (BBUE-711)

Credit 4

BBUE-713   **Advanced Microeconomic Theory**

Registration #0103-713

An advanced study of the fundamental economic principles underlying the nature of a business firm. Topics include: theories of demand and revenue; theory of costs and production analysis in both the short-run and the long-run; equilibrium of demand and supply and efficiency of competition; market structures and their characteristics; pricing and output under perfect competition, pure monopoly, imperfect competition, and oligopoly; resource allocation and product distribution. Business applications are given along with the exposition of the theory. (BBUE-711)

Credit 4

BBUE-714   **Advanced Macroeconomic Theory**

Registration #0103-714

An advanced study of the fluctuations and growth of economic activity in a modern complex society. Topics include measuring macroeconomic activity; modeling economic activity; microeconomic foundations in macroeconomic theory (the labor, the commodity, the money, and the bond markets); a parallel discussion of the complete classical and Keynesian macroeconomic models; recent criticism of the two models; the general equilibrium; the phenomena of inflation and unemployment and the way business can forecast them; the impact of fiscal and monetary growth; reality and macroeconomic disequilibrium; and wage-price policies. (BBUE-712)

Credit 4

BBUE-715   **Managerial Economics**

Registration #0103-715

Analysis of the economic conditions facing the firm. Topics include: demand and cost analyses, resource utilization, pricing, market structure, and other selected topics. (BBUA-703, BBUE-711, BBUQ-782)

Credit 4

BBUE-716   **Seminar in Economics**

Registration #0103-716

Content will differ depending on the quarter and instructor. Topics that may be covered include international finance, monetary theory, labor economics and market structure. (Permission of instructor)

Credit 4

Finance

BBUF-721   **Financial Management I**

Registration #0104-721

An examination of the basic financial theories relating to the valuation of assets and the analysis of risk. The course will concentrate on both the theory and practice of capital budgeting decision making. Topics include: capital budgeting techniques, portfolio risk and diversification, the capital asset pricing model, and practical problems in the selection of long-term assets. (BBUA-703, BBUE-711, BBUQ-782)

Credit 4

BBUF-722   **Financial Management D**

Registration #0104-722

An introduction to the concept of capital market efficiency. In this course, capital structure decisions and dividend policy will receive primary emphasis. Other topics will include option valuation, leasing, working capital management, and financial analysis. (BBUF-721)

Credit 4

BBUF-723   **Theory of Finance**

Registration #0104-723

This course involves a study of the current literature and most recent developments relating to the theories of valuation, risk, investment analysis, cost of capital, capital structure and dividend policy. Topics will be studied within the framework of the capital asset pricing model and the option pricing model. Also considered are specific areas of application and the policy implications of the theories studied. (BBUF-721,722)

Credit 4

BBUF 724   **Problems in Finance**

Registration #0104-724

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 in both theory and practice. Examples of specific topics that might be addressed in this course include leasing, agency cost problems, mergers and acquisitions, international finance, financial distress, and regulatory impacts on capital markets. Specific topics will be determined by the instructor. (BBUF-721, 722)

Credit 4

BBUF-725   **Securities & Investment Analysis**

Registration #0104-725

Study of securities and other investment media and their markets. Analysis of investment values based on financial and other data. Considers factors such as return, growth, risk and the impact of various institutional arrangements on value determination. (BBUF-721,722)

Credit 4

BBUF-726   **Capital Markets**

Registration #0104-726

This course will review the statistical tools employed in financial analysis and examine the descriptive evidence on the behavior of security prices. The course will consider theory and evidence of capital market efficiency, portfolio theory, and the theory and evidence on the relationship between expected return and risk. The implications of the theory for applied practice will also be considered. Other topics will include: the evaluation of portfolio performance, international capital markets and efficient markets for other assets. (BBUF-721,722)

Credit 4

BBUF-729   **Seminar in Finance**

Registration #0104-729

This course will take on different content depending on the instructor and quarter when offered. Topics that may be covered are: financial models, financial analysis techniques, financial institutions and capital markets. Specific content for a particular quarter will be announced prior to course offering. (BBUF-721,722 and permission of instructor)

Credit 4

Marketing

BBUM-761   **Marketing Concepts**

Registration #0105-761

Critical examination of the marketing system as a whole; functional relationships performed by various institutions such as manufacturers, brokers, wholesalers, and retailers. Analysis of costs, strategies and techniques related to the marketing system. Both behavioral and quantitative aspects of marketing are considered.

Credit 4

BBUM-762   **Advanced Marketing Management**

Registration #0105-762

Advanced study of selected problems that face marketing managers concerned with promotion, place, price, and product. Material centers on staff marketing functions. Research topics unique to the field of marketing are covered. (BBUM-761)

Credit 4

BBUM-763   **Consumer Behavior**

Registration #0105-763

A study of the market in terms of the psychological and socioeconomic determinations of buying behaviors, including current trends in purchasing power and population movements. (BBUM-761)

Credit 4

BBUM-764   **Marketing Logistics**

Registration #0105-764

The study of an integrated system for the distribution of products from producer to consumer. The emphasis is on the physical flow of goods both between and within marketing institutions. Specific topics covered are unit geographic location, internal product flow, inter-unit transportation, and warehousing. (BBUM-761)

Credit 4

BBUM-765   **Sales Management**

Registration #0105-765

An examination of selling and sales management as they pervade both the marketing process and the management communications process. Topics covered include building and managing an effective sales force and selling philosophy and techniques creating managerial "win-win" situations with both superiors and subordinates. (BBUM-761)

Credit 4

BBUM-766   **International Marketing**

Registration #0105-766

A study of the differences in market arrangements as well as in the legal, cultural, and economic factors found in foreign countries. Topics included are planning and organizing for international marketing operations; forecasting and analysis; interrelationships with other functions; and product, pricing, promotion, and channel strategy. (BBUM-761)

Credit 4

BBUM-767   **Marketing Communications**

Registration #0105-767

A study of inter-relationships of three communications mix functions; public relations, advertising, and sales promotion. Topics covered will center on the use of these functions in the development of models for persuasive communications and their interrelationships with other elements of the marketing mix. (BBUM-761)

Credit 4

BBUM-769   **Seminar in Marketing**

Registration #0105-769

This course will take on different content depending on the instructor and quarter when offered. Topics that may be covered are: marketing models, marketing channels, articulation with top marketing executives, and marketing positioning. Specific content for a particular quarter will be announced prior to course offering. (Permission of instructor and BBUM-761)

Credit 4

Decision Sciences/ Quantitative Methods

BBUQ-780   **Management Science**

Registration #0106-780

An introduction to quantitative approaches to decision making. Topics covered include linear programming, goal programming, integer programming, simulation, and decision analysis. The emphasis is not on the techniques per se, but rather on modeling, problem solving and showing how quantitative approaches can be used to contribute to a better decision-making process. (BBUQ-781 or equivalent)

Credit 4

BBUQ-781   **Introduction to Statistics**

Registration #0106-781

An introduction to the use of statistics in business. Topics covered include descriptive statistics, probability concepts, probability distributions, sampling methods, and sampling distributions. Includes the use of computerized data analysis.

Credit 4

BBUQ-782   **Applied Statistical Analysis**

Registration #0106-782

The course emphasizes the use of statistical tools in decision making. Topics include estimation of means and proportions, one and two sample tests of means, proportions, and variances, chi-square tests, and simple and multiple regression analysis. Extensive use of a statistical software package. (BBUQ-781 or equivalent)

Credit 4

BBUQ-784   **Decision Analysis**

Registration #0106-784

An in-depth study of the decision-making process. Emphasis will be on how to structure a complex problem into manageable form, methods for improving creative-problem solving, and the use of decision support systems in decision making. (BBUQ-780)

Credit 4

BBUQ-785   **Applied Regression Analysis**

Registration #0106-785

The primary objective of this course is to teach the student how to effectively utilize a variety of data analysis techniques commonly referred to as regression analysis. Emphasis will be placed on model formulation and analysis. All students will be required to analyze several large data sets using a standard statistical package. Relevant theory will be introduced to enable the student to pursue further study in data analysis. (BBUQ-782)

Credit 4   (not offered in 1988-89)

BBUQ-793   **Business Forecasting Methods**

Registration #0106-793

An introduction to quantitative and qualitative forecasting methods and their use in business forecasting. The student will be taught how to recognize which forecasting procedures to use based upon an analysis of problem characteristics. Includes the use of interactive forecasting techniques. (BBUQ-782)

Credit 4   (not offered in 1988-89)

BBUQ-795   **Seminar in Decision Sciences**

Registration #0106-795

This course will take on different content depending on the instructor and quarter when offered. Specific content for a particular quarter will be announced prior to course offering. (Permission of instructor)

Credit 4

Computers/Information Systems

BBUQ-789   **Simulation**

Registration #0106-789

An introductory course in the use of computer simulation in the solution of complex business problems. A simulation language is introduced and applied in the solution of a term project. Particular attention is focused on the types of problems for which computer simulation is a viable solution technique as well as methods for establishing the validity of the simulation. (BBUQ-780,782) Credit 4

BBUQ-790   **Information Systems**

Registration #0106-790

The types of computer applications which are used in business organizations are studied. Basic systems concepts and the responsibilities of the participants in systems development projects are also covered. Hands-on application of personal computer software is an integral and substantial part of the course. (BBUA-703, BBUF-721, BBUB-740,741)

Credit 4

BBUQ-795   **Seminar in Decision Sciences**

Registration #0106-795

This course will take on different content depending on the instructor and quarter when offered. Specific content for a particular quarter will be announced prior to course offering. (Permission of instructor)

Credit 4

Production/Operations Management

BBUQ-743   **Operations Management**

Registration #0106-743

Study of the production of goods and services. Topics include quality assurance, forecasting, resource planning, scheduling, materials and capacity management, inventory management, project management, just-in-time/total quality control (JIT/TQC), international operations, strategic considerations and current topics. (BBUQ-780,782)

Credit 4

BBUQ-744   **Project Management**

Registration #0106-744

An introduction to the principles of project management. Topics include: the role of the project manager, the identification and definition of the project goal; developing a strategy to accomplish that goal; planning the project; estimating the resources required; selling the project; staffing and team building; implementing the project (managing performance, resources, and schedule); shutting down the project (This course is for matriculated and non-matriculated graduate students with approval from the graduate business office.)

College of Continuing Education

Master of Science Degree in Applied and Mathematical Statistics

John D. Hromi, Frederick H. Minett Professor; Director, Center for Quality and Applied Statistics: 475-2002

Edward G. Schilling, Paul A. Miller Distinguished Professor; Chairman, Graduate Statistics: 475-6129

Objectives
Statistics today is defined as the science of making decisions in the face of uncertainty. To aid those needing the basic statistical tools to collect and analyze data, and to aid those needing to update their present statistical skills, the master of sci-

ence degree in applied and mathematical statistics is offered by the College of Continuing Education at RIT through the Center for Quality and Applied Statistics. Several options, including thesis and non-thesis options, are available. Students electing a plan of study that includes a thesis must successfully complete 36 quarter hours of course work in addition to an acceptable thesis. Non-thesis options require the candidate for the MS to successfully complete 45 quarter hours of course work.

The faculty and staff of the Center for Quality and Applied Statistics is a distinguished group that includes three members who are fellows of both the American Statistical Association and the American Society for Quality Control. A fourth member of the faculty is a fellow of the American Society for Quality Control. The center's faculty includes two past presidents of the American Society for Quality Control and the only person ever to win the prestigious ASQC Brumbaugh Award

four times. Extensive industrial experience characterizes the center's faculty, and the graduate program prepares each student for a productive career in the fields of statistics and quality control.

Cooperative education program—earn a degree while you acquire industrial experience
A unique feature of the graduate statistics program at RIT is the cooperative education program. This program allows the qualified graduate student to attend school on a full-time basis one quarter, and to earn a substantial salary the next quarter as an employee at one of Rochester's major industries. This pattern can be repeated until the student completes the MS degree.

To qualify for the cooperative education program you must have completed at least one quarter of study and received department approval.

The summer program
The summer program allows interested individuals to pursue a graduate degree in statistics during the summer. If normal progress is made, this program leads to completion of the MS degree at the end of three summers. The program features faculty of national and international reputation teaching courses in their areas of specialization.

The full-time program
Students who wish to study on a full-time basis can complete the MS degree in one year if normal progress is made.

The evening program
The Center for Quality and Applied Statistics offers courses to full-time employees of industry and other interested individuals in the evenings. The master's degree can normally be completed in two years of evening study.

The Mason E. Wescott Statistics Laboratory
The Center for Quality and Applied Statistics houses the Mason E. Wescott Statistics Laboratory, which provides computer access, assistance with problem solving, and interpretation of results for students enrolled in courses offered by the center.

In addition, RIT maintains an extensive computer center with VAX/VMS and IBM equipment available for instruction and research. Additional resource facilities include the Wallace Memorial Library and Media Resource Center that provide access to all technical references vital to the professional growth in the areas of applied statistics and quality control.

Financial assistance

A variety of financial assistance possibilities exist and are available on a competitive basis to qualified applicants. These possibilities include graduate assistantships, tuition scholarships, grants, and cooperative education opportunities.

No entrance exam

Courses are offered on an open enrollment basis which is supportive of the RIT commitment to recurrent education. There are no entrance exams, and the program is self-contained at RIT. Students are expected to take an oral examination after completing the core courses.

A practical program

Both teachers and students work to put job experience and class studies together. For example, theses and papers often have job supervisor's approval and result in being put into effect rather than into the library. Theory is used for understanding, but is not necessarily an end in itself. Here theory means gaining knowledge of the underlying mathematical principles and learning how to solve problems intelligendy.

Requirements

For the master of science in applied and mathematical statistics degree, the satisfactory completion of the following courses is required:

Two basic courses:

(These may be waived by the department chairperson upon evidence of equivalent learning, experience or competency.)
CQAS-711 and 712 Fundamentals of Statistics I & II

Six core courses:

CQAS-801 and 802 Design of Experiments I & II
CQAS-821 and 822 Theory of Statistics I & II
CQAS-841 Regression Analysis I
CQAS-742 Statistical Computing

Four required career options courses:

A new feature of the MS program is a logical grouping of core requirements, existing and new courses, which will allow the student to specialize within his or her career endeavors. The five specialized career options are:

Quality Control in Industry course requirements
CQAS-721 Statistical Quality Control I
CQAS-731 Statistical Quality Control II
CQAS-781 Quality Management
CQAS-782 Quality Engineering
Industrial Statistics course requirements
CQAS-761 Reliability
CQAS-783 Quality Engineering by Design
CQAS-856 Interpretation of Data
CQAS-875 Empirical Modeling
Administrative Applications of Quality Control course requirements
CQAS-781 Quality Management
CQAS-853 Managerial Decision Making
CQAS-873 Time Series Analysis
CQAS-881 Bayesian Statistics
Statistical Theory and Methods course requirements
CQAS-824 Probability Models
CQAS-830 Multivariate Statistics **I**
CQAS-831 Multivariate Statistics **II**
CQAS-842 Regression Analysis **II**
Quality Control in the Health Sciences course requirements
CQAS-721 Statistical Quality Control **I**
CQAS-791 Statistical Methods in Health Sciences
CQAS-792 Biological Assays
CQAS-851 Nonparametric Statistics

Each career option has four required courses. A department advisor will work with each student in identifying the appropriate career option and in developing a total program structured to achieve individual professional objectives.

Five electives:

Taken from other courses listed under "Course Descriptions" in such areas as quality control, managerial decision making, multivariate analysis, sample surveys, reliability, and probability theory.

The total of 15 or 17 courses, each counting 3 quarter credits, comes to 45 or 51 credits depending on whether the basic courses (711-712) are waived. As indicated above, studies are normally completed in two to four years by attendance one or two nights a week.

The core courses are expected to be completed early in a student's program. Upon completion of the core courses or after 30 hours of instruction, a written examination is required. After successful completion of the examination, the remainder of the program is prepared with the advice and counsel of the department

Levels of courses

There are 700 and 800 courses. The 700 level furnishes most of the standard methods currently used in industry; the 800 series covers theory and applications in special areas like the design of experiments. Generally, the 800 level is more advanced. From time to time, special courses are offered in topics of particular interest when requested by the students or as new fields of statistics open up.

Career guidance

The minimum of 24 credits in the 800 series is required. In consultation with a departmental advisor, a total program structured to achieve individual professional objectives is worked out with each person interested in such guidance.

Admission

Admission to the degree program will be granted to qualified holders of a baccalaureate degree from an accredited college or university who have acceptable mathematics credits through integral calculus. Applicants who fail to meet the latter requirement may, at the discretion of the department chairperson, be required to complete two or three undergraduate mathematics courses before being able to matriculate in the regular graduate program.

Although students are encouraged to begin their graduate studies at any time, only four courses may be taken toward the MS degree as a non-matriculated student. This will assure proper selection of courses, adequate administrative time for transcripts, etc., and the scheduling of the mid-program examination to indicate the student's capability to attain the MS degree.
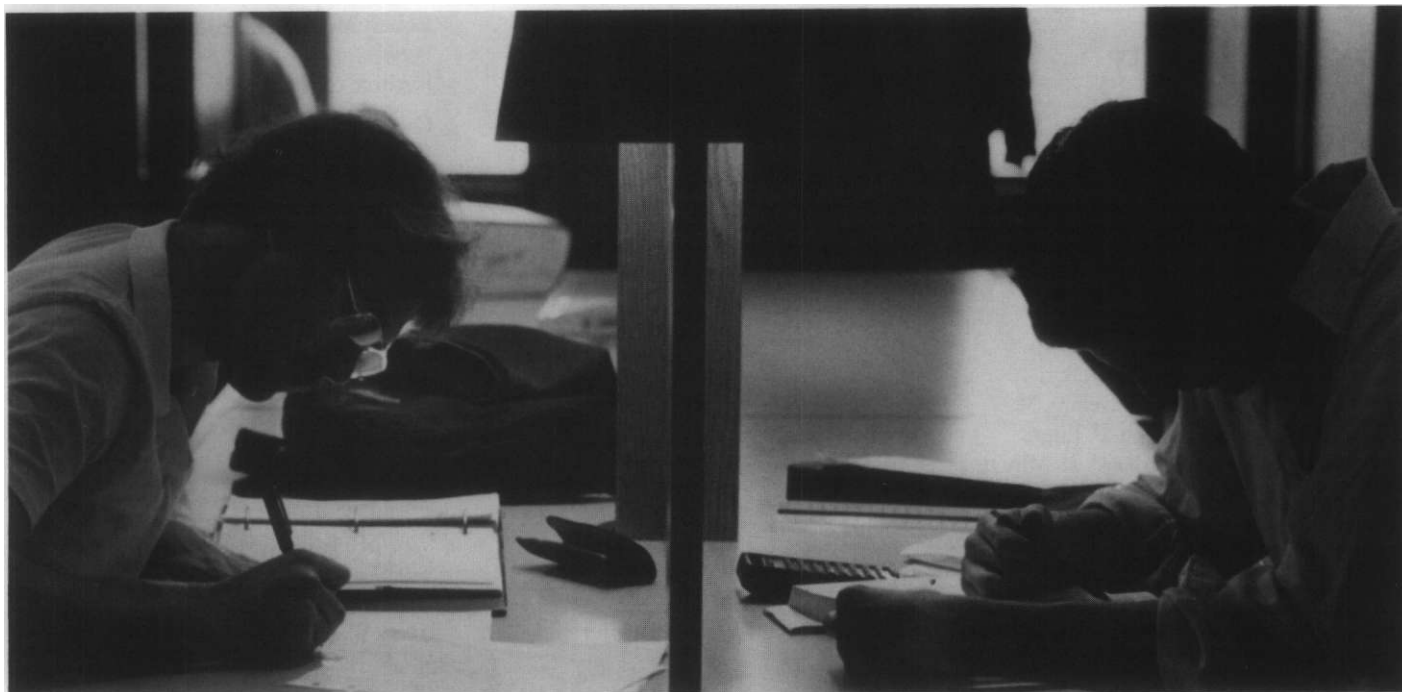
Procedure

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 a $35 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
One Lomb Memorial Drive
P.O. Box 9887
Rochester, NY 14623

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 chairperson with due regard to the candidate's objectives. However, to insure credit toward the degree, the candidate should write the chairperson indicating courses for which he or she would like transfer credit for work in the past and to obtain prior approval of courses for which transfer credit is sought. While these matters would be discussed with either the candidate's advisor or the department at various times during the advisement process, it is essential that all agreements be documented *in writing*. A letter to the departmental chairperson will assure proper recognition of outside work accomplished toward the degree.

Non-matriculated students

It is not necessary to be formally admitted or matriculated into the MS in statistics program in order to register for course offerings. However, for students who desire to enter the graduate program, only four courses may be taken toward the MS degree as a non-matriculated student. Those who do not have college degrees may be admitted to courses in fields of their special interest by consent of the department chairperson.

Grades, exams and theses

The candidate must attain an overall average grade of 3.0 (B) for graduation. An oral examination is required when the student is enrolled in the last quarter of his or her program, to assure subject matter and verbal proficiency as well as ability to perform as a statistician in a working environment. Successful completion of each quarter course normally requires passing a final exam, submission of a written paper or thesis, or completion of a group project, as determined by the instructor. Students are encouraged to develop their writing and speaking skills as well as to use the computer as ways to improve their knowledge.

Location

Courses are offered at the Henrietta campus, at selected off-campus locations, and at in-plant training facilities.

Plans of study

Students may, with the permission of the departmental chairperson, secure credits toward the master's degree in two ways:

First, a student may complete the required 45 or 51 quarter credits, depending on whether the basic "Fundamentals" courses are waived, by formal *classroom* attendance and receipt of satisfactory grades.

Second, three, six or nine of these credits may be obtained by submission of a satisfactory research project and *thesis*. The project and credits must be approved by the department chairperson prior to registration. A letter outlining the project and requesting this approval must be addressed to the chairperson by the candidate prior to the regular registration periods. The depth of the project will determine the number of credits received. Generally this type of credit should be sought at the end of the program after sufficient knowledge of the subject is available for use. CQAS-896, 897, and 898 are the registration numbers used for thesis work.

Faculty

Eight full-time and 22 adjunct faculty normally teach in the master's program in applied and mathematical statistics. All instructors have an industrial background. This is reflected in their realistic approach to the subject matter. Many of the faculty hold jobs which require them to apply daily what they teach at night; e.g., the quality control instructor installs quality control systems for his company. As with many others dedicated to continuing education, faculty members have a commitment to give the students personal attention. This often involves career counseling.

Graduate Faculty College of Continuing Education

Donald D. Baker, BA, Trinity College; ME, MBA, Ed.D., University of Rochester-Associate Professor, Dean

John D. Hromi, BS, Carnegie-Mellon University; BEE, Clemson University, M. Litt, University of Pittsburgh, D. Engr., University of Detroit—Frederick H. Minett Professor, Director, Center for Quality and Applied Statistics.

Edward G. Schilling, BA, MBA, University of Buffalo, MS, Ph.D., Rutgers University-Paul Miller Distinguished Professor, Chairman, Graduate Statistics.

Anne M. Barker, BA, Nazareth College; MS, Rochester Institute of Technology—Assistant Professor

Thomas B. Barker, BS, MS, Rochester Institute of Technology—Assistant Professor

Daniel L. Lawrence, BA, BS, University of Akron; MA, Ball State University; MS, Rochester Institute of Technology; Ph.D., University of Toronto—Assistant Professor

Daniel C. Smialek, BS, MS, Rochester Institute of Technology—Assistant Professor

Joseph G. Voelkel, BS, Rensselaer Polytechnic Institute; MS, Northwestern University; Ph.D., University of Wisconsin-Madison—Assistant Professor

Mason E. Wescott, BS, Ph.D., Northwestern—Professor Emeritus, Statistics

James L. Bossert, BA, St. John Fisher, MS, Rochester Institute of Technology

F. Rebecca Burr, BA, Mount Holyoke; MS, University of Minnesota

John T Burr, BA, Grinnel College, Iowa; Ph.D., Purdue University

Stephen J. Caffery, BS, Central Michigan University; MA, University of Iowa

J. Douglas Ekings, BS, Virginia Military Institute; MS, University of Rochester

David L. Farnsworth, BS, Union College; MA, Ph.D., University of Texas

Richard A. Freund, BS, MS, Columbia University

J. Edward Jackson, BA, University of Rochester, MA, University of North Carolina; Ph.D., Virginia Polytechnic Institute

John K. Lynch, BS, MS, University of Wyoming

Thomas E. Lynch, BS, MBA, University of Rochester

James Mason, BA, Suny at Buffalo; MA, University of Rochester

Sterling A. Mason, BS, MS, Brigham Young University

Robert M. Meisel, BS, ME, Rensselaer Polytechnic Institute; MS, Rochester Institute of Technology

Carol L. Oelkers, BS, MS, McGill University; BA, Sir George Williams College

Richard R. Scott, BS, MS, Rochester Institute of Technology

William A. Swagler, Jr., BSIE, General Motors Institute; MS, Rochester Institute of Technology

Ronald E. Swanson, BSIE, MSEE, MS, Lehigh University; Ph.D., Arizona State University

Madhusudan C. Trivedi, MS, MS University (India); MS, Virginia Polytechnic Institute; MS, Michigan State University; MA, Ph.D., MBA, University of Rochester

Harry B. Trulli, BS, U.S. Naval Academy; MS, Rochester Institute of Technology

Thomas K. Witt, BS, Kansas State University; MS, Rochester Institute of Technology

Hubert D. Wood, BS, George Washington University; MS, University of Rochester

Nicholas A. Zaino, Jr., BS, Rochester Institute of Technology; MSEE, University of Pennsylvania; MA, University of Rochester

Statistics

CQAS-701   Statistical Concepts

Registration #0280-701

A service course designed for non-concentrators which emphasizes statistical thinking instead of mathematical manipulations. This is an intuition-based introduction to the subject. Topics include: exploratory data analysis, methods for collecting data, statistical inference, regression analysis, and analysis of variance. This course does not count as credit for the MS degree in statistics. (None)

Credit 4

CQAS-711   Fundamentals of Statistics I

Registration #0280-711

For those taking statistics for the first time. Covers the statistical methods used most in industry, business, and research. Essential for all scientists, engineers, and administrators. Topics: organizing observed data for analysis and insight; 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.

Credit 3 or 4

CQAS-712   Fundamentals of Statistics D

Registration #0280-712

Continuation of CQAS-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; learning how to separate 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. (Fund, of Statistics I CQAS-711)

Credit 3 or 4

CQAS-721   Statistical Quality Control I

Registration #0280-721

A practical course designed to give depth to practicing quality control personnel. Topics: statistical measures; theory, construction, and application of control charts for variables and attributes; computerization procedures for control charts; tolerances, specifications, and process capability studies; basic concepts of total quality control, and the management of the quality control function.

Credit 3

CQAS-731   Statistical Quality Control II

Registration #0280-731

Investigation of modern acceptance sampling techniques with emphasis on industrial applications. Topics: single, double multiple, and sequential techniques for attributes sampling, variables sampling, techniques for sampling continuous production. The course highlights Dodge-Romig plans, Military Standard plans, and recent contributions from the literature.

Credit 3

CQAS-742   **Statistical Computing**

Registration #0280-742

An advanced course in statistical computing using SAS statistical software. The course will cover basic SAS procedures; the creation, manipulation, and analysis of data bases; graphical display techniques; and the development and writing of custom numerical analysis procedures. (Fund, of Statistics IICQAS-712)
Credit 3

CQAS-761   **Reliability**

Registration #0280-761

A methods course in reliability practices: What a reliability engineer must know about reliability predictions, estimation, analysis, demonstration, and other reliability activities. Covers most methods presently being used in industry. Topics: applications of normal, binomial, exponential, and Weibull graphs to reliability problems; hazard plotting, reliability confidence limits and risks; strength and stress models; reliability safety margins; truncated and censored life tests; sequential test plans; Bayesian test programs. (Fund, of Statistics II CQAS-712)
Credit 3

CQAS-781   **Quality Management**

Registration #0280-781

A course designed to cover concepts and methods of quality management. Topics include: basic concepts, history of quality control, quality policy, economics of quality, quality costs, organization for quality, design for system effectiveness, manufacturing planning for quality, and quality data systems.
Credit 3

CQAS-782   **Quality Engineering**

Registration #0280-782

A course designed to cover important elements of quality engineering. Topics include: specifications, statistical tolerancing, measurement, vendor relations, process control, motivation, customer relations, diagnostic techniques, process improvement studies, and quality planning.
Credit 3

CQAS-783   **Quality Engineering by Design**

Registration #0280-783

The Taguchi Method of off-line control including parameter design and tolerance design leading to improved products and processes at lower costs. (Design of Experiments IICQAS-802)
Credit 3

CQAS-791   **Statistical Methods in Health Sciences**

Registration #0280-791

A course designed as an introduction to statistical methods for those involved in the health sciences. Topics include: types of biological data, descriptive statistics, tests of significance, experimental design, tests of association, relative risk, diagnostic tests. (Fund, of Statistics II CQAS-712)
Credit 3

CQAS-792   **Biological Assays**

Registration #0280-792

An advanced course in biostatistics which deals with the important research concerns of identifying and verifying drug-dose response. Topics include: parallel-line assays, slope-ratio assays, quantal response assays. (Design of Experiments II CQAS-802)
Credit 3

CQAS-801   **Design of Experiments I**

Registration #0280-801

How you design and analyze experiments in any subject matter area; what you do and why. Topics: basic statistical concepts, scientific experimentation, completely randomized design, randomized complete block design, nested and split plot design. Practical applications to civil engineering, pharmacy, aircraft, agronomy, photo-science, genetics, psychology, and advertising. (Fund, of Statistics II CQAS-712)
Credit 3

CQAS-802   **Design of Experiments D**

Registration #0280-802

Continuation of CQAS-801. Topics: factorial experiments; fractional, three-level, and mixed factorial designs; response surface exploration. Practical applications to: medical areas, alloys, highway engineering, plastics, metallurgy, animal nutrition, sociology, industrial and electrical engineering. (Design of Experiments ICQAS-801)
Credit 3

CQAS-821   **Theory of Statistics I**

Registration #0280-821

Provides a sound theoretical basis for continuing study and reading in statistics. Topics: constructs and applications of mathematical probability; discrete and continuous distribution functions for a single variable and for the multivariate case; expected value and moment generating functions; special continuous distributions. (Fund, of Statistics II CQAS-712)
Credit 3

CQAS-822   **Theory of Statistics II**

Registration #0280-822

Continuation of CQAS-821. Topics: supporting theory for and derivation of sampling distribution models; applications and related material; point estimation theory and applications; the multivariate normal probability model, its properties and applications; interval estimation theory and applications. (Theory of Statistics ICQAS-821)
Credit 3

CQAS-824   **Probability Models**

Registration #0280-824

An introduction to probability theory and stochastic processes. Topics include: random variables, conditional probability and expectation, Markov chains, renewal theory, queuing theory, and reliability. (Theory of Statistics I CQAS-821)
Credit 3

CQAS-830   **Multivariate Analysis I**

Registration #0280-830

This course deals with the summarization, representation, and interpretation of data sampled from populations where more than one characteristic is measured on each sample element. Usually the several measurements made on each individual experimental item are correlated and certainly one should not apply univariate analysis to each measurement separately. This course covers the use of the basic multivariate techniques. Computer problem solving will be emphasized. Topics will include: multivariate t-tests, ANOVA, MANOVA, regression analysis, repeated measures, quality control, and profile analysis. (Design of Experiments II CQAS-802)
Credit 3

CQAS-831   **Multivariate Analysis D**

Registration #0280-831

A continuation of CQAS-830, this course covers the use of advanced multivariate techniques. Topics include: principal component analysis, cluster analysis, multi-dimensional contingency tables, discrete discriminant analysis, multi-dimensional scaling, and regression with errors in the independent variable. Practical applications will be emphasized. (Multivariate Analysis I CQAS-830)
Credit 3

CQAS-841   **Regression Analysis I**

Registration #0280-841

A methods course dealing with the general relationship problem. Topics include: the matrix approach to simple and multiple linear regression; analysis of residuals; dummy variables; orthogonal models; and computational techniques. (Design of Experiments II CQAS-802)

Credit 3

CQAS-842   **Regression Analysis II**

Registration #0280-842

A continuation of CQAS-841. Topics: selection of best linear models; regression applied to analysis of variance problems; nonlinear estimation; and model building. (Regression Analysis I CQAS-841)

Credit 3

CQAS-851   **Nonparametric Statistics**

Registration #0280-851

Distribution-free testing and estimation techniques with emphasis on applications. Topics: sign tests; Kolmogorov-Smirnov statistics; runs tests; Wilcoxon-Mann-Whitney test; chi-square tests; rank correlation; rank order tests; quick tests. (Fund, of Statistics II CQAS-712)

Credit 3

CQAS-853   **Managerial Decision Making**

Registration #0280-853

Statistical decision analysis for management. Topics: utilities; how to make the best decision (but not necessarily the right one); normal and beta distributions; Bayesian theory; many action problems; optimal sample size; decision diagrams. Applications to marketing, oil exploration; portfolio selection; quality control; production; and research programs. (Bayesian Statistics CQAS-881)

Credit 3

CQAS-856   **Interpretation of Data**

Registration #0280-856

Advanced topics related to use of statistics in investigational analysis, including narrow limit gauging, practical design of experiments, analysis of small sample data, analysis of means, identifying assignable causes, and other methods for troubleshooting with statistical methods. (Design of Experiments I CQAS-801)

Credit 3

CQAS-864   **Advanced Acceptance Sampling**

Registration #0280-864

An advanced course in acceptance control techniques including basis of acceptance sampling, attributes plans; variables plans for process parameters; variables plans for proportion nonconforming, sampling schemes including MIL-STD-105D and MIL-STD-414; plans for special applications; rectification and continuous procedures; cumulative results plans; compliance sampling, reliability sampling, and administration of sampling plan. (Statistical Quality Control II, CQAS-731)

Credit 3

CQAS-871   **Sampling Theory and Applications**

Registration #0280-871

An introduction to sample surveys in many fields of applications with emphasis on practical aspects. Topics: review of basic concepts, sampling problem elements; sampling, random, stratified, ratio, cluster, systematic, two-stage cluster, wild life populations, questionnaires, sample sizes. (Fund, of Statistics II, CQAS-712)

Credit 3

CQAS-873   **Time Series Analysis**

Registration #0280-873

A methods course in modeling and forecasting of time series with emphasis on model identification, model fitting, and diagnostic checking. Topics: survey of forecasting methods, regression methods, moving averages, exponential smoothing, seasonality, analysis of forecast errors, Boxjenkins models, transfer function models, case studies. (Regression Analysis I CQAS-841)

Credit 3

CQAS-875   **Empirical Modeling**

Registration #0280-875

A course in model building based on the application of empirical data gathered through appropriate experimental design and analyzed through regression techniques. Topics: response variable construction, experimental design methods, and related analysis techniques. (Design of Experiments II CQAS-802 and Regression Analysis I CQAS-841)

Credit 3

CQAS-881   **Bayesian Statistics**

Registration #0280-881

An introduction to Bayesian statistics and decision making which explores Bayes' Theorem in its relation to classical and Bayesian methodology. Topics: probability, Bayes' Theorem, assessment of prior probabilities and likelihoods, hypothesis testing, and the multivariable case. (Fund, of Statistics II CQAS-712)

Credit 3

CQAS-886   **Sample Size Determination**

Registration #0280-886

The question most often asked of an industrial statistician is "What size sample should I take?" This course answers that question for a wide variety of practical investigational projects. Techniques for the full use of the optimal sample evidence are also offered. (Fund, of Statistics II CQAS-712 and Design of Experiments ICQAS-801)

Credit 3

CQAS-891,892,893   **Special Topics in Applied Statistics**

Registration #0280-891,892,893

These courses provide for the presentation of subject matter of important specialized value in the field of applied and mathematical statistics not offered as a regular part of the statistics program. (Consent of the Department)

Credit 3 each course

CQAS-895   **Statistics Seminar**

Registration #0280-895

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 or 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

CQAS-896,897,898   **Thesis**

Registration #0280-896,897,898

For students working for the MS degree in applied and mathematical statistics who use a research project and thesis for three, six, or nine credits. (Consent of the Department)

Credit 3,6, or 9

Department of Career and Human Resource Development

Dr. Dorothy Paynter, Director

Human resource development today

The field of human resource development continues to expand and gain stature as an independent field. Government, industrial, educational, and other organizations are recognizing that their future success depends on cultivating the potential of the people who work at all levels in the organization—not only in top positions, but also in entry-level and middle-level positions. Competent executives who are mapping their organizations' futures do not ignore the fact that their people are the single most important resource for ensuring future success.

These executives and their organizations are turning to individuals with the necessary skills and knowledge to assist in this important process. These individuals, identified by a variety of titles—trainers, counselors, internal and external consultants, personnel administrators, human resource planners—need very specific education, training and skills.

Graduates of RIT's program in Career and Human Resource Development meet this need.

The program

The Career and Human Resource Development Program is a 52 quarter credit hour program with three major curriculum components: career development, organizational development, and human resource development. Students are required to take a theory course and a techniques course in each area. Two additional techniques courses are required. Students have the option of concentrating in a specific area through their choice of additional techniques courses and electives.

Many work environments are open to graduates of the program. Students focus on the environment of their choice-education, business, industry, public agencies—through their selection of projects, research topics and the setting of their internship.

Admissions 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.
- A recent writing sample.
- An oral presentation.
- An interview with program faculty.

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 Studies, RIT Admissions, or the department. Call 475-5062 for further information.

Financial assistance

In addition to the assistance available through the RIT Financial Aid Office (716/475-2186) or the dean of Graduate Studies (716/475-6523), the department has scholarship and assistantship opportunities. The number and kind vary from year to year. For more information contact the CHRD Department (716/475-5062) for further information.

Degree requirements

The degree requires the completion of a minimum of 52 quarter hours at the graduate level. Of the 52 hours, 24 are in nine courses required of all students. In addition, all students are required to complete 15 credits in techniques courses and 13 credits of electives. The degree can usually be completed in five consecutive quarters if the student starts in the Fall Quarter. However, the majority of students attend part time and take from two to four years to complete the degree work. Students must maintain a B average, and complete the degree within seven years from the first course taken and applied to the degree. Almost all courses are offered in the evenings, giving students the freedom to work during the day while they take courses.

Students are relatively free to choose the electives they feel best meet their needs. The only restrictions are: all courses must be graduate-level courses; a maximum of 12 quarter hours (not counted toward another degree) may be transferred from another college or university; a maximum of 12 hours may be taken outside the department of Career and Human Resource Development.

Upon matriculation, each student is assigned an academic advisor. At this time the student and advisor will develop a plan of study. For specific questions about courses and a plan of study, the advisor or department director should be consulted.

Required Courses	Credit
CHRD-700 Introduction to Career & Human Resource Development	3
CHRD-705 Assessment Methods in CHRD	3
CQAS-701 Statistical Concepts	3
CHRD-710 Theory of Organizational Development	3
CHRD-720 Theories of Career Development	3
CHRD-730 Theory of Human Resource Development	3
CHRD-877 Internship*	6

For students with appropriate professional experience, special projects or additional course work may be substituted for the Internship. Departmental approval is required.

Organizational Development Techniques Courses

CHRD-711 Futures Research & Simulation	3
CHRD-712 Planning & Evaluation in Organizational Development	3
CHRD-713 Practice of Consultation in Organizational Development	3

Career Development Techniques Courses

CHRD-721 Individual Career Counseling Techniques	3
CHRD-722 Career Counseling Techniques for Groups	3
CHRD-723 Information Use in Career Planning	3

Human Resource Development Techniques Courses

CHRD-731 Techniques of HRD	3
CHRD-732* Design & Delivery of Training	2
CHRD-733 Needs Assessment & Problem Solving Techniques	3

CHRD-732 may be taken more than once.

Electives

CHRD-750 Microcomputer Applications in CHRD	3
CHRD-850 Special Projects	Variable
CHRD-891 Special Topics	3

Electives May Include:

Techniques courses not applied to degree requirements

Courses in other graduate-level programs at the Institute with permission of advisor

Degree Requirements

24	Credits-Required Courses
15	Credits-Techniques Courses
13	Credits-Electives
52	Credits Total

Career and Human Resource Development

CHRD-700   Introduction to Career and Human Resource Development

Registration #0290-700

As a result of this course, students will better understand the CHRD program and its courses/options as well as related RIT and community resources; better understand the general concepts of human resource development, career development and organizational development as they apply to individuals and groups in a wide variety of settings and structures; and better understand the past, present and future significance of social, economic, technological factors influencing organizations and occupational categories as well as the corresponding role and activities of the human resource professional.

Credit 3

CHRD-705   Assessment Methods

Registration #0290-705

This course will enable professionals in the fields of career development, organizational development and human resource development to accurately describe groups of people and their characteristics of interest to career and human resource development (e.g., skills, performance, background, attitudes, etc.). Topics include techniques of empirical investigation, questionnaire and test design, interviewing, and evaluations of training, counseling and development. (Note: following this course, students should take CQAS-701.)

Credit 3

CHRD-710   Theory of Organizational Development

Registration #0290-710

This course introduces the student to organizational development theories and their application in an organization setting. Consideration will be given to the 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 the theorists upon which their philosophies are based. This course also will demonstrate how the theories of organizational development can be applied in organizations to foster change, innovation, and the revitalization of the organization.

Credit 3

CHRD-711   Futures Research and Simulation

Registration #0290-711

In this course students will learn to understand the techniques, theories, and advantages/limitations of simulation and futures research methods, and the application of simulation and futures research methods for facilitating individual and organizational decision making. (CHRD-705, CQAS-701, CHRD-710)

Credit 3

CHRD-712   Planning & Evaluation in Organizational Development

Registration #0290-712

In this course students will learn to understand the techniques, theories, and advantages/limitations of systematic planning strategies and the application of methods for strategic and tactical planning, and the decision making that assure accountability. (CHRD-705, CQAS-701, CHRD-710)

Credit 3

CHRD-713   The Practice of Consultation in OP

Registration #0290-713

Students will develop an understanding of the various roles that organizational development practitioners play in applying their knowledge and skill in organizational settings, e.g., serving as internal consultants, process consultants, and change agents. Students will learn those skills and practices that pertain to the field of organizational development including organizational performance analysis, group dynamics, problem solving, intervention techniques, dealing with resistance to change, implementing change, stress management, and approaches that foster employees' acceptance of change and organizational transformation, revitalization and renewal. (CHRD-705, CQAS-701, CHRD-710)

Credit 3

CHRD-720   Theories of Career Development

Registration #0290-720

Career Development Theories provide mechanisms to examine and define the needs of the work place in relationship to the needs and abilities of the worker. This course will emphasize the structure of selected theories and explore their relationship to the individual's decision-making process.

Credit 3

CHRD-721   Individual Career Counseling Techniques

Registration #0290-721

This course will introduce selected theories and techniques that may be used in individual career counseling situations. Students will practice techniques and develop their own style of career counseling. This course is not meant for individuals seeking to develop clinical therapeutic skills. (CHRD-720)

Credit 3

CHRD-722   Career Counseling Techniques for Groups

Registration #0290-722

This course will introduce students to small group theory and the use of small groups to assist individuals in identifying and implementing their career goals. Students will participate in a small group as they learn and practice group leadership and membership tasks as well as develop career counseling skills. This course is not meant for individuals seeking to develop clinical therapeutic skills. (CHRD-720)

Credit 3

CHRD-723   Information Use in Career Planning

Registration #0290-723

This course will explore the role of information in the educational, work, and leisure aspects of individuals' lifelong career and personal development Students will be introduced to the following areas that may be useful in the development of career development and planning services: career planning models, selection and use of standardized tests and personal assessment instruments, career information data resources, research issues, and community resources. (CHRD-705, CQAS-701, CHRD-720)

Credit 3

CHRD-730   Theories of Human Resource Development

Registration #0290-730

Professionals in the fields of career counseling, organizational development and human resource development require an organized plan of human learning and development. This course presents recent investigations, both theoretical and empirical, into human learning research, and will emphasize the information-processing model of learning and memory. Students will acquire, through readings and group activities, an intellectually consistent basis for the practical procedures of human resource development.

Credit 3

CHRD-731   Techniques of Human Resource Development

Registration #0290-731

This course is designed for future trainers in industrial settings and educators in college and university environments. The course is based on the theory that future trainers and educators must first identify and clarify the value systems within themselves and others prior to organizing a content to be learned. There then must be a self-need assessment by exploring what one knows and must know about learning, curriculum design, information delivery and the assessment of that learning. With this data, the future trainer/educator will seek out the resources to satisfy those needs by mastery of the management of learning principles and skills. With these needs satisfied, the next phase is to create a demonstration of this mastery by developing, facilitating, and evaluating a real course or training experience. The course will provide participants with a model experience that can serve as the basis for developing additional learning/training packages in future work and educational settings. (CHRD-730)

Credit 3

CHRD-732   **Design & Development of Training**

Registration #0290-732

Students will gain practical experience in human resource development by designing, producing, teaching and evaluating a workshop, seminar or training session. Students will select a needed training module from the broad areas of personal and professional dervelopment, skills training and career development and carry out the necessary design, production and delivery steps. Students may take this course more than once in order to gain practical HRD experience and to add competencies to their resumes. (CHRD-730,731)
Credit 2

CHRD-733   **Needs Analysis and Problem Solving Techniques**

Registration #0290-733

Students will learn techniques to foster innovation and problem solving within organizations, through strategies to help themselves and others define problems, state goals, identify solutions and make decisions. Topics considered will include general systems theory, barriers to creativity, strategic plans, intrapreneuring, product development, and technology-driven worker training. (CHRD-730)

Credit 3

CHRD-750   **Microcomputer Applications in CHRD**

Registration #0290-750

Professionals in the fields of human resource development and career development make frequent use of computer technology to write proposals, track clients, design training, monitor budgets, evaluate services and produce reports. In this course, students will learn to utilize MS-DOS software for word processing, file management, spreadsheets and communications. After completing this course, students will have a general understanding of these classes of software, be moderately competent using such software and be experienced using this software to produce products appropriate to their intended professions.

Credit 3

CHRD-850   **Special Projects**

Registration #0290-850

This course provides for independent study, investigation, 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 prior to registration. This course may be taken more than once, but for no more than a total of 6 credit hours.

Credit variable

CHRD-891,892,893   **Selected Topics**

Registration #0290-891,892,893

Selected Topics are innovative courses not reflected in the curriculum. Titles will appear in the course listing each quarter. The course may be taken more than once as topics change, but for no more than a total of 6 credit hours.

Credit 3

CHRD-877   **Internship**

Registration #0290-877

The internship is required of all students.* The course consists of two parts: a) at least 20 hours per week of professional experience in appropriate setting, and b) attendance at a seminar that will meet at various times throughout the quarter. Students will work with their advisors to complete all necessary arrangements, and should meet with their advisors at least two months before planning to take the internship. Proposals for the internship must be approved and on file before registration.

Credit 6

For students with appropriate professional experience, special projects or additional course work may be substituted for the Internship. Departmental approval is required.

College of Engineering

Richard A. Kenyon, Dean

The College of Engineering offers programs leading to both the traditional master of science degree as well as the master of engineering degree. The MS degree is offered in electrical engineering, mechanical engineering and computer engineering and requires successful completion of no less than 45 quarter credits beyond the baccalaureate and preparation of a master's thesis (or departmentally acceptable alternative). The MS program, which may be pursued on either a full- or part-time basis, leads to employment in engineering in an industrial environment or to further graduate study at the doctoral level. The College of Engineering also offers, jointly with the College of Science, a program leading to the MS degree in materials science and engineering. The master of engineering degree, with options in electrical engineering, mechanical engineering, industrial engineering, systems engineering, engineering management, manufacturing engineering, computer engineering and microelectronic manufacturing engineering (new for 1988-89), is essentially a terminal master's program leading to industrial employment and substituting an industrial internship or an engineering case study for the traditional thesis. It requires completion of no less than 48 quarter credits (including credit for the internship or case study) in a program that is highly flexible to meet the needs of a variety of student backgrounds and projected employment fields. The master of engineering program also may be pursued on either a full- or part-time basis.

Specific details of several master of science and master of engineering programs offered by the college are covered in the following sections. Details of the MS degree in materials science and engineering are to be found in the section of the catalog devoted to the College of Science. Further information, such as course schedules, availability of assistantships, research activities and thesis requirements can be obtained from the department in question by telephone, mail or personal visit.

Part-time study

The College of Engineering encourages practicing engineers in the greater Rochester industrial community to pursue a program toward the master of science 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 than eight credits while employed in full-time industry must obtain the permission of his or her advisor and the approval of the department head.

It is possible for a student to obtain the MS degree in two academic years (or six academic quarters) by taking courses in late afternoons or early evening only.

A student in the master of engineering degree program may earn academic credits for industrial experience which 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 need of a large number of practicing engineers who wish to pursue a part-time program, the different programs may also enroll full-time graduate students. A full-time student may take up to 16 credits per quarter.

A full-time student in the master of engineering degree program alternates academic quarters with his or her internship. A full-time student can normally complete the degree requirements in one calendar year.

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.

In-plant 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.

Admission

Admission

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 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 additional undergraduate 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.

Non-matriculated status

An applicant is permitted to take graduate courses as a non-matriculated 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 non-matriculated student will be limited to an absolute maximum of 12 credits.

An applicant who wishes to enroll in a graduate course as a non-matriculated 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 non-matriculated 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 insure transferability, prior approval should be obtained. The student should contact the individual department office about the procedure for obtaining transfer credits.

Faculty advisor

A member of the graduate faculty is appointed as a faculty advisor for each graduate student. The faculty advisor supervises the progress of the student towards the master's degree. Non-matriculated students should direct their questions to either the department head or the chairperson of the department's Graduate Committee.

Course descriptions

For a complete outline of courses, refer to the course description section.

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 advisor may recommend to the dean that the student's performance be reviewed and appropriate action taken.

Thesis

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 regulations:

The thesis must be completed and accepted at least 30 days before the last day of scheduled classes of the quarter in which the student expects to receive a degree. Three copies of the thesis must be submitted to the departmental office before the above deadline. These copies are for transmittal to the Institute library, the departmental office, and the student's thesis advisor. For detailed instructions about the organization of the thesis, the student should consult the brochure "Thesis Format," available at the departmental office.

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 non-matriculated student.

Courses of instruction

Information about the courses that will be offered in a particular quarter will be available from the departmental 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.

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 industrial internship for the conventional thesis or equivalent requirement for an MS degree.

Special features of the program

An industrial internship of duration equivalent to two academic quarters in a full-time engineering position is an integral part of the program. A minimum of eight and a maximum of 16 credits may be earned by 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 and the director of graduate programs.

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 which will best help the student meet professional objectives. A maximum of 16 credits can be taken by the student in courses outside the traditional area of engineering and the sciences, subject to advisor approval.

Admission requirements

The requirements and general standards for admission and the selection procedure will be essentially similar to those for the MS degree programs.

Degree requirements

A minimum of 48 credits, including the academic credits awarded for the internship experience, are required for the master of engineering degree.

Faculty advisor

Each student will be assigned a faculty advisor as soon as he or she is formally admitted to the program.

In cases where the student's background warrants it, a committee of two advisors will be assigned. The faculty advisor will assist the student in preparing a meaningful plan of study. The advisor will also monitor and evaluate the student's internship experience (in cooperation with the student's industrial supervisor) and recommend to the Graduate Committee of the College of Engineering the number of academic credits to be awarded for the internship experience.

For information

Specific questions on the individual department programs:
  Computer Engineering 475-2987
    (Dr. Czernikowski)
  Electrical Engineering 475-2165
    (Dr. Madhu)
  Industrial Engineering 475-2147
    (Dr. Reeve)
  Mechanical Engineering 475-2163
    (Dr. Karlekar)
  Microelectronic Engineering
    475-2035 (Dr. Fuller)
Questions on course schedules and registration:
  Computer Engineering 475-2987
  Electrical Engineering 475-2165
  Industrial Engineering 475-2598
  Mechanical Engineering 475-2163
  Microelectronic Engineering
    475-2035

Computer Engineering Department

Roy Czernikowski, 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 core curriculum as specified below. This includes six courses in a core curriculum, an area of concentration, graduate electives subject to faculty advisor's approval, and five to eight quarter credits of master's thesis. Both the area of concentra-

tion 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 chairman of the student's graduate committee will normally serve as the student's faculty advisor. The intent is to allow students reasonable creativity in articulation in an area of concentration.
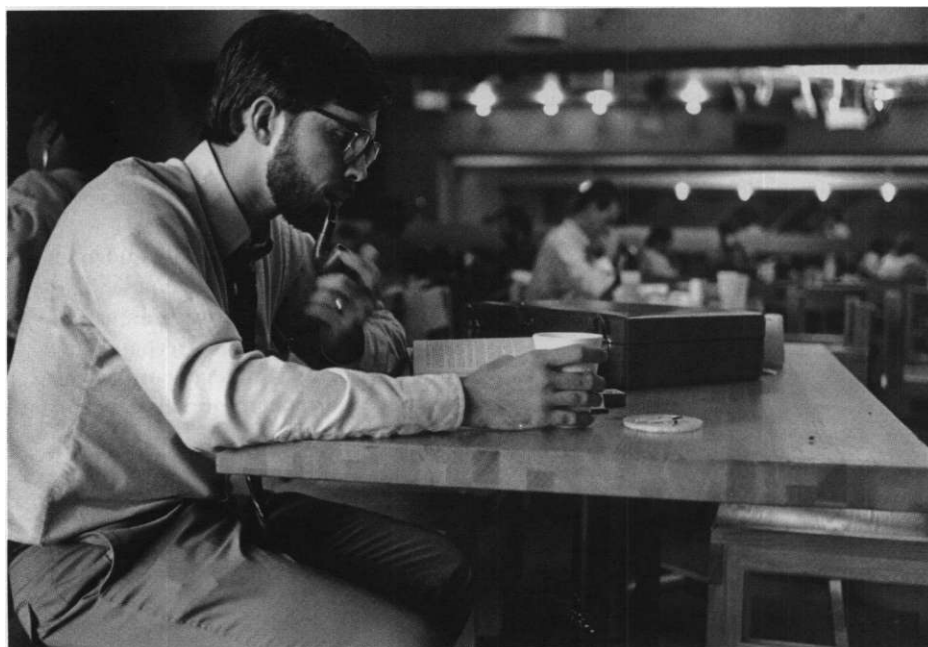
Master's degree in computer engineering core courses:
EECC-722 Advanced Computer Architecture (Winter)
EECC-740 Analytical Topics for Computer Engineers (Fall)
EECC-759 Principles of Digital Interfacing (Fall)
EECC-756 Multiple Processor Systems (Spring)
ICSS-706 Foundation of Computing Theory (Fall, Winter, Spring)
ICSS-709 Programming Language Theory (Fall, Spring, Summer)

The graduate curriculum will require the following courses above a BS degree in computer engineering:
  6 courses in core (24 quarter credits)
  2 courses in graduate electives (8 quarter credits)
  2 courses in concentration (8 quarter credits)
  5-8 credits in master's thesis project
  45-48 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/her faculty advisor. The total of all graduate courses transferred from other appropriate institutions of higher learning may not exceed 12 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

Swaminathan Madhu, Department Head

Admission requirements
Admission into the graduate studies 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.) may be considered for admission provided the student agrees to complete a certain number of undergraduate courses in electrical engineering with at least a B average. For further information, please contact the EE Department.

Master of science degree program
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. Under certain circumstances a student chooses or is required to complete more than the minimum number of credits.

Core courses
These courses are required of all candidates for the MS degree in electrical engineering: EEEE-754, 755, 756, Analytical Techniques I, II, and **III**. A waiver of any of the above courses can only be granted if the student has taken credit-bearing graduate courses covering the appropriate topics.

A graduate student will be expected to take the required core courses during the first year of his or her program, since these courses are prerequisites for many of the other graduate courses.

Elective courses
Students are allowed to choose courses of his or her preference from the available graduate courses in electrical engineering to make up the necessary course credits.

Transfer credits

A maximum of 12 credit hours can be earned from courses available from other departments within **RIT** with the *prior approval* of the faculty/department advisor. For students transferring credits from other universities, the total number of credits transferred from outside the Electrical Engineering Department from all sources shall not exceed 12.

Under some extraordinary circumstances, a resident full-time student may appeal the 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 ICSA-701,702, 703,704, and 705 will be treated as advanced undergraduate courses and 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 thesis

The inclusion of a thesis (EEEE-890) as a formal part of the MS degree program in electrical engineering is optional but is strongly encouraged. Students who decide to write a thesis can earn a minimum of six credits and a maximum of 12 credits toward their degree from the thesis, nine being the most common number of credits earned. Typically, they take nine approved courses for 36 credits to meet the course requirements.

A thesis is written under the supervision of a faculty advisor and presented and defended before a thesis committee when complete.

Non-thesis option: the graduate paper

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 findings. A faculty member interested in the topic of the paper 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 number EEEE-800 Graduate Paper is used in registering for the paper. The student choosing this option will earn the remainder of the required credits for the degree by means of course work.

Schedule of graduate courses in electrical engineering for 1988-89

Fall
EEEE-723 Semiconductor Physics
EEEE-727 VLSI Design*
EEEE-754 Analytical Techniques I
EEEE-763 Stochastic Estimation and Control
EEEE-775 Optical Engineering I
EEEE-794 Information Theory
*The course EECC-731 VLSI Design may be used as a substitute for EEEE-727.

Winter
EEEE-724 Physics of Semiconductor Devices I
EEEE-726 Analog IC Circuits
EEEE-755 Analytical Techniques II
EEEE-742 Advanced Microprocessor Software Design
EEEE-765 Optimal Control
EEEE-776 Electro-optics

Spring
EEEE-725 Physics of Semiconductor Devices II
EEEE-730 Advanced Analog IC Design
EEEE-756 Analytical Techniques III
EEEE-761 Modern Control Theory
EEEE-795 Optical Engineering II
EEEE-793 Error Detection and Correcting Codes

Besides the courses listed above, others may be offered during the 1988-89 academic year. Please call the EE office about a month before the beginning of an academic quarter for up-to-date information.

Industrial and Manufacturing Engineering Department

N. Richard Reeve, Department Head

Although there is no master of science degree in industrial engineering at present, the master of engineering degree can be earned with specialization in the following fields: industrial engineering; systems engineering; engineering management; and manufacturing engineering.

Close cooperation with 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 emphasizing computer methods to realistic problem solving is employed in all the above specialties.

Admission requirements

Admission into the graduate ME program within industrial engineering requires a BS degree in an engineering discipline. 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 (FORTRAN), and Probability/Statistics.

Program of study

The student in conjunction with his/her advisor 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.

Graduate Course Offerings

Department of Industrial & Manufacturing Engineering

Even Years (e.g., 88/89, 90/91 etc.)

FALL	WINTER	SPRING
EIEI-715 Statistical Analysis	EIEI-716 Registration	EIEI-630 Comp. Aided Mfg II
•EIEI-625 Comp. Aided Mfg. **I**	EIEI-730 Human Factors I	EIEI-734 Safety Engrg.
EIEI-7XX Special Topics/ Reliability	EIEI-7XX Special Topics/ SLAM	EIEI-720 Production Control
EIEI-7XX Special Topics/ Decision Analysis	EIEI-7XX Special Topics/ Multiobjective Analysis	EIEI-7XX Special Topics/ Case Studies
		EIEI-725 Technological Forecasting

Odd Years (e.g., 87/88, 89/90 etc.)

FALL	WINTER	SPRING
EIEI-715 Statistical Analysis	EIEI-716 Regression	EIEI-630 Comp. Aided Mfg II
•EIEI-625 Comp. Aided Mfg. 1	EIEI-620 Engrg. Economy	EIEI-734 Safety Engrg.
EIEI-701 Linear Programming	EIEI-731 Human Factors II	EIEI-702 Non-Linear Prog
EIEI-7XX Special Topics/ Design of Experiments	EIEI-710 Simulation (CPSS)	EIEI-601 Value Analysis
		EIEI-7XX Special Topics/ Advanced Engrg Economy

The following courses are offered upon demand:

EIEI-732, 733	Human Factors III, IV
EIEI-723	Facilities Planning
EIEI-718	Inventory Design

*If the 5th year is a B block, this course is shifted to the Winter Quarter (91/92), etc.

Mechanical Engineering Department

Bhalchandra V. Karlekar,
Department Head

The graduate faculty of the Mechanical Engineering Department is dynamic and committed to professional growth. Some of the current research interests of the faculty in the Mechanical Engineering Department include finite elements, robotics, programmable automation, and computer-aided design and manufacturing. Research also is conducted in areas such as thermal stresses, response of structures to laser heating, analysis and optimization of vehicular systems subject to impulsive and random excitations, and mechanism of fracture in materials. Also, there is interest in software design and development for engineering applications; analysis of satellite data to derive information on the physical oceanography of the southern ocean using time series techniques; minimax optimal control and the problem of space glider re-entry using a multiple sub-arc approach; developing techniques of airfoil optimization to solve the inverse problem; flow in time-varying boundaries; two-phase heat transfer; three-dimensional reconstruction of two-dimensional echocardiographic images; soft-tissue biomechanics; and finite element investigation of blood vessel collapse phenomena in the heart wall.

The department has access to three general purpose VAX/VMS systems. The systems include a VAX 8650 and VAX 8700 which can each support up to 150 interactive users and three VAX-11/785 units that can support approximately 50 interactive users each. The general purpose systems provide a wide variety of programming languages including APAL, BASIC, COBOL, FORTRAN, MACRO (DEC Assembler), PASCAL, PLI, MODULA-2, and C. Engineering software such as NASTRAN, A PATRAN-G, ANSYS, CTRLC, ROMANS II, SPICE, PADL, GIFTS, ADS, ACSL, FLUENT, DADS, ADAMS, and SUPERSAP is available for research and development work on Finite Elements, CAD/CAM, Modal Analysis, Vibrations, and Heat Transfer. Intergraph CAD systems with 16 work stations also are available to students. The department has a dedicated micro-VAX computer and a 15-station PC Lab. The department laboratories include a low-velocity wind tunnel, a supersonic wind tunnel, PUMA robots, a TEKTRONIX CAD/CAM facility, spectrum analyzers, a holographic camera, and a laser doppler anemometer.

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 33 credits are to be earned in course work, while independent work carries a minimum of five credits and a maximum of 12 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 the chairman of the departmental Graduate Committee.

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 department head will recommend which undergraduate courses must be taken in order to acquire an acceptable background.
3. If an applicant has a BS degree, but not in mechanical engineering, he must receive at least a 3.0 grade point average in the recommended undergraduate courses before admission is granted to the mechanical engineering graduate program.

Core courses

All graduate students in the MS program are required to complete the following core courses which are offered every year:

EMEM-870 Mathematics for Engineers 1(F)
EMEM-871 Mathematics for Engineers II (F, W)
EMEM-872 Mechanics (S)
EMEM-874 Numerical Analysis (W)
EMEM-877 Fluid Dynamics (W)

In cases where students have had the equivalent in graduate level courses of any of the core courses, the departmental Graduate Committee may permit substitution or award transfer credit for the appropriate course.

Elective courses

The following elective courses are available to the student for graduate credit:

EMEM-810 Introduction to Continuum Mechanics (even year, F)

EMEM-811 Theory of Elasticity (every year, W)

EMEM-812 Theory of Plates and Shells (odd year, S)

EMEM-813 Theory of Plasticity (even year, W)

EMEM-815 Experimental Stress Analysis (even year, S)

EMEM-816 Finite Elements (every year, F)

EMEM-820 Advanced Optimal Design (odd year, S)

EMEM-821 Vibration Theory and Applications (every year, S)

EMEM-823 Applied Systems Dynamics (every year, F)

EMEM-827 Computer Graphics in Design (even year, S)

EMEM-833 Heat Exchanger Design (odd year, W)

EMEM-838 Ideal Flows (odd year, S)

EMEM-864 Production Tool Design (even year, F)

EMEM-865 Computer Implementation of Finite Elements (odd year, W)

EMEM-873 Convective Heat Transfer (odd year, F)

EENG-801 Design for Manufacture (every year, S)

SESM-701 Introduction to Materials Science (every year, F)

SESM-710 Materials Properties I (odd year, TBA)

Students with a background deficient in engineering materials are strongly advised to take SESM-701 as an elective.

When the needs of a particular program require additional courses, the student may elect to take up to 12 credits from other departments in the Institute. Graduate students are allowed to take those upper-level undergraduate electives in mechanical engineering specified in the course description catalog as EMEM-6XX. Some examples are:

EMEM-605 Applications in Fluid Mechanics (F, W)

EMEM-615 Robotics (F,W)

EMEM-618 Computer-Aided Engineering (S)

EMEM-635 Heat Transfer II (S, SR)

EMEM-652 Fluid Mechanics of Turbomachinery (S, SR)

EMEM-658 Engineering Vibrations (F, W)

EMEM-660 Refrigeration and Air Conditioning (S)

EMEM-672 Dynamics of Machinery (S, SR)

EMEM-685 Advanced Strength of Materials (S)

EMEM-694 Stress Analysis (S, SR)

A maximum of two such courses is allowed for graduate credit. 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, lubrication, convective and radiative heat transfer, fluid mechanics, thermodynamics, wind and solar energy, control systems, optimal control, thermal stresses, composite materials, biomechanics, and viscoelasticity.

Thesis and other options

Once a student has completed about 20 quarter credit hours of graduate work, he or she ought to consider selecting one of the four options offered by the department with regard to completing the requirements of the master of science degree. These are a research thesis, a literature search, a design project, or additional course work with a comprehensive examination that is usually given in the Spring Quarter. A student selecting one of the first three options has to earn a minimum of five credits in the option chosen, and has to make a successful oral presentation of the work.

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.

A student seeking admission to the master of engineering degree in manufacturing engineering is expected to have undergraduate background in FORTRAN programming, engineering materials, manufacturing processes, and probability and statistics.

The mechanical engineering option for the master of engineering degree

A student in the ME degree program with the mechanical engineering option is required to take a certain number of core courses as determined by the departmental graduate committee. Depending on the student's professional interest, he can choose from the graduate courses offered in the engineering departments, College of Business, or computer science to fulfill the total requirements for the course work.

The manufacturing engineering option for the master of engineering degree

This option is offered jointly by the departments of mechanical engineering and industrial engineering. In this option, 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

Schedule of Graduate Courses in Mechanical Engineering

Even Years (e.g., 88/89,90/91 etc.)

FALL	WINTER	SPRING
EMEM-810 Introduction to Continuum Mechanics	EMEM-811 Theory of Elasticity	EMEM-815 Experimental Stress Analysis
EMEM-816 Finite Elements	EMEM-813 Theory of Plasticity	EMEM-821 Vibration Theory and Applications
EMEM-823 Applied System Dynamics	EMEM-871 Math for Engineers II	EMEM-827 Computer Graphics in Design
EMEM-864 Production Tool Design	EMEM-874 Numerical Analysis	EMEM-872 Mechanics
EMEM-870 Math for Engineers I	EMEM-877 Fluid Dynamics	EENG-801 Design for Manufacture
EMEM-871 Math for Engineers II		
SESM-701 Introduction to Materials Science		

Odd Years (e.g., 1989-90, 1991-92, etc.)

FALL	WINTER	SPRING
EMEM-816 Finite Elements	EMEM-811 Theory of Elasticity	EMEM-812 Theory of Plates and Shells
EMEM-823 Applied System Dynamics	EMEM-833 Heat Exchanger Design	EMEM-820 Advanced Optimal Design
EMEM-870 Math for Engineers I	EMEM-865 Computer Implementation of Finite Elements	EMEM-821 Vibration Theory and Applications
EMEM-871 Math for Engineers II	EMEM-871 Math for Engineers II	EMEM-838 Ideal Flows
EMEM-873 Convective Heat Transfer	EMEM-874 Numerical Analysis	EMEM-872 Mechanics
SESM-701 Introduction to Materials Science	EMEM-877 Fluid Dynamics	EENG-801 Design for Manufacture

student is required to take a core course: 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.

Course descriptions
For a complete outline of graduate courses offered, please consult the course description section.

Assistantships and scholarships
Some assistantships and scholarships may be available for full-time students. Appointment as a teaching assistant carries a 12-hour per week commitment to a teaching function, and usually permits a student to take graduate work for 8 credits per quarter. Appointment as a research assistant usually permits taking 8 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 Dr. Paul Bernstein, dean of Graduate Studies (716-475-6523).

Course calendar
The core courses are offered every quarter, 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 (716-475-5788 or 475-2163).

Microelectronic Engineering Department

Lynn Fuller, Department Head

The College of Engineering is proud to offer a master of engineering degree program in microelectronic manufacturing engineering. This one-year program emphasizes all aspects of microelectronic engineering and provides a broad interdisciplinary background in optics, chemistry, device physics, computer science, electrical engineering, photographic science, and statistics, which are necessary for entry into the semiconductor industry.

Students in the program 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 microelectronic engineering program, are among the best in the nation.

As the shortage of microelectronic engineers continues to grow, RIT graduates will provide a valuable resource to the microelectronic industry. This program offers an unparalleled opportunity for students to prepare for professional challenge and success in one of the leading areas of engineering of our time.

The program
The master of engineering degree in microelectronic manufacturing engineering is awarded upon the successful completion of an approved graduate program consisting of a minimum of 48 credit hours: 10 courses and an internship. Under certain circumstances, a student may be required to complete more than the minimum number of credits.

The program consists of 10 courses including: one transition course; six core courses; and three concentration courses. The transition course is in an area other than the area for which the BS degree is being earned. Up to four quarter credits will be given for completing the transition requirements. 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 Manufacturing

Science I. Concentration courses may be selected from a list of courses including: Computer-Integrated Manufacturing, Statistical Design of Experiments, and others.

The program also consists of an internship worth eight quarter credits, which may be completed at RIT or in industry. The internship will involve the investigation of some problem or process directly related to microelectronic manufacturing engineering. This is not a thesis, but does require a report and oral presentation.

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. All appointments provide full tuition and stipend. Applicants for financial aid should write directly to the department head for details.

Schedule

Fall	Winter
Microelectronics I	Microelectornics II
Microlithography I	Manufacturing Science I
Transition Course	Core Course

Spring	Summer
Microelectronics III	Internship
Microlithography II	Core Course
Core Course	
Internship	

Microelectronics

The first two courses in the microelectronics sequence cover all aspects of integrated circuit processing. The courses are taught at the level of VLSI Technology by Sze. SUPREME and ROMANS II are introduced to the students and RIT written modeling programs for oxide growth and diffusion are studied in detail. The students study semiconductor devices, bipolar and MOS processing, specific processing steps, measurement and characterization. The students also go through several integrated circuit designs in different technologies, such as bipolar, NMOS and CMOS. They use SPICE to model the circuit operation, ICE integrated circuit layout editor and many other design tools. The students create a process, and manufacture and test their integrated circuits.

The Microelectronics III course covers chemical vapor deposition, plasma etching and deposition, and surface analysis techniques. Advance transistor design is studied including low doped drain structures, and poly emitter BJTs.
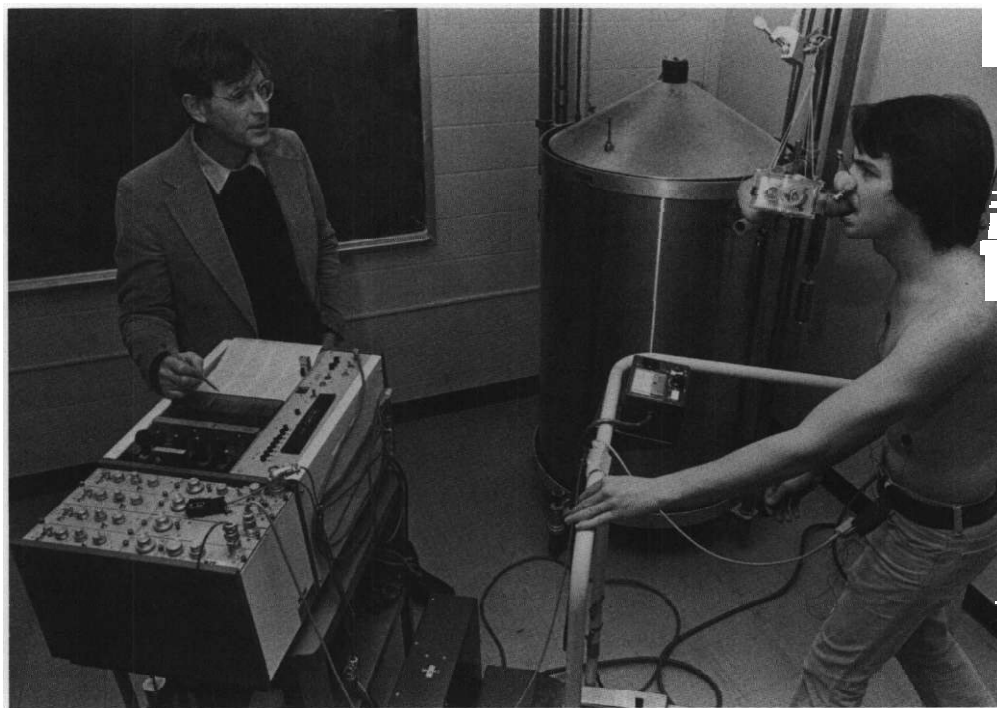
Microlithography

The microlithography courses are advanced courses in the chemistry of photoscience and lithography. Topics include negative and positive photoresist systems, developers, multilayer imaging systems, polyimides, electron beam and ion beam resist systems, contrast enhancement materials, adhesion promotion materials, lift-off and reversal processes.

Imbedded within these courses are topics which are important to the physical limitations of lithography, including a study of the characteristics of image-forming and image-recording elements and their matching for optimum performance. Topics include spread and transfer functions, partial coherence in image systems, and limitations imposed by the wave and particle nature of radiation. This course also compares optical, X-ray and electron beam imaging.

Laboratory experience includes introduction to maskmaking, steppers, scanners, and contact aligners, radiometry, design of experiments, metrology, and lithographic processing demonstrating topics from the lecture.

Manufacturing

The manufacturing course includes topics such as scheduling, work in progress tracking, costing, inventory control, capital budgeting, productivity measures and personnel management. The laboratory for this course is the student-run factory. Measurement of yield, defect density, wafer mapping, control charts and other tools are introduced to the student.

Graduate Faculty College of Engineering

Richard A. Kenyon, Ph.D., RE., Syracuse-Dean, Professor, Mechanical Engineering
Charles W. Haines, Ph.D., Rensselaer Polytechnic Institute—Associate Dean; Professor, Mechanical Engineering

Computer Engineering Department

Roy Czernikowski, Ph.D., RPI—Professor and Department Head, Real-Time-Computation, Computer Architecture, and Distributed Systems

George Brown, MSEE, University of Rochester—Professor, Systems and Control

Tong-han Chang, Ph.D., Chinese Academy of Science, Beijing—Associate Professor, System Design Methodology, Communication and Computation

Kenneth Hsu, Ph.D., Marquette—Associate Professor, Microcomputers and Control Systems

Ronald G. Matteson, Ph.D., Syracuse University—Associate Professor, Image Processing, Data Communications, Computer Architecture

Pratapa Reddy, Ph.D., Indian Institute of Technology—Associate Professor, Digital Systems

Electrical Engineering Department

Swaminathan Madhu, Ph.D., University of Washington—Professor, Communication Theory, Logic Design, Department Head

Lance Breger, Ph.D., University of Illinois—Assistant Professor, crystal physics, electromagnetic fields

Joseph D. DeLorenzo, Ph.D., Boston University—Associate Professor, electromagnetic scattering, image analysis, communication systems

Soheil A. Dianat, Ph.D., George Washington University—Associate Professor, Control Systems

Lynn Fuller, Ph.D., Buffalo—Professor, Solid State Devices and Microelectronics

Roger Heintz, Ph.D., Syracuse—Professor, Solid State Devices

Michael A. Jackson, M.S., SUNY Buffalo-Assistant Professor, semi-conductor processing

A. V. **Mathew,** Ph.D., Queens University (Ontario)—Associate Professor, Control Systems

James E. **Palmer,** Ph.D., Case Institute of Technology—Professor, Digital Systems

David Perlman, MS, Cornell University-Associate Professor, Electronics

Mysore Raghuveer, Ph.D.—Assistant Professor, Signal Processing

Sannasi Ramanan, Ph.D., I.I.T.-India-Assistant Professor, semi-conductor devices

Alton Riethmeier, M.S., University of Rochester—Associate Professor, Digital Systems

Edward R. Salem, Ph.D., Buffalo-Professor, Digital Processing, Microcomputers

David Sumberg, Ph.D., Michigan State-Associate Professor, Optics

Fung-I Tseng, Ph.D., Syracuse—Professor, Electromagnetic Theory

Renan Turkman, Ph.D., Paris—Assistant Professor, Solid state devices

Raman M. Unnikrishnan, Ph.D., Missouri—Professor, Power Electronics, Control Systems

Jayanti Venkataraman, Ph.D., Indian Institute of Science—Assistant Professor, Electromagnetic Theory

Watson F. Walker, Ph.D., Syracuse-Professor, Communication Theory

Adjunct Faculty in Electrical Engineering

Isaac Ajewole, Ph.D., University of Rochester—image processing

Robert Hopkins, MS, RIT—control systems

K. H. Gurubhasavaraj, Ph.D., Nebraska—control systems

Majid Rabbani, Ph.D., Wisconsin—image processing, pattern recognition

James Schueckler, MS, RIT—microcomputers

James Wiseman, Ph.D., Boston University—coding theory

Industrial & Manufacturing Engineering Department

Richard Reeve, Ph.D., Buffalo—Professor, Applied Operations Research; Department Head

Madhu Nair, BS, RIT; MS, Lehigh—Instructor, Computer-Aided Manufacturing

Sudhakar R. Paidy, Ph.D., Kansas State University—Associate Professor, Statistics, Reliability, and Operations Research

Jasper E. Shealy, Ph.D., SUNY at Buffalo—Professor, Human Factors

Paul H. Stiebitz, ME, RIT—Assistant Professor, simulation and operations research

Brian K. Thorn, MS, Georgia Tech-Assistant Professor, applied statistics, behavior science

Mechanical Engineering Department

Bhalchandra V. Karlekar, Ph.D., P.E., University of Illinois—Professor and Department Head, Heat Transfer, Energy

Richard G. Budynas, Ph.D., P.E., Massachusetts—Gleason Professor, Applied Mechanics

Robert A. Ellson, Ph.D., P.E., University of Rochester—Associate Professor, Energy Conversion, Fluid Mechanics

Jon E. Freckleton, BS, University of Rochester—Lecturer, manufacturing engineering

Hany A. Ghoneim, Ph.D., Rutgers—Assistant Professor, Finite elements

Amitabha Ghosh, Ph.D., Mississippi State University—Associate Professor, Computational Fluid Dynamics

Surendra K. Gupta, MS, Notre Dame—Assistant Professor, Materials Science and Computer Science

Charles W. Haines, Ph.D., Rensselaer Polytechnic Institute—Associate Professor, Applied Mathematics

Robert Hefner, Ph.D., Georgia Inst, of Tech.—Associate Professor, Systems Analysis, Heat Transfer

Richard B. Hetnarski, Dr. Tech. Sci., P.E., Polish Academy of Sciences—Professor, Thermoelasticity

Satish G. Kandlikar, Ph.D., Indian Institute of Technology—Associate Professor, Thermal Systems and Energy

Mark Kempski, Ph.D,, SUNY, Buffalo-Assistant Professor, Biomechanics

Richard Kenyon, Ph.D., P.E., Syracuse-Professor, Thermodynamics and Fluid Mechanics

George T. Komorowski, MS, Rochester Institute of Technology—Assistant Professor, Computer Science

Chris Nilsen, Ph.D., P.E., Michigan State-Associate Professor, Metallurgy and Materials Science

Alan H. Nye, Ph.D., University of Rochester—Associate Professor, Fluid Mechanics

Frank Sciremammano, Jr., Ph.D., University of Rochester—Associate Professor, Geophysical Fluid Dynamics and Environmental Control

Robert L Snyder, Ph.D., P.E., Iowa State-Professor, Materials Science, Chemistry

Joseph S. Torok, Ph.D., Ohio State University—Assistant Professor, Theoretical and Applied Mechanics, Applied Mathematics

P. Venkataraman, Ph.D., Rice University—Assistant Professor, Optimal Control, Fluid Mechanics, Optimal Design

Wayne W. Walter, Ph.D,, P.E., Rensselaer Polytechnic Institute—Professor, Applied Mechanics

Microelectronic Engineering Department

Lynn F. Fuller, Ph.D,, SUNY Buffalo-Professor, Analog I.C. Design, Manufacturing; Integrated Circuit Processing

Katherine H. Hesler, MS, University of Vermont—Instructor, Microlithography, Resist Technology and Processing

Michael A. Jackson, MS, SUNY Buffalo-Assistant Professor, Surface Analysis, Integrated Circuit Metrology, Solid State Devices

Richard L. Lane, Ph.D., SUNY Alfred-Professor, Materials, Chemical Vapor Deposition, Crystal Growth

Robert E. **Pearson,** MS, Rochester Institute of Technology—Assistant Professor, Digital I.C. Design, Testing, I.C. Processing

Renan I. Turkman, Ph.D., Paris—Assistant Professor, Process Modeling, Solid State Devices, Plasma Processing

Computer Engineering

EECC-605   Introduction to the Theory of Computation

Registration #0306-605

This course deals with the basic mathematical, logical and linguistic concepts that underlie the formal aspects of computation. It provides a first acquaintance with the theoretical framework that is essential to the understanding of the more detailed study of advanced topics in computer science and computer engineering. (SMAM-265)

Class 4, Credit 4 (S)

EECC-620   Design Automation of Digital Systems

Registration #0306-620

Design automation deals with the use of computers as a tool or aid in the design and manufacturing of digital systems. Topics covered will include methods for digital design, hardware description languages, simulation techniques at system level, register-transfer level, and logic element level, partitioning of digital systems, placement, routing, and fault test generation. (EECC-550 or ICSS-520, or 720)

Class 4, Credit 4 (F,W)

EECC-683   A Survey of Electronic Document/Digital Image Processing

Registration #0306-683

This course serves as an introduction to the several topics involved in electronic document processing input scanning, output printing, digital image processing, and computer communications. It provides a framework for showing the relationships among these various topics in electronic document processing. The course includes image scaling, halftoning, compression, and feature extraction. (Fifth-year standing in computer engineering)

Class 4, Credit 4 (Sp)

EECC-694   Data and Computer Communications

Registration #0306-694

This course provides a unified view of the broad field of data and computer communications. Emphasis will be on the basic principles underlying the technology of data and computer communications. These critical design issues in data communication networks as well as the current and evolving standards in computer communication architecture will be discussed. Alternative approaches to meeting user requirements will be explored. (Fifth-year standing in computer engineering or with permission of instructor)

Credit 4, Class 4 (S)

EECC-722   Advanced Computer Architecture

Registration #0306-722

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. (EECC-551 or ICSS-720)

Class 4, Credit 4 (W)

EECC-730   VLSI Design

Registration #0306-730

An introduction to the design and implementation of Very Large Scale (VLSI) systems. Basic NMOS devices and circuits are described. From this base, a variety of methods for designing both combinational logic and state machines is developed, with emphasis on the use of regular structures such as programmed logic arrays. System architecture and use of Computer Aided Design (CAD) tools will be stressed. Extensive laboratory projects will be required.

Class 4, Credit 4 (S, SR)

EECC-731   VLSI Design Projects

Registration #0306-731

A second course in the design and implementation of Very Large Scale (VLSI) systems. CMOS devices will be studied. System architecture and the use of Computer Aided Design (CAD) tools will be stressed. A major laboratory design project will be required. In addition the students will test chips fabricated in the first course. (EECC-730 or EECC-630)

Class 4, Credit 4 (F,W)

EECC-740   Analytical Topics for Computer Engineers

Registration #0306-740

This course begins by reviewing signal and system analysis techniques for analyzing linear systems. It includes Fourier techniques, as well as 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.

Class 4, Credit 4(F)

EECC-756   Multiple Processor Systems

Registration #0306-756

This course will cover the general guidelines, methodology, and approaches for the design, development, and use of single and multi, micro or minicomputer systems. The 16-bit microprocessors have vast address spaces and virtual memory capability, incorporate complex I/O facilities, and permit rapid execution of cost-saving, high-level languages. The hardware and software support available for 16-bit microprocessors also makes them a cost-effective alternative to minicomputers. Distributed systems based on microcomputer technology will be investigated with emphasis on interconnect structures, intercommunications, software and hardware. The course will include a laboratory workshop in which each student will be required to design, implement, and test one or more parts of a practical system. Emphasis will be placed on engineering ability and management skill to meet proposed technical goals on time and within budget. (Graduate standing in Computer Engineering with at least three core courses completed or permission of instructor)

Class 4, Credit 4 (S)

EECC-758   Fault-Tolerant Digital Systems

Registration #0306-758

Formal models and concepts in fault diagnosis. Test generation and minimization. Redundant and self-checking systems. Fault tolerant hardware- and software-based computer systems. (ICSS-400 or EEEE-650 or EEEE-750, EECC-550 or ICSS-720)

Class 4, Credit 4 (S)

EECC-759   Principles of Digital Interfacing

Registration #0306-759

Standard bus interface-parallel and serial. LSI interface devices. Interface design-peripherals and memory. Data acquisition-A/D & D/A converters, multiplexing. Remote control. Error detection and correction. (EECC-560 or permission of instructor)

Class 4, Credit 4 (S)

EECC-772   Special Topics in Computer Engineering

Registration #0306-772

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)

EECC-784   Digital Image Processing Algorithms

Registration #0306-784

This is a graduate-level course which emphasizes the computational and algorithmic techniques required for processing digitized pictorial images. The acquisition and quantization of digital images is described, followed by analysis and filtering techniques. Segmentation, projection, and reconstruction techniques are discussed. Finally, bi-level image processing including contour filling and thinning techniques is covered. Programming projects will be required. (Competence in calculus, engineering math, and structured programming are required.)

Class 4, Credit 4 (S, R)

EECC-890   Thesis

Registration #0306-890

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 5 and a maximum of 9 credits.

Credit variable

Electrical Engineering

EEEE-723   **Semiconductor Physics**

Registration #0301-723

An introductory course in semiconductor physics for engineering students. The emphasis in this course is semiconductor materials rather than semiconductor devices. Topics include: band tap theory, equilibrium carrier concentrations, transport mechanisms, deep and shallow impurities and properties of silicon, GaAs, Ge and other semiconductors.

Credit 4

EEEE-724   **Physics of Semiconductor Devices I**

Registration #0301-724

A basic course dealing with the physics of semiconductor devices. Topics include: evaporation, sputtering, epitaxial growth, diffusion, ion implantation, oxidation of silicon, photolithography, pattern generation, layout of silicon integrated circuits, resistors, MOS capacitors, isolation techniques, and in-process measurement and testing. (EEEE-723)

Credit 4

EEEE-725   **Physics of Semiconductor Devices II**

Registration #0301-725

An intermediate level course in semiconductor device physics for engineering students. Limitations of bipolar and field effect transistors are studied. The physics of pnpn devices, solid-state optical devices, interface devices, and others are also discussed. (EEEE-724).

Credit 4

EEEE-726   **Analog IC Circuits**

Registration #0301-726

A course in the analysis and design of bipolar and MOS analog integrated circuits. Topics include: device models, amplifiers, current sources and active loads, output stages, operational amplifiers, and analog circuit design in MOS-LSI. Course will involve circuit design and computer simulation projects.

Credit 4

EEEE-727   **VLSI Design**

Registration #0301-727

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. (EEEE-724,670, and a course in computer architecture.)

Credit 4

EEEE-728   **IC Operational Amplifiers**

Registration #0301-728

Analysis of operational amplifier circuits using the ideal op amp; development of circuit models to predict non-ideal op amp characteristics; study of feedback systems, stability (using Bode plots), and compensation; direct coupled amplifiers and operational amplifier design; interpretation of manufacturers' specifications and basic applications with emphasis on practical aspects. (EEEE-442, 754,755)

Credit 4

EEEE-730   **Advanced Analog I.C. Design**

Registration #0301-730

An advanced course in analog integrated circuit design. Students will study bipolar and MOS realization of op amps, analog multipliers, A to D and D to A convenors, and more. The students will participate in design projects including circuit design, layout, and SPICE simulation (EEEE-726)

Credit 4

EEEE-742   **Advanced Microprocessor Software Design**

Registration #0301-742

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. The 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, multitasking, concurrent and re-entrant programs, and symbolic debugging. (EEEE-665 or a high-level programming language)

Credit 4

EEEE-744   **Advanced Microprocessor Systems Design**

Registration #0301-744

The effective application of microprocessors in the design of digital systems requires a knowledge of both hardware and software. This course will develop an understanding of assembly language programming and hardware design techniques. The role of macro-assemblers, editors, linking loaders, and other system software aids used in microcomputer development systems to produce efficient modular code will be covered. Several aspects of hardware/software organization of input/output programs will be considered including interrupts and direct memory access. The use of special LSI interface devices to allow a microcomputer to operate with peripheral devices such as A/D and D/A converters, CRT terminals, floppy disks, etc. will be studied. Laboratory sessions will be used to provide experience in the use of software development systems, and logic analyzers in developing and testing a microcomputer system design. (EEEE-665)

Credit 4

EEEE-745   **Topics in Digital Systems**

Registration #0301-745

Topics will be selected on different aspects of digital systems design. Some of the proposed topics are signature analysis, bit slice processors, timing problems, reliable systems design, and designing for maintainability. (EEEE-650)

Credit 4

EEEE-747   **Topics in Switching Theory**

Registration #0301-747

A selection of topics on various theoretical aspects of switching circuits will be presented. Topics such as decomposition of combinational switching functions, experiments on sequential circuits, and regular expressions will be covered. (EEEE-650)

Credit 4

EEEE-748   **Microcomputers in Control and Instrumentation**

Registration #0301-748

The use of microcomputers in process control and instrumentation to achieve intelligent industrial operations will be discussed. Topics include: concepts of control, analog vs. digital controllers, sensors, A/D and D/A convenors, dc motor and stepper motor controllers, real-time systems, microcomputer bus standards, and the local networks. Lab work may include temperatures, pressure, and optical controllers, stepper motor controllers, and robotics control. Intel 8086 microcomputer is used. (EEEE-744)

Credit 4

EEEE-754   **Analytical Techniques I**

Registration #0301-754

Complex variable theory including conformal mapping, the Laurent expansion; Cauchy's theorem; the evaluation of contour integrals; advanced topics in continuous time Fourier series and transforms; the Laplace transforms, its existence and convergence; inversion integral; branch points; applications.

Credit 4(F)

EEEE-755   **Analytical Techniques II**

Registration #0301-755

Discrete time signals and systems; the z transform and its applications; solution of difference equations; concepts of stability; discrete Fourier analysis; DFT; FFT algorithms; topics in Matrix theory: eigen values and eigen vectors; functions of a matrix; transformations; differentiation, integration, and exponentiation of matrices; matrix polynomials; Cayley-Hamilton theorem; concept of state variables; relationship between transfer functions and state variable representation for LTI systems; State Transition Matrix and its determination. (F.F.F.F. 754)

Credit 4 (W)

EEEE-756   Analytical **Techniques m**

Registration #0301-756

Review of probability theory; conditional probability and Baye's theorem; random variables, distribution and density functions; functions of one and several random variable; sequences of random variables and central limit theorem; elements of statistics: sampling theory, sampling distribution and confidence interval, tests of hypothesis, linear and non linear regression; introduction to random processes; response of linear systems to random inputs. (Graduate Standing, AT **I** and AT **II** are NOT prerequisites.)
Credit 4 (S)

EEEE-761   **Modern Control Theory**

Registration #0301-761

Review of state-space formulation of SISO systems; solution of state equations; STM and its properties. Applications of state-space concepts; state variable design. Multivariate systems; preliminaries; systems of least order; stability and control. (EEEE-754,755,513)
Credit 4

EEEE-762   **Nonlinear Control Systems**

Registration #0301-762

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 Popov's criterion. Analysis of switching and relays. These are applied to both piecewise-linear and analytical nonlinear systems. (EEEE-761)
Credit 4

EEEE-763   **Stochastic Estimation and Control**

Registration #0301-763

Stochastic control and optimization; estimation and filtering techniques; such as Wiener filtering and Kalman filtering; stochastic stability; applications. (EEEE-756,761)
Credit 4

EEEE-764   **Digital Control Systems Design**

Registration #0301-764

Introduction to the analysis and design of control systems in which microcontroller plays a principal role. Topics include: sampled data systems, Z and W-plane 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. (EEEE-754, 755)
Credit 4

EEEE-765   **Optimal Control**

Registration #0301-765

Introduction of calculus of variations; conditions of optimality, optimizing transient performance by statistical and variational procedures, dynamic programming and by Pontryagin's maximum principle; design of optimal linear systems with quadratic criteria. (EEEE-761)
Credit 4

EEEE-767   **Power Semiconductor Circuits**

Registration #0301-767

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 commutated inverter. McMurray inverter; DC systems; principles of DC-DC conversion, choppers, DC motor control, single phase DC motor drives, three phase DC motor drives, dual converter, cyclo-converter, frequency conversion using SCR's phase-controlled cyclo-converters; 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

EEEE-772,773,774   **Special Topics in Electrical Engineering**

Registration #0301-772,773,774

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 4 per course (no regular course schedule)

EEEE-775   **Optical Engineering I**

Registration #0301-775

An introduction to the properties of optical components and their combination into systems, primarily from a geometrical optics point of view, but with reference to the wave nature of light where appropriate. Refracting and reflecting components. Radiation sources. Object-image relations. Stops and energy ray tracing and matrix methods of analysis and design. Discussion of common optical devices and instruments.
Credit 4

EEEE-776   **Electro-optics**

Registration #0301-776

An advanced treatment of optical systems through the use of Maxwell's equations describing light interaction will be considered. Lens systems, optical modulation, laser operation, optical detection and associated noise problems will be discussed. Classroom work will be complemented by demonstrators. (EEEE-472 or equivalent)
Credit 4

EEEE-778   **Fiber Optics**

Registration #0301-778

The objective of this course is to educate the engineer in the applied optics field. Fundamentals of the fiber waveguide are treated using geometrical optics and Maxwell's equations. Other topics include design criteria, practical coupling techniques, discussion of optical sources and dectors used in fiber optical systems. Applications to communications and other areas will be discussed. (EEEE-472 or equivalent)
Credit 4

EEEE-779   **Digital Image Processing**

Registration #0301-779

This is an introductory course in digital image processing. The course 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 transformations and histogram equalization and specification. Image smoothing methods are considered including spatial and frequency domain low pass filtering. ADHOC 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 and methods of image segmentation are degradation and methods of image restoration including deblurring. Several extensive computer assignments are required. (EEEE-755, 554 or permission of instructor)

EEEE-780   **Independent Study**

Registration #0301-780

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

EEEE-781   **Electromagnetic Fields**

Registration #0301-781

Development of electromagnetic theory from basic postulated leading to Maxwell's equations for the plane waves, transmission lines, wavelengths, and antennas.
Credit 4

EEEE-782   **Boundary Value Problems**

Registration #0301-782

Techniques for solving boundary value problems. Numerical methods, analog and relaxations methods. Green's function, special methods making use of symmetries, images, inversion, and conformal mapping, introduction to integral equations. Wiener-Hopf and Watson transformations Saddlepoint integration. Variational techniques. (EEEE-754,755,756)
Credit 4

EEEE-783   **Antennas and Antenna Systems**

Registration #0301-783

Theoretical and practical characteristics of electromagnetic radiators. Equivalent circuits and radiating properties of antenna elements. Dipoles, slots, small loops, helical and dielectric radiators. Pattern analysis, primary and secondary patterns. Theory of phased antenna arrays, reflectors, and horns. (EEEE-781)
Credit 4

EEEE-784   **Advanced Electromagnetic Engineering**

Registration #0301-784

Time varying electromagnetic fields. Field theorems, propagation and reflection of plane waves, transmission theory, waveguides, resonators, radiation and diffraction. Microwave networks. (EEEE-781)
Credit 4

EEEE-785   **Special Topics in Electromagnetic Theory**

Registration #0301-785

Advanced and current topics in electromagnetic theory. Topics vary each time and may include; array theory, electromagnetic compatibility, numerical methods, propagation and radiation in ionized media, moving media, and random media. May be repeated for additional credit. (Permission of instructor)
Credit 4

EEEE-786   **Microwave Devices**

Registration #0301-786

Theory of intereaction between electron beams and electromagnetic waves. Microwave tubes; klystron, magnetron, traveling-wave tubes. Solid state devices: microwave transistors, tunnell diodes, Gunn diodes. IMPATT diodes LSA diodes.
Credit 4

EEEE-787   **Radar Engineering**

Registration #0301-787

Radar system and radar equations; electronic scanning radar systems, microwave radar antennas. Atmospheric effects in radio wave propagation, synthetic aperture radar. Signal detection and parameter estimation for radar applications. (EEEE-754,755,756)
Credit 4

EEEE-790   **Random Signals and Noise**

Registration #0301-790

Functions of two random variables. Mean square estimation. Orthogonality principle. Sequences of random variables. Central limit theorem. Random processes; correlation functions; spectrum of periodic functions and periodic random processes; spectral densities; the Gaussian random process; noise through linear systems. (EEEE-755,756)
Credit 4

EEEE-791   **Topics in Signal Analysis and Processing**

Registration #0301-791

Signal representation of orthogonal functions; analytic signals and Hilbert transforms; optimum filters (matched, maximum fidelity, Wiener); discrete representation of continuous signals (sampling theorems); the discrete Fourier transform; linear discrete filters, introduction to homomorphic signal processing. (EEEE-790)
Credit 4

EEEE-793   **Error Detecting and Error Correction**

Registration #0301-793

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 fundamentals 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 Viterbi and sequential decoding algorithms will be studied. Questions of system performance, speed, and complexity will be examined. (EEEE-756)
Credit 4

EEEE-794   **Information Theory**

Registration #0301-794

An introduction to the fundamental concepts of information theory; entropy, equivocation, transinformation, and redundancy; coding for binary channels; measurement of signal parameters in the presence of noise; bandwidth vs. accuracy. (EEEE-756)
Credit 4

EEEE-795   **Optical Engineering II**

Registration #0301-795

A continuation of EEEE-776, Electro-optics, that emphasizes the application of wave optics to optical systems. Interference and interferometers. Thin films. Diffraction. Partial coherence. Fourier optics. Discussion of holography, optical data processing, imaging and other topics of current interest. (Graduate standing; Optical Engineering I is NOT a prerequisite.)
Credit 4

EEEE-800   **Graduate Paper**

Registration #0301-800

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

EEEE-890   **Thesis**

Registration #0301-890

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

Industrial Engineering and Engineering Management

The following courses are recommended as part of the Master of Engineering program in Industrial Engineering and Engineering Management. They are offered on sufficient demand.

EIEI-620   **Engineering Economy**

Registration #0303-620

Time value of money, methods of comparing alternatives, depreciation and depletion, income tax consideration, replacement, retirement and obsolescence, and capital budgeting.
Credit 4

EIEI-715, -716   **Statistical Analysis for Engineering I & II**

Registration #0303-715, -716

A basic two-quarter course in probability and statistics designed to give the student a foundation for further study in areas such as design of experiments, stochastic systems, and simulation.
Credit 4

The following courses can be used as part of the Master of Engineering program in Industrial Engineering and Engineering Management. The courses are generally offered in alternating years and/or as demand dictates.

EIEI-601   **Value Analysis**

Registration #0303-601

This course examines the nature and measurement of value. The concept and construction of a value index, representing average value is related. Numerical estimation methods such as ranking, pair comparison, magnitude estimation, and criteria analysis are explained and used to measure the value of diverse items. The methods used are applicable to the study of a wide variety of problems and have special utility in engineering design studies.
Credit 4

EIEI-701   **Principles of Operations Research I**

Registration #0303-701

Applied linear programming. Computational techniques for solving constrained optimization problems. Linear programming, the Simplex method and variations, duality and sensitivity testing.

Credit 4

EIEI-702   **Mathematical Programming**

Registration #0303-702

Application of non-linear programming techniques. Classical optimization techniques; quadratic, stochastic, integer programming and dynamic programming. Applications to industry. (EIEI-701)

Credit 4

EIEI-705   **Survey of Operations Research**

Registration #0303-705

A survey course designed to introduce the student to such topics as waiting line analysis, inventory, scheduling, replacement, and simulation. This course is intended to present an integrated view of the field of operations research to students who will take more specialized courses as well as those in other disciplines desiring only a limited exposure to the field.

Credit 4

EIEI-710   **Systems Simulation**

Registration #0303-710

Methods of modeling and simulating man-machine systems. Model validation, design of simulation experiments, variance reduction techniques, random number generation and distribution generation are discussed. However, emphasis is placed on the G.P.S.S. simulation language.

Credit 4

EIEI-718   **Inventory Design**

Registration #0303-718

Overview of inventory problems. Single period models under risk and uncertainty, dynamic models under certainty, dynamic models under risk and uncertainty. Forecasting, inventory system analysis.
Credit 4

EIEI-720   **Production Control**

Registration #0303-720

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 is encouraged.

Credit 4

EIEI-723   **Facilities Planning**

Registration #0303-723

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.

Credit 4

EIEI-725   **Technological Forecasting**

Registration #0303-725

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

EIEI-730   **Biotechnology and Human Factors I**

Registration #0303-730

Basic functional anatomy and physiology. Human body systems. Anthropometry. Applications on the design for man and man-machine systems. Work physiology, Industrial biomechanics.

Credit 4

EIEI-731   **Biotechnology and Human Factors II**

Registration #0303-731

Effect of mechanical and physical environment on: physiology, behavior, performance of man. Design considerations to protect man against environmental effects (thermal environment, noise, vibration, acceleration, light, altitude).

Credit **4**

EIEI-732   **Biotechnology and Human Factors III**

Registration #0303-732

Theoretical fundamentals of human body mechanics. Development applications of biomechanics and biomechanical models. Kinematics of the link system of the body and extremity joints.

Credit **4**

EIEI-733   **Biotechnology and Human Factors IV**

Registration #0303-733

Measurements of human performance. Functions that man performs in man-machine systems. Techniques to quantify man's behavior at work.

Credit **4**

EIEI-734   **Systems Safety Engineering**

Registration #0303-734

Accident study of the human component in occupational systems. Product systems safety analysis. Approaches in accident prevention.

Credit **4**

EIEI-740   **Numerical Control and Manufacturing**

Registration #0303-740

Numerical control is the technique of programming a machine (such as a mill) to manufacture a part with minimum operator interaction. Several levels of NC programming will be studied: manual programming, computer assisted programming and interactive graphics. Students will participate in extensive hands-on work using a mill and a lathe. In addition, the role that NC machines play in the Factory of the Past, Present, and Future will be discussed and analyzed.

Credit **4**

EDEI-747   **Microprocessor Applications**

Registration #0303-747

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-assembles, high level languages and system 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 structures, interrupt handling, communication protocols to design efficient hierarchical control systems for Computer Integrated Manufacturing.

Credit **4**

Special courses related to a particular student's interest can be arranged via the following course:

EIEI-771,772,773,774,775   **Special Topics in Industrial Engineering**

Registration #0303-771,772,773,774,775

This is a variable credit, variable topics course which can be in the form of regular courses or independent study under faculty supervision.

Credit variable (maximum **4** per course number)

EENG-777   **Engineering Internship**

Registration #0302-777

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 advisor and subject to the Graduate Committee of the College of Engineering.

Credit variable

EENG-801   **Design for Manufacture**

Registration #0302-801

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 Mechanical Engineering and presents an overview of the factors influencing product design and the manufacturing cycle. Topics include component design and analysis, design for function and manufacturability, design for manual and automated assembly, methods and systems for computer-aided design and manufacturing, simulation of manufacturing systems, and the role of robotics in manufacturing. Students will gain hands-on experience with the RIT computer facilities, robots, and CAD/CAM laboratories as these relate to modern trends in the design for manufacture.

Credit 4 (TBA)

Mechanical Engineering

EENG-801   **Design for Manufacture**

Registration #0302-801

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 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, design for manual and automated assembly, and the role of robotics in manufacturing. Students will gain hands-on experience with the Boothroyd/ Dewhurst system to quantify design efficiency. The various manufacturing processes as they relate to modern trends in DFM are covered in detail. (Graduate standing)

Class 4, Credit 4 (every year, S)

EMEM-810   **Introduction to Continuum Mechanics**

Registration #0304-810

A rigorous basis for the study of advanced fluid mechanics and theory of elasticity is presented. Cartesian tensors. Analysis of stress and deformation. Motion of a continuous medium. Applications to theory of elasticity, thermo-elasticity, viscoelasticity, and fluid mechanics. (EMEM-871)

Class 4, Credit 4 (even year, F)

EMEM-811   **Theory of Elasticity**

Registration #0304-811

Stress-strain relations and formulation of boundary value problems. State of plane strain, state of plane stress. Solutions by potentials, Airy stress function. Torsion of bars with circular, elliptic, rectangular cross-sections. Stresses and displacements in thick cylinders, disks, and spheres. Contact stress problems. Energy principles. (Graduate standing)

Class 4, Credit 4 (every year, W)

EMEM-812   **Theory of Plates and Shells**

Registration #0304-812

Theory of thin plates for small deflections. Rectangular and circular plates with various boundary conditions, elliptic and triangular plates. Navier and Levy solutions. Thermal stress in plates. Membrane theory of shells. Cylindrical shells and shells of revolution. (EMEM-685 or equivalent)

Class 4, Credit 4 (odd year, S)

EMEM-813   **Theory of Plasticity**

Registration #0304-813

The analysis of stress and strain. Criteria for yielding. Stress-strain relations of the theory of plasticity. Elastoplastic problems of spheres and cylinders. Torsion, Creep. (Graduate standing)

Class 4, Credit 4 (even year, W)

EMEM-815   **Experimental Stress Analysis**

Registration #0304-815

Experimental methods of analysis of structural machine members, including strain gages and instrumentation, photoelastic methods, brittle coating, Moire fringe method, holographic techniques; and the hydrodynamic, electrical, and membrane analogs. Different methods will be demonstrated. (EMEM-694 or equivalent)

Class 4, Credit 4 (even year, S)

EMEM-816   **Finite Elements**

Registration #0304-816

Boundary value problems in mechanical engineering are discussed and presented through the development of the governing field equations of a continuum in structural mechanics, heat transfer and fluid mechanics. The process of discretization of a continuum by the finite element method is presented using energy principles, and applied to the field equations outlined above. In the course of application, various line, surface, and solid elements are defined and developed. Numerical considerations presented include topics such as solution time, optimization, condensation methods, computer characteristics, etc. Commercial codes such as NASTRAN, ANSYS, GIFTS, and SAP will be discussed. However, the students will solve problems using fundamental approaches that will involve hand calculations and writing some individual computer prorams. (EMEM-870, EMEM-871, EMEM-440 or equivalent)

Class 4, Credit 4 (every year, F)

EMEM-820   **Advanced Optimal Design**

Registration #0304-820

Topics from nonlinear programming as applied to automated optimal design. Use of penalty functions for the transformation of constrained nonlinear optimization problems. Multivariate pattern and gradient based algorithms, such as the method of steepest descent, Newton's method, quasi-Newton methods, and generalized conjugate gradient techniques. Algorithms for the univariate sub-problem of the line search. Applications to the solution of practical nonlinear optimization problems using the digital computer. (EMEM-871 and EMEM-874)

Class 4, Credit 4 (odd year, S)

EMEM-821   **Vibration Theory and Applications**

Registration #0304-821

Vibration of discrete multi-mass systems using matrix methods. Normal mode theory, and matrix eigenvalue extraction procedures. Matrix forced response. Two and three degrees of freedom. Applications. Vibration of continuous systems. Computer simulations. (EMEM-871, EMEM-874)

Class 4, Credit 4 (every year, S)

EMEM-823   **Applied System Dynamics**

Registration #0304-823

Review of ordinary differential equations and their applications to the mathematical modeling of dynamic systems; the LaPlace and Fourier transforms and their application to the modeling of dynamic systems both experimentally and analytically; the known input-known output concept and the transfer function concept for system identification. Overview of analytical and experimental methods to obtain the dynamic characteristics of mechanical systems. Deterministic vs. Stochastic inputs. Autocorrelation and Cross-correlation functions and their Fourier Transforms. Stationary and Non-stationary processes. The Frequency Response Function (FRF) and its relationship with the Transfer Function. Instrumentation and sensors: accelerometers, velocity, sensors, displacement sensors, shakers, vibration tables, power amplifiers, force sensors, signal generators, signal conditioning devices, and data acquisition systems. Data reduction and analysis of results. Curve fitting techniques. Graphical techniques. Bode and Nyquist plots. Time domain vs. frequency domain. The use of model analysis software and its advanced simulation features. Non-linear systems, feedback control applications, or other areas of interest for the students. Laboratory experience consisting of understanding and using frequency analyzers to determine the FRF, experimental set-up, and data gathering procedure for the identification of the dynamic characteristics of a mechanical system or structure. Presentation of term projects. (Graduate standing)

Class 4, Credit 4 (every year, F)

EMEM-827   **Computer Graphics in Design**

Registration #0304-827-01

The course emphasizes the current role of computer graphics in computer-assisted design and design analysis. Subjects include: components of CAD systems, methods of geometric modeling, visualization methods, techniques of interactive communication, and design applications utilizing available software packages for multi-dimensional graphic display, pre- and post-processing modelers for finite element analyses, and three-dimensional solids modeling. (Graduate standing)

Class 4, Credit 4 (even year, S)

EMEM-828, -829   **Special Topics in Applied Mechanics**

Registration #0304-828, -829

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. A listing of topics for special courses is found at the end.

Credit variable (maximum of 4 credits/quarter) (TBA)

EMEM-833   **Heat Exchanger Design**

Registration #0304-833

This course covers analytical models for forced convection through tubes and over surfaces, experimental correlations for the Nusselt number and pressure drop, design of single and multiple pass shell and tube heat exchangers; compact baffled, direct contact, plate, and fluidized bed heat exchangers; radiators, recuperators, and regenerators. (EMEM-514)

Class 4, Credit 4 (odd year, W)

EMEM-838   **Ideal Flows**

Registration #0304-838

This graduate course introduces the students to the analysis of ideal flows from an advanced mathematical as well as engineering viewpoint. Steady acyclic motion, superposition of flows, vorticity dynamics; the theory of complex variables; airfoil and wing theories. (EMEM-871)

Class 4, Credit 4 (odd year, S)

EMEM-848,849   **Special Topics in Thermo Fluid Systems**

Registration #0304-848,849

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. A listing of topics for special courses is found at the end.

Credit variable (maximum of 4 credits/quarter) (TBA)

EMEM-864   **Production Tool Design**

Registration #0304-864

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 year, F)

EMEM-865   **Computer Implementation of Finite Elements**

Registration #0304-865

This is a course in the core group, CAD, of the manufacturing engineering option in the master of engineering degree program. This course emphasizes the application of the finite element method to problems in the area of static and dynamic structural analysis, heat transfer, and analogous solutions. A standard commercial software package is used for these applications where the general structure, operating characteristics, and use of this complex program is presented. Topics include: the finite element method; shape factors, element formulations, and the element library; program sequencing; general modeling methods (loads, constraints, material factors, mesh generation, interactive graphics, model conditioning, etc.); convergence, error analysis, and the "patch" test; vibration and heat transfer analysis, and analogous analysis such as acoustics, illumination, etc. (EMEM-816)

Class 4, Credit 4 (odd year, W)

EMEM-870   **Mathematics for Engineers I**

Registration #0304-870

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-Schimdt orthonormalizing procedure. (Graduate standing)

Class 4, Credit 4 (every year, F)

EMEM-871   **Mathematics for Engineers II**

Registration #0304-871

Topics covered are orthogonal functions including Fourier Series, Fourier Integrals, Bessel functions, Legendre Polynomials, Sturn-Liouville problems and eigenfunction expansions; an introduction to calculus of variations, including problems with constraints; vector analysis including the directional derivative, the gradient, Green's Theorem, the Divergence Theorem and Stokes' Theorem. (Graduate standing)

Class 4, Credit 4 (every year F, W)

EMEM-872   **Mechanics**

Registration #0304-872

Variational principles are developed and applied to the area of solid mechanics. Exact and approximate solution techniques are applied to the solutions of static and dynamic structural problems. Although static analysis is emphasized, dynamic problems will be introduced. Topics presented include: Calculus of Variations, Virtual Work, minimum potential energy, Castigliano's method, the Rayleigh-Ritz method, Galerkin's method. Hamilton's principle, and Lagrange's equations. (EMEM-871 and EMEM-543)

Class 4, Credit 4 (every year, S)

EMEM-873   **Convective Heat Transfer**

Registration #0304-873

This course deals with mechanisms and applications of forced convection heat transfer. Governing equations are analyzed and applied to practical situations such as single phase heat transfer during flow inside tubes, cooling of electronic components, flow boiling, and augmentation of single phase and two phase heat transfer. (EMEM-877)

Class 4, Credit 4 (odd year, F)

EMEM-874   **Numerical Analysis**

Registration #0304-874

The course emphasizes both the development of the current numerical methods that are available to solve engineering problems and the use of the digital computer to implement these techniques. The methods are developed for: Algebraic and transcendental equations in single variable; system of linear algebraic equations by both direct and iterative techniques; system of nonlinear equations, interpolation and approximation theory; numerical differentiation and integration, initial value problems for ordinary differential equations; boundary value problems for ordinary linear and nonlinear differential equations; and partial differential equations; discussion on convergence and stability of methods, effect of truncation and round off errors. Extensive use of the computer will be required. (Graduate standing, knowledge of FORTRAN, experience in the use of digital computers)

Class 4, Credit 4 (every year, W)

EMEM-877   **Fluid Dynamics**

Registration #0304-877

This is an introductory course at the graduate level in fluid dynamics intended to give the students a broad exposure to incompressible flows. This course lays the foundation, and is a prerequisite for a study of advanced topics in heat transfer, advanced aerodynamics, computational fluid dynamics, wave mechanics, and geophysical fluid dynamics. This course includes conservation laws and boundary conditions, potential flows, highly viscous flows, boundary layer theory, flow stability and transition to turbulence. (EMEM-871, Graduate standing)

Class 4, Credit 4 (every year, W)

EMEM-880   **Independent Study**

Registration #0304-880

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.

Credit variable (maximum of 4 credits/quarter) (every year)

EMEM-890   **Thesis, Design Project, or Literature Search**

Registration #0304-890

In conference with an advisor, a topic is chosen. The work may involve a thesis, design project, or literature search. Periodic progress reports and a final written document with an oral examination are required.

Credit variable (5 to 12 credits total) (every year F, W, S, SR)

SESM-701   **Introduction to Materials Science**

Registration #1028-701

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. (SCHG-208 or equivalent)

Class 4, Credit 4 (every year, F)

SESM-710   **Properties and Selection of Engineering Materials**

Registration #1028-710

This course deals with effective material selection which requires that a designer be familiar with many material systems and be acquainted with a nominal number of specific materials in these systems. The course contains theory not found in handbooks and practical information not covered in materials science or metallurgy courses. Emphasis is placed upon the application of materials according to the properties and principles of material behavior. Ferrous, nonferrous and nonmetallic materials are covered. (SESM-701 or equivalent)

Class 4, Credit 4 (odd year, TBA)

Special topic courses will be offered in the following areas if there is a sufficient demand:

Advanced Heat Transfer
Advanced Thermodynamics
Advanced Vibration Theory
Biomechanics
Control Systems
Energy Methods in Mechanics
Lubrication
Mechanics of Composite Materials
Optimal Control
Rotor Dynamics
Structural Analysis
Thermal Stresses
Viscoelasticity

Microelectronic Engineering

The courses listed below are normally open to students who have been formally admitted into the graduate program. Students with a baccalaureate degree in engineering or science may be permitted to enroll in any of these courses as non-matriculated students if they have already completed the stated prerequisites for a particular course. Undergraduate students may be permitted to take some of these courses as undergraduate technical electives provided they are seniors and have already completed the prerequisites. The permission of the director of graduate programs is required for enrolling in these courses except in the case of matriculated graduate students.

EMCR-701   **Microelectronics I**

Registration #0305-701

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 and SPICE. Laboratory work includes the fabrication of MOS integrated circuits providing an introduction to all I.C. fabrication processes.

Class 3, Lab. 3, Credit 4(F)

EMCR-702   **Microelectronics O**

Registration #0305-702

A continuation of Microelectronics I with emphasis on details of individual processing steps. The laboratory portion includes the design and fabrication of an integrated circuit.

Class 3, Lab. 3, Credit 4 (W)

EMCR-703   **Microelectronics IE**

Registration #0305-703

A selection of topics from physical and plasma chemistry that is important to the understanding of integrated circuit processing. Including plasma etching, chemical vapor deposition, and related technologies. Advanced transistor design is studied including low doped drain structures, polysilicon emitter BJTs, etc.

Class 3, Lab. 3, Credit 4 (S)

EMCR-721   **Microlithography I**

Registration #0305-721

Selected topics from organic, polymer, physical, and photographic chemistry important to the understanding of photoresists. Photoresist processes such as negative, positive, reversal, dyed, antireflective coatings, multilayer, contrast enhancement, image stabilization, electron beam, x-ray, and deep UV materials. Laboratory course topics emphasize photolithographic process characterization techniques and design of experiments.

Class 3, Lab. 3, Credit 4(F)

EMCR-722   **Microlithography II**

Registration #0305-722

A study of the characteristics of image-forming and image-recording elements and their matching for optimum performance. Spread and transfer functions, partial coherence in image systems, limitations imposed by the wave and particle nature of radiation. Modeling using SAMPLE, PROSIM, DREAMS and other tools is introduced. Techniques and instruments for the exposing and evaluation of images is studied in the laboratory.

Class 3, Lab. 3, Credit 4 (W)

EMCR-731   **Manufacturing Science I**

Registration #0305-731

A manufacturing course covering topics such as scheduling, work in progress tracking, costing, inventory control, capital budgeting, productivity measures and personnel management. The laboratory for this course is the student-run factory. Measurement of yield, defect density, wafer mapping, control charts and other tools are introduced to the student.

Class 3, Lab. 3, Credit 4 (W)

EMCR-770   **Independent Study**

Registration #0305-770

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

EMCR-777   **Internship**

Registration #0305-777

This course number is used to fulfill the internship requirement. The student must obtain the approval of an appropriate faculty member to supervise the paper before registering for this course.

Credit variable

College of Fine and Applied Arts
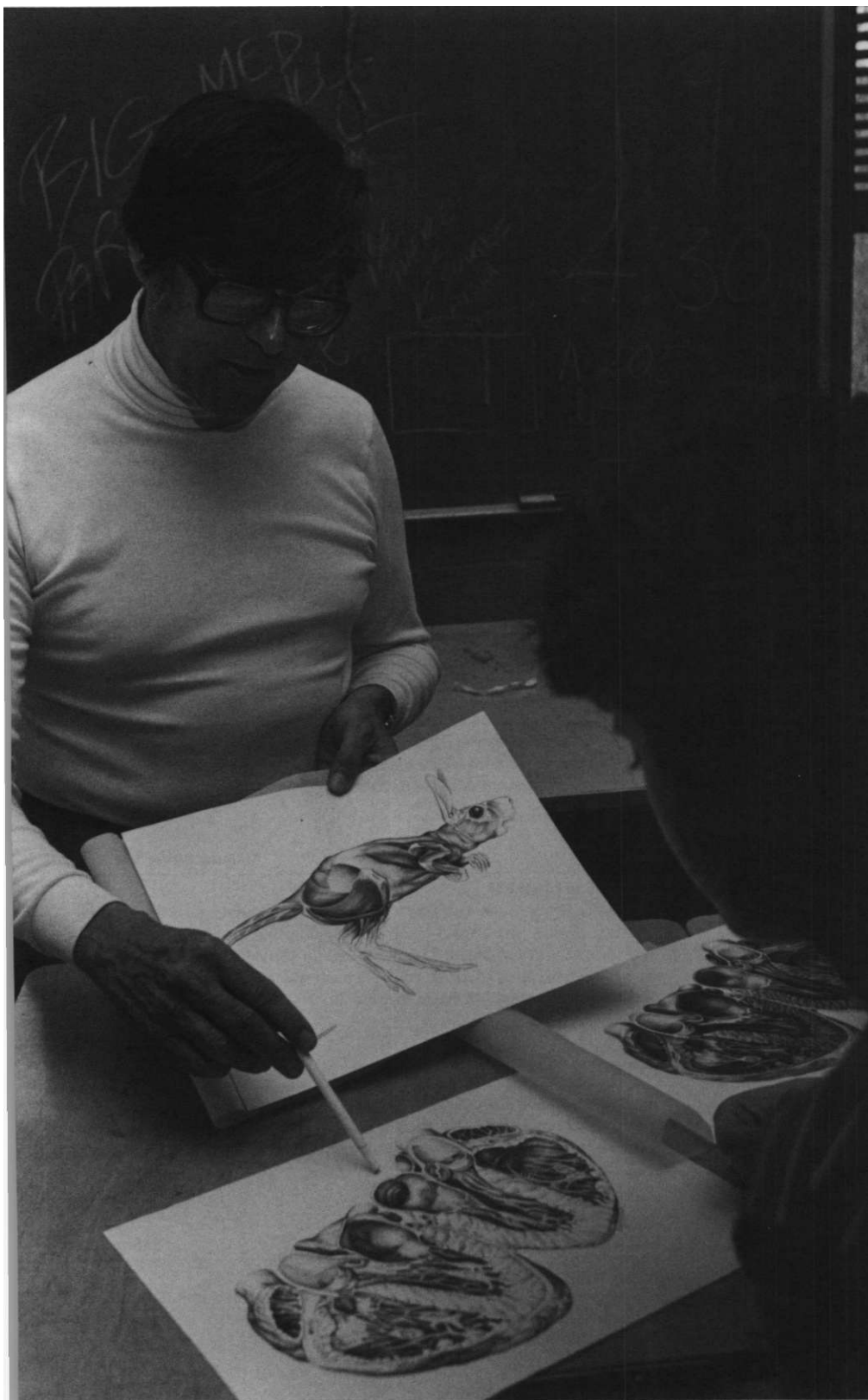
Robert H.Johnston, Dean
Peter Giopulos, Associate Dean
(475-2634)

Master of Fine Arts
Master of Science for Teachers
In the College of Fine and Applied Arts there are 12 possible concentrations of study for the artist, designer or craftsman. The School of Art and Design offers programs in industrial and interior design, graphic design, medical illustration*, painting, printmaking, and computer graphics design*. Students are prepared to operate their own studios and shops, to be self-employed professionals, and to work in business and industry as artists and designers. It prepares graduates to teach at elementary and secondary levels through a concentration in art education. In the School for American Craftsmen, there are five studio concentrations for a professional career through the crafts: ceramics and ceramic sculpture, glass, metalcrafts and jewelry, weaving and textile design, woodworking and furniture design.

The College of Fine and Applied Arts provides a center for advanced study in the graphic, plastic and the fine arts in which the student has the opportunity to work in a professional environment; it stimulates and encourages work of the highest quality. Students of superior ability who possess a baccalaureate degree in art, crafts or design may increase their competence in the field of their ipajor interest under the guidance of accomplished professional artists and craftsmen. For those students who have a background in graphic design, industrial and interior design, painting, sculpture, printmaking, illustration, computers or one of the five craft areas, there is opportunity to develop new areas of competence. The master's programs are also designed to enable students to broaden their experience in the practice of art in areas other than their majors and to increase their understanding of the arts in the humanistic sense. Students are expected to participate in the planned non-credit program of assemblies, seminars, and exhibits as well as their formal class requirements.

*Onty MFA in Medical illustration and Computer Graphics Design.

Graduate degrees

The College of Fine and Applied Arts offers two graduate degrees. The master of science for teachers may be taken in nine studio areas and, in addition, in art education. The art education concentration leads toward permanent art N-12 certification to teach in the public schools of the State of New York and involves pedagogical studies and student teaching. The MST in Art Education is a September to May program. The master of science for teachers may also be pursued in the studio areas of graphic design, industrial and interior design, painting, printmaking, ceramics and ceramic sculpture, glass, metalcrafts and jewelry, weaving and textile design and woodworking and furniture design. This MST in studio may also lead to certification if provisional or temporary certification has been previously earned as an undergraduate. Students may select the summer option or one year full-time study for this studio concentration.

The second graduate degree is the master of fine arts, considered the highest degree of study in the studio arts. This involves the presentation of a thesis and usually requires two years of full-time study.

Objectives

The MFA and MST programs are constituted to reflect the goals of Rochester Institute of Technology.

The programs are designed to graduate artists, designers, craftsmen and teachers who are cognizant of the contemporary situation and desire to better it by devotion to their work and high standards of personal discipline.

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 non-matriculated 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 the provisional certification, the graduate concentration should be in the studio area, 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.

Requirements for admission to the MFA degree programs

The applicant should hold the baccalaureate degree in a field of the arts, science or education from a regionally accredited college in the United States or Canada and demonstrate, in the quality of the undergraduate record and creative production, a genuine, professional potential. (See also non-matriculated students.) The undergraduate degree should include 75 quarter credit hours (50 semester hours) in studio courses.

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 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 require-

ments. 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 students will receive prior to admission as a graduate student. Extended study may require additional time on campus.

Human Gross Anatomy and biology or equivalent content is necessary for the MFA in medical illustration. Human Gross Anatomy is taught by the University of Rochester, and a surcharge for tuition is required.

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.

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 (studio concentration) or the master of fine arts.

Admission as non-matriculated students

Students who have a baccalaureate degree and who wish to take particular courses may be admitted as non-matriculated 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 record and portfolio indicate an ability to meet graduate standards.

Studio residence program

The School for American Craftsmen offers a craft residence program. Residence will be accepted in ceramics and ceramic sculpture, weaving and textile design, metalcrafts and jewelry design, woodworking and furniture design and the glass studios. 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, excellent 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 Fine and Applied Arts, Rochester Institute of Technology, One Lomb Memorial Drive, Rochester, N.Y. 14623.

Admission procedure

To apply for admission to graduate study a student must submit evidence of his or her baccalaureate degree, a portfolio of 20-24 slides or other evidence of creative work, a statement of purpose, and references.

All correspondence concerning applications, catalogs and portfolios should be addressed to Director of Admissions, Rochester Institute of Technology. Program inquiries should be addressed to Graduate Programs, College of Fine and Applied Arts.

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 College of Fine and Applied Arts reserves 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.

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 do honor to the works of the past. The gallery, architecturally impressive, and a part of the college, serves to enrich the cultural life of the community, the Institute at large, and to inform and inspire the college's graduate body.

The Faculty Show, Graduate Thesis Show, and Student Honors Show are annual events on the gallery calendar.

The MFA and MST degrees

The MFA degree is designed as a professional degree for the practicing artist, craftsman, or designer, and for those wishing to teach at the college or university level. This is earned normally in two years of full-time study and the completion of a minimum of 90 credit hours including the presentation of an acceptable thesis. Those who have entered the MST program and who may wish to change to the MFA program must petition the graduate faculty for permission to change the degree objective. In view of the pronounced difference in entrance requirements, students requesting a transfer from MST to the MFA program may be required to take additional undergraduate or graduate courses. Such students must also have demonstrated their professional potential by establishing a "B" average (3.0) in at least one quarter (or one summer session) of the MST course of study.

The MST degree may be earned normally in one academic year or in summer sessions through the satisfactory completion of a minimum of 48 credit hours in course work. It is arranged for the student holding the BFA degree (or a BA degree with an art major) who wishes to earn teacher certification, or who holds provisional certification (with a BS or BA degree in art or industrial arts education) and seeks permanent certification. The MST degree may also be taken as a concentration in the studio areas with supporting courses on the basis of need and interest from graduate offerings in other schools and departments of the Institute. This major in art education integrates public school teaching, social sciences and studio classes. In contrast, the studio MST candidate selects one of the nine art areas: graphic design, industrial and interior design, painting, printmaking, ceramics, metals, textiles, wood or glass. Summer sessions can accommodate teachers seeking permanent certification through study in an art area. The art education concentration has a September start, and is earned in one academic year.

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.

Peter Giopulos

Graduate art students 'usually know where they're going'

"Today's art student is not just interested in courses, but in a program of study that's well planned," says Peter Giopulos, coordinator of graduate programs in the College of Fine and Applied Arts.

"Most of our graduate students have been through an experimental stage, both in their lives and in their creative work. They've learned how to bring that experimentation into focus, whether personally or artistically. And they usually know where they're going."

RIT offers a variety of graduate programs through the School for American Craftsmen and the School of Art and Design, but all of them, Giopulos says, have "depth within the major and allow for a minor sequence and electives, which are available from many other programs."

In the graduate program, study is geared to the person "who has gained a marketable skill as an undergraduate or in other previous experience," Giopulos says. "These are people with very definite ideas about where they're going artistically."

Giopulos is a graduate of Syracuse University (BFA), and Pennsylvania State University (M.Ed., Ph.D.). He has been on the faculty of the College of Fine and Applied Arts for 18 years, and has been named associate dean of that college and coordinator of graduate programs.

The programs

The **Master of Fine Arts** program includes six categories of study:

1. Major concentration   30 cr.
   Designed to give depth of experience in the area of the student's major interest and chosen from one of the eleven areas: ceramics and ceramic sculpture, metalcrafts and jewelry, woodworking and furniture design, weaving and textile design, glass, industrial and interior design, graphic design, fine art (painting), fine art (printmaking), medical illustration, computer graphics design.

2. Minor Concentration*   15
   From the above, to consist of studio and related electives other than major.

3. Electives   18
4. Graduate Forum   3
5. Humanities, art history   10
6. Thesis   <u>14</u>
                    Total   90 cr.

Graphic Design graduates may consider a minor in the American Video Institute, where an advanced certificate in electronic and optical storage applications can be earned. Application to AVI's certificate is required, and upon acceptance the student will enroll in 22 quarter credits of study. This will have an impact on the minor and electives in the MST or MFA degree in graphic design. Students blend graphic design into videodisc systems, image-bank management, advanced video, optical disc storage, moving imagery and communication theory. See page 105 for further information.

The **Master of Science for Teachers** program requirements include two categories of studies:
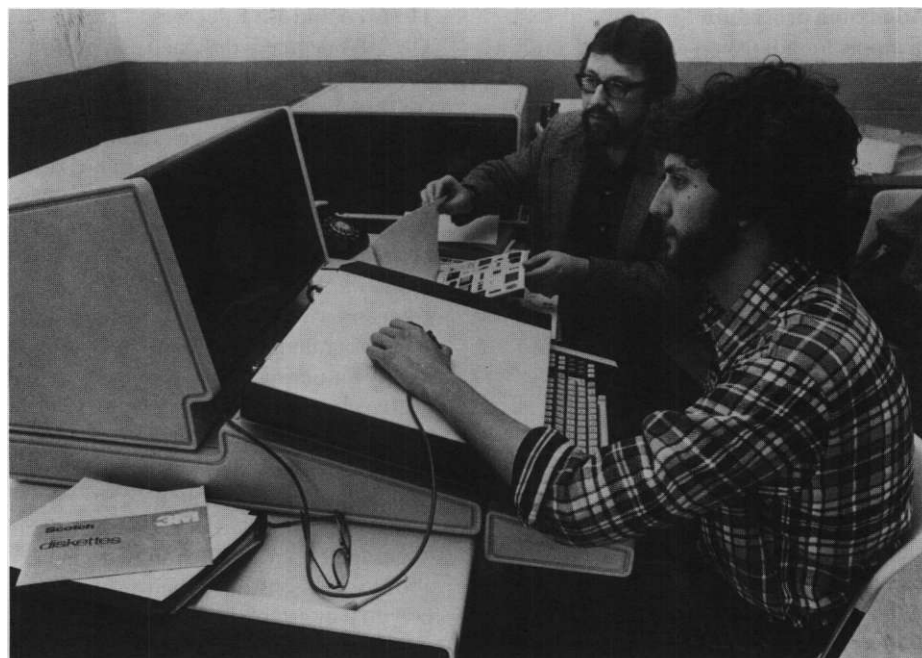
MST ART EDUCATION

1. 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 the public schools.

The degree offers a concentration consisting of background courses

in Education, Psychology   20 cr.
and Sociology
Art Education Concentration: 22
Methods and Materials in Art Education, Seminar in Art Education, Practice Teaching
Studio electives   <u>6</u>
                    Total   48 cr.

MST STUDIO

2. Master of Science for Teachers in *studio art* (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 requirements for the degree.
Major Concentration:
Studio art, or crafts   24 cr.
Humanities, art history   10
Minor Concentration   9
Electives   <u>5</u>
                    Total   48 cr.

The City Center
The College of Fine and Applied Arts graduate painting is housed in downtown Rochester's historic area, within its cultural, education, and business center, at 50 West Main Street. This provides students who enroll in these programs with stimulating surroundings, city resources, and ample work space.

	MFA	MST STUDIO	MST ART EDUCATION
Major	30 credits	24 credits	22 credits
Minor	15	9	
Humanities	10	10	20 Social Sciences
Graduate Forum	3		
Electives	18	5	6
Thesis	14		
	90 credits	*48 credits	**48 credits

*()neyear or summers
**September start only

In certain cases the minor concentration or courses may be taken elsewhere in the Institute (photography, printing, etc.) when related to the objectives of the student. Such courses must be approved in advance, normally after arrival mi campus, by the advisor and the deans of the colleges involved. The minor supptirts the spirit of the MFA degree.
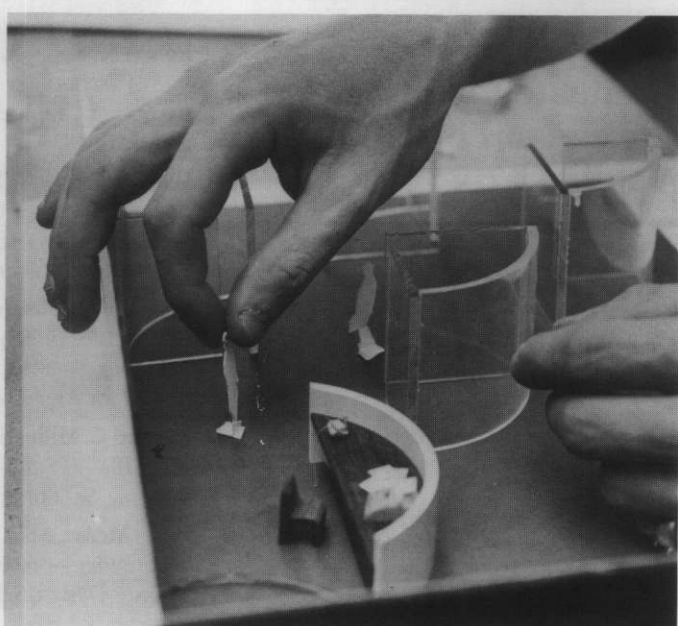
Portfolio Guidelines For Graduate Applicants

The following guidelines are presented for all graduate students applying to the College of Fine and Applied Arts* Presentation of the portfolio is one of the requirements used in totally assessing the performance and academic capabilities of the applicant.

1. The portfolio should contain examples of at least 20-24 pieces of the applicant's best work—35mm slides are preferred, displayed in an 8½" x 11" vinyl slide protector page.

2. Slides will be returned by the College of Fine and Applied Arts only when return postage is enclosed.

3. While every precaution will be taken to insure proper care and handling, the Institute assumes no responsibility for loss or damage to slides.

4. Identify slides by name and address. Please send portfolio and all other application materials to:

Rochester Institute of Technology
Office of Admissions
One Lomb Memorial Drive
Box 9887
Rochester, New York 14623
Telephone: (716) 475-6631

Industrial and interior design and art education majors are offered only during Fall, Winter and Spring Quarters. Art education applicants should arrange a personal interview with Dr. Peter Giopulos, associate dean, College of Fine and Applied Arts, (716) 475-2634.

Graduate Faculty College of Fine and Applied Arts

Robert H. Johnston, Ph.D., Pennsylvania State University—Professor, Dean

Peter Giopulos, Ph.D., Pennsylvania State University—Professor, Associate Dean

Philip W. Bornarth, MAE School of the Art Institute—Professor, Painting, School of Art and Design

Donald G. Bujnowski, MA, University of Minnesota—Professor, Weaving and Textile Design, School for American Craftsmen

Wendell Casde, MFA, University of Kansas—Artist-in-Residence, Chair, School for American Craftsmen; Professor

David Dickinson, MFA, Rochester Institute of Technology—Associate Professor, Printmaking, School of Art and Design

Robert Heischman, U.C.EA., Ruskin School of Drawing and Fine Art, Oxford University—Associate Professor, Painting, School of Art and Design

Glen R. Hintz, MS, The Medical College of Georgia—Assistant Professor, Medical Illustration; School of Art and Design

Barbara Hodik, BS Ed., Benedictine College; MA, New York University; Ph.D., Pennsylvania State—Professor, Art Education, School of Art and Design

Robert K. Keough, MFA, Rochester Institute of Technology—Associate Professor, Computer Graphics Design, School of Art and Design

William Keyser, MFA, Rochester Institute of Technology—Professor, Woodworking and Furniture Design, School for American Craftsmen

Max Lenderman, MFA, University of Kansas; MS, Indiana State University—Professor, Weaving and Textile Design, School for American Craftsmen

Edward C. **Miller,** BFA, SUNY at Buffalo; MFA, Illinois State—Associate Professor, Painting, School of Art and Design

Craig McArt, MFA, Rochester Institute of Technology—Professor, Industrial and Interior Design, School of Art and Design

Albert Paley, MFA, Tyler School of Art—Artist-in-Residence, Chair; School for American Craftsmen; Professor

R. Roger Remington, MS, University of Wisconsin—Professor, Graphic Design, School of Art and Design

Robert Schmitz, MFA, University of Wisconsin; MS, Alfred University—Professor, Ceramics, School for American Craftsmen

James H. Sias, MA, Michigan State University—Associate Professor, Industrial and Interior Design, School of Art and Design

Douglas Sigler, MFA, Rochester Institute of Technology—Associate Professor, Woodworking and Furniture Design, School for American Craftsmen

Mark Stanitz, MA, Kent State University-Assistant Professor, Metalcrafts and Jewelry, School for American Craftsmen

Michael Taylor, MFA, East Tennessee State University—Associate Professor, Glass, School for American Craftsmen

Toby Thompson, MFA, Rochester Institute of Technology—Professor, Industrial and Interior Design, School of Art and Design

Leonard A. Urso, MFA, State University of New York at New Paltz—Assistant Professor, Metalcrafts and Jewelry, School for American Craftsmen

James C. Ver Hague, Jr. MFA, State University of New York at Buffalo; MS, Rensselaer Polytechnic Institute—Professor, Computer Graphics Design, School of Art and Design

Robert Wabnitz, Diploma, Rochester Institute of Technology—Associate Professor, Medical Illustration, School of Art and Design

Lawrence Williams, MFA, University of Illinois—Professor, Printmaking, School of Art and Design

Norman Williams, MS, Syracuse University—Associate Professor, Art Education, School of Art and Design

School of Art and Design

Beginning September 1982, the Communication Design program name has been changed to Graphic Design, and Environmental Design has been changed to industrial and Interior Design.

Courses for the education concentration of the MST program are offered through the College of Liberal Arts, and course descriptions are given under that heading with a Liberal Arts call number.

Art Education

FADA-701, -702 (MST)   **Methods and Materials in Art Education**

Registration #0401-701, -702   **(Major)**
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 every year)

FADA-820 (MST)   **Seminar in Art Education**

Registration #0401-820   **(Major)**
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 (offered every year—Spring)

FADA-860 (MST)   **Practice Teaching in Art**

Registration #0401-860   **(Major)**
A 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 (offered every year—Spring)

Graphic Design

FADC-750   **Graphic Design**

Registration #0402-750   **(Major, Elective)**
Advanced creative problem-solving experiences in graphic design imagery. Professional problems in visual techniques for communication media. Media Center facility available for extension of studio problems.

Lab 6, Credit 3 (offered every quarter)

FADC-780   **Graphic Design**

Registration #0402-780   **(Major)**
Advanced creative problem-solving experiences relating to graphic design imagery. Formal design values are emphasized and utilized in communications applications. Studio involvement is directed toward the solution of individual, group and assigned graphic design problems. Specification of the program is developed in accordance with the professional goal of the individual student and work leading toward the master's thesis. Media Center facilities are availble for application of studio imagery.

Lab 9-27, Credit 3-9 (offered every quarter)

Computer Graphics Design

FADG-780   **Introduction to Computer Graphics Design**

Registration #0432-780   **(MFA Major)**
An introduction to creating designs on the computer. Basic familiarity with using the keyboard, CRT, disk drive, tablet, printer, plotter and image digitizer to create imagery. Emphasis on creating image files, pictures and hard copy.

Lab 9, Credit 3 (offered each year)

FADG-781   **Two-Dimensional Computer Graphics Design**

Registration #0432-781   **(MFA Major)**
Exposure to computer graphic algorithms, design heuristics, design methodology, language data structures, and program structures for two-dimensional imagery. Projects involve complex programming.

Lab 9, Credit 3 (offered each year)

FADG-782   **Three-Dimensional Computer Graphics Design**

Registration #0432-782   **(MFA Major)**
Extension of previous experience to include three-dimensional objects, hidden lines and surfaces, solid modelling, perspective. Projects involve complex pro gramming.

Lab 9, Credit 3 (offered each year)

FADG-783   **Visual Semiotics/Graphic Design**

Registration #0432-783   **(MFA Major)**
The application of syntactic, semantic and pragmatic levels of visual design activities. These concepts will be applied to creative projects utilizing the computer as the primary tool.

Lab 9, Credit 3 (offered each year)

FADG-784   **Digital Typography**

Registration #0432-784   **(MFA Major)**
A study of the evolution of typography, typesetting and typesetting systems from metal type through photo typesetting to today's digital typesetting. Hands-on experiences in production typesetting including photo typesetting, digital typesetting, word processing and prepress planning for accurate typographic reproduction.

Lab 9, Credit 3 (offered each year)

FADG-785   **Computer-Generated Slide Design**

Registration #0432-785   **(MFA Major)**
The design of slides for business graphics and audio-visual presentations. Hands-on experience with a sophisticated computer graphics system for the generation of high resolution slides. Emphasis on both commercial production concerns and creative problem solving.

Lab 9, Credit 3 (offered each year)

FADG-786   **Computer-Generated Animation**

Registration #0432-786   **(MFA Major)**
Extension of computer generated slide design using keyframe animation techniques to automatically create frames for film, video or multi-image slide presentations.

Lab 9, Credit 3 (offered each year)

FADG-787   **Advanced Computer Graphics Design**

Registration #0432-787   **(MFA Major)**
Advanced explorations of computer graphic applications. Projects include such topics as computer generated layout, digital type development, computer-aided instruction lessons, TV and electronic mail promotions and computerized animation.

Lab 18, Credit 6 (offered each year)

Industrial and Interior Design

FADD-750   **Industrial and Interior Design**

Registration #0403-750   **(Minor, Elective)**
The reasoned application of theoretical and practical background to advanced projects in industrial and interior design.

Lab 6, Credit 3 (offered every quarter)

FADD-780   **Industrial and Interior Design**

Registration #0403-780   **(Major)**
Selected projects in industrial or interior design which allow individual application of design methodology and technical skills toward professional goals. Selection of the projects is directed at providing an adequate background for development of the master's thesis.

Lab 9-27, Credit 3-9 (offered every quarter)

Painting

FADP-750   **Painting**

Registration #0405-750   **(Minor, Elective)**

Study of present techniques and concepts in painting and their relation to the tradition of painting. Development of painting skills in a chosen medium.

Lab 6, Credit 3 (offered every quarter)

FADP-750   **Illustration**

Registration #0405-750   **(Painting Minor, Elective)**

An elective exploring the art of illustrators, their relation to audience, publishers, and media. Studio problems will develop and expand basic concepts of illustration.

Class 3, Lab 3, Credit 3 (offered each year)

FADP-751   **Drawing Problems**

Registration #0405-751   **(Painting Minor, Elective)**

Individual drawing projects related to graduate students' major area of study. Opportunity to refine drawing skills on the graduate level.

Lab 6, Credit 3 (offered each year)

FADP-780   **Painting**

Registration #0405-780   **(Major)**

Development of mastery of a permanent painting medium and related preparatory study. Examination of ideas and relationships in the field of painting with emphasis upon individual creative solutions.

Lab 9-27, Credit 3-9 (offered every quarter)

Printmaking

FADR-750   **Printmaking**

Registration #0406-750   **(Minor, Elective)**

Advanced techniques in etching, lithography and woodcutting, as well as in many experimental areas including color processes, photo-etching, photo-lithography, paper making and combination printing. Students are expected to develop along independent lines, and direction is offered in contemporary thought and concept. The emphasis is toward developing a complete respect for the printmaking craft and profession.

Lab 6, Credit 3 (offered every quarter)

FADR-780   **Printmaking**

Registration #0406-780   **(Major)**

Contemporary and historical printmaking concepts are presented as stimulant and provocation for the development of an individual approach to expression. Advanced techniques are demonstrated in intaglio, relief and lithography with resources available in non-silver photo processes, paper making and combinations. A complete understanding of the development and maintenance of the print studio is supportive for the professional artist. The work leads toward the master's thesis.

Lab 9-27, Credit 3-9 (offered every quarter)

Sculpture

FADS-750   Sculpture

Registration #0407-750   **(Elective)**

Sculptural concepts are approached through a variety of processes and materials. The studio work is executed in paper, wood, fabrics, metal, stone, clay and plastics.

Lab 6, Credit 3 (offered each year)

Medical Illustration

FADM-781   **Medical Illustration Topics I**

Registration #0408-781   **(MFA Major)**

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)

FADM-782   **Medical Illustration Graphics and Exhibits**

Registration #0408-782   **(MFA Majors)**

A course emphasizing the use of tides, animation, charts and graphs, schematics, and illustrative procedures as vehicles for meeting instructional and communicative needs. Students will learn the various techniques available and will apply those techniques while constructing three dimensional illustrations for in house presentation or for traveling displays. In addition, students will learn to plan and cost analyse their illustrative exhibits.

Lab 6, Credit 3 (offered each year)

FADM-783   **Medical Illustration Anatomical Studies**

Registration #0408-783   **(MFA Major)**

A study of pathological specimens and human dissection using colored pencil, pen and ink, carbon dust, and airbrush. Emphasis will be on rapid but accurate sketching and observation in the laboratory with a representation of form and structure in living tissue for the preparation of surgical procedures.

Lab 6, Credit 3 (offered each year)

FADM-784   **Medical Illustration Topics II**

Registration #0408-784   **(MFA Major)**

A course emphasizing photographic techniques as employed in medical illustration. Students will learn to use the copystand and various films to reproduce continuous tone, black and white, and color artwork. The copystand and other lighting techniques will be introduced for photographing anatomical specimens, models, and surgical instruments. Combining photographic images and processes with illustrative techniques also will be explored.

Lab 6, Credit 3 (offered each year)

FADM-785   **Medical Illustration Surgical Procedures I**

Registration #0408-785   **(MFA Major)**

The application of illustrating and photographing in the operating room. The student will become familiar with the organization of operations and with his or her role as a medical illustrator. Sketches are to be drawn directly from the observation of surgery, consulting with the surgeon for accuracy of detail and development. The final preparation of the art work will be submitted for publication or portfolio.

Lab 6, Credit 3 (offered each year)

FADM-786   **Medical Illustration Surgical Procedures II**

Registration #0408-786   **(MFA Majors)**

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)

Thesis

FAD (C, D, P, R, M or G)-890   **Research and Thesis Guidance**

Registration #040 (2,3,5,6,8, or 32)-890   **(MFA Major)**

The development of a thesis project initiated by the student and approved by a faculty committee and the Special Assistant to the Dean for Graduate Affairs. Primary creative production, the thesis must also include a written report and participation in a graduate thesis show.

Lab 27, Credit 3-14 (offered every quarter)

FASA-785   **Forms of Inquiry**

Registration #0420-785   **(Required for MFA)**

The exploration and organization of forms of inquiry in the fields of art, craft and design.

Class 2, Credit 2 (offered each year)

FASA-790   **Graduate Forum**

Registration #0420-790   **(Required for MFA)**

The presentation and dicussion of issues in aesthetics, criticism, creativity and perception as they relate to art, design and craft will be undertaken. Points of view will be clarified through critical writing. Required for MFA; to be taken prior to Thesis.

Class 2, Credit 3

School for American Craftsmen

Ceramics and Ceramic Sculpture

FSCC-750   **Ceramics and Ceramics Sculpture**

Registration #0409-750   **(Minor, Elective)**

Development towards an individual aesthetic supported by clay and glaze technology and ceramic art history.

Lab 6, Credit 3 (offered every quarter)

FSCC-780   **Ceramics and Ceramic Sculpture**

Registration #0409-780   **(Major)**

A program structured on the basis of individual 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 ceramic expression. The student will be encouraged to evaluate new techniques, materials and concepts. This sequence leads to the master's thesis, suggested by the student and approved by the faculty.

Lab 9-27, Credit 3-9 (offered every quarter)

Glass

FSCG-720   **Stained Glass**

Registration #0411-720   **(Minor, Elective)**

An elective providing exploration of personal approaches to visual expression and techniques in flat glass. Technical processes may incorporate all hot and cold processes used in glass.

Lab 6, Credit 3 (offered on sufficient demand)

FSCG-750   **Glass**

Registration #0411-750   **(Minor, Elective)**

Collaborative work with the student's major area of study and glass fabrication is encouraged. Various techniques, both hot and cold will be considered: casting, slumping, fusing, blowing, cutting, electroplating, lamp working and sculptural construction. Course emphasis on personal, independent development encouraging contemporary thought and concept.

Lab 6, Credit 3 (offered every quarter)

FSCG-780   **Glass**

Registration #0411-780   **(Major)**

A program structured on the basis of individual needs, interests and background preparation as they may be determined through faculty counseling. All technical processes and techniques are to be considered relevant. The course is structured to provide a foundation for professional activity and to encourage exploration of personal concepts relating to the presentation of a body of visual work. This sequence leads to the master's thesis, suggested by the student and approved by the faculty.

Lab 9-27, Credit 3-9 (offered every quarter)

Metalcrafts and Jewelry

FSCM-750   **Metalcrafts and Jewelry**

Registration #0412-750   **(Minor, Elective)**

This is the study and manipulation of metals for holloware/jewelry. Design sensitivity and concepts are approached through the raising, forming and planishing or casting, forging, and fabricating techniques.

Lab 6, Credit 3 (offered every quarter)

FSCM-780   **Metalcrafts and Jewelry**

Registration #0412-780   **(Major)**

A program structured on the basis of individual needs, interests and background preparation as they may be determined through faculty counseling. Both holloware and jewelry areas will be explored. It is designed to give the student a broad exposure to metalworking techniques, expand the student's knowledge of applied design, strengthen perceptual and philosophical concepts and develop an individual mode of expression. This sequence leads to the master's thesis, suggested by the student and approved by the faculty.

Lab 9-27, Credit 3-9 (offered every quarter)

Weaving and Textile Design

FSCT-750   **Weaving and Textile Design**

Registration #0413-750   **(Minor, Elective)**

This is the study and appreciation of weaving and textile techniques, soft sculpture, off loom weaving and printing. Design approaches are stressed.

Lab 6, Credit 3 (offered every quarter)

FSCT-750   **Business Practices for the Craftsperson**

Registration #0413-750   **(Elective)**

Fundamental craft business practices, including setting up a business basic record keeping, banking, pricing, government regulations, insurance, marketing, and studying operations.

Class 3, Credit 3 (offered every other year)

FSCT-780   **Weaving and Textile Design**

Registration #0413-780   **(Major)**

A program structured on the basis of individual needs, interests and background preparation as they may be determined through faculty counseling. Techniques offered are combination weaves and pattern design, double weave, embroidery and stitchery, finn-weave, Ikat, multiple layer, dyeing, non-loom, pile rug, printed surface, silk-screen, tapestry, and soft sculpture. Design concepts are complements to the techniques. This sequence leads to the master's thesis, suggested by the student and approved by the faculty.

Lab 9-27, Credit 3-9 (offered every quarter)

Woodworking and Furniture Design

FSCW-750   **Woodworking and Furniture Design**

Registration #0414-750   **(Minor, 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 6, Credit 3 (offered every quarter)

FSCW-780   **Woodworking and Furniture Design**

Registration #0414-780   **(Major)**

A program structured on the basis of individual needs, interests and background preparation as they may be determined through faculty counseling. This provides an opportunity for technical, aesthetic and design competency to grow through the exploration of hand and machine tools; solid wood theory, joinery and practice; veneer theory, and practice; production theory; chair, table, cabinet design and construction. This sequence leads to the master's thesis, suggested by the student and approved by the faculty.

Lab 9-27, Credit 3-9 (offered every quarter)

Thesis

FSC (C, G, M, T or W)-890   **Research and Thesis Guidance**

Registration #04 (09,11,12,13, or 14)-890   **(Major MFA only)**

Research and presentation of an acceptable thesis with a focus on technique, design, and/or production. The thesis subject will be chosen by the candidates with the approval of the faculty advisor. The thesis will include a written summation or report of the research and participation in the graduate thesis show.

Lab 27, Credit 3-14 (offered every quarter)

College of Graphic Arts and Photography

Dr. Edward C. McIrvine, Dean

The College of Graphic Arts and Photography represents what RIT is all about—an interdisciplinary institution. A broad range of disciplines is available to students including design, science, technology, engineering, and management, as well as world-class faculty, who are at the forefront of their disciplines.

Six graduate programs are offered in the field of imaging arts and sciences: **master of science degree in graphic arts systems, master of science degree in graphic arts publishing and master of science degree in printing technology** from the School of Printing Management and Sciences; **master**

of science degree in imaging science and a **master of science degree in color science, appearance and technology** from the Center for Imaging Science. The School of Photographic Arts and Sciences offers a **master of fine arts degree in photography** and an advanced certificate in electronic and optical storage.

With over $70 million in state-of-the-art and advanced equipment supporting course work and research, students have the opportunity to excel in their chosen areas of emphasis.

The advancement of our graduates upon employment is excellent; their successes are what our programs are all about—excellence through learning.

Master of Science Degree Programs in the 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.

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. Applicants are also encouraged to take the Graduate Record Examination (GRE) as an aid in counseling during the development of the individual's program of studies.
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 3.0 or higher,

   if required
TOEFL score of at least 525
   (international students)

Application deadlines
Candidates are encouraged to apply to the graduate program at any time during the year. However, the necessity to take foundation courses before the start of the required course sequence in the Fall Quarter requires that several deadlines for application must be established. These deadlines will allow sufficient time for accepted candidates to make arrangements to attend the Spring Quarter and/or Summer Session to complete their foundation requirements in time to start the required core program in the Fall Quarter.

Candidates who have determined that they will need the majority of foundation courses should apply by January 16,1989.

Candidates who have determined that they will need the minimum of foundation courses should apply by April 28,1989.

Candidates who hold an undergraduate degree in printing and have determined that they meet all foundation course requirements should apply before July 28, 1989.

Summer session
The School of Printing Management and Sciences operates a unique Summer Session program that offers course work in two-week, concentrated sessions. This allows the candidate for a graduate program to take several foundation courses, including the special foundation course in chemistry. It also provides an opportunity for the student to take part in a wide assortment of the school's undergraduate course offerings, beyond the required foundation courses.

Special libraries
Students may use two special libraries related to the school. The Technical and Education Center of the Graphic Arts maintains a library of current printing-related information. Some students find employment in the center writing abstracts for its publications. The School of Printing Management and Sciences has the Melbert B. Cary,Jr. Graphic Arts Collection, composed of more than 9,000 volumes including many rare books and other materials illustrating past and present fine printing, book design and illustrations, papermaking, binding, and other aspects of the graphic arts. The Frederick W. Goudy-Howard W. Coggeshall Memorial Workshop contains letters, papers and memorabilia of Mr. Goudy along with cases of Goudy types that can be seen only at RIT, because matrices for their manufacture were destroyed by fire in 1939.

Master of Science Degree in Graphic Arts Publishing

Dr. Mark F. Guldin, Coordinator
(716) 475-5484

Today's printing and publishing industry is the seventh largest industry in the country, producing more than $129 billion in products in 1987. Because the industry is undergoing massive technological change and increasing its production by about $10 billion annually, it is in need of increased numbers of employees who are better educated than in the past and who are highly flexible and innovative in decision making. Employment in printing and publishing is projected to grow at an annual rate of 1.1 percent from 1986 through the year 2000.

One of today's key areas in the printing and publishing industry is the production and publication of magazines and books, together accounting for $34.5 billion in products in 1987. The MS degree program is oriented toward educating individuals of high competency for technical production and management positions in the multifaceted publishing industry.

Program orientation
Most existing courses of study in publishing taught in the United States are concerned with the historical/editorial/advertising aspects of the industry. This new program addresses publishing from the technological/production viewpoint (including its management) and how it interrelates with the historical, advertising, circulation, and fulfillment functions. The program is open to students with a variety of undergraduate degree backgrounds. Therefore, a foundation program of courses has been made available for all applicants into the Graphic Arts Publishing Program.

The options
The Graphic Arts Publishing Program has four options.

Typography and Printing Design
This option prepares students to make responsible management-level decisions affecting printing design, typographic specifications, planning, scheduling, copy and film organization and budgeting/estimating functions. Graphic arts publishing concerns are an integral part of the option core and elective course work. Option content is concentrated in pre press areas and is specifically structured to develop practical and theoretical skills which will enable the graduate to function successfully as art director, type director, corporate printing buyer, production art director, or account executive.

The unique structure of the Typography and Printing Design Option allows professional-level development at an accelerated pace, thereby permitting a modest investment in student time. Interrelationships among the design and typography disciplines with all the major printing processes are thoroughly explored. The goal is to build within each student a firm foundation of printing technology on which sensitive, precise, and practical aesthetic judgment will rest.

Magazine Publishing
This option is specifically designed to prepare graduates for careers in magazine publishing. It includes all aspects of publishing from the editorial function to production and distribution, and concentrates particularly on decision making at the management level in the publishing production functions. An overview of contemporary publishing includes studies on publishing strategies for magazines with particular emphasis on the critical role played by the production manager. Graduates of the Magazine Publishing Option will fully qualify for positions in all areas of magazine production, including production manager, design production, technical sales, and systems management.

The Magazine Publishing Option gives students an aesthetic and practical appreciation of the large-scale development in composition, printing, binding, and distribution, factors, which have made today's magazines so dynamic. In addition, the interrelationships among the major printing processes and production systems are thoroughly examined, and important interpersonal relationships among production, editorial, and design personnel are explored. As in the other options, both the core curriculum and elective course work in the Magazine Publishing Option will utilize the extensive graphic arts laboratories and classroom facilities, the Institute's Wallace Memorial Library, and two specialized libraries in the College of Graphic Arts and Photography.

Fine Printing

This option is specifically oriented toward the "book arts." The student will acquire a fundamental theoretical knowledge of graphic reproduction technology, make an in-depth investigation into the history of the book and typeface development, including a thorough acquaintance with paper, type, printing and binding through a series of lectures and integrated laboratory courses.

The option will appeal most to those students who eventually would like to establish a small press or fine printing firm, or who would like to work for a book publisher in a variety of positions. Some students may wish to develop the ability to select high-quality (and compatible) materials and acquire a familiarity with short-run printing technology.

Other students may be attracted by the chance to use historic printing equipment, or by exercising their creative and hands-on abilities to design and produce a small book, retaining absolute control over all aspects of production. To meet these needs, students in the Fine Printing Option will have ample opportunity to use the school's renowned hand composition laboratory, monotype and linotype equipment, and will learn to print on a wide variety of relief presses ranging from Washington hand presses and precision proofpresses to sheet-fed production presses. On the other hand, those students who wish to explore state-of-the-art technology in screen printing and lithographic processes will be given ample opportunity to register for courses in those disciplines.

Electronic Publishing

(Starting Date to be Determined)

This option is systems oriented and focuses on the various segments of electronic publishing from the most elaborate segment of the high-volume production of prototypes of newspapers, catalogs and magazines to the single user, desktop systems for producing newsletters, office forms and short reports. The growth potential of the electronic publishing industry will be startling, escalating from $5.5 billion in revenues in 1985 to an estimated $50 billion by 1990. Both corporate and commercial markets for electronic publishing will need experienced individuals to work as publishing systems architects, font and format managers, specialized programmers, and corporate publishers.

To produce these individuals for industry, this option is made up of course work in the theoretical aspects of publishing and reproduction technologies, software and hardware considerations, and management strategies for electronic publishing centers. This option will utilize new electronic publishing laboratories equipped with the latest in electronic publishing computers, typesetters and printers. Like the other Graphic Arts Publishing options, a thesis, research paper, or project is required for graduation.

Thesis requirements

All four options in the Graphic Arts Publishing Program will require a thesis or a project of thesis equivalency. The primary purpose of the thesis is to demonstrate original thinking, creativity and research in areas decided upon by the students with the guidance and consent of their advisors. The thesis may take on different forms, subject to the approval of the advisor: printed specimens with written summary of purpose and procedure, written research report, or an electronic film or video presentation along with a written summary of purpose and procedure.

Foundation Program

A foundation program is completed by all applicants prior to being matriculated into the Graphic Arts Publishing Program. It is intended that the foundation program will provide each student with the necessary background in printing and publishing prior to matriculation.

Each student's background will be surveyed in terms of education and experience to determine the amount and kinds of course work each will be required to complete.

Those students anticipating a concentration in Typography and Printing Design should demonstrate competence through undergraduate course work or professional experience in layout and design, graphic design, or other related areas. Foundation Program courses will be selected from among the following:

		Credit (Q.H.)
0911-700-03	Printing Design and Layout	3
0911-700-04	Reproduction Photography	3
0911-700-05	Lithographic Press and/or Gravure	3
0911-700-06	Planning and Finishing	3
0911-700-01	Typography I	3
0911-700-02	Composition Technology **I**	3
0911-700-08	Applications of Computers in the Graphic Arts	3
0911-700-52	Chemistry Preparation for Printing Graduate Study	3
	Technical Writing	3
	Financial Controls**	3

Foundation course requirements may be satisfied by the completion of equivalent course work at other colleges or universities and are determined during the review process.

Students will be asked to take courses from the above Foundation Program based on their previous education and experience.

**Or an introductory-level accounting course covering managerial and financial accounting*

Students are permitted to begin their regular graduate classes only in September. Foundation courses are taken in the preceding Spring and Summer quarters.

NOTE: The graduate faculty is reviewing the foundation course curriculum at this writing. Changes may be made in course design for the Spring Quarter. Contact the department for current information.

Required graduate degree courses

Typography and Printing Design

Fall

*0911-702	Graphic Reproduction Theory	4
*0911-713	Phototypography Procedures	4
*0911-723	Contemporary Publishing	3
0911-725	Typefaces, Their Development, Classification and Recognition	3
Elective		_4
	Total Credits	18

Winter

0911-727	Typographic Style-Development	3
0911-729	Computer-Aided Printing Design and Copy Preparation	4
0911-730	History of the Book	3
Elective		_8
	Total Credits	18

Spring

*0911-754	Ink, Color, and Substrates	4
*0911-711	Tone and Color Analysis	4
0911-890	Thesis	5
Elective		_3
	Total Credits	16

Magazine Publishing

Fall

*0911-702	Graphic Reproduction Theory	4
*0911-713	Phototypography Procedures	4
*0911-723	Contemporary Publishing	3
0911-725	Typefaces, Their Development, Classification and Recognition	3
Elective		_4
	Total Credits	18

Winter

0910-708	Marketing & Economic Planning in Graphic Communications Production	4
0911-732	The Editorial Function	3
0911-733	Production Function	4
0911-734	Advertising, Circulation and Fulfillment	3
Elective		_4
	Total Credits	18

Spring

*0911-754	Ink, Color, and Substrates	4
*0911-711	Tone and Color Analysis	4
0911-890	Thesis	5
Elective		_3
	Total Credits	16

Fine Printing

Fall

*0911-702	Graphic Reproduction Theory	4
*0911-713	Phototypography Procedures	4
*0911-723	Contemporary Publishing	3
0911-725	Typefaces, Their Development, Classification and Recognition	3
Elective		_4
	Total Credits	18

Winter

0911-737	Book Production	3
0911-730	History of the Book	3
0911-738	Machine Typesetting	4
0911-739	Paper & Binding for the Fine Printer	4
	Relief Printing	_4
	Total Credits	18

Spring

*0911-754	Ink, Color, and Substrates	4
*0911-711	Tone and Color Analysis	4
0911-890	Thesis	5
Elective		_3
	Total Credits	16

Core courses

Elective courses are selected by the student to develop additional expertise in a particular area of interest. Elective courses must have the program coordinator's approval.

Program equipment

The School of Printing Management and Sciences has state-of-the-art printing equipment valued at $60 million. This equipment is available to all graduate students for industrial and research purposes.

Students in the Typography and Printing Design Option will receive optional laboratory work in the Typography, Design, Composition Systems, and other pre press laboratories, utilizing both traditional and the latest computer-aided design equipment. Magazine Publishing majors have access to a broad spectrum of equipment to observe and utilize, from the latest in computer-based typesetting systems to a new Harris M1000B publication press recently installed in the college's Technical and Education Center. The Scitex 350 digital image processing system will be of great value to this and other options as well as the 399 Hell scanner and the Crosfield Studio 800 system.

Students in the Fine Printing Option will use the school's traditional hand composition, linotype and monotype equipment, as well as letterpress, offset, bindery and other equipment normally used by the fine printer. In addition, students matriculated into the Electronic Publishing Option will work with the latest in electronic equipment, including, the Kodak KEEPS system, Xerox Star 8010 system and the Compugraphic MCS system with its companion flat-top scanner for integrating text and halftone illustrations. The starting date for the Electronic Publishing Option, however, has not yet been determined.

The equipment is not only used to reinforce the theoretical aspects of the program, but also to give students at the graduate level first-hand knowledge of considerations in managing a state-of-the-art publishing operation.

Program requirements

In addition to general admission requirements for all graduate students in the School of Printing Management and Sciences, students selecting the Typography and Printing Design Option must demonstrate competence in aesthetic applications.

If the applicants have completed all admission requirements, they will be conditionally accepted as graduate students pending the successful completion of any required foundation courses.

Master of Science Degree in Graphic Arts Systems

Barbara A. **Birkett,** Coordinator
(716) 475-2889

Today's printing industry is technology driven, competitive, and rapidly changing. Because of the broad range of company size and structure, the printing industry provides graduates with many opportunities, from exercising the entrepreneurial spirit of ownership to becoming a part of a large multinational firm. But whatever the size, to be effective and to feel comfortable in this changing environment, graduates must have honed managerial skills and solid technical knowledge.

Today's graduates must be equipped with people skills and a knowledge of financial controls, cost allocation systems, pricing strategies, and long- and short-range planning. A printing leader must be vitally aware of how competitors are adapting to the environment: what markets are they going after; what specializations are they developing; and what pricing strategies are they using?

Graduates who have a solid technical background have a distinct advantage: they do not have to "learn on the job." They are ready to assume responsibility. As complex as the technology is, it must be applied in a specific plant, in a specific locale, with specific employees. Graduates need to be aware of technology's limits and to see opportunities for new research, new techniques, and new applications. In short, they must be in control.

Program objective

The MS degree program in Graphic Arts Systems seeks to meet the challenges of the printing industry. It provides graduates with the managerial and technical knowledge needed to be effective.

The program should be of particular interest to non printing undergraduates, such as journalism, English, business, history, psychology, and other liberal arts and technical majors. Abilities developed in undergraduate work, such as to comprehend, analyze, and communicate, become the foundation of graduate study. This program focuses students' skills on a variety of roles within the printing industry, whether administration, production, or sales. It provides students with the requisite knowledge needed to understand and control the processes for which they are responsible.

The program

The Graphic Arts System Program requires 48 credit hours of graduate work, 36 of which must be taken at RIT. Twelve of the 48 hours—essentially three courses—are electives selected by the student to develop expertise in an area of particular interest Elective courses must have the coordinator's approval.

Students are permitted to begin their regular graduate classes only in September. Foundation courses are taken in the preceding Spring and Summer quarters.

Project design (Course 850)

In the Spring Quarter, the student must complete a project related to graphic arts systems. The student is responsible for selecting the topic and type of project; however, the project must include a written report documenting the project work. The student must review the project with the program coordinator during the Winter Quarter before being allowed to register for the project design course.

Foundation courses

Foundation courses, scheduled in the Spring and Summer quarters, provide students who have little or no printing or managerial background with the opportunity to gain the required background before commencing their regular courses in the Fall Quarter. Student backgrounds are evaluated individually to determine foundation course requirements. Many students will have had equivalent courses in their undergraduate degree work. The student's individual foundation program of courses must be completed before beginning the regular graduate degree requirements in September.

NOTE: The graduate faculty is reviewing the foundation course curriculum at this writing. Changes may be made in course design for the Spring Quarter. Contact the department for current information.

Foundation courses for the graphic arts Systems Program

0911-700-01	Typography I	
0911-700-04	Reproduction Photography	
0911-700-05	Lithographic Press	
0911-700-06	Planning and Finishing	
0910-240	Printing Financial Controls	
	or	
	Introductory accounting course covering financial and managerial accounting	
0910-280	Printing Management Leadership Concepts	
	or	
	Organizational Behavior	
	Introduction to Economics	
	Computer Literacy	
	Writing Competency	
	College course in mathematics or statistics	
	College course in physics or chemistry	

Required graduate degree courses

0911-702	Graphic Reproduction Theory	4
0910-705	Estimating and Analyzing in Graphic Arts Systems	4
0910-706	Operations Management in the Graphic Arts	
	or	
0106-743	Operations Management	4
0910-708	Marketing and Economic Applications in Graphic Communications	
	or	
0105-761	Marketing Concepts	4
0911-709	Trends in Printing Technology	4
0911-711	Tone and Color Analysis	4
0911-713	Phototypographic Procedures	4
0911-722	Ink, Color and Substrates	4
Elective		12
0910-850	Project Design	_4
	Total Credits	48

A typical schedule of courses
Fall

0911-702	Graphic Reproduction Theory	4
0911-709	Trends in Printing	4
0911-713	Phototypographic Procedures	4
Elective		_4
	Total Credits	16

Winter

0910-706	Operations Management in Graphic Arts	
	or	
0106-743	Operations Management	4
0910-708	Marketing and Economic Applications in Graphic Communications	
	or	
0105-761	Marketing Concepts	4
0910-705	Estimating and Analyzing in Graphic Arts Systems	4
Elective		_4
	Total Credits	16

Spring

0911-711	Tone and Color Analysis	4
0911-754	Ink, Color and Substrates	4
Elective		4
0910-850	Project Design	_4
	Total Credits	16

Master of Science Degree in Printing Technology

Joseph L. Noga, Coordinator
(716)475-2849

Technology in the printing industry continues to evolve rapidly with the incorporation of innovative materials and concepts from other disciplines. This evolution covers all aspects of graphic communication as well as such non-communicative graphics as circuit printing and textile decorating. The graduate program is designed to help the student remain current after leaving RIT.

This graduate program is specifically arranged for students so that completion prepares them for participation in a volatile industry whether in production, research or other functions, as well as for the possibility of a career in teaching. In this regard, the program rests on theory and the applications of basic theory along with training in the use of modern equipment The student must complete a thesis allowing him or her to bring to bear acquired knowledge on a specific problem. Thesis work affords the student the opportunity to contribute to the knowledge of the printing technologies. This work is done under the guidance of faculty experienced in that area of printing on which the student has chosen to focus.

This graduate program recognizes the value of aesthetics in the graphic arts and allows opportunity for the student to bring technology to bear on design and attractive form. Those students whose interests run heavily to this aspect of printing, such as book design, are encouraged to master the technology so that thesis work can apply technology to aesthetic goals. The program remains a technical one, however, with strongest attraction for the students primarily interested in technology.

The program

The printing technology curriculum leading to a master of science degree in the School of Printing Management and Sciences is a professional program designed to provide graduate education in printing for students whose undergraduate majors were in the arts, sciences, education, or other non-printing areas, as well as for graduates with a major in printing. Candidates who do not have adequate undergraduate work in printing must make up foundation courses prior to starting the required core program.

The printing technology major provides graduate level study in printing technology and in research methods. The program is not intended to give a broad exposure of the printing field, but to provide the student an opportunity to specialize in a particular area, and to develop research skills useful to the graphic arts. This objective is accomplished through the program's core courses, selection of electives, and the development of the thesis. The goal of the program is to educate students who will have, in addition to an understanding of the procedures and theoretical concepts in printing processes, an appreciation of particular problems in special areas at an advanced level. The students wishing to take additional course work to explore areas beyond the course requirements of the program are encouraged to take additional course work to broaden their experience in the printing field.

The printing technology major is a full-time master's degree program. The length of time required to earn a degree varies according to the student's undergraduate preparation in printing, mathematics, and science. All students must earn 48 credits as a graduate student, 36 of which must be taken at RIT, to earn the master of science degree. The program generally requires one academic year at the graduate level. Candidates who wish to enter the program, but lack adequate preparation, must take as many as 28 credits of foundation courses in printing, mathematics and science prior to starting the required core program. Foundation courses can be accomplished in the Spring Quarter and the Summer Session. With foundation course work completed, the candidate will start the core graduate program sequence with the Fall Quarter.

Program objectives

The goal of the technology major is to graduate well-educated students in both the theoretical and practical aspects of graphic arts technology. The program will provide graduates with the necessary education to approach solutions to printing problems by an orientation to processes and materials based on systematic analysis.

Preparation in the technology major provides entry as a professional into the printing field in areas such as production management, research and development, technical sales representative, quality assurance, administration, marketing, etc. Because the printing industry is large and extremely varied, the student's overall preparation, interest and background would allow for entry level positions in these and in a number of other areas in the printing industry.

The foundation program

The technology major is designed for the candidate who has an undergraduate degree in a discipline other than printing, or for the candidate with an undergraduate degree in printing. The program offers an excellent opportunity for the individual who wishes to change his or her career goals, by preparing the student for entry-level positions in the printing field.

Candidates with the necessary undergraduate course work will start the required graduate core program with the Fall Quarter. Candidates without adequate undergraduate course work in printing must take foundation courses prior to starting the required core program sequence. These students will enter the School of Printing Management and Sciences as a matriculated graduate student with the classification of Conditional Matriculation. Foundation courses must be completed (with an overall B average) before a student can begin the required graduate core program. As students approach completion of the foundation course work, they will each petition to begin the required core program. If petitioning students have no more than two foundation courses to complete prior to the start of the Fall Quarter, they will be granted permission to begin the required core courses. The remaining foundation courses will be added to the student's program requirements and must be completed with all other requirements for the graduate degree.

In addition to basic printing courses, course work in mathematics and science is expected if these courses are not indicated on the candidate's transcript. A technology degree requires entering students to have a minimum level of competency in mathematics and science. This will be helpful in the program and in the student's research activities. Basic knowledge of printing before starting the required core program will be helpful in giving the student more direction in terms of career goals, and assist in the development of a thesis topic at an early stage in the graduate program. Six basic undergraduate printing courses, two in mathematics and one course in the physical sciences, are required.

The basic foundation course work can be taken during the Spring Quarter and the Summer Session. The foundation courses are not offered during any other quarter during the school year. The number of foundation courses required of a candidate will be determined by a review of the candidate's transcripts during the admissions process. Candidates may need to attend both the Spring Quarter and the Summer Session, or they can complete foundation courses during the Summer Session if only a few courses are required. The number of courses required can be different for each candidate and is dependent on the individual's background at the time of application for admission to the program.

To aid the candidate with the science requirement, a special chemistry course is offered in the school's Summer Session program, Chemistry Preparation for Printing Graduate Study. It is important that candidates apply early so that the transcripts of accepted applicants can be evaluated to determine if foundation courses will be required. In this way, students will be notified in sufficient time to determine if they will need to attend the Spring Quarter and Summer Session or if they can meet their foundation requirements within one term.

Students will be notified as to the schedule of foundation courses for the Spring Quarter and Summer Session at the time they receive their acceptance letter.

Candidates who feel they would like to have a foundation requirement waived because of work experience can contact the instructor of that discipline and request an interview. If the instructor waives that requirement, the candidate will have that foundation course removed from his or her requirements.

Foundation courses

The courses listed below represent the graphic arts areas required to meet foundation course requirements.

Printing (Five Courses)

0911-700-01	Typography I
0911-700-04	Reproduction Photography
0911-700-05	Lithographic Press
0911-700-06	Planning and Finishing
0911-700	Application of Computers to the Graphic Arts

NOTE: These are the only printing subject areas acceptable to meet the foundation course requirements. Printing courses in other subject areas will not be accepted.

Mathematics (Select Two Courses)

SMAM-204 College Algebra

or

SMAM-214 Introductory Calculus

or

SMAM-225 Algebra for Management Sciences

or

SMAM-226 Calculus for Management Sciences

PPRM-210 Financial Controls I

Physical Science (Select One Course)

General College Chemistry

General College Physics

PPRT-560 Chemistry Preparation for Printing Graduate Study

NOTE: The graduate faculty is reviewing the foundation course curriculum at this writing. Changes may be made in course design for the Spring Quarter. Contact the department for current information.

Program requirements

The master of science degree program in printing technology requires the completion of 48 quarter credit hours of study including eight hours for the thesis. If foundation courses are not required, the program can be completed in one academic year. The program's length is based on each individual's program of study and the length of time each student chooses to complete his or her thesis work. Students who are qualified in one or more of the required courses may substitute other course work with the permission of the program coordinator.

Technology major
Required courses

701-Research Methods	4
709-Trends in Printing Technology	4
702-Graphic Reproduction Theory	4
703-Statistical Inference	4
713-Phototypography Procedures	4
711-Tone and Color Analysis	4
722-Ink, Color and Substrates	4
Electives	12
890-Thesis	8
Total Credits	48

A **typical schedule of courses**
Fall

702-Graphic Reproduction Theory	4
709-Trends in Printing Technology	4
713-Phototypography Procedures	4
Elective	4
Total Credits	~~16

Winter

701 -Research Methods	4
703-Statistical Inference	4
Electives	8
Total Credits	~~16

Spring

711-Tone and Color Analysis	4
722-Ink, Color and Substrates	4
890-Thesis	8
Total Credits	16

School of Printing Management and Sciences

PPRM-702   **Computers in Management**

Registration #0910-702

An applications workshop which covers printing requirements in relation to computer systems configurations; applications of computers to management and production control problems; investigation of computer-oriented production control techniques. (PPRM-301)

Credit 4

PPRM-850   **Project Design**

Registration #0910-850

The student selects, plans, organizes, and investigates a topic in the field of graphic arts systems and produces a suitably documented, tangible report of thesis quality. The student is responsible not only for originating and doing the project, but also for obtaining a faculty sponsor for the project.

Class 4, Credit 4

PPRT-701   **Research Methods in Graphic Arts**

Registration #0911-701

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 including ink and paper, reproduction methods, and quality control.

Class 4, Credit 4

PPRT-702   **Graphic Reproduction Theory**

Registration #0911-702

Analysis of the basic theories of graphic reproduction and study of the principles underlying prevalent and proposed printing processes; special topics such as classification and description of the various light-sensitive systems as applied to the graphic arts, ink transfer theory, present and proposed systems of printing based on electrostatics; electrolysis, magnetism and lasers; study of hybrid systems and the significance and application of interdisciplinary methods. The Neugebauer and color correction equations.

Class 4, Credit 4

PPRT-703   **Statistical Inference**

Registration #0911-703

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

PPRM-705   **Estimating and Analyzing in Graphic Communications**

Registration #0910-705

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 estimating, pricing and the supply and demand forces which occur in the marketplace, and to expose the student 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 on a written term paper on a computerized solution, of the student's own design, to an estimating, pricing, time study or other cost-related problem of special interest to the student.

Class 4, Credit 4

PPRM-706   **Operations Management in Graphic Arts**

Registration #0910-706

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 managing personnel.

Class 4, Credit 4

PPRM-708   **Marketing and Economic Applications in Graphic Communications**

Registration #0910-708

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 material.

Class 4, Credit 4

PPRT-708   **Introduction to Systems Analysis**

Registration #0911-708

Problems of systems analysis in printing operations for the highest quality product at the minimal cost including optimal floor designs and methods of study. (PPRM-301)

Class 4, Credit 4

PPRT-709   **Trends in Printing Technology**

Registration #0911-709

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

PPRT-711   **Tone and Color Analysis**

Registration #0911-711

A study of the methods and instrumentation necessary for the evaluation of printed materials for product quality assurance. The ultimate objective being the optimization of the production processes and the control of those processes.

Credit 4

PPRT-713   **Phototypography Procedures**

Registration #0911-713

Utilizing phototypesetting equipment, the student learns to develop the typographic skills necessary to plan and mark-up typesetting jobs so that the end results will closely match the original concept. Coding, format planning and development are taught so that the student will feel at ease in the creation and completion of the projects. Lectures include the aesthetics and technical information on phototypesetting equipment; mark-up; system analysis of equipment; and front-end systems.

Credit 4

PPRT-722   **Ink, Color and Substrates**

Registration #0911-722

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.

Credit 4

PPRT-723   **Contemporary Publishing**

Registration #0911-723

An overview of contemporary book, magazine and newspaper publishing with emphasis on comparative editorial, production, circulation and marketing strategies. Analysis of 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.

Credit 3, Credit 3

Typefaces: Their Development, Classification
PPRT-725   **and Recognition**

Registration #0911-725

This in-depth course deals with the historical development of typefaces to the present time. Proposed classifications systems are discussed. Students will be encouraged to develop a system to suit their own needs. A system for substituting typefaces also will be a major consideration of this course. Factors that aid in the identifying of typefaces are shown through the extensive use of slides. Students will be expected to write two papers. (PPRT-713)

Class 3, Credit 3

PPRT-727   **Typographic Style Development**

Registration #0911-727

A course created with the idea that students will develop a corporate style manual. At the end of the course students will make a presentation of their style manual and show examples of its implementation.

Categories that will be included, but not necessarily limited to, are "Looks," editorial style, terminology, typefaces, illustrations, document structures. Extensive library research will be expected. Examples of style manual implementation will be produced during the lab time. (PPRT-713)

Class 3, Credit 3

Computer-Aided Printing Design
PPRT-729   **and Copy Preparation**

Registration #0911-729

An in-depth study of methods of preparing camera-ready copy. Applications of these methods to line and continuous tone images for reproduction, leading to considerations and implications for use of electronic advancements in the pre-press area. Page make-up (pagination) and grid systems will be incorporated into copy assembly, facilitating multipage, color reproduction and special effects. Extensive utilization of slides and other visual aids including professional samples and demonstrations of various methods and equipment.

Class 4, Credit 4

PPRT-730   **History of the Book**

Registration #0911-730

The "book," or codex, in manuscript and printed form, has served for over a thousand years as the principle 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 3, Credit 3

PPRT-732   **The Editorial Function**

Registration #0911-732

An examination of the historic forces that have helped to shape the structure of magazines today, and how this structure has affected the administrative and editorial functions of these magazines. The future of magazines also will be considered. Course conducted by lecture and discussion.

Class 3, Credit 3

PPRT-733   **Production Function**

Registration #0911-733

An examination of the various operations involved in the production of a magazine along with designing the optimum system of production for a given magazine. The interrelatedness of the various production operations also will be studied. Course conducted by lecture and discussion.

Class 4, Credit 4

PPRT-734   **Advertising, Circulation, and Fulfillment**

Registration #0911-734

An examination of magazine advertising, circulation, fulfillment, and distribution functions as they affect the marketing of magazines. The impact of the legal aspects of publishing upon advertising and distribution will be examined. Course conducted by lecture and discussion.

Class 3, Credit 3

PPRT-737   **Book Production**

Registration #0911-737

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

PPRT-738   **Machine Typesetting**

Registration #0911-738

An introduction to hot metal typesetting in which students will become familiar with the mechanisms of the Linotype, Monotype and Ludlow systems. Emphasis on developing a good background in machine operation and ability to select proper equipment for private press use.

Class 4, Credit 4

PPRT-739   **Paper and Binding for the Fine Printer**

Registration #0911-739

The first half of this course is a study of the papers—handmade, fine mould or machine-made—suitable for fine printing with an emphasis on those which may be used in relief processes, through papers suitable for offset printing.

The second half of the course will cover contemporary binding techniques used for limited editions. Sewn and adhesive bound structures with various endpaper constructions will be studied and practiced. Full- half- and quarter-case bindings, including slipcase making will allow a student to become competent in making those important decisions on bindings used in book manufacture.

Class 4, Credit 4

PPRT-740   **Relief Printing**

Registration #0911-740

An introduction to the techniques of relief printing as applied to type and illustration. Basic operational procedures and individual make-ready and lock-up techniques will be demonstrated and practiced for printing press that will include Washington Handpress, Heidleberg platen press and the Vandercook Proof Press.

Class 4, Credit 4

PPRT-741   **Image Processing Systems**

Registration #0911-741

This course will introduce the student to the concepts underlying the digital representation and manipulation of images. Students will be evaluated based upon examinations and a term project.
Class 4, Credit 4

PPRT-742   **Document Processing Languages**

Registration #0911-742

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

PPRT-743   **Markets for Electronic Publishing**

Registration #0911-743

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

PPRT-745   **Management Strategies for Corporate and Commercial Publishing Enterprises**

Registration #0911-745

An examination of the strategies in the operation and management of both corporate and commercial publishing enterprises, including organization and administration, employee considerations, work flow, marketing and sales, and financial matters including chargeback systems. Course conducted by lecture and discussion.

Class 4, Credit 4

PPRT-760   **Advertising**

Registration #0911-760

This course will examine the origins of advertising and its development into the major force it exerts on our lives today. An inquiry of the various media will be pursued with primary attention focused on print advertising. The role of the advertising agency will be explored. The different types of advertising and the various stages of advertising will be examined. The course will include several weekly quizzes and both a mid-term and final examination.
Class 3, Credit 3

PPRT-765   **Corporate/Electronic Composition Systems**

Registration #0911-765

A combination lecture and laboratory course dealing with the image processing systems and in electronic publishing. A comparative study from a technical as well as aesthetic perspective. Specialized hardware and software are analyzed in three class projects.
Class 4, Credit 4

PPRT-767   **History of Letters**

Registration #0911-767

This course will examine the origins of man's desire to record graphically events that were important in his life. It will trace man's first crude attempts scratched on bone and rock to the sophisticated sound/symbol alphabets of the present. The main evolutionary steps in this process will be emphasized. The tools used and how they influenced the forms will be stressed. Technology's influence also will be part of this process. Periodic quizzes and both a mid-term and final examination will be utilized.
Class 3, Credit 3

PPRT-850   **Research Projects**

Registration #0911-850

Individual research projects in which independent data is collected by the student, followed by analysis and evaluation. A comprehensive written report is required. Consent of advisor is required.
Credit variable 14

PPRT-890   **Research and Thesis Guidance**

Registration #0911-890

An experimental survey of a problem area in the graphic arts.

Credit 8

Graduate Faculty School of Printing Management and Sciences

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Barbara Birkett, MBA, University of Michigan—Assistant Professor, Technical Writing/Financial Controls, Graduate Program Coordinator of Graphic Arts Systems

William H. Birkett, MBA, University of Michigan, C.MA.—Associate Professor, Printing Management

Joseph E. Brown, Jr., MS, Kansas State-Professor, Paper Technology

Walter A. Campbell, M. Ed., MBA, University of Rochester—Professor, Printing Management

Robert Y. **Chung,** MS, Rochester Institute of Technology—Associate Professor, Computer Technology

John Compton, MS, Rochester Institute of Technology—Professor, Quality Control

Frank Cost, MS, Rochester Institute of Technology—Assistant Professor, Coordinator, Printing and Applied Computer Science

W. Frederick Craig, M. Ed., University of Rochester—Associate Professor, Newspaper Production Management

Chester J. Daniels, MS, Rochester Institute of Technology—Senior Technologist, Technical and Education Center of the Graphic Arts

Joseph L. DeLorenzo, Ph.D., Boston University—Professor, Electronic Communications

Hugh R. Fox, Ph.D., Rutgers University-Assistant Professor, Printing Management

Clifton T. Frazier, M. Ed., University of Rochester—Associate Professor, Photo-Lithography Technology

Marie Freckleton, MST, Rochester Institute of Technology—Assistant Professor, Printing Design

Edward Granger, Ph.D., University of Rochester—Graduate Printing Faculty, Professor, Center for Imaging Science, Sr. Staff, Graphic Imaging, Div. of Eastman Kodak Company

Mark F. Guldin, Ph.D., University of Iowa—Melbert B. Cary, Jr., Professor of Graphic Arts, Graduate Program Coordinator of Graphic Arts Publishing

Robert G. Hacker, Ph.D., University of Iowa—Paul and Louise Miller Professor in Newspaper Management, Computer Applications

Sam Hoff, MS, California State University—Assistant Professor, Screen Printing/Image Assembly

Walter G. Home, M. Ed., University of Rochester—Professor, Printing Plate Technology

Charles Layne, Ph.D., The Ohio State University—Director, Industry Education, Technical and Education Center

Jooseph L. Noga, MS, University of Bridgeport—Professor, Electronic Color Imaging, Graduate Program Coordinator of Printing Technology

William Pakan, Ph.D., Kent State University—Professor, Printing Management

David Pankow, MLS, Columbia University, New York City—Curator, Melbert B. Cary, Jr. Graphics Arts Collection

Archibald D. Provan, M. Ed., University of Rochester—Associate Professor, Typography

Harry Rab, MSME, Newark College of Engineering—Associate Professor, Electro-Mechanics of Printing

Emery E. Schneider, M. Ed., University of Rochester—Associate Professor, Phototypesetting

Franz Sigg, MS, Rochester Institute of Technology—Research Associate, Technical and Education Center of the Graphic Arts

Julius L. Silver, Ph.D., Connecticut-Professor, Ink Technology, Graphic Theory

Miles F. Southworth, M. Ed., University of Rochester—Professor, Director, School of Printing Management and Sciences

Charles J. Weigand, MS, SUNY at Oswego—Associate Professor, Flexographic Technology

Associates of the Graduate Faculty

Herbert H. Johnson, BS, Rochester Institute of Technology—Associate Professor, Book and Magazine Production

Werner Rebsamen, Diploma, Academy of Fine Arts, Zurich—Professor, Planning and Finishing
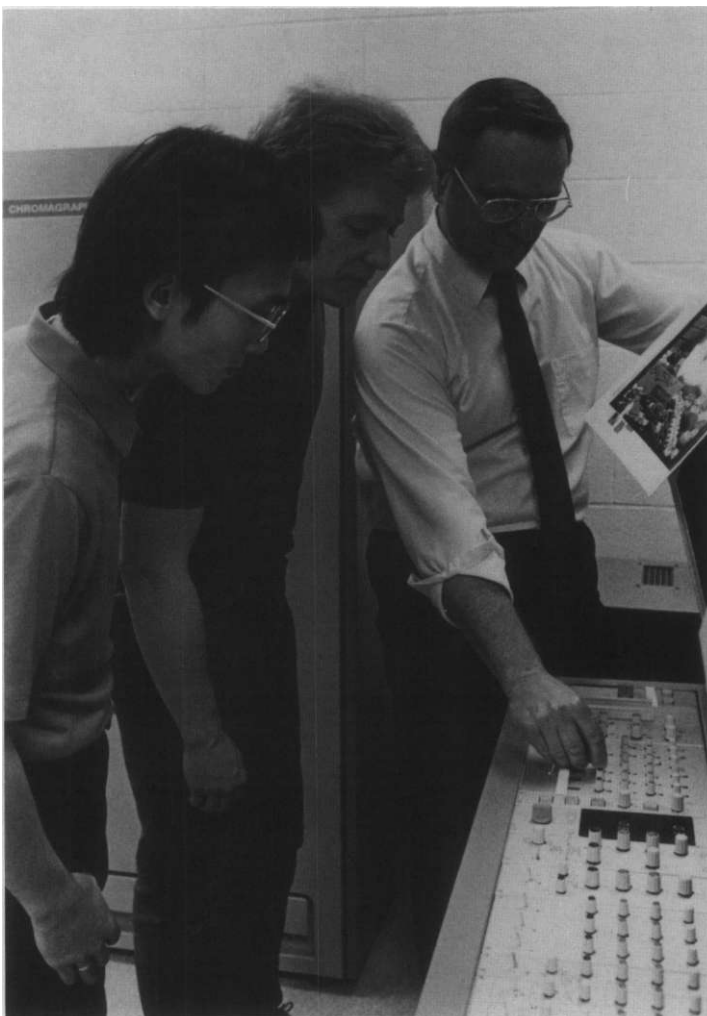
Master of Science Degree Programs in the Center for Imaging Science

The Center for Imaging Science was established in 1985 as an interdisciplinary focus for the study of all aspects of imaging. The Munsell Color Science Laboratory, within the Center for Imaging Science, is devoted to the study of color science, appearance, and technology. Graduate programs within the Center for Imaging Science lead to MS degrees in imaging science and color science, with much flexibility, and an overlap is possible in course electives.

Master of Science Degree in Imaging Science

Dr. Pantazis Mouroulis
Coordinator, MS Program
(716) 475-6678

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 photography and other imaging modalities to problems in engineering or science. Formal course work includes consideration of the physics and chemistry of radiation-sensitive materials and processes, the application of physical and geometrical optics to photo-optical systems, the mathematical evaluation of image forming systems, and the statistics of experimental design and qual-ity control. Technical electives at the graduate level may be selected from the courses offered in imaging science, color science, engineering, science, mathematics, and graphic arts. A thesis is required.

Faculty within the Center for Imaging Science supervise thesis research in areas of the chemistry and physics of radiation-sensitive materials and processes, digital image processing, remote sensing, photo-optical instrumentation, and the evaluation of imagery and image systems. In addition, research opportunities are available in all aspects of color in the Munsell Color Science Laboratory within the Center for Imaging Science. Other inter-disciplinary efforts are possible with the colleges of Engineering and Science. Opportunities also exist to perform thesis work under the direction of selected scientists and engineers in industry who act as adjunct faculty.

The degree requirements can be completed either on a full- or a part-time basis.
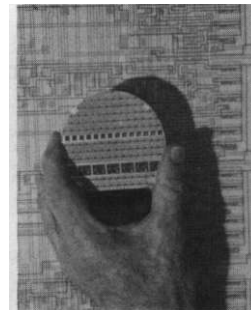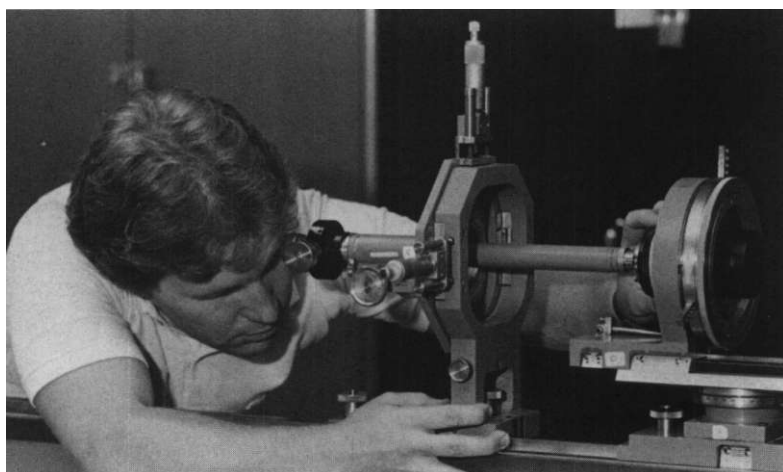
Clockwise from above: Finger Lakes Area of New York State (Courtesy NASA/ USGS EROS Data Center); optical instrumentation lab; a silicon wafer containing more than 100 chips, each chip having thousands of circuit elements; measuring film density with a micro densitometer

1. Master of Science in Imaging Science (Full-Time)

This program is designed for persons holding a bachelor's degree in science or engineering. All students must complete the PIMG-701, 2, 3 sequence, Basic and Advanced Principles of Imaging Science. These courses develop a necessary broad background in imaging. Students with undergraduate degrees in imaging science are allowed to test out of PIMG-701 and 702, but not 703. In addition, all students must complete a minimum of five quarters chosen from any two of the other three core areas of study: Image Evaluation, Optics, and Imaging Mathematics and Statistics.

The student also must complete nine credit hours of research with three credit hours assigned to the graduate research course and six credit hours assigned to the thesis research and defense. The student will elect graduate courses to bring the total credit count to 57. Up to six credit hours applicable as graduate technical electives may be selected from graduate courses outside the Center for Imaging Science. All non-imaging science courses must be approved by the CIS graduate faculty as acceptable for CIS credit.

2. Master of Science in Imaging Science (Part-Time)

This program is identical to the full-time program except that the requirements can be met on a part-time basis. Part-time students should normally complete the graduate requirements within three to four years. The maximum time allowed for the completion of all degree requirements is seven years.

Some courses are offered in the evening for the benefit of part-time students. Information concerning these courses may be obtained from the coordinator of the graduate program.

Admission

Admission to full-time or part-time programs 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; a full-year, college-level course in physics, with laboratory; a similar course in chemistry.

Applicants must demonstrate to the Graduate 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 the 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 are also required to take the GRE test. Students whose native language is not English must demonstrate proficiency in English, as evidenced, for example, by a TOEFL score of 550 or higher.

After admission has been granted, the student is required to take a diagnostic examination to identify areas of strength or weakness. Results of this exam may suggest remedial course work. In addition, the examination results will be used to help construct an appropriate plan of study that fulfills the academic requirements of the program, while taking into account the student's special needs and goals. It is expected that the examination will be taken at home, a few weeks before the beginning of classes.

Thesis

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 advisor. 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 shall have an advisor assigned 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. The work shall not have started prior to the assignment of the advisor.
4. In exceptional cases, it may be possible that the candidate is able to present published original work done outside RIT, which can be accepted in lieu of a thesis, and essentially fulfills the requirements for a completed thesis. Then, the thesis requirements may be substituted by elective courses.

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 Guidance does not carry a letter grade and is not included in the average.

COURSE OF STUDY				
	Quarter Credit Hours			
Course Title and Number	Fall	Winter	Spring	Summer
Principles of Imaging Science PIMG-701, 2,3	3	3	3	
Three-Quarter core sequence	3-4	3-4	3-4	
Two-Quarter core sequence	3-4	3-4		
Research—PIMG-890	1	1	1	6
Technical electives	3-4	3-4	3-4	
Technical electives				3-4

Imaging Science Core Sequences*

PIMG-701, 702, 703	Principles of Imaging Science
PIMG-721, 722	Statistics and Computer Techniques
PIMG-731, 732, 733	Optics
PIMG-741, 742, 743	Analysis and Evaluation of Imaging Systems

Imaging Science Technical Electives

PIMG-746, 747, 748	Digital Image Processing
PIMG-751, 752, 753	Special Topics—varies each year, typical offerings include Electro-Optics, Fourier Optics
PIMG-756, 757, 758	Principles of Electrophotography Materials and Processes
PIMG-761, 762, 763	Principles of Remote Sensing and Image Analysis
PIMG-766, 767, 768	Silver-Halide Science
PIMG-890	Research and Thesis Guidance

CIS core courses also can be taken as technical electives.

Color Science Technical Electives

PIMC-700	Vision and Psychophysics
PIMC-701, 702	Colorimetry I, II
PIMC-802	Colorimetric Instrumentation and Standardization
PIMC-803	Color Modeling

Recommended Non-CIS Electives**

EEEE-778	Fiber Optics
EEEE-723	Semiconductor Physics
F.F.F.F-794	Information Theory
CQAS-821, 822	Theory of Statistics
CQAS-841, 842	Regression Analysis
CQAS-830, 831	Multivariate Analysis
SCHA-711	Instrumental Analysis
SCHO-737	Advanced Organic Chemistry
SCHP-744	Quantum Mechanics
SCHO-835	Organic Chemistry of Polymers

*This is not a comprehensive listing. Other courses at the Institute or other universities can be taken with the approval of CIS graduate faculty.

Imaging Science

PIMG-701,702   Basic Principles and Techniques of Imaging Science

Registration #0925-701,702

A rigorous, quantitative treatment of the fundamental science undergirding the physical, chemical, electro-optical, and biological aspects of imaging science. The mean-level relationships that define the capture, processing, and reproduction of images are treated. The course will be taught in the context of imaging application with examples from the fields of medical imaging, remote sensing, etc.

Credit 3

PIMG-703   Advanced Principles and Techniques of Imaging Science

Registration #0925-703

This course incorporates the concepts of variance, noise and information theory as it impacts imaging concepts. It expands these concepts by bridging from simple theories to measurement and system-level studies of particular imaging processes.

Credit 3

PIMG-721,722   Statistics & Computer Techniques for Photographic Systems

Registration #0925-721,722

A special graduate course in applied statistics and computer techniques involving those areas of direct concern in design, analysis, and evaluation of photographic systems.

Credit 4

PIMG-731,732,733   Optics

Registration #0925-731,732,733

The fundamental laws of geometrical and physical optics. Paraxial refraction and reflection through axially centered systems, pupils and stops, photometry, principles of optical instruments, gradient index optics. Polarization, interference and diffraction. Finite raytracing, geometrical and diffraction theory of aberrations, optical systems concepts, measures of image quality.

Class 3, Lab 3, Credit 4 (F,S)
Class 3, Credit 3 (W)

PIMG-741,742,743   Analysis and Evaluation of Imaging Systems

Registration #0925-741,742,743

Complex variables and Fourier analysis with application to the evaluation of imaging systems; properties of optical images, structure of photographic images, methods of photo-optical system evaluation.

Class 2, Lab 6, Credit 4 (W)
Class 3, Credit 3 (F,S)

PIMG-746,747,748   Digital Image Processing

Registration #0925-746,747,748

The characteristics and properties of digital images; sampling, quantization, and frame rate. Digital image input/output systems. Operations on digital imagery: point operations, geometric operations, neighborhood operations, and global operations on single and multiple images. The frequency-space representation, the discrete Fourier transform, image convolution and filtering. Applications of digital image processing, image enhancement and restoration; medical applications.

Credit 3

PIMG-751,752,753   Special Topics in Photographic Science

Registration #0925-751,752,753

Advanced topics of current or special interest, varying from quarter to quarter, selected from the field of imaging science. Specific topics announced in advance. (Not offered every quarter; consult coordinator of the graduate program.)

Credit varies

PIMG-756,757,758   Principles of Electrophotography Materials and Processes

Registration #0925-756,757,758

The principles of electrophotographic and electrostatic imaging, with emphasis on charge variation and field variation electrophotography as applied to xerographic systems design, analysis, and characterization. Xerography, xerographic systems, raster output scanning systems, ionographic imaging.
Credit 3

PIMG-761,762,763   Principles of Remote Sensing & Image Analysis

Registration #0925-761,762,763

The principles of electromagnetic imaging, image processing and image analysis as they apply to remotely sensed information. Photogrammetry aerial photography, aerial photometry, thermography, multispectral image analysis and satellite image analysis are treated. Overall emphasis is on extraction of quantitative information from remotely sensed data.

Class 3, Lab 3, Credit 4 (W,S)
Class 3, Credit 3(F)

PIMG-766,767,768   Silver-Halide Science

Registration #0925-766,767,768

Physical structure and optical properties of silver-halide emulsions and their relations to chemistry and preparation of emulsions; treatment of theory of sensitivity and latent image formation; chemistry and kinetics of processing, chemistry and physics of selected non-silver imaging systems.
Class 3, Credit 3

PIMG-890   Research and Thesis Guidance

Registration #0925-890

Thesis based on experimental evidence obtained by the candidate in an appropriate field as arranged between the candidate and his or her advisor.

Credit 9 (minimum for MS)

Master of Science Degree in Color Science, Appearance, and Technology

Dr. Roy S. Berns
Coordinator, MS Program
(716) 475-2230 or (716) 475-5842

Color science is broadly interdisciplinary, encompassing physics, chemistry, physiology, and psychology. The curriculum leading to a master of science degree in color science, appearance, and technology is a program developed to educate students using a broad interdisciplinary approach. This is a unique opportunity for students as this is the only graduate program in the country devoted to this discipline. The program is designed for students whose undergraduate majors are in physics, chemistry, psychology, physiology, textiles, graphic or fine arts, art conservation, or any discipline pertaining to the quantitative description of color. Candidates who do not have adequate undergraduate work in related sciences must make up foundation courses before matriculating into the program.

The color science, appearance, and technology major provides graduate level study in both color science theory and its practical application. The program will give students a broad exposure to the field of color and will afford students the unique opportunity of specializing in a particular area appropriate for their background and interest. This objective will be accomplished through the program's core courses, selection of electives, and completion of the thesis.

The degree program in color science, appearance, and technology revolves around the activities of the Munsell Color Science Laboratory within the Center for Imaging Science. The Munsell Laboratory is already the pre-eminent academic laboratory in the country devoted to color science. Since its inauguration in 1984, two industrial conferences have been held, both 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

The color science, appearance and technology major is a full-time or part-time master's degree program. The length of time required to earn a degree varies according to the student's undergraduate preparation in mathematics, computer science, general science, and the number of courses taken per quarter. 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 a minimum of four quarters of study at the graduate level. Part-time students generally require two to three years of study at the graduate level. The curriculum is a combination of required courses in color science, appearance, and technology, elective courses appropriate for the candidate's background, and a research thesis. 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, computer science, and general science prior to matriculation with graduate status. Foundation courses can be completed in three quarters.

The foundation program

The color science, appearance and technology major is designed for the candidate with an undergraduate degree in a scientific or non-scientific discipline. Candidates with adequate undergraduate work in related sciences will start the program as a matriculated graduate student

Candidates without adequate undergraduate work in related sciences must take foundation courses prior to matriculation into the graduate program. These students will enter the program as "Special Students." This will help identify the candidate in foundation courses, and allow for guidance from the coordinator of the program.

Course work in mathematics, computer science, and general science is expected if these courses are not indicated on the candidate's transcript. Students who require foundation courses may be required to take as many as 36 credits in these subjects. A written agreement between the candidate and the coordinator of the program will be developed to identify the courses required to complete the foundation course requirements.

Foundation courses must be completed before a student can matriculate into the graduate program, and the student must earn an overall B average in these undergraduate foundation courses to be accepted. A maximum of nine credit hours at the graduate level may be taken prior to matriculation into the graduate program.

Foundation courses

The courses listed below represent the courses required to meet the foundation course requirements.

SMAM-251,252,253 Calculus I, II, III-4cr.

SPSP-211,212,213 College Physics I, II, HI—3 cr.

SPSP-271,272,273 College Physics Lab I, II, III—1 cr.

ICSA-220 FORTRAN Programming for Engineers—3 cr. or ICSA-200 Survey of Computer Science—4 cr.

SMAM 309 Elementary Statistics—4 cr.

GSSP 509 Psychology of Perception—4 cr.

It should be noted that these foundation courses prepare the student only for required course work in color science, appearance, and technology. Additional undergraduate course work may be necessary in order to have the appropriate requirements for graduate electives offered in other areas.

Program requirements

The master of science degree program in color science, appearance, and technology requires the completion of 45 quarter credit hours of study including nine hours for the thesis. If foundation courses are not required, the program can be completed in four quarters at full-time status and in two to three years at part-time status. Students who are qualified in one or more of the required courses may substitute other course work with the permission of the coordinator of the program. The program curriculum is a combination of required courses in color science, appearance, and technology, and elective courses which will satisfy the student's individual needs. The student may choose elective courses with the approval of the coordinator of the program. This flexibility enables the program to be broadly interdisciplinary.

Required Graduate Courses

PIMC-700 Vision and Psychophysics—4 cr.
PIMC-701 Colorimetry 1—4 cr.
PIMC-702 Colorimetry II—4 cr.
PIMC-801 Advanced Colorimetry—3 cr.
PIMC-802 Colorimetric Instrumentation and Standardization—4 cr.
PIMC-803 Color Modeling—4 cr.
PIMC-890 Research Thesis—9 cr.

Electives

Appropriate electives should be selected to bring total course work to 45 credit hours. The following is a partial list of possible recommended electives.

CQAS-801,802 Design of Experiments I, II—3 cr.

CQAS-821,822 Theory of Statistics I, II—3 cr.

CQAS-830,831 Multivariate Analysis I, II—3 cr.

CQAS-841,842 Regression Analysis I, II—3 cr.

PIMG-731,732,733 Optics-4 cr.

PIMG-741,742,743 Analysis and Evaluation of Imaging Systems—3 cr.

PPRT-702 Graphic Reproduction Theory—4 cr.

PPRT-722 Ink, Color and Substrates—4 cr.

SCHO-736 Spectrometric Chemical Identification of Organic Compounds—3 cr.

SCHA-711 Instrumentation Analysis—3 cr.

ICSA-770 Fundamentals of Computer Graphics—3 cr.

ICSA-771 Advanced Topics in Computer Graphics—4 cr.

Thesis

Nine credit hours are required. Topics should be chosen that complement the candidate's undergraduate education. The technical advisory board to the Munsell Color Science Laboratory, in addition to the coordinator of the program, can aid the candidate in selecting a thesis topic which has current industrial relevance.

Admission

Prior to being admitted to the master of science degree program, applicants must satisfy the coordinator of the program in that their previous education, ability, and practical experience indicate a reasonable chance of success. Applicants may be admitted who hold a baccalaureate degree from an accredited institution. Applicants must have undergraduate records of 3.0 or higher. They will be required to take the Graduate Record Examination (GRE) as an aid in academic counseling during the development of the individual's program of studies.

Requirements

Graduate application
Earned baccalaureate degree
Graduate record examination (GRE)
Official undergraduate transcript
Two professional recommendations
An on-campus interview when possible
Undergraduate GPA of 3.0 or higher
Foundation course work of 3.0 or higher (if required)
TOEFL score of at least 550 (international students)

Munsell Advisory Board

In order to ensure that the research activities surrounding the degree program are relevant to current industrial needs, the Munsell Color Science Laboratory Advisory Board was established. 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 provides an excellent resource for students in both the selection of a thesis topic and future placement.

A Typical Full-Time Schedule

Courses	Credits
Fall	
PIMC-700 Vision and Psychophysics	4
Graduate Electives	8
Winter	
PIMC-701 Colorimetry I	4
Graduate Electives	8
Spring	
PIMC-702 Colorimetry II	4
PIMC-802 Colorimetric Instrumentation and Standardization	4
PIMC-890 Thesis	4
Fall	
PIMC-801 Advanced Colorimetry	3
PIMC-803 Color Modeling	4
PIMC-890 Thesis	5
Total	48

Color Science, Appearance, and <u>Technology</u>

PIMC-700   **Vision and Psychophysics**

Registration #0926-700

This course will provide an overview of the human visual system and psycho-physical techniques used to investigate it. Topics include: the optical design of the eye; mechanisms of photoreception; neural coding and processing of visual information; and experimental techniques. Emphasis will be placed on color vision.

Credit 4

PIMC-701   **Colorimetry I**

Registration #0926-701

For those taking colorimetry for the first time, colorimetric procedures commonly used in industrial quality control and research and development are covered. The emphasis is on the spectral and colorimetric characterization of chromatic stimuli using modern instrumental methods, and deriving the relationships between appearance attributes and instrumental data. Accompanying laboratory stresses instrumental measurements.

Credit 4

PIMC-702   **Colorimetry n**

Registration #0926-702

A continuation of Colorimetry I, this course emphasizes visual methods to determine color tolerances, characterizing surface properties of objects, visual scaling techniques using color order systems, and the effects of viewing and illuminating conditions on color appearance. Accompanying laboratory stresses visual measurements.

Credit 4

PIMC-751   **Special Topics**

Registration #0926-751

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 varies

PIMC-801   **Advanced Colorimetry**

Registration #0926-801

A detailed treatment and evaluation of current research and development in color science. Topics include current developments in CIE technical committees, luminescent colorimetry, color rendering of light sources, observer metamerism, color differences, self-luminous displays, and color appearance specification.

Credit 3 '

PIMC-802   **Colorimetric Instrumentation and Standardization**

Registration #0926-802

This course covers current methods of precisely measuring the spectral properties of object colors, and of radiation sources. Proper procedures in calibration, standardization, data analyses, instrument maintenance, and standards selection are discussed. The use of standard reference materials in optical metrology are explored. Various measurement assurance programs are introduced for the diagnostic evaluation of current colorimetric instrumentation.

Credit 4

PIMC-803   **Color Modeling**

Registration #0926-803

This course explores mathematical techniques for predicting the coloring of absorptive systems including polymers, textiles, paper (impact and non-impact), and coatings, and the modeling of additive systems such as self-luminous displays. Emphasis is placed on Kubelka-Munk turbid media theory for opaque and translucent systems and on Grassman's laws for additive systems. Accompanying laboratory stresses the use of commercial computer colorant formulation systems and the use of multivariate statistics to model colorant behavior.

Credit 4

PIMC-890   **Thesis**

Registration #0926-890

Thesis is 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)

Graduate Faculty Center for Imaging Science

Rodney Shaw, BS, Leeds University; Ph.D., Cambridge University—Professor, Director of the Center for Imaging Science

Roy S. Berns, BS, MS, University of California; Ph.D. Rensselaer Polytechnic University—Richard S. Hunter Professor, Director of the Munsell Color Science Laboratory

John Schott, BS, Canisius College; MS, Ph.D., Syracuse University—Associate Professor

Roger L. Easton, Jr., BS, Haverford College; MS, University of Maryland; MS, Ph.D., University of Arizona—Assistant Professor

Pantazis Mouroulis, BS, University of Athens; Ph.D., University of Reading—Assistant Professor

Master of Fine Arts Degree in Imaging Arts

Ken White, Coordinator
MFA Program, (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. It is rooted in the belief that the study of imaging as a fine art can be enhanced by the study of imaging as an applied art, as a liberal art and as a technical art The program provides each student an opportunity to pursue graduate study in photography and other imaging arts as a means to personal, aesthetic, intellectual and career development.

The MFA curriculum is not based on a fixed pattern of study, but rather on a flexible one which is continually sensitive to the needs of each student and builds upon the strengths that he or she brings to the program. Flexibility extends beyond what is to be learned to *where* it can be learned and *how* it can be learned and validated.

The degree in imaging arts is offered with three areas of academic concentration: photography, computer animation and museum studies. Successful completion of the program enables a student to seek careers in education, museum or gallery work, business, broadcasting, A/V production, advertising or as a self-employed professional.

The broad goals of the program are to:
1. Provide students with the opportunity to use photography and other imaging arts as a means to pursuing a career and earning a livelihood.
2. Provide students with the opportunity to use photography and other imaging arts as a means of enriching their personal lives and society as a whole.
3. Provide an environment that encourages a sense of community, creativity, scholarship and purpose.

Electives and minors
Minor concentration must be planned with and approved by the coordinator.

Elective courses are available in animation, video, video discography, printmaking, painting, communications design, museum studies, crafts, bookbinding, typography, color photography, mixed media, studio photography, advertising photography, perception, sensitometry, computer graphics, teaching, archival preservation and conservation. There are also opportunities for independent studies and experiential study.

Photography
This program concentration spans a wide range of imaging arts from traditional black-and-white photography to hand-applied emulsions to altered multimedia collage and electronic or computer-generated imagery. Projects can be in the form of video, books or installations—the artist is not limited by the usual connotations of the word "photography."

Computer animation
This two-year, 90-credit program concentration in the Film/Video Department emphasizes computer animation as a studio art and views computer graphics programming as a skill necessary for the mature computer animator. Both course

work and thesis work combine the technical and aesthetic practice of computer animation with the learning of programming techniques relevant to the discipline.

Museum studies

The concentration in museum studies is designed to train individuals in the care and identification of photographs from all eras and in the management and interpretation of photographic collections.

The faculty

The MFA in imaging arts program is supported by a staff of 45 faculty members within 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, College of Fine and Applied Arts and 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. 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 to the coordinator of the program based on the above interlocking criteria.

Students who are judged to need more study in the general areas of art, photography and/or technology will be advised to take such courses either prior to entrance or during their first year of study. Recommendations will be made by the coordinator with advice from the appropriate faculty members. Areas of art and photography include art history, photographic history, aesthetics, criticism, and general studio work in any form of image making.

To apply for admissions to graduate study, a student must submit evidence of his or her undergraduate degree, an acceptable portfolio, a statement of purpose, and references. All correspondence concerning applications, catalogs and portfolios should be addressed to the Director of Admissions at RIT.
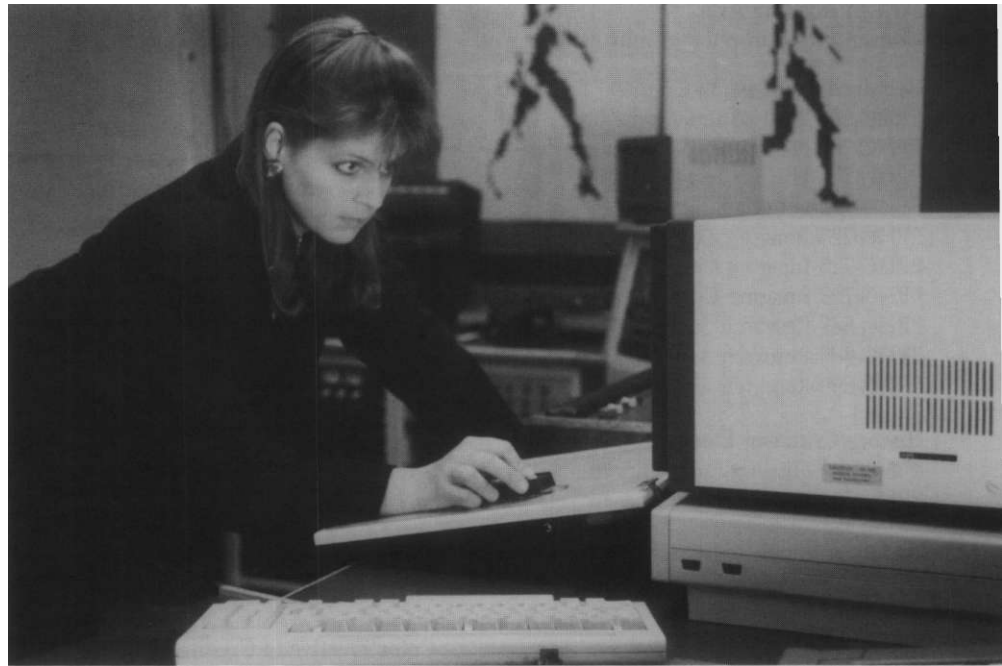
Transfer credit

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 (nine semester hours) of B or better of graduate work is transferable toward the degree with the approval of the coordinator.

Portfolio

Selection of candidates for the graduate program is a difficult process. Along with written records of accomplishment and recommendations, the portfolio serves to inform the faculty of the applicant's imaging accomplishments. It is a pictorial statement of the candidate's performance to date in terms of her or his skills and visual sophistication.

About 20 black-and-white and/or color photographs that represent a cohesive body of work should be sent. (The word *photograph* includes such photo-related media as printmaking, screen printing, computer-generated images, electrophotography, color proofing, gum bichromate, cyanotype and albumen.) *Original* prints provide the best means of assessment. *Copy slides of original work are discouraged.* Prints can be sent mounted or unmounted. Please put your name on each print or slide.

Applicants who are interested in the computer animation concentration are advised to send in a portfolio that consists of videotape (VHS or %" format) images and/or evidence of computer imagery, animation or cinematography. Do not send master tapes or original films. Museum studies applicants will be reviewed on the basis of a visual portfo-

lio; however, documentation of scholarly papers, projects and/or work experience will weigh heavily in the graduate faculty's decision.

The portfolio should be packaged in such a way as to facilitate handling (unpacking, viewing, repacking and shipping). A label with a return address would be helpful. Be sure to include a check or money order sufficient to cover return postage or shipping. The portfolio should be sent directly to the coordinator of the MFA photography program. Applications are accepted beginning in September of each year. Portfolios should be submitted in time to arrive the first week in March.

Initial selection of the Fall class in the imaging arts program is made in mid-March from among all portfolios and completed applications received from September of the previous year. Under a modified "rolling admissions" policy, some candidates are offered admission after the initial selection process. For further information or advice on this situation contact the MFA Coordinator directly.

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 minima   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 prerequisite for graduate courses.

MFA in Imaging Arts
Concentration in photography

Required Courses (39 Credits)	Credits
PPHG-701 History and Aesthetics	3
PPHG-702 History and Aesthetics	3
PPHG-703 History and Aesthetics	3
PPHG-705 Graduate Seminar	2
PPHG-725 Imaging Core	4
PPHG-726 Imaging Core	4
PPHG-727 Imaging Core	4
PPHG-887 Research Seminar I	2
PPHG-889 Research Seminar II	2
PPHG-890 Research and Thesis	12

History/Criticism Electives (6 Credits)	
PPHG-7** History and Criticism	3
PPHG-7** History and Criticism	3

Technical Elective (4 Credits)	
OPEN	4

Color Electives (8 Credits)	
OPEN	8

Electives, Other (25 Credits)	
OPEN	25

Liberal Arts (8 Credits)	
OPEN	_8
Total	90

MFA in Imaging Arts
Concentration in computer animation

Required Courses (42 Credits)	Credits
ICSA-711 Intro, to Graph. Prog.	4
ICSA-712 Graph. Prog. II	4
ICSA-713 3-D Modeling and Rend.	4
PPHG-705 2 Graduate Seminar	2
PPHG-725 Photo Core	4
PPHG-726 Photo Core	4
PPHG-727 Photo Core	4
PPHG-887 Research Seminar I	2
PPHG-889 Research Seminar II	2
PPHG-890 Research and Thesis	12

History Elective (4 Credits)	
PPHG-704 History of Animation	4

Technical Elective (4 Credits)	
ICSA-721 Image Storage & Comm.	4

Color Elective (7 Credits)	
PPHG-820 3-D Color Comp. Anim.	7

Electives, Other (25 Credits)	
OPEN	25

Liberal Arts (8 Credits)	
OPEN	J
Total	90

MFA in Imaging Arts
Concentration in museum studies

Required Courses (41 Credits)	Credits
PPHG-701 History and Aesthetics	3
PPHG-702 History and Aesthetics	3
PPHG-703 History and Aesthetics	3
PPHG-705 Graduate Seminar	2
PPHG-725 Imaging Core	4
PPHG-717 Exhibitions	4
PPHG-718 Conservation	4
PPHG-719 Preservation	4
PPHG-889 Research Seminar II	2
PPHG-890 Research and Thesis	12

History/Criticism Electives (6 Credits)	
PPHG-7** History and Criticism	3
PPHG-7** History and Criticism	3

Technical Elective (4 Credits)	
PPHG-764 Alternative Process	4

Color Elective (4 Credits)	
PPHG-751 Special Topics (Color I)	4

Museum Internship (4 Credits)	
PPHG-877 Museum Internship	4

Electives, Other (23 Credits)	
OPEN	23

Liberal Arts (8 Credits)	
OPEN	_8
Total	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 help of the MFA coordinator and made a matter of record. Modifications in this prescribed program thereafter must be approved and recorded.

Humanities
The required 8 quarter credit hours of humanities courses are usually taken in the College of Liberal Arts.

Grade 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 MFA coordinator.

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.

Thesis
The thesis exhibition/project should be an original body of work appropriate to the major commitment of the degree candidate. A written thesis of record will be prepared for inclusion in the library. Specific directions are available in the MFA handbook, which is given to students upon entrance into the program.

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 newer visual imaging methods by courses in computer graphics, computer animation and video discography. The Rochester area is enhanced with outstanding physical and human resources. In addition to those located in the College of Graphic Arts and Photography 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 45 highly specialized and diverse instructors. The program is designed to reflect this diversity.

Because RIT is a member of the Rochester Area Colleges Consortium, students are able to pursue course work at 14 other member colleges at no additional charge.

Fine Arts in Imaging Arts

PPHF-704   History of Animation

Registration #0902-704

This course is based upon the belief that a knowledge of the history of animation will enable students to make better informed creative decisions. The four divisions of the subject studied are: origins and early experiments in animation; the industrialization of the process, independent and experimental animation; and computer animation. Students are responsible for writing a paper drawn from an independent investigation of some aspect of the subject; topic to be approved by instructor. The course format includes lectures, discussions, and screenings of historically significant films.
Credit 3

PPHF-710   Film/Video Tools for Computer Animation

Registration #0902-710

A hands-on review of the various methods of copying and manipulating computer-generated animation. This includes the transfer of images and sound to 16mm film or videotape, the skills needed to edit these formats, and the technical manipulations available once the images have been transferred.
Credit 3

PPHF-721   Scriptwriting for Animation

Registration #0902-721

This course explores the principles of dramatic structure and storytelling in both fiction and non-fiction animated film and video. Students prepare short scripts suitable for production and prepare finished storyboards from those scripts.
Credit 4

PPHF-724   Introduction to Animation and Graphic Film Production

Registration #0902-724

This course is designed to introduce students to the expressive potential of single-frame film- and video-making. The course does not use computers and does not concentrate on traditional eel and character animation. Students use a professional animation stand to complete several short film- or videodisc sequences in response to a variety of creative problems and technical challenges. Screenings of numerous professionally produced films accompany and illustrate the lectures.
Credit 4

PPHF-727   Microcomputer Animation I

Registration #0902-727

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.
Credit 4

PPHF-728   Microcomputer Animation II

Registration #0902-728

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 on various post-production 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.
Credit 4

PPHG-701,702,703   History and Aesthetics of Photography

Registration #0903-701,702,703

The course will survey the major issues throughout the development of the medium: (1st quarter) pre history up to the 20th century; (2nd and 3rd quarters) *fin de stick* to present.
Credit 3

PPHG-704   Minor White Seminar

Registration #0903-704

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 2 (not offered every year)

PPHG-705,706   Graduate Seminar

Registration #0903-705,706

The seminar provides an opportunity for all MFA students to develop a sense of community and to openly discuss matters of concern, to discuss each others' photographs, to meet with visiting artists on campus and to participate in a thesis sharing from time to time.
Credit 2

PPHG-707,708,709   Film History and Aesthetics

Registration #0903-707,708,709

An extended comparative survey of the History & 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

PPHG-711   The Landscape as Photographs

Registration #0903-711

A first-year graduate course in the major artistic, mythological, political, and economic issues influencing the development and use of landscape photography in America from the 1840s to the 1980s. The student will be introduced to a diversity of historical and contemporary image makers.
Credit 3

PPHG-712   Dadaism, Surrealism and Photography

Registration #0903-712

An examination of the work of a group of artists, known as the Dadaists, who rejected the social order and values that produced World War I. Students will 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.
Credit 3

PPHG-715   Photographic Extensions

Registration #0903-715

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

PPHG-718   Conservation Procedures for Fine Art and Historical Photographs

Registration #0903-718

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

PPHG-719   Preservation Issues with Fine Art and Historical Photographs

Registration #0903-719

This is a non-laboratory technical course which surveys the structure and deterioration mechanisms of major historical photographic processes. It examines the technical basis of preservation strategies within a museum or archive, and presents an approach to preservation which is integral with collection management and curatorial functions.
Credit 4

PPHG-720,721,722   Imaging Workshop

Registration #0903-720,721,722

Each faculty member offers a different opportunity for students to explore the multiplicity of ways that imaging can be used as a vehicle for expression and for communication. Visual research, group critiques, seminars, field trips, studio and laboratory practice are used.
Credit 4

PPHG-725,726,727   **Imaging Core**

Registration #0903-725,726,727

Major emphasis is placed on the individual's learning to generate and intensify his or her personal statement through imaging. Some of the projects are assigned while others are selected by the candidate.

Credit 4

PPHG-733   **Animation and Graphic Film Production**

Registration #0903-733

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.

Class 2, Discussion 1, Lab 2; Credit 4 (F, W)

PPHG-734   **Animation and Graphic Film Production**

Registration #0903-734

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 PPHG-733. 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. (PPHG-733)

Class 2, Discussion 1, Lab 2; Credit 4 (W, S)

PPHG-735   **Animation and Graphic Film Production**

Registration #0903-735

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. (PPHG-734)

Class 2, Discussion 2, Lab 2; Credit 4 (S, F)

PPHG-740,741,742   **Photographic Museum Practice**

Registration #0903-740,741,742

Museum internship workshop, still or motion picture; research, assigned projects, seminars in history, function and administration of museums, with emphasis on photographic curatorial duties; practice in exhibition planning and development; field trips.

Credit 3-9 (not offered every year)

PPHG-750,751,752   **Special Topics Workshop**

Registration #0903-750,751,752

Advanced topics of current or special interest designed to broaden and intensify the student's ability to use imaging as a means of communication and expression.

Credit 3-9

PPHG-753   **Teaching Photography**

Registration #0903-753

A graduate course concerned with the art and craft of teaching photography in a formal and informal setting. Emphasis is on the practice of teaching photography based on accepted learning principles.

Credit 4

PPHG-754   **Photographic Workshop for Teachers**

Registration #0903-754

A graduate course in the principles and practices of photography designed especially for the high school or community college teacher, counselor or advisor, who may be involved in instruction or career guidance in photography.

  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

PPHG-755   **Applied Sensitometry**

Registration #0903-755

This course presents relevant sensitometry and photographic theory, principles and practices in a manner sensitive to the background and needs of a fine art photographer.

Credit 4 (not offered every year)

PPHG-756   **Zone System Principles**

Registration #0903-756

An applied course of selected sensitometric, statistical and perceptual principles to the understanding and practice of the Zone System. The principles are taught so that they can be generalized and transferred to the understanding and practice of other image-forming systems such as film making, video, graphic arts printing, screen printing, etc.

Credit 4

PPHG-760   **Perception & Photography**

Registration #0903-760

An advanced course which provides an applied psychological framework for the ways we select, code, organize, store, retrieve and interpret visual images and explores how photographs relate to art and perception.

Credit 4 (not offered every year)

PPHG-762,763,764   **Alternative Processes**

Registration #0903-762,763,764

An advanced course in the production and presentation of 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, the production of visual books, and generative systems such as electrostatics and offset lithography.

Credit 4

PPHG-767,768,769   **Contemporary Issues**

Registration #0903-767,768,769

A study of current issues relevant to fine art photography, how they relate to broader historical/cultural issues, and how they might suggest future directions.

Credit 2

PPHG-799   **Independent Project**

Registration #0903-799

The student proposes an advanced project to an individual instructor. The student and the instructor are jointly responsible that the material to be covered is appropriate to the student's program and that the number of credits proposed are justified. Both will sign the proposal which must also be approved by the graduate coordinator and the director of the school.

Credit 1-10

PPHG-877   **Museum Internship**

Registration #0903-877

Experential learning is provided in collection management, cataloguing and classification, exhibition preparation and exhibitions, research and critical writing.

Credit 14

PPHG-887,888,889   **Research Seminar**

Registration #0903-887,888,889

The seminar serves as a basis for exchanging ideas for research work and for a general orientation of the procedures and requirements for the completion of a successful thesis.

Credit 2

PPHG-890   **Research and Thesis**

Registration #0903-890

The thesis is designed and proposed by the candidate. It is considered his culminating experience in the program, involving research, a creative body of work, an exhibition or suitable presentation, and a written illustrated report.

Credit 1-12

Advanced Certificate in Electronic *8c* Optical Storage Applications

Dr. John Ciampa, Chair
American Video Institute at RIT
(716)475-6625

The interdisciplinary expertise required by the modern systems architect will be addressed by offering a sequence of three storage applications courses (Fall, Winter and Spring quarters) which mix electronics, computer science, communication theory, system design, production and project management skills. Along with these three specialized courses, a second course is required each quarter that will add background and specialized knowledge in related fields.

In the fall, Video Materials and Processes, an existing undergraduate course, will provide background to those who have little or no experience in video systems.

During the Winter Quarter, a microcomputer course will teach some programming as it relates to videodisc control.

In the Spring, the selection of one of three courses will allow the student to add an additional emphasis in one of the three related fields, depending on his or her special interests: Advanced Video, an existing undergraduate course, for those in production careers; Image Bank Management for those in computer science careers; and Communication Theory for those in careers in design and/or education.

In order to complete the requirements for the certificate, satisfactory course work must be completed in the three storage application courses: Video Materials and Processes, Microcomputer Controls and one of the three Spring Quarter electives. In addition, a project must be finished that represents an original application design with sufficient steps toward implementation.

Students will have at their disposal the American Video Institute (AVI) Videodisc and Optical Publishing Laboratory, which contains over $1 million in computer hardware and software.

Fall	Credits
PPHV-0922 731	4
Storage Applications Design I	
PPHF-310 Video Materials	
and Processes	2
Winter	
PPHV-0922 732	4
Storage Applications Design II	
PPHV-0922 736	
Microcomputer Control	4
Spring	
PPHV-0922 733	4
Storage Applications Design III	
One of the following three	
electives:	
PPHF-434 Advanced Video	3
PPHV 0922 734	4
Image Bank Management	
PPHV-0922 735	4
Communication Theory	

Storage Applications Design

PPHV-731   **Storage Applications Design I**

Registration #0922-731

An exploration of the technology, psychology, and aesthetics of modern storage applications with their massive image/information/delivery capacities, including an analysis of the hardware and software of videodiscs and optical discs as image banks with attendant data bases and the effects of interactivity on system design. (Completion of undergraduate degree or equivalent; some background in computers or communication arts or science)
Class 4, Credit 4

PPHV-732   **Storage Applications Design II**

Registration #0922-732

An experiential laboratory working with existing interactive software, authoring systems, original image retrieval programs, for existing image banks primarily on videodisc and optical disk; also involving experience with interactive input devices such as keyboard and touch-screen. (PPHV-731)
Class 4, Credit 4

PPHV-733   **Storage Applications Design III**

Registration #0922-733

Having already acquired an understanding of the theory and practice of modern storage applications, primarily in the area of videodisc and optical disc, students will be assigned to project teams in such a way that a balanced blend of artistic and scientific backgrounds is achieved where possible. The project team will be assigned an application which will be taken from the assessment of the end user's need right through final production; and software design which will include, in some shared projects, actual production on "Draw" disc or videodisc, so that an up-and-running system is the product of the project team rather than a paper design. (PPHV-732)

Class 4, Credit 4

PPHV-734   **Image Bank Management**

Registration #0922-734

An adaptation of database concepts to the special problems of the massive, randomly accessible signal stores now possible with optical storage. (PPHV-736)
Class 4, Credit 4

PPHV-735   **Communication Theory**

Registration #0922-735

Analysis of all communication forms in terms of a taxonomy which divides communication forms into immediate and mediate, and then further subdivides in terms of channel capacity and characteristics such as one-way systems, two-way interactive systems, etc. Within the mediate class, the course shall consider, among other things, the comparative effects on expression and impression processes of the television medium, computer storage, interactive video, and so forth. (Permission of instructor)
Class 4, Credit 4

PPHV-736   **Microcomputer Control**

Registration #0922-736

A survey of current computer-driven videodisc playback systems, involving both microcomputers and supermicrocomputers. Topics covered include hardware configurations, videodisc instruction sets, software interfaces, and system utilization. The course requires computer and video literacy.
Class 4, Credit 4
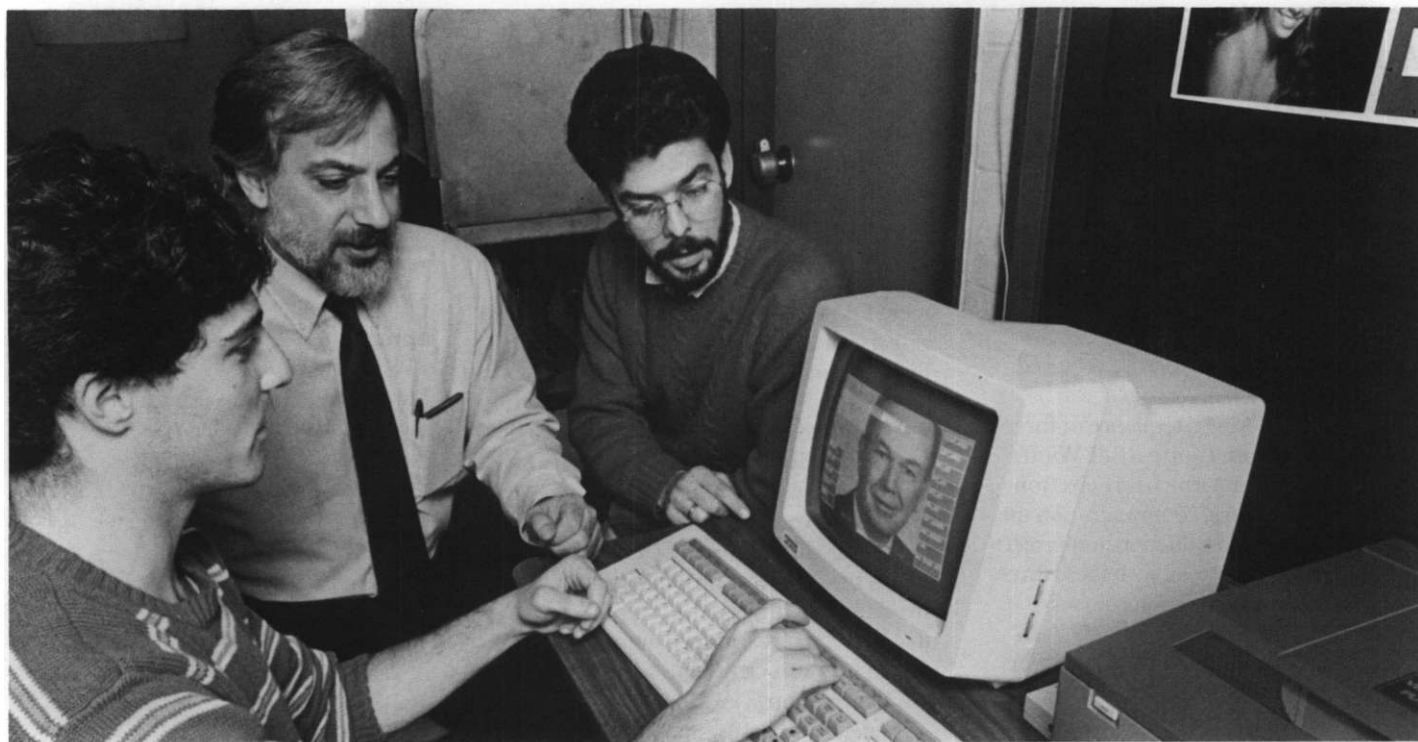
Graduate Faculty School of Photographic Arts and Sciences

John Ciampa, BA, Boston University; MA, University of Michigan; JD, Cornell University—Associate Professor, American Video Institute

Andrew Davidhazy, MFA, Rochester Institute of Technology—Professor, Imaging and Photographic Technology

Lothar K. Engelmann, Ph.D., J. W. Goethe University, Germany—Professor, Imaging and Photographic Technology

Bradley T. Hindson, BA, Rutgers; MFA, Ohio University—Associate Professor, Fine Art Photography

Russell Kraus, Ed. D., Massachusetts—Associate Professor, Imaging and Photographic Technology

Martha Leinroth, AB, Wellesley College; MFA, Rhode Island School of Design-Lecturer, Fine Art Photography

Elliott Rubenstein, MFA, SUNY, Buffalo; MA, St. John's University-Associate Professor, Fine Art Photography

Leslie D. Stroebel, BS, Ed. D., University of Rochester—Professor; Imaging and Photographic Technology

Erik Timmerman, MFA, USC—Associate Professor, Film/Video Department

Ken White, BA, Princeton University; MA, MFA, University of New Mexico—Assistant Professor, Chairman, Fine Art Photography

Tom Muir Wilson, BFA, Cranbrook Academy of Art; MFA, Rochester Institute of Technology—Associate Professor, Fine Art Photography

Richard D. Zakia, BS, Rochester Institute of Technology; Ed. D., University of Rochester—Professor; Chairman, Fine Art Photography

Associates of Graduate Faculty

Skip Battaglia, MS, Syracuse University-Associate Professor, Film/Video Department

Owen Butler, BFA, Rochester Institute of Technology—Associate Professor, Applied Photography

Chris Compte, MS, Computer Science, Rochester Institute of Technology-Assistant Professor, Applied Computer Studies

Andrew H. Eskind, MS, Illinois Institute of Technology—Interdepartmental Services, George Eastman House; Lecturer, Photography

Richard Floberg, MS, Boston University-Associate Professor, Film/Video

Edward Granger, Ph.D., University of Rochester—Lecturer, Photographic Science and Instrumentation

Guy Johnson, MS, Syracuse—Professor, Chairman, Applied Computer Studies

Steven Kurtz, MFA Photography, MS Computer Science, Rochester Institute of Technology—Assistant Professor, Applied Computer Studies

Roger Merton, BFA, Rochester Institute of Technology, MFA, SUNY Buffalo, Associate Professor, University of Rochester

Judy Natal, BFA, University of Kansas; MFA, Rochester Institute of Technology—Assistant Professor, Fine Art Photography

John Pfahl, MA, Syracuse University-Lecturer, Photography

James M. Reilly, BA, Franklin and Marshall, MA SUNY Buffalo, Director, Imaging Permanence Institute, Rochester Institute of Technology, Lecturer, Photography

David J. Robertson, MS, Columbia-Professor, Applied Photography

Grant B. Romer, BFA, Pratt Institute, MFA, Rochester Institute of Technology, Conservator, International Museum of Photography, George Eastman House; Lecturer, Photography

Robert A. **Sobieszak,** MA, Stanford-Director, Photographic Collections, International Museum of Photography, George Eastman House; Lecturer, Photography

Malcolm Spaull, MFA, Rochester Institute of Technology—Associate Professor, Chairman of Film/Video Department

Michael Starenko, BA, Kalamazoo College; MA, University of Chicago—Lecturer, Fine Art Photography

Charles C. Werberig, BFA, MS, Syracuse University—Associate Professor, Film/Video

College of Liberal Arts

Dr. Stanley D. McKenzie, Acting Dean

The College of Liberal Arts offers a master of science degree in School Psychology. In addition, the college has a cooperative relationship with the State University of New York at Buffalo School of Social Work, which offers the MSW degree with a concentration in deafness. Contact Marshall Smith at 475-2417 for further details.

The college provides a number of graduate courses which serve as electives for some of the master's degree programs offered by other colleges at RIT. A primary objective of these elective graduate courses is to 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.

Master of Science Degree in School Psychology

Dr. Margery Reading-Brown, chairperson, School Psychology (716-475-2765)

The College of Liberal Arts offers a graduate program leading to the master of science degree 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 theory, and to develop their skills and competencies in evaluation and consultation.

School psychologists work with elementary and high school students, teachers and administrators, parents and professionals. They provide services which lead to the amelioration of existing student-related educational difficulties, and attempt to prevent potential school problems. Through diagnostic testing and intervention, they help students deal with their learning difficulties, and improve their adjustment to school.

The school psychology program is rich in resources. RIT-affiliated facilities such as the Learning Development Center, Horton Child Care Center, and the National Technical Institute for the Deaf are available for training experiences. Nearby urban, suburban, and rural public schools offer prospective placements for practicum and internship experiences under the supervision of certified school psychologists.

Admission guidelines
Admission to the program is based on the following criteria:
• Successful completion of the Baccalaureate degree at an accredited college or university
• A cumulative grade point average of 3.0 or above
• Completion of at least 27 quarter hours in behavioral sciences with a B grade or above

Prerequisite courses include:
  General Psychology
  Elementary Statistics
  Child or Developmental Psychology
  Psychology of Learning
  Abnormal Psychology
• Minimum Graduate Record Examination (GRE) scores:
  Verbal 550
  Quantitative 500
  Psychology 500
• Evidence of professional commitment and potential for developing effective relationships with children, youth, and adults:
  • Letters of reference
  • Student statement about goals, prior related experience, and future plans
• An individual interview
All credentials must be submitted and reviewed by the staff prior to the completion of 12 quarter hours of graduate work in the program.

Course number and tide

Required Psychological Foundations and Professional Courses	32
GSSP-701 Developmental Psychology	4
GSSP-720 Theories of Personality	4
GSSP-722 Psychology of Learning	4
GSSP-723 Emotional Adjustment	4
GSSP-724 Counseling Theory	4
GSSP-725 Counseling Practicum	4
GSSP-726 Tests and Measurements	4
GSSP-727 Cognitive Psychology	4
Required Statistics and Research Methodology	8
GSSP-728 Research for the School Psychologist	4
ICSA-706 General Purpose Software Tools	4
Required Specialized Courses	24
GSSP-730 Seminar for the School Psychologist	4
GSSP-731 Intellectual Assessment	4
GSSP-732 Personality Assessment	4
GSSP-733 Behavioral Management Techniques and Assessment	4
GSSP-734 Analysis of Exceptional Individuals	4
GSSP-742 Learning Disabilities: Identification and Intervention	4
Required Field Experience	16
GSSP-735 Practicum in School Psychology I	3
GSSP-736 Practicum in School Psychology II	3
GSSP-737 Internship in School Psychology I	5
GSSP-738 Internship in School Psychology II	5
Electives*	12
Master's Project	4
Total Credits	96

Educational Psychology, Educational Sociology, Social Psychology (GSSP-739), and Psychology of Deafness (GSSP-740). Electives from the graduate level courses offered by the College of Business and the College of Applied Science and Technology, with permission.

Proposed plan of study

1st Quarter Psychology of Learning
Tests and Measurements
Theories of Personality
Developmental Psychology

2nd Quarter Research for the School Psychologist
Emotional Adjustment
Counseling Theory
Intellectual Assessment

3rd Quarter Seminar for the School Psychologist
Personality Assessment
Counseling Practicum
Learning Disabilities: Identification and Intervention

4th Quarter Computer Technology for the School Psychologist
Cognitive Psychology
Practicum in School Psychology I
Analysis of Exceptional Individuals

5th Quarter Master's Project—Begun in the 5th Quarter
Behavioral Management Techniques and Assessment
Practicum in School Psychology II
Elective (Educational Psychology)

6th Quarter Internship I
Elective (Social Psychology; Psychology of Deafness)

7th Quarter Internship II
Elective (Educational Sociology)

Degree requirements

A minimum of 96 quarter credit hours, which includes a master's project, is required for completion of the program. Before registering for the internship, students must pass a comprehensive examination. A cumulative grade point average of 3.0 or above is required.

School Psychology Courses

GSSP-701   **Developmental Psychology**

Registration #0514-701

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 requirements for admission for prerequisites or receive permission of instructor.)

Class 3, Credit 4 (offered annually)

GSSP-702   **Educational Psychology**

Registration #0514-702

This course is designed to furnish students with an understanding of the basic psychological processes underlying the educational process, and to apply them to concrete situations that may arise for persons who teach. (See requirements for admission for prerequisites or receive permission of instructor.)

Class 3, Credit 4

GSSP-720   **Theories of Personality**

Registration #0514-720

This course will cover the major theoretical approaches to understanding human personality, including, but not limited to, psychodynamic, behavioral, cognitive and humanistic approaches. (See requirements for admission for prerequisites or receive permission of instructor.)

Class 3, Credit 4

GSSP-722   **Psychology of Learning**

Registration #0514-722

History and principles of psychological learning theories. Comparative study of behaviorism, cognitive approaches and social learning theory. Basic factors affecting learning, forgetting and transfer of various tasks relevant to learning and instruction. Discussion of theories of memory, neuro-physiological processes and computer models of human learning. (See requirements for admission for prerequisites or receive permission of instructor.)

Class 3, Credit 4

GSSP-723   **Emotional Adjustment**

Registration #0514-723

Normal and deviant adaptation in relationship to human growth and development with emphasis on children and youth. Models of deviant childhood behavior with attention to physical, learned and social bases of deviant behavior. Rehabilitation facilities and treatment are discussed. (See requirements for admission for prerequisites or receive permission of instructor.)

Class 3, Credit 4

GSSP-724   **Counseling Theory**

Registration #0514-724

This course examines various approaches to counseling students in an educational setting. An understanding of development underlies the traditional, cognitive and behavioral models that are examined. Crisis intervention and short-term strategies therapy are discussed. (GSSP-720)

Class 3, Credit 4

GSSP-725   **Counseling Practicum**

Registration #0514-725

This practicum provides the opportunity for students to learn interview techniques and offers appropriate services under supervision. (GSSP-724)

Class 3, Credit 4

GSSP-726   **Tests and Measurements**

Registration #0514-726

This introductory course, in a series of assessment courses, discusses assessment, types of tests and their uses, strengths and weaknesses, basic measurement, principles of reliability, validity, scales and norms. Students will acquire an understanding of quantitative and qualitative principles of measurement. There will be extensive laboratory experiences on a variety of instruments, the clinical method, and the uses of tests in schools and other settings.

Sample tests include Kaufman Test of Educational Achievement (K-TEA), Peabody Individual Achievement Test (PIAT), Woodcock Johnson Psychoeducational Battery-Part II, Berry Visual Motor Integration (VMI), Wide Range Achievement Test, the Detroit Test of Learning Aptitude, Bender Visual Motor, Gestalt Test, and various standardized diagnostic tests in subject areas. (Matriculation in the School Psychology Program or receive permission of instructor)

Class 3, Credit 4

GSSP-727   **Cognitive Psychology**

Registration #0514-727

This introduction to the theories, issues and related research in concept learning, problem-solving, information processing, perception, attention, cognitive development and creativity will be applicable to the practicing school psychologist in analysis of school learning behaviors. (See requirements for admission for prerequisites or receive permission of instructor.)

Class 3, Credit 4

GSSP-728   **Research for the School Psychologist**

Registration #0514-728

The different research methods available to school psychologists will be critically examined and utilized in analyzing each method's advantages and disadvantages. The actual procedure of producing a completed research study will be presented, from grant acquisition to publication. Statistics will be reviewed and amplified in the course. (See requirements for admission for prerequisites or receive permission of instructor.)

Class 3, Credit 4

GSSP-730   **Seminar for the School Psychologist**

Registration #0514-730

Critical professional issues, theories and practices; role of the school psychologist as defined by competencies and responsibilities in the settings in which school psychology is practiced. Emphasis will be placed on legal and ethical issues that bear on the role of the psychologist in the school. (Matriculation in the School Psychology Program plus 16 quarter credit hours successfully completed in the program or permission of instructor)

Class 3, Credit 4

GSSP-731   **Intellectual Assessment**

Registration #0514-731

This course concentrates on development of intellectual assessment skills. Students learn to select and administer individual intelligence tests, to interpret results, and provide written and oral reports.

Laboratory experiences involve administration, scoring, and interpretation of tests including the Stanford-Binet-IV, Wechsler Intelligence Scale for Children (WISC-R), Wechsler Adult Intelligence Scale Revised (WAIS-R), Wechsler Pre-school and Primary Scale of Intelligence (WPPSI), Kaufman Assessment Battery for Children (K-ABC), McCarthy Scales of Children's Abilities, Raven's Progressive Matrices. (GSSP-726 and matriculation in the School Psychology Program or receive permission of instructor)

Class 3, Credit 4

GSSP-732   **Personality Assessment**

Registration #0514-732

This course uses interview, behavioral observation, rating scales, and projective measures for assessment of child and adolescent personality 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 GSSP-726 or permission of instructor)

Class 3, Credit 4

GSSP-733   **Behavioral Management Techniques and Assessment**

Registration #0514-733

This course offers training in the behavioral assessment of students in educational settings. Various techniques for recording and analyzing behavior are implemented, and programs for behavior management are designed. (Matriculation in the School Psychology Program or permission of instructor)
Class 3, Credit 4

GSSP-734   **Analysis of Exceptional Individuals**

Registration #0514-734

An applied course in the diagnostic evaluation of exceptional individuals in order to provide psychoeducational and psychoneurological information to multidisciplinary evaluation teams. Students select, administer and integrate test data, and report results and recommendations for treatment An overview of relevant information on theory of exceptionality and current status of diagnosis and treatment of exceptional children and adolescents is provided. (Matriculation in the School Psychology Program plus GSSP-726, 731, 732 or permission of instructor)

Class 3, Credit 4

GSSP-735,736   **Practicum in School Psychology I & II**

Registration #0514-735,736

The practicum serves as a bridge from theory and research to the professional practice of school psychology. Completion of at least 48 hours of sequential courses will serve as a basis for this course. A weekly classroom seminar will be provided in addition to a 15-hour/week placement in a school or agency setting. The practicum experience is a major part of preparation for the field placement internship. (Matriculation in the School Psychology Program plus 24 quarter credit hours successfully completed in the program or permission of instructor)
Class 3, Credit 4

GSSP-739   **Social Psychology**

Registration #0514-739

This course examines the way human behavior is affected by the social and physical environment. It analyzes the situational variables which promote or inhibit various behaviors and suggests ways in which individuals can recognize and resist social influence or fashion an environment conducive to attainment of their goals. (See requirements for admission for prerequisites or receive permission of instructor.)

Class 3, Credit 4

GSSP-740   **Psychology of Deafness**

Registration #0514-740

This course is an introduction to the cognitive, linguistic and emotional processes of hearing-impaired persons. Emphasis is placed on understanding the functional integrity and the dynamics of hearing-impaired persons' psychological systems. (See requirements for admission for prerequisites or receive permission of instructor.)
Class 3, Credit 4

GSSP-742   **Learning Disabilities: Identification and Intervention**

Registration #0514-742

This course provides the student with an overview of the issues and research on learning disabilities. Because the topic of learning disabilities is diverse, the course emphasizes criteria and content that have an established empirical base. Attention is directed to the issues of definition with a focus on identification (definition and diagnosis) and intervention (instruction and service delivery). Issues related to etiology and theoretical constructs of learning disabilities are presented in readings and by lecture content A neuropsychological approach is emphasized. (See requirements for admission for prerequisites or receive permission of instructor.)

Class 3, Credit 4

GSSP-777,778   **Internship in School Psychology I & II**

Registration #0514-777,778

Through direct, supervised 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 completion of 60 hours in graduate program and qualifying examination)
Class 3, Credit 5

GSSS-701   **Educational Sociology**

Registration #0515-701

This course is designed to furnish students with an understanding of the basic sociological processes underlying the educational process, and to help students apply it to concrete situations that may arise for teachers. (See requirements for admission for prerequisites or receive permission of instructor.)
Credit 3, Credit 4 (offered annually)

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 graduate committee and 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 (offered annually)

Liberal Arts
Graduate Elective Courses

GLLL-702   Film and Society

Registration #0504-702

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 3, Credit 4 (offered occasionally)

GSHF-702   Film History and Criticism

Registration #0505-702

A critical examination of key aspects of film criticism and of the development of film as an art. The emphasis of the course will be historical, with the development of cinema being traced through major films by important directors. There will be an opportunity to pursue individual interests.

Class 3, Credit 4 (offered occasionally)

GSHF-703   American Architecture

Registration #0505-703

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 3, Credit 4 (offered occasionally)

GSHF-705   Theories of Aesthetics and Art Criticism

Registration #0505-705

A course of the art-oriented graduate student centering on the student's search for a supportable and reliable basis for making value judgments about works of art as well as introducing the student to major concepts in aesthetics.

Class 3, Credit 4 (offered occasionally)

GSHF-707   Cubism to the Present

Registration #0505-707

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 3, Credit 4 (offered on sufficient demand)

GSHF-708   Oriental Art

Registration #0505-708

A seminar exploring the philosophical and cultural perspectives underlying traditional Far Eastern art as a prelude to examining selected topics in Indian, Chinese and Japanese art. Emphasis will be placed on the application of research techniques and critical methods of an individually selected area of interest which may serve as a foundation for continuing study.

Class 3, Credit 4 (offered occasionally)

GSHF-711   20th Century American Art

Registration #0505-711

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 3, Credit 4 (offered occasionally)

GSHF-712   Arts and Crafts in Tribal Societies

Registration #0505-712

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 will also be discussed.

Class 3, Credit 4 (offered occasionally)

GSHF-713   Contemporary Issues in Art

Registration #0505-713

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 3, Credit 4 (offered occasionally)

GSHF-714   Art Vision and Concept

Registration #0505-714

Though the course will develop chronologically from the Renaissance 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 3, Credit 4 (offered occasionally)

GSHF-715   Picasso

Registration #0505-715

The impact of Picasso and his circle on 20th century art. Their affinities with modern scientific and philosophical attitudes will also be discussed.

Class 3, Credit 4 (offered occasionally)

GSHF-716   Rembrandt

Registration #0505-716

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 artist's relationship to their society and to the character of the Baroque outlook.

Class 3, Credit 4 (offered occasionally)

GSHF-717   Topics in Music History

Registration #0505-717

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 3, Credit 4 (offered occasionally)

GSHH-701
History of American Educational Thought and Practice

Registration #0507-701

An historical analysis of change and continuity in American educational history from the colonial through contemporary periods. Special emphasis will be on the leading historiographical aspects of American educational history, and enabling the student to acquire mastery of the relevant bibliography. Lectures 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, final exam and paper.

Class 3, Credit 4 (offered occasionally)

GSHP-705
Seminar in Aesthetics

Registration #0509-705

This is a seminar, not a lecture course. At each meeting one or two students will give a presentation and then lead the discussion. Active participation in the discussions is required of all students at all seminar meetings. About half of the meetings will be devoted to critical examination of standard theories of art, including the theory that art is representation, that it is the expression of the artist's emotions, and that it is "significant form." We also will explore the history of the concept of fine art as it relates to such concepts as skill, craft, and design. Topics for the latter part of the course will be chosen by students, Recent seminar classes have discussed such things as conceptual art, minimalism, the status of computer art, feminist aesthetics, the commercialization of art in the 20th century, and kitsch.

Class 3, Credit 4 (offered occasionally)

GSHP-706
The Philosophy of Mind

Registration #0509-706

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 means 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)

GSSM-701
Country Risk Assessment

Registration #0513-701

An interdisciplinary introduction to the methods and procedures of country risk assessment. Practice in developing a country risk assessment will be offered in order to familiarize the student with the role of international environment analysis (political stability analysis) in the operations of business and financial institutions planning investments or operations abroad.

Class 3, Credit 4 (offered occasionally)

Other graduate courses

The State University of New York at Buffalo School of Social Work offers seven graduate social work courses on the RIT campus: Social Welfare Policies and Programs; History and Philosophy of Social Welfare; Behavioral Sciences I: Individual Development; Behavioral Sciences II: Organizational Development; Introduction to Statistical Research; Social Work Research; and Small Group Dynamics. These courses comprise most of the first year of study toward the MSW degree. For information, contact Dr. Marshall L. Smith, 475-2018.

Graduate Faculty
College of Liberal Arts

Dane Gordon, MA, Cambridge and University of Rochester—Associate Dean, Professor

Frank Annunziata, Ph.D., Ohio State University—Professor, History

Bruce Austin, Ph.D., Temple University—the William A. Kern Professor in Communications

Brian Barry, Ph.D., Syracuse University-Associate Professor, Psychology

Kathleen Chen, Ph.D., Pennsylvania State University—Professor, Psychology

Douglas Coffey, MA, Case Western Reserve University—Professor, Fine Arts

Charles Collins, Ph.D., University of Iowa—Assistant Professor, Fine Arts

Virginia K. Costenbader, BA, Dickinson College; MS, Ph. D., Syracuse University-Visiting Assistant Professor.

Janet E. Farnum, Ph.D., University of Rochester—Assistant Professor, Psychology

Robert Golden, Ph.D., University of Rochester—Associate Professor, Language and Literature

Roger Harnish, Ph.D., Oklahoma State University—Assistant Professor, Psychology

Morton Isaacs, Ph.D., Yeshiva University-Professor, Psychology

Paul Kazmierski, Ph.D., Syracuse University—Adjunct Professor, Psychology

Tina Lent, MA, University of California, Los Angeles—Assistant Professor, Fine Arts

Salvatore Mondello, Ph.D., New York University—Professor, History

John Morreall, Ph.D., University of Toronto—Associate Professor, Philosophy

Margery S. Reading-Brown, Ph.D., State University of New York at Albany—Assistant Professor, Psychology

Murli M. Sinha, Ph.D., Cornell University—Associate Professor, Sociology

David B. Suits, Ph.D., University of Waterloo—Associate Professor, Philosophy

Houghton Wetherald, MA, Oberlin College—Professor, Fine Arts

Hans Zandvoort, MFA, Royal Academy of Fine Arts, The Hague—Professor, Fine Arts

College of Science

Master of Science in Chemistry

John D. Paliouras, Dean, College of Science

Gerald A. Takacs, Department Head, Chemistry (475-2497)

Terence C. Morrill, Chair, Chemistry Graduate Committee (475-2047)

The Department of Chemistry offers a program leading to the master of science degree in chemistry on either a part-time or full-time basis with a variety of program options 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.

Two program options are available to cover the differing needs of graduate chemists.

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 student must further demonstrate mastery of analytical, organic, and physical chemistry in qualifying examinations administered by RIT's Department of Chemistry.

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 non-matriculated student.
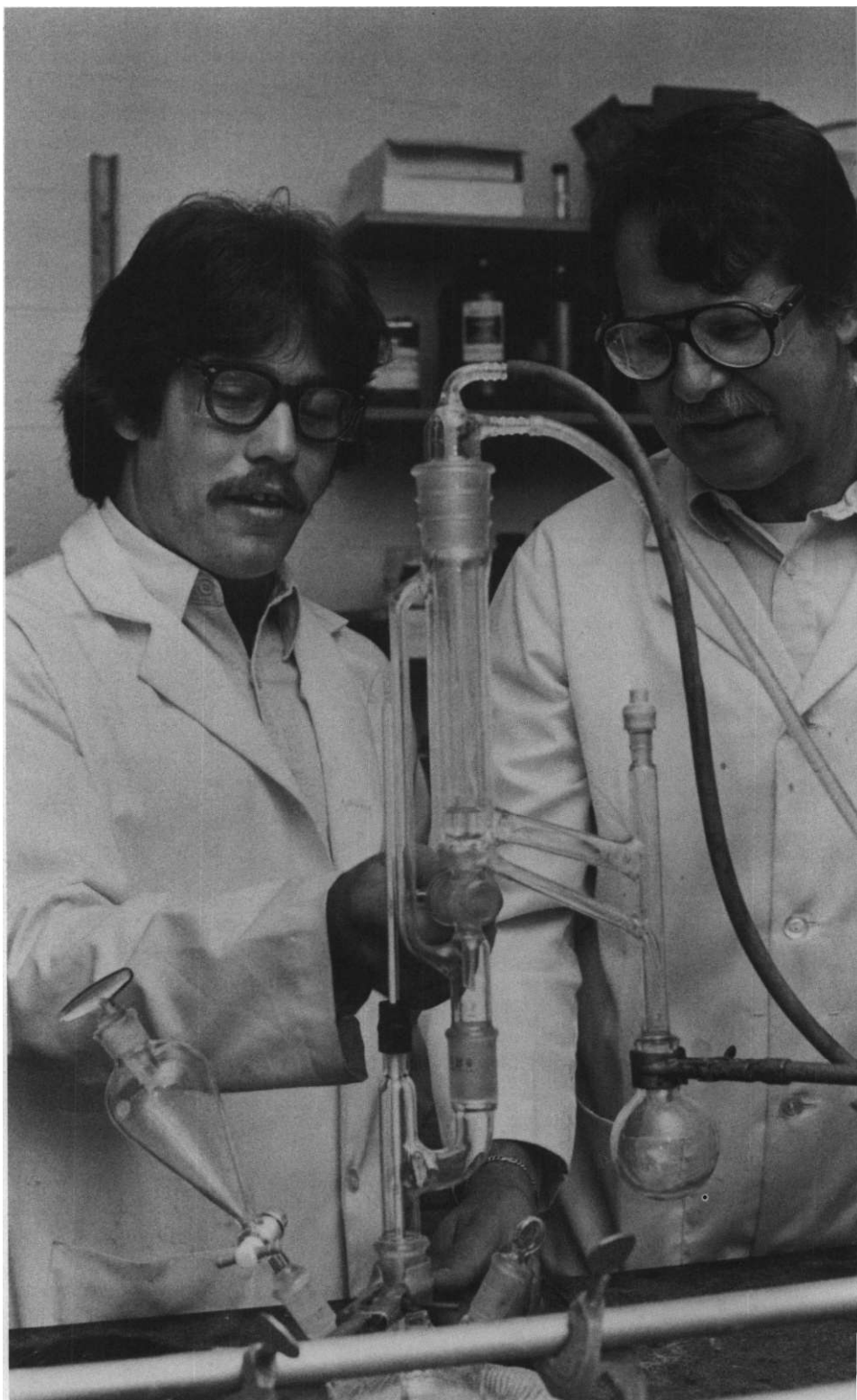
Courses taken for credit can usually be applied toward the master's degree if the student is formally admitted to the graduate program at a later date. However, the number of credits that will be transferred to the degree program from courses taken at RIT as a non-matriculated student will be limited to a maximum of 9 credits.

Any applicant who wishes to enroll in a graduate course as a non-matriculated student must obtain permission from the person in charge of the graduate program plus the appropriate faculty member.

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 a vigorous, research oriented faculty and 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.

Students enrolled in the program full-time are expected to complete 45 hours of course work and submit an independent research thesis. A full-time student normally takes 6 to 8 graduate credits per quarter, including thesis work. Typically, all requirements are met within two years.

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 normally be completed within four to five years.

Internship option
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 accommodates students at the master's level who have or are able to obtain industrial employment which allows for quarters of full-time academic work. If industrial employment permits research, up to 16 of the 45 required credits may be obtained through the industrial internship option.

If industrial employment does not permit research, research credits may be obtained within the Department of Chemistry.

Program
Each student, together with an advisor, 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 chairperson of the Graduate Committee.

A deliberate effort will be made to strengthen any areas of weakness indicated by the student's undergraduate records and/or the qualifying examinations.

In order 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 those with SCH-700 and SCH-800 numbers and should include one or more representing each of the four fields: analytical, inorganic, organic and physical. A maximum of 9 quarter credits may be taken in SCH-600 level courses.

Each student must select courses (subject to approval by the student's advisor and the graduate committee) which include the following core: SCHA-711, either SCHO-737 or SCHO-739, one of SCHP-741, SCHP-743 or SCHP-744, and one of SCHB-702, SCHI-762, SCHI-763 or SCHI-764. Demonstrated proficiency can supplant one of the core courses. As part of the required credits, each student must have one or two quarter credit hours in seminar SCH0870, and three to four quarter credit hours from outside of the Department of Chemistry.
2. A minimum of nine quarter credit hours in research and submission of a satisfactory thesis. This may be waived for part-time students.
3. Demonstrated competence in a foreign or computer language.
4. Pass an oral thesis defense or comprehensive examination.

Additional information
More information may be obtained from the chair of the Graduate Committee (716) 475-2047, or the Department of Chemistry (716) 475-2497.

Master of Science in Clinical Chemistry

John D. Paliouras, Dean,
College of Science

Joseph E. Devine, Director,
Clinical Chemistry Program (475-2182)

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 requiring both advanced technical and managerial proficiencies for 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.

Financial support
Teaching assistantship applications should be completed by March 15. Late applications may be considered under unusual circumstances. Information regarding other types of financial aid may be obtained from RIT's Financial Aid office.

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, SCHB-702; Biochemistry-Metabolism, SCHB-703; Advanced Clinical Chemistry, SCLC-820,821,822; Organizational Behavior and Organization and Management, BBUB-740,741; Statistics and Quality Control, SCLC-712; Survey of Physical Chemistry, SCHP-742; Introduction to Electricity and Electronics, SPSP-331; Clinical Laboratory Computer Applications, SCLC-722; Clinical Chemistry Research, SCLC-859 or 879; Mechanisms of Disease, SCLC-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 underlying focus of the program is on the clinical laboratory. Students without clinical laboratory experience are expected to acquire experience prior to completion of the program.

Graduate Faculty College of Science

John D. Paliouras, Ph.D., University of Illinois—Professor and Dean

Department of Biology

Richard L. Doolitde, Ph.D., University of Rochester—Assistant Professor, Biology

Irene Evans, Ph.D., University of Rochester—Associate Professor, Biology

Paul A. Haefner, Ph.D., University of Delaware—Professor, Biology

Jeffrey S. Lodge, Ph.D., University of Mississippi—Assistant Professor, Biology

Douglas Merrill, Ph.D., SUNY College of Environmental Science and Forestry, Syracuse University—Associate Professor, Biology

Robert H. Rothman, Ph.D., University of California, Berkeley—Associate Professor, Biology

Franz K. Seischab, Ph.D., SUNY College of Environmental Science and Forestry, Syracuse University—Professor, Biology

Department of Chemistry

Jerry M. Adduci, Ph.D., University of Pennsylvania—Professor, organic chemistry: organic mechanisms, polymer synthesis, and characterizations

B. Edward Cain, Ph.D., Syracuse University—Professor, inorganic chemistry: chemical education, methodologies and adaptation for the handicapped student

Robert A. Clark, Ph.D., University of Maryland—Professor and Director of Materials Science and Engineering: imaging science, physical and organic chemistry, polymers

Robert E. Gilman, Ph.D., University of Michigan—Professor, organic chemistry: synthesis of novel hosts for cation complexation; cyclization via aryl-aryl coupling reactions

Joseph P. Hornak, Ph.D., University of Notre Dame—Associate Professor, physical chemistry: magnetic resonance and magnetic resonance imaging

Marvin L Dlingsworth, Ph.D., University of Massachusetts—Assistant Professor, inorganic chemistry: coordination polymers, synthesis of eight-coordinate complexes and complexes with ambidentate ligands

Earl Krakower, Ph.D., University of British Columbia—Professor, physical chemistry: nuclear magnetic resonance, structure, and properties of molecules, chemical education

Terence C. Morrill, Ph.D., University of Colorado—Chair, Graduate Committee; Professor, organic chemistry: stereochemistry and mechanism of organic reactions, and organic structure effects upon lanthanide-induced shifts in NMR spectrometry; C-13 NMR, relaxation reagents; NMR applications to plasma-etched polymers

Eric Moskala, Ph.D., The Penn State University—Assistant Professor, polymer chemistry: materials science, polymer blends

John P. Neenan, Ph.D., University of California, Santa Barbara—Associate Professor, biochemistry: design of active-site-directed irreversible enzyme inhibitors

S. Jason Pan, Ph.D., Case Western Reserve University—Assistant Professor, macromolecular science: polymer chemistry, polymer morphology and crystallization, deformation and structure-property relationship, elastomers and reinforcement

Christian G. Reinhardt, Ph.D., University of Rochester—Associate Professor, biophysical chemistry: biological drug receptor recognition, binding and stereochemistry, mechanisms of interferon induction, nucleic acid structure

L. Paul Rosenberg, Ph.D., University of New Hampshire—Associate Professor, analytical chemistry: quantitative determination of metal and anion binding by computer-assisted EPR, HPLC, spectroscopy and fluorescence; computer interfacing

Gerald A. Takacs, Ph.D., University of Wisconsin—Professor, physical chemistry: chemical kinetics, atmospheric chemistry, plasma chemistry and photochemistry

Laura Ellen Tubbs, Ph.D., University of Rochester—Assistant Professor, physical chemistry: accelerator-based ultrasensitive mass spectroscopy, natural radioisotope dating

Kay G. Turner, Ph.D., Ohio State University—Associate Professor, synthetic organic chemistry: synthesis of natural products including fluorescent estradiol analogs; study of estrogen receptor mechanisms

Vladimir Vukanovic, Ph.D., University of Munster, Germany—Distinguished Professor, physical chemistry: low and high pressure plasma chemistry, atomic spectroscopy

Department of Clinical Sciences

James C. Aumer, MS, Michigan Technological University—Program Director, Medical Technology; Associate Professor

Joseph E. Devine, Ph.D., DABCC, University of Southern Mississippi—Program Director, Clinical Chemistry; Associate Professor: clinical enzymology, therapeutic drug monitoring, toxicology

Adjunct Faculty

Richard M. Bayer, Ph.D., Rutgers University—Rochester General Hospital, Adjunct Clinical Professor

Nathan Hamblin, BS, Rochester Institute of Technology—Rochester General Hospital, Adjunct Clinical Assistant Professor

Howard Harrison, Ph.D., Cornell University—Rochester General Hospital, Adjunct Clinical Associate Professor

Norman P. Kubasik, Ph.D., Syracuse University-Upstate Medical Center—The Genesee Hospital, Adjunct Clinical Professor

Department of Mathematics

Maurino Bautista, Ph.D., Purdue University—Assistant Professor, Mathematics

Patricia Clark, Ph.D., University of Rochester—Professor, Mathematics

David Farnsworth, Ph.D., University of Texas—Professor, Mathematics

Lester B. Fuller, Ph.D., Michigan State University—Professor, Mathematics

George Georgantas, Ph.D., SUNY at Buffalo—Professor, Mathematics

James A. Glasenapp, MA., SUNY at Buffalo—Professor, Mathematics

Marvin Gruber, Ph.D., University of Rochester—Professor, Mathematics

Laxmi Gupta, Ph.D., SUNY at Buffalo—Associate Professor, Mathematics

James J. Halavin, Ph.D,, SUNY at Buffalo—Associate Professor, Mathematics

Edwin T. Hoefer, Ph.D,, SUNY at Buffalo—Associate Professor, Mathematics

Jack Hollingsworth, Ph.D., University of Wisconsin—Professor, Mathematics

Wanda S.-Lojasiewicz, Ph.D., University of Cracow, Poland—Assistant Professor, Mathematics

James E. Marengo, Ph.D., Colorado State University—Assistant Professor, Mathematics

David Mathiason, Ph.D., University of Rochester—Assistant Professor, Mathematics

Douglas Meadows, Ph.D., Stanford University—Associate Professor, Mathematics

Edward A. Newburg, Ph.D., University of Illinois—Professor, Mathematics

Richard Orr, M.S., Case Institute of Technology—Associate Professor, Mathematics

Harry M. Schey, Ph.D., University of Illinois—Associate Professor, Mathematics

Theodore Wilcox, Ph.D., University of Washington—Associate Professor, Mathematics

Paul Wilson, Ph.D., University of Illinois—Professor, Mathematics

James A. Wiseman, Ph.D., Boston University—Associate Professor, Mathematics

Elmer Young, Ph.D., Ohio State University—Assistant Professor, Mathematics

Department of Physics

John D. Andersen, PhD., University of Rochester—Assistant Professor, Physics

Hrishikesh Baneijee, Ph.D., Institute of Nuclear Physics, Calcutta—Professor, Physics

Peter A. Cardegna, Ph.D., Clemson University—Assistant Professor, Physics

Tracy A. Davis, Ph.D., Clemson University—Assistant Professor, Physics

F. Kingsley Elder, Jr., Ph.D,, Yale University—Professor, Physics

Alan B. Entenberg, Ph.D., University of Rochester—Assistant Professor, Physics

Charles A. Hewett, Ph.D., University of Missouri—Professor, Physics

Ronald E. Jodoin, Ph.D., University of Rochester—Professor, Physics

James R. Kern, Ph.D., Clemson University—Associate Professor, Physics

Michael Kotlarchyk, Ph.D., Massachusetts Institute of Technology—Assistant Professor, Physics

Arthur Z. Kovacs, Ph.D,, Duke University—Professor, Physics

Vern Lindberg, Ph.D., Case Western Reserve University—Associate Professor, Physics

Varadaraja V. Raman, Ph.D., University of Paris—Professor, Physics

Earl H. Sexton, PhJD., SUNY at Albany—Professor, Physics

John S. Shaw, Ph.D., SUNY at Albany—Associate Professor, Physics

Jerome Wagner, Ph.D., University of Wisconsin—Associate Professor, Physics

Anne G. Young, Ph.D,, Cornell University—Associate Professor, Physics

Materials Science and Engineering

Richard A. Kenyon, Dean, College of Engineering

John D. Paliouras, Dean, College of Science

Robert A. Clark, Director, Materials Science and Engineering Program (475-2944)

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.

The objectives of the program are three-fold:
• 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, electrical and mechanical 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, and physics; 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 industrial internship 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 eight and a maximum of-16 quarter credit hours, subject to review and approval of the project

The industrial internship option allows participants to continue their studies in their work environment, thus enhancing job satisfaction. In-plant work experience in the materials-related areas may include independent study and creative research. This industrial internship option may be applied, for a minimum of four and a maximum of 16 quarter credit hours, toward the completion of the master of science degree.

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 director.

Part-time study
Practicing scientists and engineers are encouraged to pursue the program on a part-time basis; therefore, the majority of the courses are offered in the late afternoon or early evening hours. (This may not apply to courses offered off campus at several 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 advisor.

Degree requirements
A minimum of 45 quarter credit hours, which includes five core courses and the seminar course, 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 the industrial internship and elective courses, or as elective courses. The elective courses may be 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 on the basis of a one-year cycle and the advanced courses will be scheduled on the basis of a two-year cycle.

Admission
The program is open to individuals with a bachelor's degree in chemistry, physics, and chemical, electrical or mechanical engineering from an accredited college or university. Any student who wishes to study at the graduate level must first be admitted to the program. An applicant is permitted to take graduate courses as a non-matriculated student, however, 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.

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 non-matriculated student

Graduate Faculty

Materials Science and Engineering
College of Engineering and College of Science

Richard A. Kenyon, Ph.D., P.E., Syracuse University—Dean, College of Engineering, Professor: mechanical engineering, thermodynamics and fluid mechanics

John D. Paliouras, Ph.D., University of Illinois—Dean, College of Science, Professor: mathematics, analysis

Robert A. Clark, Ph.D., University of Maryland—Director of Materials Science and Engineering, Professor: chemistry, physical and organic chemistry, polymers, plasma science

Lynn Fuller, Ph.D,, University of Buffalo-Associate Professor and Department Head: microelectronic engineering, solid state devices and microelectronics

Bhalchandra V. **Karlekar,** Ph.D., P.E., University of Illinois—Professor and Department Head: mechanical engineering, heat transfer, applied mathematics

Arthur Z. Kovacs, Ph.D., Duke University-Professor and Department Head: physics, high energy physics, systems engineering and management science

Swaminathan Madhu, Ph.D., University of Washington—Professor and Department Head: electrical engineering, communications theory, logic design

Gerald A. Takacs, Ph.D., University of Wisconsin—Professor and Department Head: chemistry, plasma physical chemistry and atmospheric science

Jerry M. Adduci, Ph.D., University of Pennsylvania—Professor: chemistry, organic mechanisms, polymer synthesis and characterization

Hrishikesh Baneijee, Ph.D., University of Calcutta—Professor: physics, nuclear physics, solid state and semi-conductor physics

Alan B. Entenberg, Ph.D., University of Rochester—Assistant Professor: physics, laser fusion and thin films adhesion

G. Thomas Frederick, Ph.D., Ohio State University—Professor and Department Head: biology, scanning electron microscopy, energy dispersive X-ray analysis

William G. Frizelle, MS, P.E., University of Rochester—Assistant Professor: mechanical engineering technology, polymer engineering

Surendra K. Gupta, MS, University of Notre Dame—Lecturer: mechanical engineering, X-ray diffraction, power metallurgy

Roger E. Heintz, Ph.D., Syracuse University—Associate Professor: electrical engineering, solid state devices

Charles A. Hewett, Ph.D., University of Missouri—Professor: physics, solid state physics, fluorescence

Marvin L. Dlingsworth, Ph.D., University of Massachusetts—Assistant Professor: inorganic polymers, coordination compounds, and specialty materials

Ronald E. Jodoin, Ph.D., Univeristy of Rochester—Professor: physics, optics, lasers and digital image processing

Michael Kotlarchyk, Ph.D., Massachusetts Institute of Technology—Assistant Professor: physics of neutron depth profiling, characterization and phase transitions in colloidal systems

Vern Lindberg, Ph.D., Case Western Reserve University—Associate Professor: physics, thin film deposition and analysis

Eric J. Moskala, Ph.D., The Penn State University—Assistant Professor: chemistry, polymer chemistry, polymer blends and infrared spectroscopy

Chris Nilsen, Ph.D., RE., Michigan State-Associate Professor: mechanical engineering, metallurgy and materials science

Alan H. Nye, Ph.D., University of Rochester—Associate Professor: mechanical engineering, solid mechanics and heat transfer

S.Jason Pan, Ph.D., Case Western Reserve University—Assistant Professor: polymer morphology and crystallization, deformation and structure-property relationships in polymers, elastomers and reinforcement

Harvey E. Rhody, Ph.D., Syracuse University—Professor: electrical engineering, communication theory

Tapan K. Sarkar, Ph.D., Syracuse University—Associate Professor: electrical engineering, E.M., fields, time domain studies

Robert L. Snyder, Ph.D., P.E., Iowa State-Professor: mechanical engineering, materials science, chemistry

David A. Sumberg, Ph.D., Michigan State University—Associate Professor: electrical engineering, lasers and optoelectronics

Renan Turkman, Ph.D., University of Paris—Visiting Assistant Professor: electrical engineering, solid state devices

Raman M. Unnikrishnan, Ph.D., Missouri—Associate Department Head, Associate Professor: power electronics, control systems.

Vladimir Vukanovic, Ph.D., University of Miinster—Distinguished Professor: chemistry, plasma physical chemistry, atomic spectroscopy with arc plasma source

Jerome Wagner, Ph.D., University of Wisconsin—Associate Professor: physics, defect properties in solids, medical physics and radiation dosimetry

Adjunct Faculty

John F. 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., Univeristy 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 Univeristy—Director of R&D, Beta Physics, Division of Eastman Technologies, Rochester, N.Y.

Robert Lord, MS, Syracuse University—Manager, IBM-Endicott, Endicott, N.Y.

Gerald F. Meyers, BS, University of Pittsburgh—Plant Metallurgist, Delco Produts, 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—Market Intelligence Associate, Eastman Kodak Company, Rochester, N.Y.

Edward G. Williams, MS, University of Rochester—Manager of Plastics Technology, Xerox Corporation, Rochester, N.Y.

Chemistry

SCHA-620   **Building Scientific Apparatus**

Registration #1008-620

Basic skills associated with the construction of scientific laboratory apparatus, some of which is not commercially available, will be covered: machine shop skills, working with glass, vacuum technology, optics, and electronics. Special emphasis will be placed on the function-structure relationship between an instrument and its intended use. Several references on construction techniques will be provided and information about current manufacturers and suppliers of necessary components will be given. (Corequisite SSEG-621) (SCHP-441, SPSP-212,213 or 312,313)

Class 3, Credit 3 (offered upon sufficient request)

SSEG-621   **Building Scientific Apparatus Laboratory**

Registration #1018-621

Basic skills associated with the construction of scientific laboratory apparatus, some of which is not commercially available, will be covered: machine shop skills, working with glass, vacuum line technology, optical spectrometer design, and instrument electronics. (Corequisite SCHA-620) (SCHP-441, SPSP-212, 213 or 312,313; or permission of instructor)

Lab 4, Credit 1 (offered upon sufficient request)

SCHA-711   **Instrumental Analysis**

Registration #1008-711

Theory, applications and limitations of selected instrumental methods in qualitative, quantitative, and structural analysis. Topics covered include mass spectroscopy, nuclear magnetic resonance, electrochemistry, surface methods and new analytical methods. (SCHA-312)

Class 3, Credit 3 (offered every year) (F, W)

SCHA-720   **Instrumental Analysis Lab**

Registration #1008-720

Lab accompanying SCHA-711. Experiments include AA, fluorimetry, coulometry, ^{13}C and ^1H NMR, polarography. Assignments depend on student background. (Corequisite SCHA-711)

Lab 6, Credit 2 (offered every year) (F, W)

SCHB-702   **Biochemistry: Biomolecular Conformation & Dynamics**

Registration #1009-702

Introduction to biological chemistry. Chemical structures, reactions, molecular organization and physiological functions of the molecular components of cells; amino acids, proteins, enzymes, enzyme kinetics, co-enzymes, biochemical thermodynamics, carbohydrates and lipids, membrane structure, and active transport. Emphasis is on the structure-function relationships of biomolecules, their solution behavior and dynamics. (SCHO-433 and SCHP-340 or SCHP-742)

Class 3, Credit 3 (offered every year) (F, W)

SCHB-703   **Biochemistry: Metabolism**

Registration #1009-703

Bioenergetics principles; catabolism of carbohydrates, fatty acids and amino acids; photosynthesis, biosynthesis of carbohydrates, lipids, and nitrogenous compounds; metabolic diseases. (SCHB-702)

Class 3, Credit 3 (offered every year) (F, W)

SCHB-704   **Biochemistry: Nucleic Acids and Molecular Genetics**

Registration #1009-704

The biochemistry of inheritance, expression of genetic information, protein biosynthesis, differentiation, viral and bacterial infection and the "origin of life." (SCHB-702)

Class 3, Credit 3 (offered every year) (S, SR)

SCHC-772   **Special Topics**

Registration #1010-772

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 will 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 (offered every year)

SCHC-870   **Chemistry Seminar**

Registration #1010-870

Credit 1 (offered every year)

SCHC-877   **External Research**

Registration #1010-877

Industrial internship research.

Credit 1-16 (offered every year)

SCHC-879   **Research and Thesis Guidance**

Registration #1010-879

Hours and credits to be arranged. Chemical research in a field chosen by the candidate, subject to approval of the department head and advisor.

Credit variable (offered every year)

SCHC-899   **Independent Study-Chemistry**

Registration #1010-899

Credit variable (offered every year)

SCHI-762   **Inorganic Chemistry I: Periodicity and Reactivity**

Registration #1012-762

For the common elements, mastery will be required of chemical reactions which describe: (1) their isolation, (2) their characteristic chemical reactivities, and (3) large volume industrial processes. Relationships between the reactivities of neighboring elements will be elucidated and justified according to current theories. (SCHO-433, SCHP-442)

Class 3, Credit 3 (offered every year) (S, SR)

SCHI-763   **Inorganic Chemistry II: Isomerism, Symmetry, and Bonding**

Registration #1012-763

This course provides an in-depth view of how bonding theories endeavor to account for and predict the physical properties (e.g., color, magnetism, stability, chemical potential, electrical conductivity, and others) of a wide variety of inorganic compounds. (SCHO-443, SCHP-442)

Class 3, Credit 3 (offered every year) (F, W)

SCHI-764   **Inorganic Chemistry III: Physical Methods and Recent Advances**

Registration #1012-764

This course introduces the student to the more sophisticated tools with which an inorganic chemist investigates inorganic materials. These physical methods, with the bonding theories from SCHI-763, are applied to inorganic reactions that exemplify the similarities and anomalous behavior of the elements in each family of the periodic table. Application of this knowledge to contemporary research areas of inorganic chemistry is conducted. (SCHI-763)

Class 3, Credit 3 (offered every year) (S, SR)

SCHI-765   **Preparative Inorganic Chemistry**

Registration #1012-765

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. (Corequisite SCHI-763) (SCHI-762 or permission of instructor)

Class 1, Lab 6, Credit 3 (offered every year) (W, S)

SCHO-601   **Organic Chemistry of Polymers**

Registration #1013-601

The chemistry of high molecular weight organic polymers and their properties are introduced and discussed in depth. Mechanisms of step-growth and chain-growth polymerization reactions, polymer reactions and degradations are studied. (SCH0433)

Class 4, Credit 4 (F,W)

SCHO-730   **Chemical Toxicology**

Registration #1013-730

Xenobiotic mechanism, chemical carcinogenesis, drug-induced toxicology, environmental and genetic toxicology, teratology and bioassay/biometrics. (SCHO-433)

Class 3, Credit 3 (offered upon sufficient request)

SCHO-736   **Spectrometric Identification of Organic Compounds**

Registration #1013-736

Theory and application of proton and carbon nuclear magnetic resonance, infrared, mass spectrometry, and ultraviolet spectra as applied to organic structure determination. (SCHO-433)

Class 4, Credit 4 (offered every year)

SCHO-737   **Advanced Organic Chemistry**

Registration #1013-737

Several of the following advanced topics in organic chemistry are covered: polyfunctional compounds, modern synthetic methods, stereochemistfy, conformational analysis, free radical reactions, natural products, new synthetic reagents. (SCHO-433)

Class 4, Credit 4 (offered every year)

SCHO-739   **Advanced Organic Chemistry**

Registration #1013-739

Selected topics in physical organic chemistry including: techniques for elucidation of mechanism (kinetic, linear free, energy relationships, isotope effects), molecular orbital theory, electrocyclic reactions. (SCHO-433, SCHP-443)

Class 4, Credit 4 (offered every year)

SCHO-832   **Stereochemistry**

Registration #1013-832

Advanced treatment of steric relationships and stereoisomerism in organic compounds. (SCH0433, SCHP-443)

Class 4, Credit 4 (offered upon sufficient request)

SCHO-833   **Heterocyclic Chemistry**

Registration #1013-833

This course will contain a comprehensive treatment of heterocyclic chemistry. Based on the concept of x-excessive and x-deficient ring systems, the student will be introduced to categorical similarities and differences among various heterocyclic systems. In addition, the course will explain the logical consistency of the numerous syntheses and relative reactivities of heterocyclic compounds as demonstrated by their chemical reactions and spectroscopic properties. These results of reactivities and synthetic studies are then applied to a number of commercially important heterocyclic compounds. (SCHO-433)

Class 4, Credit 4 (offered upon sufficient request)

SCHP-602   **Physical Chemistry of Polymers**

Registration #1014-602

Study of the theoretical and experimental aspects of polymer characterization. In addition, theoretical considerations of the configuration of polymer chains and statistical thermodynamics of polymer solutions will be related to experimental results. (SCHP-443)

Class 3, Credit 3 (S, SR)

SCHP-603   **Structure-Property Relationships in Polymers**

Registration #1014-603

An introduction to amorphous and semicrystalline polymeric systems; thermomechanical, tensile, and impact properties of polymers; rubber elasticity, viscosity, viscoelasticity. (SCHO-601 or SCHP-602)

Class 4, Credit 4 (F,W)

SCHP-604   **Characterization of High Polymers**

Registration #1014-604

Experiments on dilute solution viscosity, gel permeation chromatography, vapor phase osmometry, differential scanning calorimetry, thermogravimetric analysis, tensile testing, infrared spectroscopy, NMR spectroscopy and other aspects of polymer characterization. (SCH0 601 or SCHP-602)

Lab 6, Credit 2 (F,W)

SCHP-605   **Synthesis of High Polymers**

Registration #1014-605

Experiments on condensation, free radical, ring opening, and ionic polymerizations and polymer modifications. (SCHO-437)

Lab 6, Credit 2 (F,W)

SCHP-630   **Magnetic Resonance Imaging**

Registration #1014-630

This course introduces the principles of magnetic resonance imaging (MRI) at a level understandable by both the scientist and non-scientist. The course begins with the basics of nuclear magnetic resonance, the foundation of MRI. Magnetic resonance imaging techniques and instrumentation will be explained. Emphasis will be placed on understanding the imaging process. A discussion of information available for water proton content images of body parts and tissue types will be presented. Future directions of MRI will be presented.

Class 4, Credit 4 (W)

SCHP-741   **Chemical Thermodynamics**

Registration #1014-741

A study of the basic fundamentals of thermodynamics and their use in deriving the interrelationships of thermodynamic functions. Thermodynamic properties of gases will be calculated based on spectroscopic data. (SCHP-443, SMAM-306)

Class 4, Credit 4 (offered alternate years)

SCHP-742   **Survey of Physical Chemistry**

Registration #1014-742

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 with applications to the life sciences. Not acceptable for BS in chemistry.

Class 3, Credit 3 (offered alternate years) (W)

SCHP-743   **Chemical Kinetics**

Registration #1014-743

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. (SCHP-443)

Class 4, Credit 4 (offered alternate years)

SCHP-744   **Quantum Mechanics**

Registration #1014-744

Matrix formulation of quantum mechanics; variation and perturbation methods, group theory molecular orbital energies of complex molecules, calculation of vibrational frequencies and selection rules for complex molecules. Emphasis on use of spectroscopy and quantum chemistry to obtain chemical information. (SCHP-442)

Class 4, Credit 4 (offered alternate years)

SCHP-747   **Principles of Magnetic Resonance**

Registration #1014-747

This course will consist of a series of lectures designed to introduce the principles of both nuclear magnetic resonance (NMR) and electron spin resonance spectroscopies, two of the more popular of magnetic resonance spectroscopies. Modern applications, classical and quantum mechanical theory and instrumentation, both pulsed and continuous wave, of magnetic resonance spectroscopies are the general subject areas to be covered. A few of the specific topics to be covered are Fourier transform spectroscopy, magnetic resonance imaging, solid state NMR, spin relaxation, two dimensional NMR, resonance line shapes, laser magnetic resonance, magic angle spinning, and spectrometer design. (SCHP-443)

Class 4, Credit 4 (offered upon sufficient request)

Clinical Chemistry

SCLC-705   **Mechanisms of Disease**

Registration #1023-705

Following a brief review of normal physiology, emphasis will be on aspects of the development and reversal of functional abnormalities in disease states. Cellular damage will be integrated with organ failure and multi-organ systemic disease and healing.

Class 4, Credit 4 (offered every other year)

SCLC-712   **Statistics and Quality Control**

Registration #1023-712

The principles of statistics as applied to biomedical research as well as clinical laboratory analysis will be studied. Using a problem-oriented approach, probability, normal values, analysis of variance and quality control as well as the relationship of these procedures to patient care will be studied.

Class 3, Credit 3 (S)

SCLC-722   **Clinical Laboratory Computer Applications**

Registration #1023-722

The basic concepts of data processing as well as the design, evaluation and utilization of computer systems in both hospitals and clinical laboratories will be studied. The legal aspects of biomedical data processing as well as instrument interfacing will also be studied.

Class 3, Credit 3 (offered every other year)

SCLC-820   **Advanced Clinical Chemistry I**

Registration #1023-820

Toxicology, therapeutic drug monitoring, electrolytes, acid-base, vitamins, oncology, hepatitis, coagulation, and various standard methods. (Permission of instructor)

Class 4, Credit 4(F)

SCLC-821   **Advanced Clinical Chemistry II**

Registration #1023-821

Proteins, enzymes, hemoglobins, iron, renal functions, lipids, quality control, automation, and method selection. (Permission of instructor)

Class 4, Credit 4 (S)

SCLC-822   **Advanced Clinical Chemistry ID**

Registration #1023-822

Radioimmunoassay, hormones, fetal-placement unit, integration of laboratory data. (Permission of instructor)

Class 4, Credit 4 (offered every other year)

SCLC-870   **Clinical Chemistry Seminar**

Registration #1023-870

Credit 1

SCLC-872   **Special Topics in Clinical Chemistry**

Registration #1023-872

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 examinations.

Class variable, Credit variable (offered upon sufficient request)

SCLC-877   **External Clinical Chemistry Research**

Registration #1023-877

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 for determination of credit to be awarded.

Credit variable

SCLC-879   **Clinical Chemistry Research**

Registration #1023-879

Research carried out in 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 1-16

SCLC-899   **Independent Study**

Registration #1023-899

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 determined after review of a study proposal.

Credit variable

Materials Science and Engineering

SESM-701   **Introduction to Materials Science**

Registration #1028-701

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 (offered every year)

SESM-702   **Introduction to Polymer Science**

Registration #1028-702

A study of the chemical nature of plastics detailing the relationships between polymerization conditions, structure and properties in both the solid and fluid states. (SESM-701 or equivalent)
Class 4, Credit 4 (offered every year)

SESM-703   **Solid State Science**

Registration #1028-703

This course will survey topics in the physics' of solids. Included in these will be crystal symmetry, structure, and binding, mechanical, thermal, and electrical properties of insulators, semiconductors, and conductors including band theory. (SESM-704 or equivalent)
Class 4, Credit 4 (offered every year)

SESM-704   **Introductory Theoretical Methods**

Registration #1028-704

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. (SESM-701 or equivalent)
Class 4, Credit 4 (offered every year)

SESM-705   **Introductory Experimental Techniques**

Registration #1028-705

This course introduces the student 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 will be conducted. (SESM-702 or equivalent)
Class variable, Lab variable, Credit 4 (offered every year)

SESM-706   **Experimental Techniques**

Registration #1028-706

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. (SESM-701 or equivalent)

Class variable, Lab variable, Credit 4

SESM-707   **Experimental Techniques**

Registration #1028-707

The course includes a detailed study of scanning electron microscopy and modern applications in microelectronic engineering. (SESM-701 or equivalent)
Class variable, Lab variable, Credit 4

SESM-708   **Experimental Techniques**

Registration #1028-708

The course is designed to provide an in-depth integrated approach to the analysis, investigation and development of materials, concentrating on specific types of classes. (SESM-701 or equivalent)

Class variable, Lab variable, Credit 4

SESM-710   **Material Properties and Selection I**

Registration #1028-710

A 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.
Class 4, Credit 4

SESM-711   **Material Properties and Selection II**

Registration #1028-711

Mechanical properties of metallic polymeric materials; application and selection of such materials based on strength, fatigue, impact, creep, processing, and economy. (SESM-710)
Class 4, Credit 4

SESM-714   **Ceramics and Glass**

Registration #1028-714

Topics covered will include the structure and properties of glass, applied areas such as glass melting and processing, and various technological applications of glass. (SESM-701 or equivalent)
Class 4, Credit 4

SESM-717   **Materials Degradation Corrosion**

Registration #1028-717

This course introduces the student to the basic electrochemical nature of corrosion and considers the various factors which influence the rate of corrosion in a variety of environments. Various means of controlling corrosion are considered. (SESM-701 or equivalent)
Class 4, Credit 4

SESM-720   **Organic Polymers**

Registration #1028-720

This course is designed to meet the needs of students in the area of organic chemistry related to synthesis, polymerization mechanism, structures, stereochemistry and reactions of organic polymers and their industrial usage. (SESM-702 or equivalent)
Class 4, Credit 4

SESM-721   **Physical Chemistry of Polymers**

Registration #1028-721

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. (SESM-702 or equivalent)

Class 4, Credit 4

SESM-722   **Polymer Processing**

Registration #1028-722

A study of the basic principles and methods involved in the technology of processing polymeric materials, including treatment of heat transfer, mass transfer, mixing and shaping or molding of these materials.

Class 4, Credit 4

SESM-730   **Optical Properties of Materials**

Registration #1028-730

Fundamentals of geometrical and physical optics; interaction of radiation with matter, dielectrics and thin films; introduction to electro-optic and acousto-optic effects. (SESM-701 or equivalent)

Class 4, Credit 4

SESM-733   **Electrical and Magnetic Properties of Materials**

Registration #1028-733

Band structures of pure and doped solids and solid compounds, transport phenomena, semiconduction, optical properties, galvanomagnetic and magneto-optic effects. (SESM-701 or equivalent)

Class 4, Credit 4

SESM-734   **Advanced Optics**

Registration #1028-734

Lasers', theory, types and construction; optics of metals; multilayer dielectrics; electro- and acousto-optic modulators and deflectors; optical detectors. (SESM-730 or equivalent)

Class 4, Credit 4

SESM-736   **Amorphous and Semicrystalline Materials**

Registration #1028-736

Electrical, thermal, and optical properties of amorphous materials; models and conduction. (SESM-703 or equivalent)

Class 4, Credit 4

SESM-740   **Nuclear Science and Engineering**

Registration #1028-740

Systematics of the atomic nuclei, radioactivity, nuclear reactions, fission, nuclear reactor principles, designs, materials and safety. (Permission of instructor)

Class 4, Credit 4

SESM-760   **Plasma Science**

Registration #1028-760

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 atomospheric science. (SESM-701 or equivalent)

Class 4, Credit 4

SESM-770   **Physics and Chemistry of I.C. Processing**

Registration #1028-770

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 modelling by using SUPREM. (Permission of instructor)

Class 4, Credit 4

SESM-800   **Special Topics**

Registration #1028-800

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

SESM-879   **Research and Thesis Guidance**

Registration #1028-879

A project involving research on a topic in materials science and engineering carried out either on campus or off campus under the industrial internship option. An oral examination and written thesis are required.

Credit variable

SESM-890   **Seminar**

Registration #1028-890

This course is required for completion of the program and will involve a one-hour presentation on some topic in materials science and engineering.

Class variable, Credit 1 (offered every year)

SESM-899   **Independent Study**

Registration #1028-899

This course number should be used by students wishing to study a topic on an independent study basis. (Permission of instructor)

Credit variable

The National Technical Institute for the Deaf

William E. Castle, Director

The National Technical Institute for the Deaf (NTID) was created in 1965 to offer deaf students technical and professional education that can lead to meaningful employment in business, industry, government, and education. Rochester Institute of Technology (RIT) was chosen as NTID's sponsoring institution in late 1966 by the Department of Health, Education and Welfare. In the fall of 1968, the first group of deaf students began their studies at NTID. For more than 16 years, NTID at RIT has provided postsecondary education to deaf students from every state in the nation.

While it is a national institution, it also is one of the nine colleges of RIT. NTID is the world's only technological college serving deaf students in comprehensive career-oriented postsecondary programs.

Graduate programs for deaf students
NTID encourages qualified deaf students to pursue master's degree programs at RIT. Students who request them will receive appropriate support services through NTID, including sign language interpreting, tutoring, notetaking, career counseling, personal/social counseling, and job placement assistance.

Many NTID faculty members teach in the RIT graduate programs and share a wide range of technical expertise as well as knowledge of both deafness and education of deaf people.

For more information, contact the RIT Office of Admissions or the NTID Office of Career Outreach and Admissions, One Lomb Memorial Drive, Post Office Box 9887, Rochester, New York 14623.
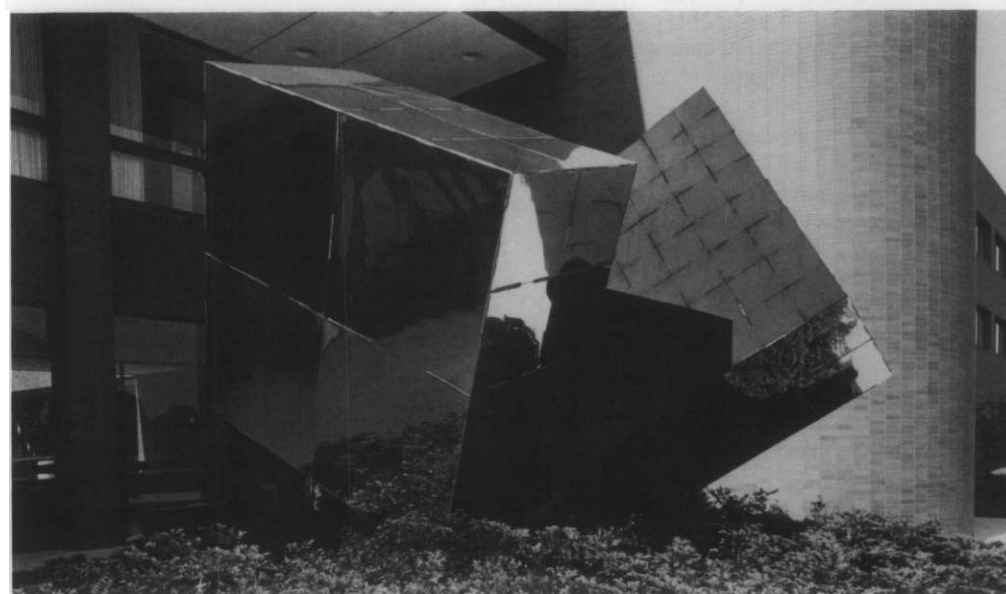
Joint Program to Prepare Educational Specialists for the Deaf at the Secondary Level

Cosponsors: University of Rochester
through the Graduate School of Education and Human Development
Guilbert Hentschke, Dean
and
Rochester Institute of Technology
through the National Technical Institute for the Deaf
William E. Castle, Director

A new type of professional
The University of Rochester's Graduate School of Education and Human Development and Rochester Institute of Technology through the National Technical Institute for the Deaf have jointly developed a graduate program designed to improve the quality of education and services for deaf people.

Graduates of the master's degree program will be qualified to work as professionals with deaf people at the secondary level in:
- teaching deaf and normally hearing secondary students in such areas as English, mathematics, science, and social studies;
- managing special educational support service systems such as tutoring, note-taking, and interpreting;
- serving as resources on deafness to schools involved in mainstreaming deaf students into regular school systems.
Graduates will work in secondary schools serving deaf students, or function as instructional leaders, working with colleagues to enrich and upgrade the quality of education for deaf people nationally.

Certification
Graduates of this program will be eligible for:
- provisional certification from New York State as an academic teacher of the normally hearing, for grades 7-12, in one or more of these areas: English, social studies, mathematics, biology, chemistry, physics, earth science, and general science;
- provisional certification from New York State as a teacher of deaf and hearing-impaired students, nursery school through grade 12;

- a master of science in education degree from the University of Rochester co-sponsored by Rochester Institute of Technology through the National Technical Institute for the Deaf. The program is approved by the Council on the Education of the Deaf (CED). Graduates can be certified by CED.

To be certified to teach one or more of the broad fields listed below at the secondary level in New York State, applicants must satisfy the following minimum course work (undergraduate or graduate level) requirements in one of these areas:

English—36 semester hours including work in linguistics, literature, and writing;
Mathematics—36 semester hours including a calculus sequence;
Science—44 semester hours in the natural sciences including a calculus sequence;
Social Studies—36 semester hours in history, geography, and the social sciences, with American studies and at least one course in the methods of inquiry in history, geography, or one of the social sciences.

The University of Rochester and the National Technical Institute for the Deaf: uniquely qualified to jointly prepare educational specialists
The University of Rochester, one of the smallest of the nation's distinguished universities, enrolls about 8,000 students, upwards of 3,000 of them at the graduate level. One of its eight colleges and schools, the Graduate School of Education and Human Development, offers doctor's and master's degrees in a variety of educational specialties. The school maintains long-established programs of teacher preparation for students in the university's departments of English, mathematics, social sciences, and natural sciences in the College of Arts and Science. Individuals and groups from the school's faculty have engaged in a number of joint activities with NTID personnel over the past 11 years. Members of the university's School of Medicine and Dentistry and Center for Visual Science have joined in similar collaborations.

NTID, an integral part of Rochester Institute of Technology, is the world's only technological college for deaf students. It is renowned, both nationally and internationally, for its efforts to integrate deaf students onto a college campus planned primarily for hearing students. Today nearly 1,250 hearing-impaired students from 50 states, the District of Columbia, and several U.S. territories study and reside on the RIT campus with 15,000 hearing students.

RIT's students are enrolled in the colleges of Applied Science and Technology, Business, Continuing Education, Engineering, Fine and Applied Arts, Graphic Arts and Photography, Liberal Arts, Science and, of course, NTID.

RIT offers more than 200 individual career study areas leading to master's, bachelor's, and associate degrees.

About the program
This full-time master's degree program normally requires three to five semesters to complete, depending upon the applicant's entry-level qualifications. The program is designed for people who seek academic certification to teach both hearing and deaf students. It also serves those who already are certified to teach academic subjects to hearing students at the secondary level and who seek additional certification to teach deaf students.

Applicants must have at least an undergraduate major in an academic area normally taught at the secondary school level, such as English, literature, mathematics, chemistry, or history. Some applicants also may need more advanced work in their area of academic expertise, or may need to develop a broader perspective in several academic areas. For example, persons with an undergraduate degree in mathematics may need additional mathematics preparation to meet the University of Rochester's program requirements, or to attain an appropriate breadth of knowledge in that subject.

Sign language
Participants will be required to demonstrate basic skills in expressive and receptive sign language before their student teaching begins. Those without sign language skills will be encouraged to participate in sign language courses at NTID in the summer that precedes their first semester of graduate study.

Admission requirements
To gain admittance to this graduate program, applicants must:
- complete the equivalent of an undergraduate major in at least one academic area directly related to subjects normally taught at the secondary level.

- demonstrate an interest in serving the needs of deaf people.
- satisfy the University of Rochester admission requirements: solid undergraduate background in an academic area, good recommendations, and a successful on-campus interview.
- take the aptitude section of the Graduate Record Examination (GRE) prior to admission. Those who have not done so before admission will be required to take the GRE subsequent to admission.

Participants will determine their individual programs of study with the assistance of a faculty advisor. Among the major areas of study available to participants will be specialized courses that relate deafness to the communication sciences and disorders, instructional theories and techniques, educational goals and processes, and psycho-social-cultural development. Student teaching will provide exposure to the full range of educational environments available to deaf adolescents in the region.

How to apply
Enrollment will be limited. Some financial aid may be available. For an application and additional information, please write to:

Dr. Judy Egelston-Dodd
Director, Joint Educational Specialists
   Program
507 Lattimore Hall
Graduate School of Education and
   Human Development
University of Rochester
Rochester, New York 14627
Phone (716) 2754009
   (Voice or TDD)

Note: Course descriptions can be found in the University of Rochester Graduate Bulletin.
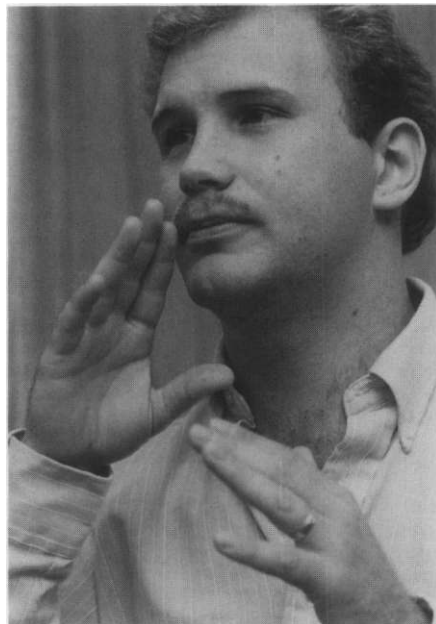
NTID/RIT graduate internships
The purpose of the NTID Internship program is to provide opportunities for students at the master's or doctoral level to gain practical experience in the application of their discipline. Interns are usually graduate students or professionals who wish to gain advanced in-service training in their career areas and in education and services for deaf persons. The duration of the internship depends on individual needs and the calendar of the sponsoring institution. NTID offers graduate internships in:

Audiology
Career and Personal Counseling
Curriculum Planning and Evaluation
Educational Administration
Educational Research
Media Development
Speech Pathology
Teaching
Theatre

In 1987, 45 interns from the United States and several foreign countries worked with NTID in their career areas.

For more information, contact:

Rochester Institute of Technology
National Technical Institute for
   the Deaf
Office of Professional Development
Coordinator of Internships
One Lomb Memorial Drive
Post Office Box 9887
Rochester, New York 14623

Graduate Faculty

William E. Castle, Ph.D., Stanford University—Director and Vice President, NTID/RIT, Professor

Jack R. Clarcq, Ed.D., Syracuse University—Associate Vice President, Technical Assistance Programs, NTID/RIT, Professor

John A. Albertini, Ph.D., Georgetown University—Associate Professor

Joseph Bochner, Ph.D., University of Wisconsin, Madison—Associate Professor

Laurie C. Brewer, Ph.D., University of Rochester—Associate Professor

Frank Caccamise, Ph.D., University of Washington—Professor

Kathleen E. Crandall, Ph.D., Northwestern University—Associate Professor

Patricia A. DeCaro, M.S., Brockport—Instructor

Judy Egelston-Dodd, Ed.D., State University of New York at Buffalo—Director of Joint Educational Specialist Program, Professor

Joyce Horvath, M.A., University of Rochester—Visiting Assistant Professor

Donald D. Johnson, Ph.D., University of Illinois—Professor

Harry G. Lang, Ed.D., University of Rochester—Professor

Betsy H. McDonald, Ph.D., State University of New York at Buffalo—Assistant Professor

Kenneth R. Nash, Ed.D., Columbia University—Associate Professor

Donald G. Sims, Ph.D., University of Pittsburgh—Associate Professor

Michael S. Stinson, Ph.D., University of Michigan—Associate Professor

Robert L. Whitehead, Ph.D., University of Oklahoma—Professor

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North

RIT City Center

To Genesee Valley Park

Brighton-Henrietta Town Line Road

To Route 15

Jefferson Road/Route 252

Ballantyne Bridge

Rochester Hilton Inn On Campus

Scottsville Road/Route 383

Genesee River

East River Road

Lomb Memorial Drive

Lowenthal Road

Andrews

John Street

Ward Road

Andrews Memorial Drive

Perkins Road

H   G

F   E   D   N   60   L

VP   55

J   M   50   K

VP   11   2   47   90
17   9   7   1   3   43   Perkins Green
Kimball Drive   6   35
13   8   5   16   25   B   A   99
14   12   4   15   C
20 Riverknoll   18
S   10   Wiltsie Drive

Energy House   94 Alumni House   97 Colony Manor

To Eastman Kodak Co. Educational Center
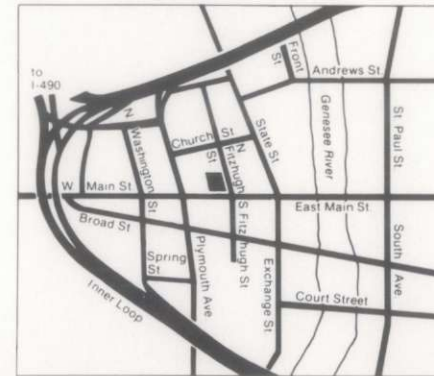
To Racquet Club

Building Numbers and Names

1 **George Eastman Memorial Building**
Administration; Admissions; Bursar; College of Continuing Education; Cooperative Education and Placement; School of Food, Hotel, Tourism Management; Packaging Science; Registrar; Social Work
2 **Frank Ritter Memorial Ice Arena**
3 **George H. Clark Memorial Gymnasium; Edith Woodward Memorial Pool**
4 **College-Alumni Union** and **Ingle Memorial Auditorium; Ritskeller**
5 **Wallace Memorial Library**
6 **College of Liberal Arts**
7 **James E. Booth Memorial Building:** College of Fine and Applied Arts, Bevier Gallery; Webb Auditorium
Frank E. Gannett Memorial Building: College of Graphic Arts and Photography

8 **Chester F. Carlson Memorial Building:** College of Science
9 **James E. Gleason Memorial Building:** College of Engineering; School of Engineering Technology
10 **Ross Memorial Building:** Information Systems & Computing; School of Computer Science and Technology
11 **Information Center**
12 **Max Lowenthal Memorial Building:** College of Business
13 **Facilities Office**
14 **The Hugh L. Carey Building:** NTID
15 **Bookstore**
16 **Kilian J. and Caroline F. Schmitt Interfaith Center**
17 **Center for Microelectronic and Computer Engineering**
18 **Link Building:** Center for Quality and Applied Statistics
20 **Riverknoll:** Campus apartment housing
25 **Grace Watson Hall:** Resident dining facilities, Counseling Center, Campus Safety, Residence Life Office

35 **Kate Gleason, Eugene Colby, Frances Baker halls:** Residences
43 **Nathaniel Rochester, Helen Fish halls:** Residences
47 **Sol Heumann, Carleton Gibson halls:** Residences
50 **Mark Ellingson, Peter Peterson, Alexander Graham Bell halls:** NTID residences
55 **Hettie L. Shumway Dining Commons:** NTID residence dining facilities
60 **Lyndon B. Johnson Building:** NTID academics
90 **Perkins Green:** Campus apartment housing
94 **Alumni House:** 415 John Street
97 **Colony Manor:** Campus apartment housing
99 **Physical Plant buildings**
VP: **visitors' parking areas**

Bailey Road

To U.S. Route 15 and Thruway exit 46

RIT City Center

to I-490

Front St.

Andrews St.

Church St.

Washington St.

State St.

Genesee River

St. Paul St.

N. Fitzhugh St.

S. Fitzhugh St.

W. Main St.

Broad St.

Plymouth Ave.

Exchange St.

East Main St.

South Ave.

Spring St.

Court Street

Inner Loop

RIT City Center, located at 50 West Main Street can be reached from campus via Scottsville Road to 390N. to 490E. Exit at Plymouth Avenue.

Rochester Institute of Technology