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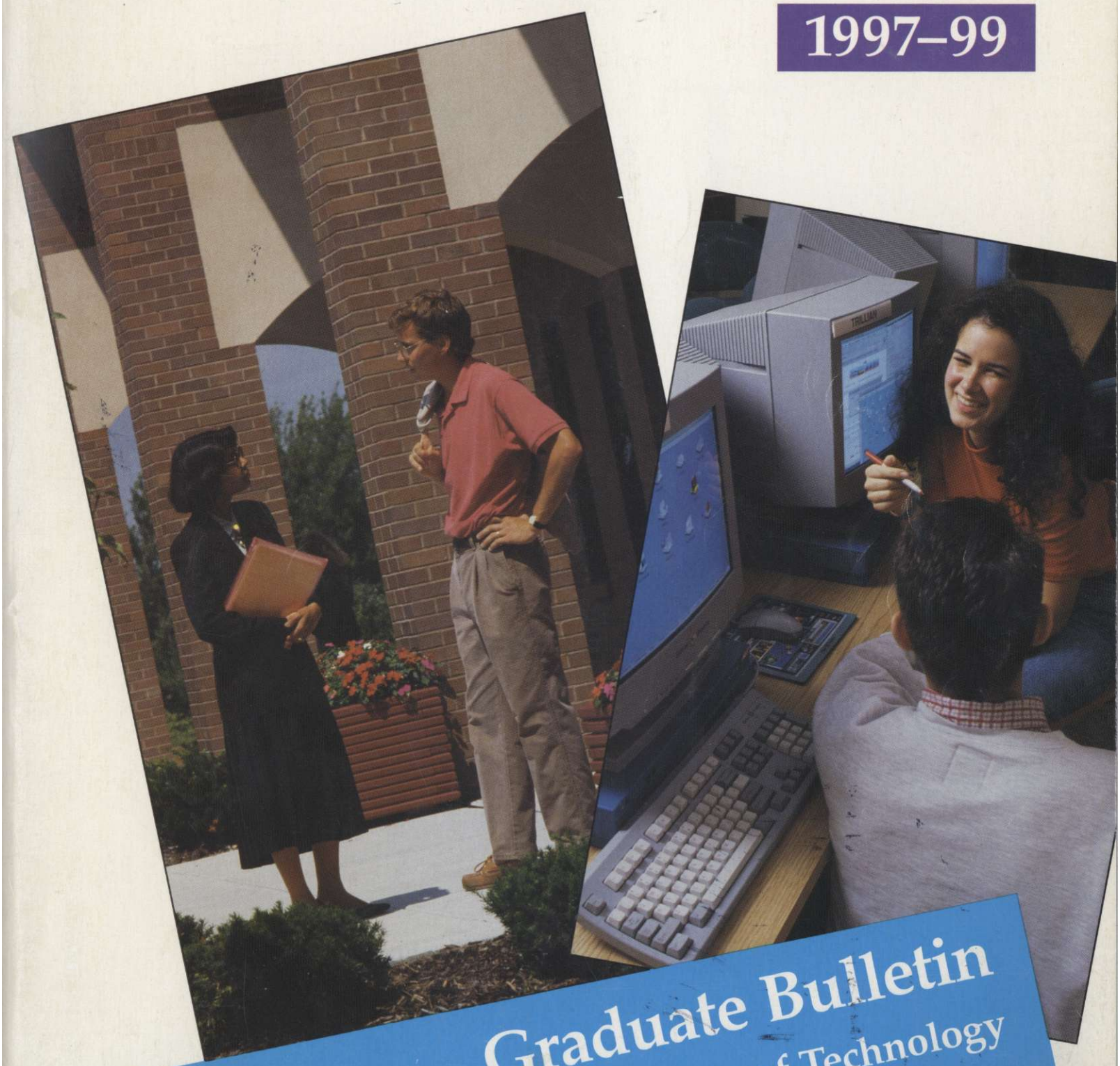
1997–99



Graduate Bulletin

Rochester Institute of Technology

R·I·T

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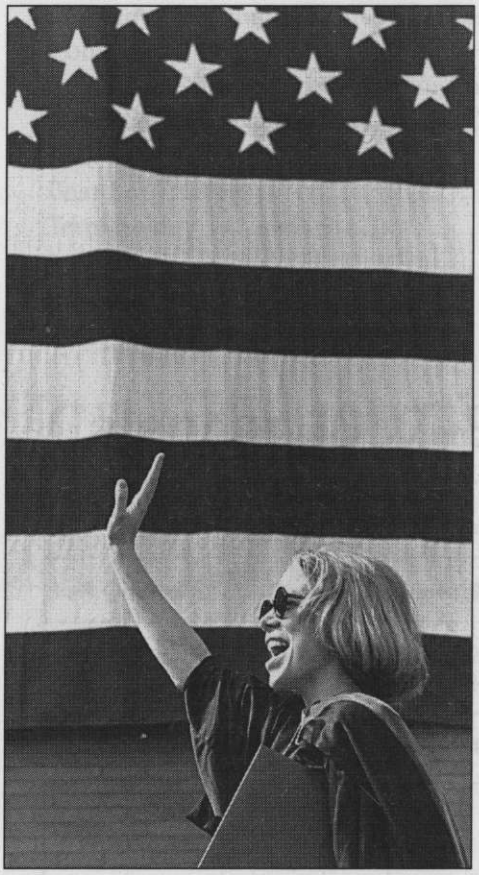


Rochester Institute of Technology

About This Bulletin—

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

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

Please note that this edition of our Graduate Bulletin covers a two-year period (academic years 1997-98 and 1998-99). Readers are encouraged to contact RIT's Office of Part-time and Graduate Enrollment Services to ensure that they have the most current information available. Please write, phone or e-mail:

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

Vol. 12 No. 3 June 30,1997

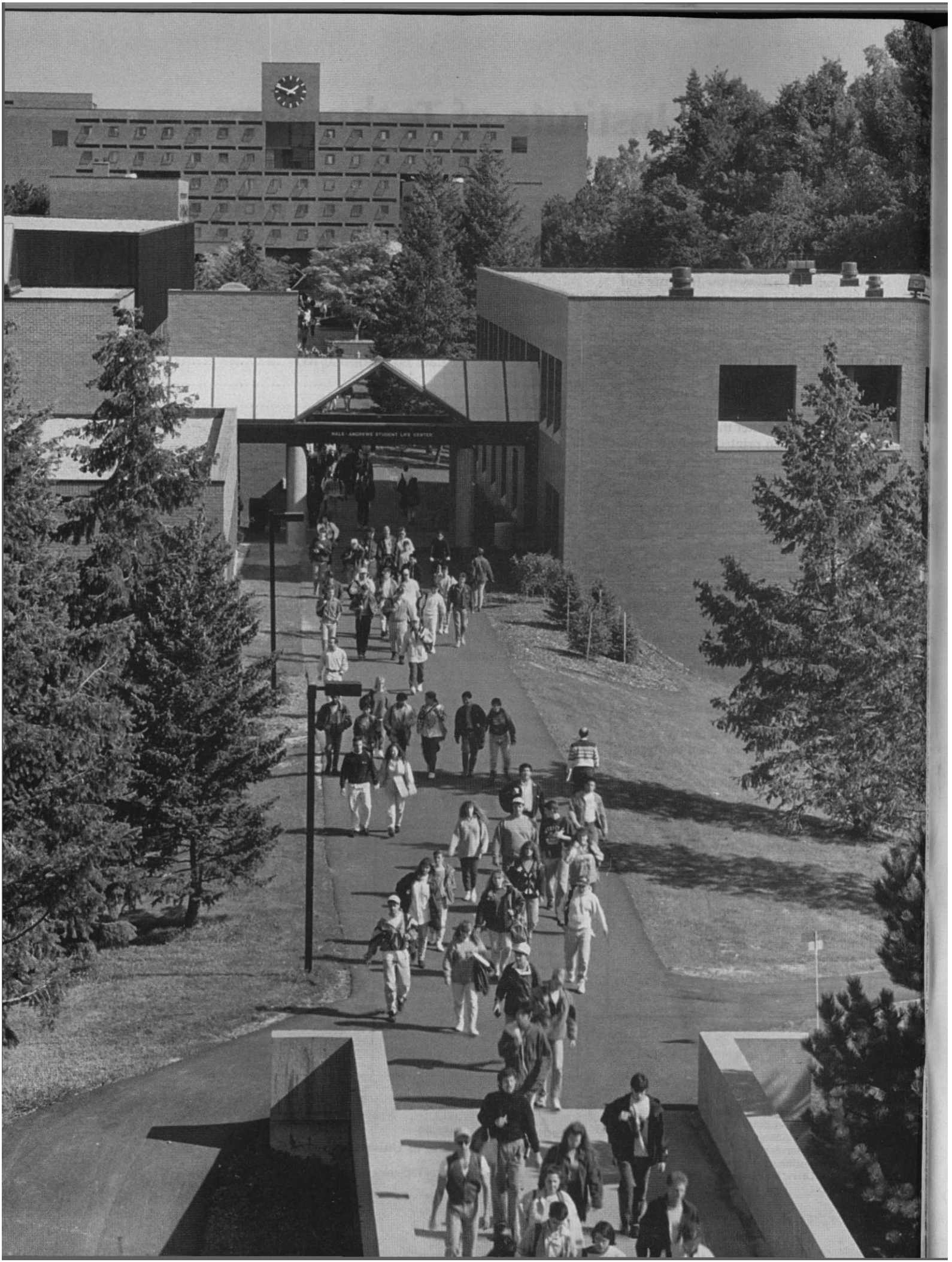
RIT (USPS-676-870) is published thirteen times annually by Rochester Institute of Technology, One Lomb Memorial Drive, Rochester, N.Y. 14623-5603, twice in July, twice in August, three times in September, twice in October and once in November. Periodicals postage paid at Rochester, N.Y. **Postmaster:** Send address changes to RIT, Rochester Institute of Technology, One Lomb Memorial Drive, Rochester, N.Y. 14623-5603.

Contents

Calendar 1997-98

	Classes Begin	No Classes	Final Exams— Day Classes	Last Day of Quarter
Fall Quarter	**Sept. 3**	**Nov. 19-30**	**Nov. 14,15,17,18**	**Nov. 18**
Winter Quarter	**Dec. 1**	**Dec. 22-Jan. 4** **Feb. 28-Mar. 8**	**Feb. 23, 24, 26, 27**	**Feb. 27**
Spring Quarter	**March 9**	**May 24-31**	**May 18-21**	**May 22**
Summer Quarter	**June 1**	**July 4**	**Aug. 10-12**	**Aug. 15**

Graduate Study 1997-99
Produced by the Office of University Publications


HALE-ANDREWS STUDENT LIFE CENTER

The RIT Philosophy and Mission

"Education is for making a living and living a life to one's fullest capacity, the two as interconnected processes."

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

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

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

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

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

For additional information, write, phone or e-mail:
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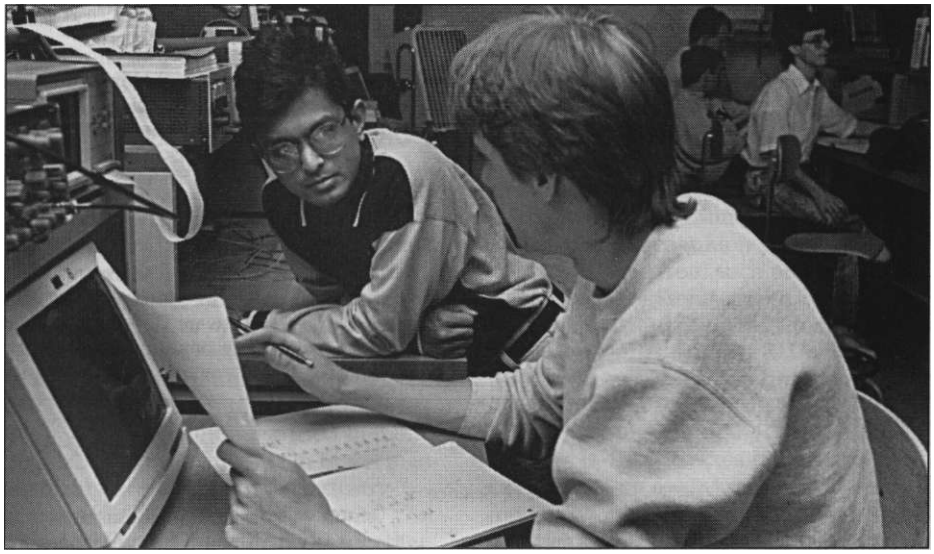


Access *to practical technology draws graduate students to RIT.*

History of Graduate Education

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

A recent example of RIT's continuing endeavor to provide education in emerging career fields is the Ph.D. in imaging science, which was also the first degree of its kind in the United States.

The Ph.D. is one of more than 50 graduate degrees now offered by the Institute.

Sponsored Research

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

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

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

Accreditation

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

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

and

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

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

Graduate Programs of Study

	Graduate Degrees Offered	Programs Available in	HEGIS* Code	For More Information See Page
College of Applied Science and Technology	Master of Science	Career and Human Resource Development	0826	
		Computer Science	0701	
		Computer Integrated Manufacturing	0913	
		Cross-Disciplinary Professional Studies	4999	
		Health Systems Administration	1202	
		Hospitality-Tourism Management	0510.1	
		Information Technology	0699	18
		Instructional Technology	0699	
		Packaging Science	4999	
		Service Management	0599	
		Software Development and Management	0799	
		Telecommunications Software Technology	0799	
	Advanced Certificate	Interactive Media Design	0699	
College of Business	Master of Business Administration	MBA Program Options listed on pages 50-52	0506	
		Accounting	0502	
	Master of Science	Finance	0504	47
		International Business	0513	
		Manufacturing Management and Leadership**	0599	
College of Engineering	Master of Science	Applied and Mathematical Statistics	1702	
		Computer Engineering	0999	
		Electrical Engineering	0909	
		Manufacturing Management and Leadership**	0599	
		Mechanical Engineering	0910	
		Materials Science and Engineeringt	0915	
		Microelectronics Manufacturing Engineering	0999	62
	Master of Engineering	Mechanical Engineering	0910	
		Manufacturing Engineering	0913	
		Industrial Engineering	0913	
		Systems Engineering	0913	
		Engineering Management	0913	
		Microelectronics Manufacturing Engineering	0999	
	Advanced Certificate	Statistical Quality	1702	
College of Imaging Arts and Sciences	Master of Fine Arts or Master of Science for Teachers	Ceramics and Ceramic Sculpture	1009	
		Graphic Design	1009	
		Industrial & Interior Design	1009	
		Glass	1009	
		Metalcrafts and Jewelry	1009	
		Painting	1002	
		Printmaking	1002	
		Weaving and Textile Design	1009	88
		Woodworking and Furniture Design	1009	
	Master of Fine Arts	Medical Illustration	1299	
		Computer Graphics Design	1009	
	Master of Science for Teachers	Art Education	0831	
	Master of Science	Printing Technology	0699	
		Graphic Arts Publishing	0699	
		Graphic Arts Systems	0699	
	Master of Fine Arts	Imaging Arts	1011	
College of Liberal Arts	Master of Science	School Psychology	0826.02	111
College of Science	Master of Science	Chemistry	1905	
		Clinical Chemistry	1223	
		Color Science	1099	
		Imaging Science	1011	119
		Industrial and Applied Mathematics	1799	
		Materials Science and Engineeringt	0195	
	Doctor of Philosophy	Imaging Science	1011	
National Technical Institute for the Deaf	Master of Science	Secondary Education of Students Who Are Deaf or Hard of Hearing	0803	142

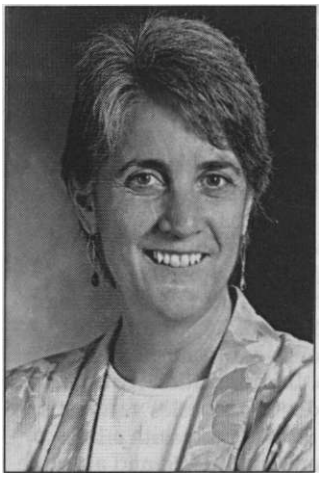
Enrollment in other than registered or otherwise approved programs may jeopardize a student's eligibility for certain student financial aid awards. All the above programs are registered with the State of New York according to the indicated HEGIS* code.

'Higher Education General Information Survey

"Joint program of colleges of Business and Engineering

tJoint program of colleges of Engineering and Science

Philosophy of Graduate Education at RIT



Joan Stone, *associate provost for academic programs*

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

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

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

Another option RIT offers is combined bachelor's/master's degree programs, such as those in the colleges of Business, Engineering and Science.

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

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

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

Graduate Programs: Specialized and Diverse

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

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

Across campus, graduate students mix exciting research and stimulating dialogues with faculty and such distinguished visitors as George Bush, Spike Lee, John Hockenberry and Maya Angelou. The William A. Reedy Memorial Lecture in Photography, sponsored by Eastman Kodak Company and presented by RIT's School of Photographic Arts and Sciences, has brought such photographers as Annie Leibovitz, Jerry Uelsmann and Greg Heisler to RIT. The College of Business draws prominent figures from the business world—including U.S. Steel CEO Thomas Usher and Robert Bartley, editor and vice president of *The Wall Street Journal*—through the William D. Gasser Distinguished Lectureship in Business.

The Institute continues to receive international recognition for the quality of its programs from such media outlets as *U.S. News & World Report, The Wall Street Journal* and the NBC "Today" show, which has profiled RIT's School for American Crafts. Recognition also has been awarded by industry: RIT's colleges of Business and Engineering were winners in the Motorola University Challenge—an award presented to just nine universities nationwide. These two colleges also won the IBM Total Quality Management Competition and received more than $1.2 million to integrate quality themes into their courses and laboratories.

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

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

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 policies and procedures:

1. Inquiries about, and applications for, graduate study are directed to the Director of Admissions, Rochester Institute of Technology, Bausch & Lomb Center, 60 Lomb Memorial Drive, Rochester, New York, 14623-5604.

RIT's flexible course scheduling recognizes the needs of students who combine both work and school.

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 file will include an RIT application, previous college records, applicable test scores, two letters of recommendation and other documents that may support admission of the candidate.
4. When all relevant admission data has been received, the applicant's file will be sent to the appropriate school or department for action.
5. When the school or department has made a decision on the application, this decision and the applicant's file will be returned to the Admissions Office.
6. The Admissions Office will notify the student of the admission decision.
7. Academic departments may informally advise nonmatriculated students, but no formal program of study can be approved prior to matriculation.
8. The formal program of study will be approved by the dean's designee (department head, coordinator or program director, etc.). This program must be followed by all students applying for admission or readmission.
9. The basic entry requirements for master's degree candidates include the completion of a baccalaureate degree and whatever other evidence of the applicant's potential to successfully complete graduate studies may be required by the particular college. Rare exceptions to the baccalaureate requirement can be made in the case of candidates who have demonstrated unusual competence in their field of specialization. For these exceptions the recommendation of the department chairperson or director and the approval of the appropriate dean and the Graduate Council are required.

   International applicants must demonstrate English language proficiency as part of the admission process. This is normally accomplished through submission of test scores from the Test of English as a Foreign Language (TOEFL). Minimum TOEFL scores vary by program. Most programs require a TOEFL score of 550 or higher. Upon arrival at RIT, students with English as a second language may be required to take the Michigan Test. Depending on the results, a student may have to enroll in English instruction, which will result in additional tuition cost.

   In certain cases graduate students may be admitted prior to, but conditional on, completion of the baccalaureate degree. Applicants will not be considered for admission prior to the start of the final year of undergraduate study. The student must present a final transcript covering all undergraduate study within one quarter after first registering for a graduate program.

   Graduate applicants who do not fully satisfy all admission criteria as to grades, test scores or their credentials, but do show sufficient promise to qualify for a trial period of graduate study, may be admitted on probation to the Institute. Such students must achieve a 3.0 ("B") program cumulative grade point average by the end of their first 12 quarter credit hours of graduate study. Those students who do not meet this criterion will be suspended. Responsibility for specific requirements and maintenance of the students' appropriate status rests with the student's academic department in consultation with the Admissions Office and the Registrar.
10. Evaluation of transfer credit (see p. 9) is made by the academic school or department in question and the College of Liberal Arts.
11. RIT will admit and hire men and women; veterans; persons with disabilities; and individuals of any race, creed, religion, color, national or ethnic origin, sexual orientation, age or marital status in compliance with all appropriate legislation.

New York State immunization requirement

New York State Public Law 2165 requires that all matriculated students enrolled for more than nine quarter credit hours in a term and born after January 1,1957, must provide RIT Student Health Center with proof that they have received the appropriate immunizations against measles, rubella and mumps. Immunization requirements include: two measles vaccinations at least one month apart with a live virus after January 1,1969, and after the first birthday and one vaccination each against mumps and rubella after January 1, 1969, and after the first birthday. Additional information concerning the necessary documentation and where it must be sent is included with the Admissions Office acceptance packet or available from the Student Health Center.

Readmission

If a student has become inactive (has not completed a course in four quarters) or has withdrawn from RIT, Institute policy requires that the student reapply for admission as follows:

1. Students who left a graduate program with a GPA of 3.0 or better (in good standing) and will return to the program within two years of the time their last course was completed, will be readmitted to the program upon reapplication.
2. Students who left the program with a GPA of 3.0 or better and return to the program more than two years after the last course was completed must meet current admission standards upon reapplication. The program of study shall be subject to review and will be rewritten. Previous waiver and/or transfer credit may be lost and program deficiencies may need to be made up.
3. Students who leave a program with a GPA below 3.0 must meet current admission standards upon reapplication. Readmission will be based on all information, including previous graduate level work. Program requirements in effect at the time of reapplication will apply. Previous waiver and/or transfer credit may be lost and program deficiencies may need to be made up.

Financial Aid

Scholarships and assistantships are available in most graduate departments. In addition, some departments offer externally funded stipends from corporate or governmental sources. Please contact the appropriate department chairperson or the Office of Part-time and Graduate Enrollment Services at 716-475-2229 for additional information.

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

Additional sources of financial assistance include the New York State Tuition Assistance Program and various work-study and student loan programs. Please refer to the accompanying chart for details.

It should be noted that international graduate students can accept pay for work related to their program of instruction (co-op, internships, etc.). They cannot accept remuneration for jobs not related to their course work.

All federal assistance programs require submission of the Free Application for Federal Student Assistance (FAFSA). The FAFSA is available from the Financial Aid Office, 716-475-2186. Satisfactory academic progress for

Graduate Student Financial Assistance Summary, 1997-98*

PROGRAM	ELIGIBILITY	AMOUNT	WHERE TO APPLY
Grants! Scholarships			
Graduate Assistantships	**Varies based on academic excellence**	**Varies up to full tuition**	**Contact your academic department at RIT for additional information.**
Graduate Scholarships	**Varies based on academic excellence**	**Varies up to full tuition**	**Office of Part-time and Graduate Enrollment Services 58 Lomb Memorial Drive Rochester, NY 14623-5604 (Scholarship appliation form is included in Admissions Application Packet)**
New York State Tuition Assistance Program (TAP)	**Matriculated graduate students attending full time who meet New York State residency and income requirements**	**"Based on net taxable income. Awards range from $75 to $550.**	**Financial Aid Office at RIT**
Bureau of Indian Affairs Higher Education Program Fellowships	**Full-time students recognized by Secretary of the Interior as members of an Indian tribe and demonstrating financial need**	**Varies**	**Contact American Indian Graduate Center, 4520 Montgomery Blvd. NE, Albuquerque, NM 87109, for application information.**
Loans			
Federal Direct Loan (formerly Stafford Loan)	**Students attending at least half time (6 credit hours) and who meet the financial eligibility requirements established by the federal government**	**Maximum loan is $8,500 per year. Aggregate total cannot exceed $65,500 for undergraduate and graduate work.**	**Applicants must file the Free Application for Federal Student Aid (FAFSA).**
Federal Direct Unsubsidized Loan	**All graduate students attending at least half time. Loans cannot exceed cost of education minus other financial aid.**	**Maximum loan is $10,000 per year. Aggregate limit is $73,000, including undergraduate loans.**	**Applicants must file the FAFSA.**
Federal Perkins Loan	**Full-time students who meet financial need requirements established by the federal government**	**Typically $1,000-$2,200 Limited funding is available for this program. Aggregate limit is $30,000, including undergraduate loans.**	**File FAFSA by March 15.**
Private Lender Loans	**Students or parents; subject to normal credit review guidelines. Variable interest rates**	**Up to the cost of education less other financial aid; subject to lender review**	**Information and applications are available from the Financial Aid Office upon request.**
Work			
Federal College Work-Study Program	**Students who meet financial need requirements as established by the federal government**	**Varies depending on hours and wage rate**	**File FAFSA by March 15.**
Institutional Employment	**Full-time students**	**Varies depending on hours and wage rate**	**Student Employment Office at RIT**

*** Information is accurate as of June 1997. Additional information covering federal financial aid programs is provided in U.S. Department of Education Student Guide. Contact RIT Financial Aid Office to request a copy.**

**** TAP award amounts are dependent upon action in the New York State budget.**

federal aid recipients is evaluated at the end of Spring Quarter each year. Students must maintain a 3.0 grade point average and complete two-thirds of credit hours attempted each year. Federal aid eligibility is exhausted after attempting 150 percent of the number of credit hours required for the degree or certificate.

Students receiving New York Tuition Assistance Program benefits must meet credit hour and grade point average requirements based on the number of TAP payments received at the graduate level at RIT. Course completion is defined as meeting course requirements and receiving a letter grade of A, B, C, D or F. Complete state student aid academic requirements are listed here.

Standard of Satisfactory Progress for the Purpose of Determining Eligibility for State Student Aid

Graduate Degree - Quarter System

Before being certified for this payment	1st	2nd	3rd	4th	5th	6th
A student must have accrued at least this many credits	0	12	24	36	48	60
With at least this cumulative grade point average	0	2.00	2.50	2.70	2.80	2.90

Costs

On the date of publication, the 1997-98 tuition for students pursuing a graduate degree is:

Full-time (12-18 credit hours)—$6,018/quarter
Part-time (11 credit hours or less)—$507/credit hour
Internship*—$290/credit hour

* *Applied only to the internships 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 and to the MS degree in school psychology in the College of Liberal Arts.*

In addition, any graduate student carrying over 18 credit hours of study will be charged the full-time tuition rate plus $507/credit hour for each hour of study exceeding 18.

Room and board for full-time students for 1997-98 will be $2,139 per quarter for a standard meal plan and double occupancy room in a campus residence hall. A variety of residence hall and apartment housing options and meal plans are available, and costs may vary according to options selected.

An estimated cost for books and supplies ranges from approximately $500 to $2,500 per year per student. For part-time students, books and supplies will depend on the number of courses taken and may cost approximately $300 to $450 per year.

All full-time graduate students are required to pay a Student Activities fee of $42 per quarter.

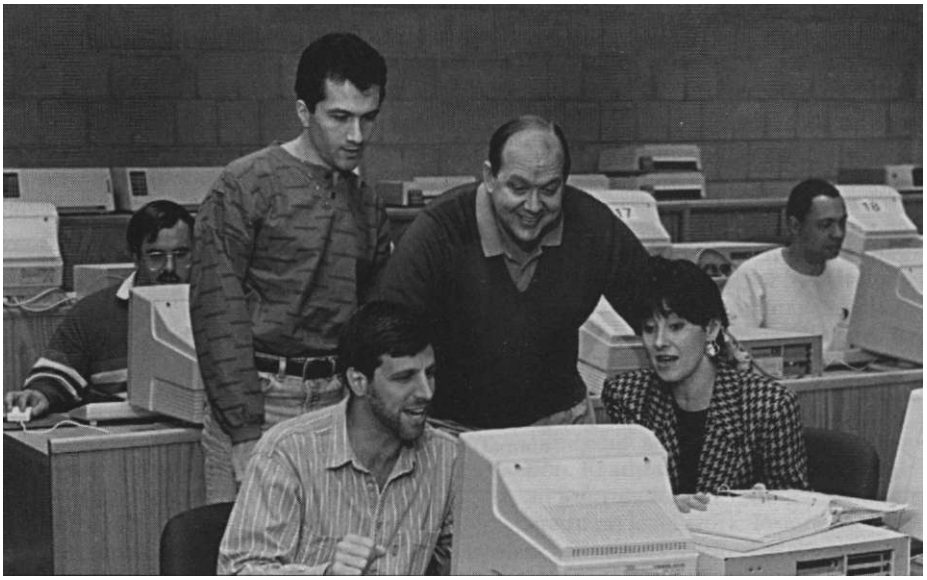
Charges for tuition, fees, and room and board are computed on a quarterly basis; bills are mailed approximately four weeks prior to the beginning of each quarter. Payments sent by mail should be made by check, payable to Rochester Institute of Technology. Due dates for the 1997-98 school year are as follows:

Fall Quarter—Aug. 20,1997
Winter Quarter—Nov. 19,1997
Spring Quarter—Feb. 27,1998
Summer Quarter—May 27,1998

Students who have not participated in the early registration process for the quarter will be expected to make payment of the quarterly charges (tuition, fees, room and board) at the time of registration. Students may pay the quarterly charges in a single payment or by the partial payment plan. Partial payments are due twice a quarter: 50 percent (plus a $25 partial payment processing fee) at the time of registration and the remaining 50 percent by the end of the fourth week of classes. A late payment fee will be assessed if the balance is not paid by the due date.

If you have questions concerning payment options, please contact Ms. Kathy Cole, RIT Bursar's Office, 716-475-2756.

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



Team projects are emphasized in many graduate business courses.

RIT Payment Options

OPTION	WHO IS ELIGIBLE	TERMS
Quarterly payment	All students	Payment in full by billing due date. Payments received after each billing due date are subject to a late payment fee.
Deferred payment plan	All students	$25 participation fee. Bill must be paid in full from prior quarter. 50% of net "out of pocket" quarterly balance due with registration. A deferred payment agreement form must be completed and submitted to the Bursar's Office on or before open registration day. Remaining 50% due at the end of the fourth week of classes. Payments received after the billing due date will be assessed a late payment fee.
Monthly payment plan	Matriculated day students (full and part time)	Interest free. Account must be paid in full from prior school year. Student must submit enrollment and housing plans for upcoming academic year by May 15. Projected net annual amount due is divided into 10 monthly installments. First monthly payment due July 1 prior to school year. The minimum annual amount must be $1,000 ($100 per month). Students must be registered for a minimum of two quarters during the academic year.
Company deferred payment plan	All students who have official verification of employer's tuition reimbursement practice	Account must be paid in full from prior quarter. Official verification form must be submitted quarterly in lieu of payment. Full payment for the quarter is due at the end of the fourth week of the quarter (regardless of whether the employer has reimbursed the student). Payment received after the billing due date will be assessed a late payment fee.
Veteran payment option	All veterans who are certified for VA educational benefits by the RIT Veteran Enrollment Services Office	Account must be paid in full from prior quarter. An authorized veteran deferment form must be submitted in lieu of payment. The student pays monthly in accordance with his or her scheduled VA benefit checks.
MasterCard/Visa payment option	All students	

PAYMENT PROCEDURES

Payment should be made by check payable to Rochester Institute of Technology. Late payment fees will be assessed as follows on accounts that are past due as of each billing due date. Since there are two billings per quarter, there is a potential that two late fees (total maximum of $150) may be assessed as well.

Past Due Amount	Late Payment Fee
$100 through $500	$25
$500 through $1,000	$50
Over $1,000	$75

Refund Policies

Advance deposits are nonrefundable. The acceptable reasons for a withdrawal with refund during the quarter are:

For a full refund

1. Active military service: A student called to active military service during the first eight weeks of the term may receive a full tuition refund. If called after the eighth week, he or she may elect to complete the course by making special arrangements with both the instructor and department or to withdraw and receive a full tuition refund. If the student withdraws, he or she will have to repeat the course at a later date.
2. Academic reasons: Students sometimes register before grades for the previous quarter are available. If such a student later finds that he or she is subject to academic suspension or has failed prerequisites, the student will be given a full refund upon withdrawal. It remains the student's responsibility to contact his or her department to assure that the withdrawal form and refund are properly processed.
3. If students drop a course(s) during the Official Drop Period (first six days of classes during that specific quarter), they may contact the Bursar's Office for a 100% refund for the courses dropped. Courses dropped after the Official Drop Period will not result in any tuition refund.

For a partial tuition refund

A student must officially withdraw from all courses or take a leave of absence from the Institute in order to be eligible for a partial tuition refund. Students must complete a leave of absence or withdrawal form, which can be initiated with their academic department.

A partial refund will be made during a quarter if withdrawal/leave of absence is necessitated for one of the following reasons:

1. Illness, certified by the attending physician, causing excessive absence from classes.
2. Withdrawal for academic reasons at the request of the Institute during a quarter.
3. Transfer by employer, making class attendance impossible.
4. Withdrawal for academic or personal reasons at the request of the student, approved by the student's adviser or department representative, the Institute Coordinator for Academic Advising and the Bursar.

Credit *"page" for two MFA students' multimedia video thesis that recently won the Adobe Flash Point Student Design Contest in both the Desktop Video and overall Grand Prize categories. The faces are the self-portraits of the winners, Su Yonca Akyuz and Aysegul Ozmen.*

Students withdrawing from the Institute must complete a withdrawal form to initiate the refund process. Refunds will be made according to the following schedule.

During the first week of classes—
100% tuition reduction
During the second week of classes—
70% tuition reduction
During the third week of classes—
60% tuition reduction
During the fourth week of classes—
50% tuition reduction
During the fifth week of classes—
25% tuition reduction
Sixth and subsequent weeks—
No tuition reduction

All students in their first quarter of attendance who are receiving any Title IV federal financial aid funds are eligible for tuition proration (see note next page) through the end of the sixth week of classes. For further specifics, please contact the Bursar's Office.

Note: Nonattendance does not constitute an official withdrawal.

A student is not "officially withdrawn" until he or she receives the student's copy of the withdrawal form. The date on which a withdrawal form is properly completed shall be the date of "official withdrawal" used to determine the refundable amount. If a student drops his or her course load from full-time (12 or more credits) to part-time (less than 12 credits) status during the Official Drop Period, he or she may contact the Bursar for a refund based on the difference between the full-time tuition payments and the total per-credit-charge for the part-time load.

No refund will be made for classes dropped after the Official Drop Period unless the student is officially withdrawing from the Institute.

Room and board

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

1. Residence hall 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
   c. During the last two weeks of classes—no refund

Appeals process

An official appeals process exists for those who feel that individual circumstances warrant exceptions from published policy. The initial inquiry in this process should be made to Richard B. Schonblom, Director of Bursar and Payroll Services.

Note: The federal government requires that students who are in their first quarter at RIT and receiving Title IV Federal Funding be eligible for prorated refunds for fees and room and board through the end of the sixth week of classes if they officially withdraw from RIT or take a leave of absence.

If institutional charges are reduced due to withdrawals, financial aid programs are reimbursed before a cash refund is issued to the student. The student is also responsible for any unpaid balance at the time of withdrawal. Aid programs are reimbursed in the following sequence: Federal Direct Loans, Perkins Loans, Federal Pell Grants, Federal SEOG, other federal financial aid, state aid, institutional aid. If a credit balance still remains, the student is then issued a refund.

For further information or comments regarding refund policies and specific withdrawal dates, contact the Bursar's Office.

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. RIT identification cards are required for students to use many campus facilities—e.g., the library, Student Life Center—and services, such as the meal plan and check payments at the bookstore. The ID office is located in the Registrar's Office.
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 nonregistration, the department should inform the Registrar as to whether the student should be put on nonmatriculated status or withdrawn from the program.)

The Steps Toward Earning Your Degree

A graduate degree at RIT may be obtained in more than 50 programs ranging from business administration to imaging science. (Please refer to page 2 for a complete listing of graduate programs of study.)

Upon completion of the stipulated requirements, a student's academic department certifies him or her for a degree. After commencement, a statement verifying that a degree has been awarded will be posted to the transcript. Degrees for fall graduates are mailed early in Winter Quarter; for winter graduates, in spring; for spring graduates, in the summer; and for summer graduates, in the fall.

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, the approval of the department offering the course may also be necessary.

Nonmatriculated students will be allowed to take graduate courses on a space-available basis with the department's approval and with the knowledge that the course work completed while a nonmatriculated student will not necessarily apply to any given academic program.

Matriculated and nonmatriculated graduate students may register for undergraduate-level courses with the understanding that these courses may not always apply to RIT graduate programs. In certain cases, where educationally sound programs will result, appropriate undergraduate courses as approved by the faculty adviser and by the department may be included in a master's program. However, not more than nine undergraduate quarter credit hours (600-level or below) may be applied toward the 45-quarter-credit minimum (12 undergraduate hours for those programs requiring 48 or more quarter credit hours). Where undergraduate work is allowed, it must be well planned and closely controlled. In the vast majority of cases, most, if not all, course work will be at the graduate (700 to 800) level.

Credit requirements

The minimum credit requirement for a master's degree is 45 quarter (or 30 semester) credit hours. At least 36 of these quarter credit hours must be earned at the graduate level and in residence at the Institute.

Transfer credit

A maximum of nine quarter credit hours in a 45-credit-hour program or 12 quarter credit hours in a 48- or more credit-hour program may be awarded as transfer credit from other institutions. A request for transfer credit must be made at the time of application for graduate student status. Only a course with a grade of B (3.0) or better may be transferred.

Transfer credits are not calculated in the student's grade point average but will count toward overall credit requirements for the degree. Transfer credits do not count in the satisfaction of residency requirements.

A graduate student who wishes to take courses at another institution and transfer them to his or her degree work at the Institute must obtain prior permission from the appropriate departmental officer or dean.

Thesis requirements

Included as part of the total credit-hour requirement may be a research, dissertation, thesis or project requirement as specified by each department. Some departments have other requirements in place of a thesis. The amount of credit the student is to receive must be determined by the time of registration for that quarter.

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

Students should also note the following continuation of thesis/project/dissertation policy.

Continuation of thesis/project/dissertation*

Once work has begun on a thesis, project or dissertation, it is seen as a continuous process until all requirements are completed. If a thesis, project or dissertation is required, or such an option is elected, and if the student has completed all other requirements for the degree, the student must register for the Continuation of Thesis/Project/Dissertation course each quarter (including Summer Quarter). This course costs the equivalent of one quarter credit hour, although it earns no credit.

1. Registration for the Continuation of Thesis/Project/Dissertation course preserves student access to the usual RIT services; e.g., Wallace Library, academic computing and faculty and administrative support. With payment of appropriate user fees, access to the Student Life Center and Student Health Center is also preserved.
2. If circumstances beyond students' control preclude them from making satisfactory progress on their thesis/project/dissertation, they should consider taking a leave of absence and should discuss such a leave in advance with their adviser and/or department head. The dean's signature of approval is required on the Leave of Absence or Institute Withdrawal form, a copy of which also must be sent to the associate provost for academic programs.

**The dissertation is required only of Ph.D. students.*

Photographer Annie Leibovitz (seated) visited RIT as part of the Reedy Lecture series, which has brought to campus such illustrious photographers as Jerry Uelsmann, Joyce Tenneson, Yousuf Karsh, Greg Heisler and Gordon Parks.

If students do not register for the Continuation of Thesis/Project/ Dissertation course, or take an approved leave of absence, their departments may elect to remove them from the program.

3. The length of time to complete a thesis/project/dissertation is at the discretion of the department. Be sure to read, however, point 1 under "Summary of requirements for master's degree" on this page.

Candidacy for an advanced degree

A graduate student must be a candidate for an advanced degree for at least one quarter prior to receipt of the degree.

The position of the Graduate Council is that a student is a candidate for the master's degree when he or she has been formally admitted to the Institute as a graduate student.

A student not formally admitted as a graduate student of the Institute (regardless of the number of graduate credits earned) is a nonmatriculated 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 nonmatriculated student will apply toward an advanced degree.

Summary experience

The Graduate Council regards some form of integrative experience as necessary for graduate students. Such requirements as the comprehensive examination, a project, the oral examination of the thesis and a summary conference are appropriate examples, provided they are designed to help the student integrate the separate parts of his or her total educational experience. The nature of the experience will be determined by the individual college or department.

Overlapping credit for second degree

At the discretion of the Graduate Committee in the specific degree area, nine to 12 previous master's quarter credit hours can normally be applied toward satisfying requirements for a second master's degree. The use of a given course in two different programs can be allowed only if the course that was used for credit toward the first degree is a required course for the second degree. The course must be used in both programs within five years; i.e., no more than five years between time used for the first degree and applied again toward the second degree.

In no case shall less than the minimum 36 quarter credit hours of residency be accepted for the second degree. If duplication of courses causes a student to go below the 36-hour limit in the second degree program, he or she would be exempted from these courses but required to replace the credit hours with departmentally approved courses. An RIT student will not be admitted through the 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 to 70 percent of the actual expense of a student's education. The rest of the cost is borne by the Institute through income on its endowment, gifts from alumni and friends and grants from business and industry.

Students, former students and graduates are in good financial standing when their account is paid in full in the Bursar's Office. Any student whose account is not paid in full will not receive transcripts, degrees or recommendations from the Institute.

The Institute reserves the right to change its tuition and fees without prior notice.

Summary of requirements for master's degree

1. Successfully complete all required courses of the Institute and the college. These requirements should be met **within seven years of the date of the oldest course counted toward the student's program.** Extension of this rule may be granted through petition to the Graduate Council.
2. Complete a minimum of 45 quarter credit hours for the master's degree. At least 36 quarter credit hours of graduate-level course work and research (courses numbered 700 to 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/project/dissertation or other appropriate research or comparable professional achievement at the discretion of the degree granting program.
5. Pay in full, or satisfactorily adjust, all financial obligations to the Institute.

Note: The dean and departmental faculty can be petitioned, in extraordinary circumstances, to review and judge the cases of individual students who believe the spirit of the above requirements have been met yet fall short of the particular requirement. If the petition is accepted and approved by the faculty, dean, and provost and vice president for academic affairs, a signed copy will be sent to the registrar for inclusion in the student's permanent record.

Jose de Rivera's sculpture (background) is a campus landmark.

Definition of grades

Grades representing the students' progress in each of the courses for which they are registered are given on a grade report form at the end of each quarter of attendance. The letter grades are as follows:

A Excellent
B Good
C Satisfactory
D and F grades do not count toward the fulfillment of program requirements for a master's degree.

The grades of all courses attempted by graduate students will count in the calculation of the cumulative grade point average. This program cumulative grade point average shall average 3.0 (B) as a graduation requirement. The dean of the college or his designee must approve all applications for graduate courses a student wishes to repeat.

Quality points

Each course has a credit-hour value based on the number of hours per week in class, laboratory or studio and the amount of outside work expected of each student. Each letter grade yields quality points per credit hour as follows:

A 4 quality points
B 3 quality points
C 2 quality points
D 1 quality point
F grades count as 0 in computing the grade point average (GPA). The GPA is computed by the following formula:

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

There are other evaluations of course work that do not affect GPA calculations. Only I and R (as described below) can be assigned by individual faculty members at the end of a quarter.

Registered (R)—a permanent grade indicating that a student has registered for a given course but has yet to meet the total requirements of the course or has continuing requirements to be met. The grade is given in graduate thesis/project/dissertation work.

Completion of this work will be noted by having the approved/accepted thesis/project/dissertation title, as received by the registrar from the department, posted to the student's academic record. Full tuition is charged for these courses. "R" graded courses are allowed in the calculation of the residency requirement for graduate programs.

Incomplete (I)—this 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 directive from the professor by the end of the second succeeding quarter (including summer terms). Full tuition is charged.

Withdrawn (W)—will be assigned in courses from which a student withdraws through the end of the eighth week of classes or if a student withdraws from all courses in a given quarter.

Audit (Z)—indicates a student has audited the course. The student need not take exams, and full tuition will be charged. A student can change from credit to audit or from audit to credit status for a course only during the first six days of classes. Audited courses do not count toward the residency requirement, do not get included in GPA calculations and do not count toward degree requirements.

Credit by examination (X)—assigned for the successful completion of various external or Institute examinations provided such examinations cover or parallel the objectives and content of the indicated course. Credit must be assigned in advance for any credit received through registration for the indicated courses. "X" graded courses do not count toward the residency requirement. A maximum of 12 quarter credit hours is allowed for graduate courses.

Exceptions to the maximum transfer credit or credit-by-exam for graduate programs can be granted by the associate provost for academic programs in unusual circumstances upon appeal from the dean of the college involved.

Waived—Waived courses are those courses eliminated from the list of requirements that a student must take to graduate. For graduate students, required courses may be waived because of previously completed academic work, but in no case shall the resulting graduate program requirements be reduced below 45 quarter credit hours.

In addition, waiver credit for graduate courses can be applied only toward required, not elective, courses. The process of waiving courses and thereby reducing graduate program requirements is not to be confused with the process of exempting certain requirements that are then replaced by an equal number of credit hours in the specified program.

Changing grades—once a grade has been reported by a faculty member, it is not within the right of any person to change this unless an actual error has been made in computing or recording it. If an error has been made, the faculty member must complete the appropriate form. The completed form must be approved by the head of the department in which the faculty member teaches. When approved, the form is then sent to the registrar. There is, however, an appeal procedure for disputed grades through the Academic Conduct Committee of the college in which the course is offered. A final appeal can be sent to the Institute Hearing and Appeals Board.

Academic probation and suspension

Any matriculated graduate student whose program cumulative GPA falls below a 3.0 after 12 quarter credit hours will be placed on probation and counseled by the departmental adviser concerning continuation in the graduate program.

Those students placed on probation must raise their program cumulative GPA to the 3.0 level within 12 quarter credit hours or be suspended from the graduate program.

Should it be necessary to suspend a graduate student for academic reasons, the student may apply for readmission to the dean of the college or his designee upon demonstration of adequate reason for readmission.

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

RIT offers a number of services for graduate students. The services described in the following pages are among the most frequently used.

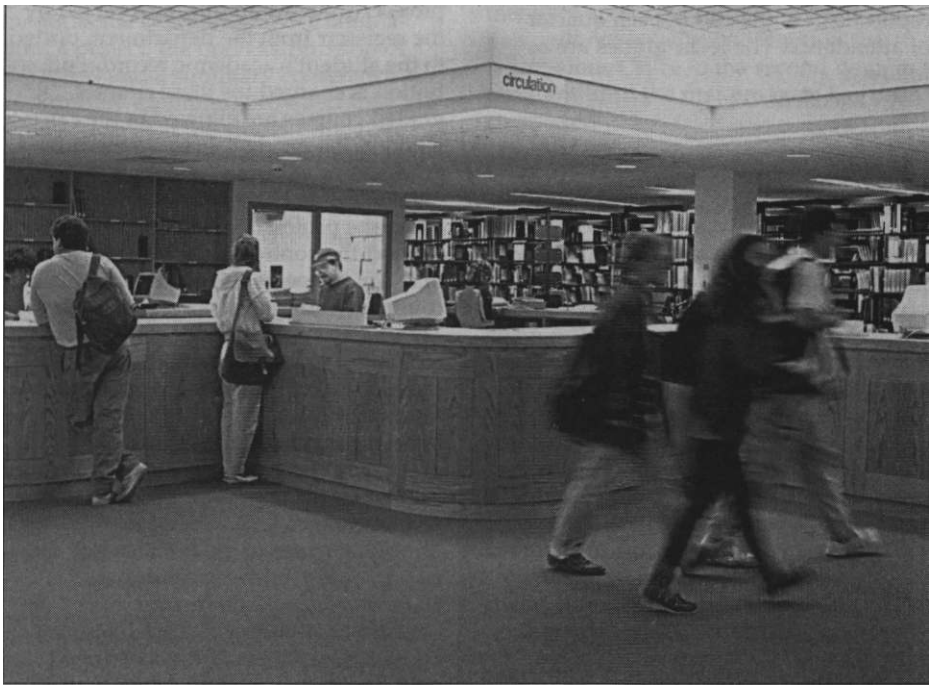
Educational Technology Center

The Educational Technology Center provides proactive service and leadership to enhance and support the educational environment at RIT. Services include media production, classroom equipment support, distance learning and the Media Resource Center. The last includes materials such as videotapes, films and audio tapes placed on reserve by faculty members for student use. There are 7,000 media items in collection and 20 viewing/listening carrels. The MRC also houses an extensive art slide library.

ETC staff members assist faculty and students in finding and preparing media for classroom presentations, club meetings or personal use. Our color laser copier is a popular tool used by many photographers and artists at RIT. Others find the photo and graphic design services of ETC helpful in preparing for presentations and lectures. A broad array of media technology, from projectors and videoplayers to multimedia-capable personal computers and teleconferencing equipment, is available for instructional support and other campus events.

RIT instruction extends beyond the classroom with assistance from the Office of Distance Learning at ETC. Students are able to complete courses in a flexible time schedule during the quarter without having to attend on-campus classes. More that 15 RIT programs, including certificates, BS and MS degrees, are available through various distance learning formats. Students interact with professors and other students through e-mail and conferencing using the World Wide Web as well as through audio, video and telephone conferencing. In addition, courses include videotapes, audio tapes and print materials. ETC supports these efforts with course development, equipment and production services.

ETC offices and the Media Resource Center are located on the lower level of Wallace Library. More than 60 students work in ETC, assisting with video production, photography, graphic design and office support. Individuals are invited to drop in and explore these resources. The offices are open Fall through Spring quarters from 8 a.m. to 10 p.m., Monday through Thursday; 8 a.m. to 5 p.m., Friday and 11 a.m. to 5 p.m. on Sunday. Hours are subject to change during break weeks and Summer Quarter.



Wallace Library offers extensive print and multimedia resources.

Computing Services

Computing services at RIT are provided by Information Systems and Computing. ISC manages a large VMSCluster (networked Digital VAX and Alpha computers), several UNIX systems (Digital Alpha computers), an IBM mainframe for administrative computing, a campus-wide network, dial-in access and 17 user computing facilities. Detailed information on the systems that ISC manages and supports may be obtained from the ISC HelpDesk. Some of the more popular features of the RIT computer facilities and network include electronic mail (used extensively by students, faculty and staff), the Notes conference system and access to the Internet/World Wide Web. Many faculty have incorporated these features into their curricula, resulting in innovative and interesting courses not available elsewhere.

The use of computing systems managed by ISC is guided by the RIT Code of Conduct for Computer Use. Computer accounts are issued to students, staff and faculty so that they may perform activities supporting educational goals and internal RIT functions. Students can obtain an account at the ISC HelpDesk or at the reference desk in the library by showing their RIT ID card. Forms may be available in campus departments or can be obtained by contacting the ISC HelpDesk, part of ISC's Client Support Services group. CSS provides consulting services, seminars, problem solving and general information to users of enterprise server systems, minicomputers and microcomputers. Contact Client Support Services through the ISC HelpDesk.

ISC's Facilities Management group operates 17 user computing centers, microcomputer labs, and smart classrooms (in cooperation with the Educational Technology Center) containing microcomputers, terminals, workstations, printers and plotters. These facilities are available to students for general computing use and to faculty for reserved class work. Assistants are available to help people use the hardware and software available in the labs.

Computer equipment repair is offered by ISC in its Equipment Service Center, which routinely repairs and upgrades Digital and Apple computer equipment and is an authorized Apple repair center. Call 475-2591 for more information.

Students are urged to contact ISC staff for advice on hardware, software and networking in order to help ensure an efficient and effective campus-wide computing environment.

ISC HelpDesk

The ISC HelpDesk is located in room A291 in the Ross building. Hours for Fall, Winter and Spring quarters:

- Mon. through Thurs.—8 a.m. to 8 p.m.;
- Fri.— 8 a.m. to 5 p.m.; and
- Sim.—noon to 8 p.m.
- Saturdays—closed

Hours for Summer Quarter, holidays and quarter breaks:

- Mon. through Thurs.—8 a.m. to 6 p.m.
- Fri.—8 a.m. to 5 p.m.
- Weekends—closed

Telephone: 475-6929 (voice) or 475-2810 (TTY)

Electronic media:

- E-mail: services@rit.edu
- RITMenu: ASK system
- World Wide Web: http://www.rit.edu/

Modem access to the campus computer network

- 2,400 to 14,400 bits per second: 475-1356
- 28.8 kilobits per second: 292-8960
- DiallP remote Internet connection service (14.4 to 33.6 Kbps): 427-2000

Wallace Library

Wallace Library is a high-technology, multimedia resource center. It is a particular boon to busy graduate students, who find that its vast information resources are as close as their computers. The library's on-line menu provides access to a wide selection of up-to-date electronic resources in Web-based and text formats.

Users can access Wallace's catalog, search many electronic commercial databases and surf the Internet using Netscape's browser. The staff offers hands-on instructional sessions for using various electronic and Internet resources. Specialized class instruction can be scheduled upon request. Reference librarians are available during the week and on weekends to provide individual assistance at the reference desk. In-depth research assistance is available by appointment.

The VAX Internet Area provides access to graphic interface workstations, image scanning and a host of interactive CD-ROM titles. Interlibrary loan services and in-house book requests are accessed through the on-line catalog. The Center for the Visually Impaired houses an Arkenstone Reader and contains periodicals in Braille. Individual carrels and small-group rooms provide more than 1,000 study spaces.

Student artwork and photographs are exhibited in gallery areas. Outstanding student work is purchased and displayed permanently.

A smaller library within Wallace Library, the Cary Library, contains more than 14,000 volumes of rare books illustrating fine printing and other materials detailing the history of printing, book design and illustration, papermaking and other aspects of the graphic arts.

The Rochester Regional Library Council's Access program allows graduate students to obtain a library card that offers access to other area libraries, including those of the University of Rochester and the State University of New York colleges at Geneseo and Brockport.

The library is open more than 100 hours per week, with extended hours before and during finals. For library hours, call 475-2046 (voice); for the reference desk, call 475-2563 (voice/TTY) or 475-2564 (voice). You can e-mail the library at 610wmlref@rit.edu (RITVAX). The circulation desk can be reached at 475-2562 (voice) and 475-2962 (TTY).

Office of Cooperative Education and Career Services

The Office of Cooperative Education and Career Services supports the Institute's commitment to preparing students for "the making of a living and the living of a life."

Since 1912, RIT has developed one of the country's strongest co-op programs. RIT's cooperative program is the fourth oldest in the world and one of the largest. For those who desire more experience in their field, co-op is an option in several graduate programs. A co-op opportunity often leads directly to a permanent position upon graduation. Students also may find permanent positions through RIT's on-campus recruitment program or job listing service.

RIT students and alumni find the services of the Office of Cooperative Education and Career Services helpful in the job search. Individual career counseling, job search skills sessions, job listings, a resource library and on-campus interviewing provide a steady linkage between campus and the workplace. Students entering the graduate program are encouraged to meet with their program coordinators early to begin developing their career plans. The Co-op and Career Services Office hosts frequent orientation sessions to inform students of the many services offered.

Counseling Center

The RIT Counseling Center, located in the Hale-Andrews Student Life Center, offers a variety of services to hearing, deaf, and hard of hearing RIT graduate students. These include:

- Personal/Psychological Counseling
- Alcohol/Drug Counseling & Referral Services
- Career Counseling
- Discover (Computer-Assisted Career Guidance)
- Testing
- Consultation
- Referral Services

Counseling Center hours are 8:30 a.m. to 4:30 p.m., Mon. through Fri. For more information about counseling services, call 475-2261.

Learning Development Center

The Learning Development Center provides individual and group instruction in efficient reading, study procedures, mathematics and writing skills. These services are available at no additional charge during regular LDC scheduled hours to all graduate students at the Institute and may be scheduled at the center, located on the second floor, north end, of the administration building.

For more information about Learning Development Center services, call 475-6682.

Student Health Center

The Student Health Center provides primary medical care on an outpatient basis. The staff includes physicians, nurse practitioners, registered nurses, health educators and an interpreter for the deaf. Allergy, psychiatric and gynecological services are available by appointment. Health education programs are provided also. The center is located on the walkway linking the academic and residential areas of campus. Students are seen on a walk-in basis, Mon. through Thurs., 8:30 a.m. to 4:30 p.m., with limited services only from 4:30 to 7 p.m., and Fri., 8:30 a.m. to 4:30 p.m. Only emergencies are seen during the last half hour of each shift. Hours are subject to change and are posted.

The Institute requires students to maintain health insurance coverage, which they may purchase on their own or through RIT while enrolled.

The quarterly student health fee is mandatory for all full-time undergraduate students. Other students may pay either the quarterly fee or a fee for service. Some laboratory work ordered through the center is not covered by this fee; there is a nominal charge for this

Life Off Campus: Rochester and Its Environs

The Main Street bridge over the Genesee River was designed by Albert Paley, artist-in-residence in the College of Imaging Arts and Scimces.

Need a break? Suffering a "creative block" on that project you're working on? Maybe what you need to do is just get away.

Rochester offers a pleasant change from academics. The city is well represented in the arts, from the world-famous International Museum of Photography to the Memorial Art Gallery and the Strong Museum. The Rochester Philharmonic Orchestra and GeVa Theatre offer performing arts.

RIT is situated close to recreational activities afforded by Lake Ontario and the Finger Lakes region, including the Bristol Mountain ski area. In addition, Niagara Falls is less than two hours away and on the way to Toronto. The Adirondack Mountain region is just six hours away.

service. Prescription medicines may be purchased from local pharmacies or, for some prescriptions, from the center. The health fee does not include prescription medications.

Questions about the Student Health Center or health insurance should be directed to the office, at 475-2255.

RIT Ambulance

RIT Ambulance is a New York State-certified volunteer ambulance service that serves the campus community, including its adjoining apartment complexes. The organization, an auxiliary of the Student Health Center, is governed by RIT students and staff and is staffed by emergency medical technicians. Twenty-four-hour ambulance service is available seven days a week. If, for some reason, the RIT ambulance is not available, there may be a charge for services provided by another corps.

For *emergency* assistance and/or transport, the RIT ambulance can be dispatched through Campus Safety at 475-3333 (voice) or 475-6654 (TTY).

Health Records

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

New York State Immunization Requirements

New York State Public Law 2165 requires that all matriculated students enrolled for more than six quarter credit hours in a term and born after Jan. 1, 1957, must provide proof that they have received the appropriate immunizations against measles, rubella and mumps.

Immunization requirements include two measles vaccinations—at least one month apart—with a live virus after Jan. 1,1968, and after the first birthday and one vaccination each against mumps and rubella (after Jan. 1,1969, and after the first birthday). Additional information concerning the necessary documentation and where to send it is included with the Admissions Office acceptance packet and is also available at the Student Health Center office.

Apartment Housing

Four apartment complexes and nearly 1,000 apartment and townhouse units distinguish RIT's apartment community as one of the largest university-operated apartment programs in the country. All four unfurnished apartment facilities—Colony Manor, Perkins Green, Racquet Club and Riverknoll—differ in layout and design. Apartments range in size from one- and two-bedroom apartments to two- and three-bedroom townhouse units. All are serviced by the Institute's shuttle bus system.

Although the majority of apartment residents are undergraduate students, a mixture of graduate and undergraduate and single and married students can be found in each apartment complex. Apartment contracts run from September through August, although, with proper notification, students may terminate their contracts with a 30-day notice without penalty. Security deposits are not required, and summer storage is available to returning residents. A modified meal plan is also available to apartment residents through RIT's Food Service Department. University apartment housing is available to graduate students on a space-available basis. For further information on RIT Apartment Housing, contact the Center for Residence Life, Rochester Institute of Technology, 63 Lomb Memorial Drive, Rochester, NY 14623-5603 or call 475-2572.

The Housing Connection

A service of the Center for Residence Life, The Housing Connection is designed to meet the general housing needs of the RIT community. The center provides free referrals for students looking for Institute or off-campus accommodations in the Rochester area. In addition, the center offers the only on-campus clearinghouse for apartment residents in need of additional roommates, providing a continually updated listing of available roommates and their specific interests.

Located on the first floor of Kate Gleason Hall (room 1060), The Housing Connection provides free maps, information pamphlets and telephones for

users of the service. A trained staff member will assist you in your search for housing or roommates. For more information, stop in or call 475-2575.

Identification Cards, Vehicle Registration

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, 475-2821 (voice) or 475-6953 (TTY).

All vehicles operated on campus must be registered with Campus Safety, and stickers must be properly displayed on the inside glass on the driver's side of the vehicle as far to the rear as possible. Institute fines are imposed for operators violating parking and traffic regulations. Fines are payable at the Bursar's Office in the George Eastman Building.

Emergencies, Escort Service

In case of emergency (fire, injury) call the Institute's 24-hour emergency number, 475-3333/6654 (TTY). For routine security services, call 475-2853/6654 (TTY), which is staffed 24 hours a day.

Campus Safety strongly encourages students to use the escort service, available seven days a week. The Mobile Escort Service is available seven days a week, 11:30 p.m. to 3:45 a.m., on a timed basis. Call the Campus Safety Department at 475-2853/6654 (TTY), or use the blue-light courtesy call boxes located throughout the campus.

International Student Services

With several of our programs receiving worldwide recognition, we welcome a growing international student population. RIT enrolls approximately 800 full-time graduate students representing 85 countries.

The International Student Program is located in the Center for Student Transition and Support and serves as a resource for all deaf and hearing international students on visas as well as for members of the campus community seeking cross-cultural help. The staff advises students on immigration issues, helps them adjust to academic and cultural expectations in the United States, and provides cross-cultural programs. In addition, the office coordinates off-campus hospitality through the Rochester International Friendship Council.

Want to celebrate Chinese New Year or any other international holiday? International student clubs on campus offer social activities throughout the year. Campus housing options include International House, a special-interest residence hall floor offering a community experience for both international and U.S. students, like those in the international business program. House members have taken trips to such cities as Toronto (just three hours away by car), Niagara Falls and Washington, D.C.

The International Student Program offers orientation each quarter. In the fall, the PAL (Peer Adviser Leader) program matches up returning students with new students on a one-to-one basis to help with their adjustment to RIT and the United States.

Students are invited to stop by the office, located on the mezzanine of the Student Alumni Union. For more information, call 475-6943 (voice/TTY); 475-6876 (voice); 475-5540 (TTY), coordinator for deaf international students.

English Language Testing

The minimum TOEFL requirement for most graduate programs at RIT is 550. Upon arrival at RIT, students with English as a second language may be required to take a battery of English tests, including the Michigan Test of English Language Proficiency. Depending on the results, the student may have to enroll in English instruction at an additional cost.

A score of 80 or higher on the Michigan Test is required to indicate the proficiency needed to handle university-level work. Students with scores below 80 or who do not demonstrate proficiency in writing, listening and speaking may be advised to take English at RIT's English Language Center.

The tests are given in the George Eastman Building at the beginning of each quarter prior to registration. The

The Student Life Center: For the Body and the Mind

A recent addition to campus, the Hale-Andrews Student Life Center offers extensive workout equipment and court space.

Halfway between the academic buildings and the RIT apartments and residence halls is one of the most popular sites on campus: the Hale-Andrews Student Life Center.

With athletic facilities rivaling a health spa, the Student Life Center offers a "no excuses" place for the RIT community to become and remain physically fit. Graduate students and their families have full access to the facilities, which include racquetball courts, an indoor running track, and shower and locker rooms. Students, as well as faculty and staff, can take a dance or martial arts class, play intramural basketball, participate in aerobics classes, network at the weight machines and relax in the saunas.

Student health services and counseling offices are also housed in the facility. For more information call 475-2261.

Margaret's House offers year-round, part- and full-time child care to children ages eight weeks through eight years.

test may be taken at a different time by appointment. Students who have paid enrollment deposits will receive information on testing dates from the Center for Student Transition and Support.

There is no cost for the test to RIT students who have already been accepted. Their spouses also may take the test free of charge. Others pay a $36 fee. For more information, call 475-6684.

The English Language Center

Students whose native language is not English can find assistance at the English Language Center. Writing, grammar, vocabulary, conversation and reading courses are offered at several levels each quarter. Courses are also available in Presentation Skills, Computer Word Processing, Pronunciation, Business Communication and TOEFL Preparation, among others.

Students also may enroll in a full-time intensive English to Speakers of Other Languages (ESOL) program. In addition, students may receive individualized instruction tailored to meet their needs. Tuition is charged for the services of the English Language Center.

International students may find employment at the English Language Center, where they can teach their native language and culture or do translations.

The office is located on the first floor (north end) of the George Eastman Building, room 1301. For more information, call 475-6684.

Margaret's House—Early Childhood Programs

Named in memory of Margaret Davis, wife of RIT vice president emeritus A1 Davis, this spacious new facility was designed specifically for young children.

Located on the residential side of campus, Margaret's House offers infant and toddler care, preschool education, full-day kindergarten and after-school care for children eight weeks through eight years old. The programs are open to children of students, faculty, staff and members of the Rochester community. Students may receive decreased rates. For complete information, call 475-5948 (voice) or 475-5176 (TTY).

During Summer Quarter, Margaret's House offers a variety of expanded activities for students in grades K through 12. Academic day camps provide an opportunity for youngsters to explore new concepts, media and technology. All programs are characterized by a dynamic project-oriented approach to learning. For more information about summer programs, please contact Susan Kurtz at 475-5987.

Commission for Promoting Pluralism

The Commission for Promoting Pluralism was established to formulate a plan of action that would address seriously and deliberately the subject of pluralism and community building in every part of the university. Its evolution is the result of an identified need for RIT constituents to deepen their respect and appreciation for all people in the RIT community and beyond. This institutional focus attempts:

- to proactively identify and eliminate barriers that restrict equality throughout the RIT community,
- to develop and implement programs that promote commitment to equality and justice in campus-wide activities and
- to develop and nurture a support system that increases participation by all members of the RIT community.

Standards for Student Conduct

The RIT community intends that campus life will provide opportunities for students to exercise individual responsibility and places high priority on self-regulation by its members. All members of the community are responsible for encouraging positive behavior by others, as well as preventing or correcting conduct by others that is detrimental to RIT's educational mission and values.

As an educational community, RIT strives for a campus environment that is free from coercive or exploitative behavior by its members. Moreover, it sets high standards that challenge students to develop values that enhance their lives professionally and that will enable them to contribute constructively to society.

RIT enjoys a diversity of backgrounds, lifestyles and personal value systems among those who compose the academic community. Students, however, are expected to observe and respect the policies and standards of the Institute and the right of individuals to hold values that differ from their own and those expressed by RIT.

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.

Veteran Services

Courses and programs at the Institute are approved for the education of veterans under the Veterans Readjustment Benefits Act, the Rehabilitation Acts and the War Orphans Act.

To receive benefits, an eligible veteran or dependent must submit an application for the VA "Certificate of Eligibility." This application must be sent to the VA Regional Office in Buffalo, N.Y., well in advance of the beginning of the starting quarter. These applications are available at local VA offices or on campus from the Office of Part-time and Graduate Enrollment Services.

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.

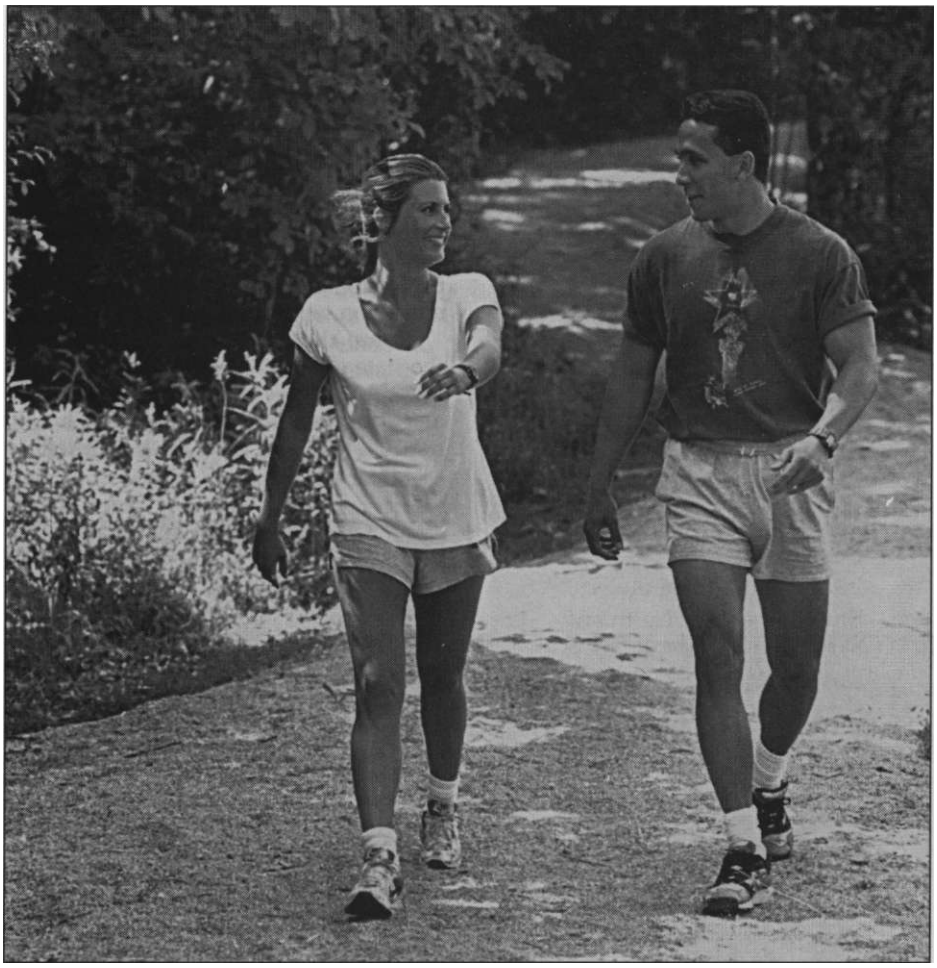
To ensure a smooth transition and successful academic program completion, start your benefits paperwork early. For benefits assistance or information, call 475-6641.

Campus Stores

RIT operates two campus stores. The main store, Campus Connections, is located on the west side of the Student Alumni Union. It consists of two selling floors and is divided into 11 departments selling everything from clothing to textbooks to computers. Store hours are Monday through Thursday, 8:30 a.m. to 8 p.m.; Friday, 8:30 a.m. to 4:30 p.m.; and on Saturday, 11 a.m. to 4 p.m. Store hours may change on holidays, during quarter breaks, and during Summer Quarter. For current information about hours and special sales, call 716-475-6033.

Campus Connections accepts cash, checks, MasterCard, VISA and RIT flexible debit cards for payment. Certain students may have arrangements with a government agency to pay for some of their books and supplies; this is handled at our service counter on the first floor.

The Candy Counter in the lobby of the Student Alumni Union sells candy, tobacco products, notions, sundries, magazines, daily newspapers and snack items. Film can be dropped off here for processing.



Campus jogging and walking trails are appreciated by faculty, staff and students.

College of Applied Science and Technology

Wiley R. McKinzie, Dean

Innovative degree programs and courses tailored for working professionals make the College of Applied Science and Technology a leader in quality graduate education.

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

We are also committed to advancing the state of our education through the latest technology, management theories and educational philosophies. RIT's new $22 million Center for Integrated Manufacturing Studies gives graduate students the opportunity to test new technologies for actual companies seeking problem solutions. Continual computer laboratory upgrades mean that we have technology that is considered the industry standard.

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

PROGRAMS

MASTER OF SCIENCE DEGREES IN:

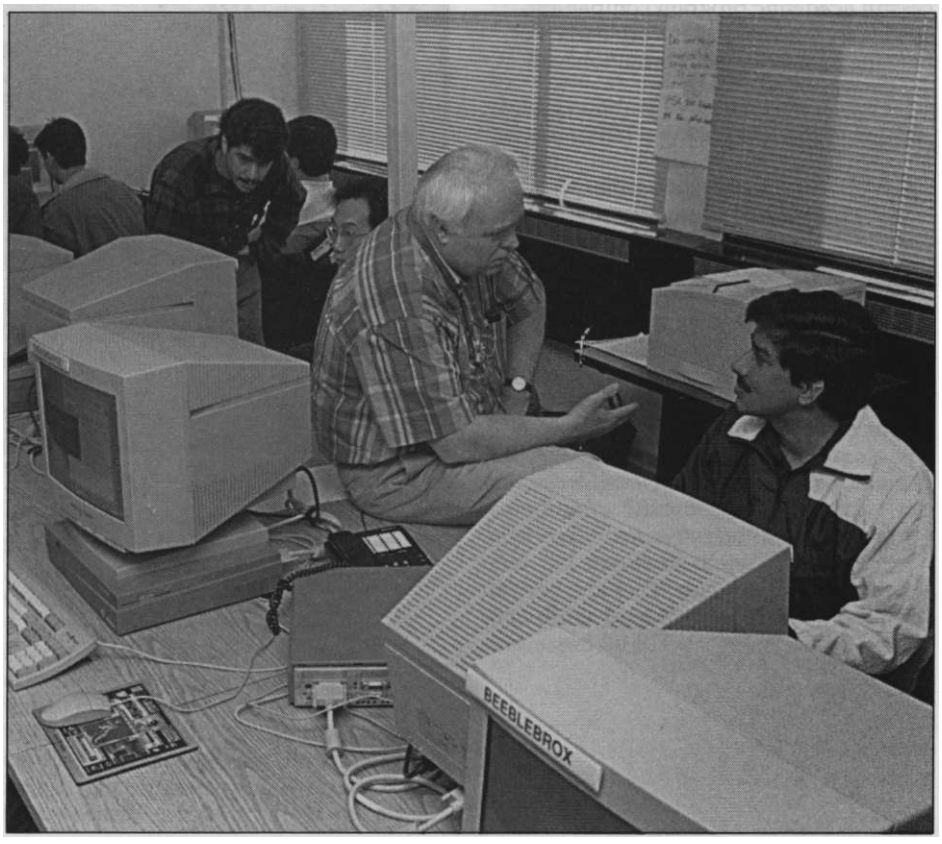
Computer Science
Information Technology
Software Development and Management
Computer Integrated Manufacturing
Hospitality-Tourism Management
Service Management
Career and Human Resource Development
Instructional Technology
Environmental, Health and Safety Management
Packaging Science
Health Systems Administration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

ADVANCED CERTIFICATES AVAILABLE IN:

Applied Computer Studies
Interactive Multimedia Development
Integrated Health Systems
Health Systems Finance

EXECUTIVE LEADER:

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



Our commitment to the latest technology means students work in a computing environment that meets the industry standard.

Computer Science

Walter A. Wolf, *Chairperson*

Computer science offers an MS degree that prepares students for a wide variety of computer-related careers in business, industry and academia. Graduates are prepared to work in computer system software development, applications development, research and education. The program is 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, as well as those with a computer science degree.

Computer facilities

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

- a graduate lab with 18 SGI Indy color workstations
- 75 SUN ULTRA1 color workstations
- 12 SGI Indy, Indy Modeler and Indigo 2 color workstations
- 4 SPARC 10 and 20 file servers with more than 20 Gig of disk available
- a 64-processor Transputer-based parallel processing platform
- A networking/distributed systems lab with 12 SGI Indys and its own internal network

These computers operate under the UNIX (a trademark of Bell Labs) operating system.

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

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

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

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

Master of Science in Computer Science

Admission requirements

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

Applicants from foreign universities should submit Graduate Record Exam (GRE) scores. (GRE scores 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 score 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 Mathematics

Computing

Experience with a modern high-level language (e.g., Pascal, Ada, Modula, Algol)
Data Structures
Assembly Language Programming
Software Design Methodology
Introductory Computer Architecture and Digital Logic
Introductory Systems Programming
Operating Systems
Programming Language Survey

The bridge program

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

Mathematics

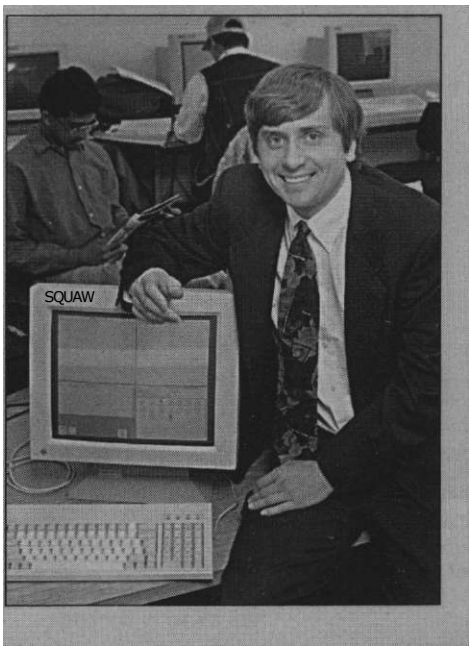
1016-251, 252, 253	Calculus
1016-351	Probability & Statistics
	or
0303-715	(Calculus based)
0603-705	Discrete Mathematics
	or
1016-265	

STUDENT PROFILE

"One reason I went to work at Xerox Corporation was because of [the benefit of] its graduate studies program. In addition to paying for your classes, GSP allows you to take time off from work to complete your studies.

"RIT's graduate computer science program was ideal for me because most classes were held in the evenings. This allowed me the flexibility to mix both work and school."

Richard Bryant
MS, Computer Science



Computing

0602-700 Computer Programming & Problem Solving
0602-703 Algorithms & Data Structures
0603-704 Computer Organization
0603-707 Programming Practices
0603-708 Computer Organization & Programming
0603-709 Programming Language Survey
0603-713 Operating Systems

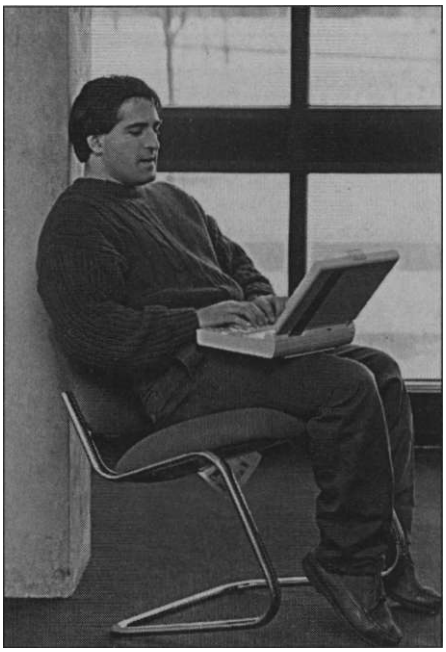
If a student matriculates before finishing the bridge program, all remaining bridge program courses must be completed with a grade of at least B; courses with lower grades must be repeated. Bridge program courses are not part of the 45 credits required for the master's degree, however, their grades are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

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

The curriculum

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

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



Computer science and information technology offers four master's degree programs and two advanced certificates.

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

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

The computer science core consists of five courses:

0605-700 Foundations of Computing Theory
0605-710 Programming Language Theory
0605-720 Computer Architecture
0605-730 Distributed Operating Systems I
0605-800 Algorithms

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

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

Computer Science

0605-701 Computability †
0605-702 Computational Complexity †
0605-703 Coding Theory †
0605-709 Topics in Computer Science Theory †
0605-711 Compiler Construction †
0605-712 Theory of Parsing †
0605-719 Topics in Programming Languages †
0605-729 Topics in Computer Architecture †
0605-731 Distributed Operating Systems II †
0605-735 Introduction to Parallel Computing
0605-736 Parallel Algorithms & Program Design †
0605-739 Topics in Operating Systems †
0605-740 Data Communications & Networks I
0605-741 Data Communication & Networks II
0605-749 Topics in Data Communications †
0605-750 Introduction to Artificial Intelligence
0605-751 Knowledge-Based Systems †
0605-755 Neural Networks and Machine Learning †
0605-756 Genetic Algorithms †
0605-759 Topics in Artificial Intelligence †
0605-761 Fundamentals of Computer Graphics
0605-769 Topics in Computer Graphics †
0605-771 Database Systems
0605-772 Database System Implementation
0605-773 Information Storage & Retrieval
0605-791 Simulation & Modeling
0605-799 Topics in Simulation & Modeling †

Philosophy

0509-706 Philosophy of Mind

Computer Engineering

0306-683 Electronic Document Processing
0306-722 Advanced Computer Architecture †
0306-730 VLSI Design †
0306-756 Multiple Processor Systems †
0306-779 Digital Image Processing †

Electrical Engineering

0301-761 Modern Control Theory
0301-715 Machine Vision +
0301-779 Digital Image Processing †

Industrial Engineering

0303-702 Mathematical Programming

Software Development & Management

0602-725 Reusable Software Design
0602-820 Systems & Software Engineering
0602-821 Analysis & Design Techniques
0602-823 Formal Methods in Software Engineering †
0602-825 Analysis & Design of Embedded Systems
0602-830 Software Project Management
0602-835 Software Testing & Inspection †

Imaging Science

2051-775 Syntactic Pattern Recognition †
2051-776 Intro, to Digital Image Processing †
2051-777 D.I.P. & Spatial Pattern Recognition †

Other departments' courses are primarily for their own majors and may have prerequisites that may not be approved for degree credit.

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

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

The master's thesis or project

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

Financial aid

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

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

Information Technology

Edith A. Lawson, *Chairperson*

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

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

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

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

Computer facilities

Supplementing the computing resources provided by RIT's main Information Systems and Computing facilities, as listed in the Student Services section of this catalog, information technology provides extensive facilities for students and faculty; all computers are connected via Ethernet.

- 70 Power PC Macintosh systems
- 135 Pentium PCs

Ethernet is used to integrate the above systems within the lab and to connect with other RIT computing facilities. These systems are also available to support departmental research, theses, projects and course work.

Master of Science in Software Development and Management

Admission requirements

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

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

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

In addition, there is a certain minimal background required of all students wishing to enter the master's program. 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 possible even though the applicant must accomplish some additional bridge program courses.

The prerequisites that constitute the required minimal background are:

Mathematics

Statistics

Computing

Programming in a high-level language, preferably C
Data structures
Elementary computer architecture and digital logic

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 study, taking one or more of the following RIT courses, as prescribed by a graduate department adviser.

0307-711	Fundamentals of Statistics I
0602-700	Computer Programming & Problem Solving
0602-703	Algorithms & Data Structures
0602-709	Fundamentals of Computer Hardware

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 if taken before matriculation.

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

The curriculum

The graduate program of study consists of 48 credits of software engineering core foundation, software engineering project and three electives. An optional cooperative work experience is possible.

The core foundation consists of nine courses:

0602-710	Software Design & Implementation
0602-720	Data Modeling & Design
0602-725	Reusable Software Design
0602-820	Systems & Software Engineering
0602-821	Specifications & Design of Information Systems

or

0602-825	Specifications & Design of Embedded Systems
0602-830	Software Project Management
0602-831	Software Project Planning
0602-835	Software Testing & Inspections

The software engineering project consists of one course:

0602-895 Software Engineering Project

The three professional electives may be chosen from information technology, computer science, computer engineering, electrical engineering or business. Graduate courses from other departments also may be appropriate. Department approval is required; students should see their advisers. Some approved courses are:

0602-716 C++ Programming Workshop
0102-740 Organizational Behavior
0102-742 Technology Management

An optional cooperative educational experience is available for those students who wish to gain industrial experience:
0602-999 Graduate Cooperative Education

Financial aid

Scholarships and graduate assistantships are available. Information may be obtained from:

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

Master of Science in Information Technology

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

Admission requirements

Students with a baccalaureate degree from an accredited institution and a minimum undergraduate grade point average of 3.0 out of 4.0 are eligible for admission. Entering students are expected to have programming skills at an introductory level in an appropriate language (such as C++, C, Pascal) and also to understand the fundamentals of computer hardware. These competencies may be demonstrated by previous course work or by comparable experience. The following prerequisite courses at RIT are also available to students, although they do not count toward graduation requirements.

Prerequisites

0602-208 Introduction to Programming
or
0602-700 Computer Programming & Problem Solving
AND
0602-410 Computer Concepts & Software Systems
or
0602-709 Fundamentals of Computer Hardware

Curriculum

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

Core courses		**Credits**
0604-745	Theories of Interactive Computing	4
0602-733	Fundamentals of Telecommunications Technology	4
0602-717	Information Integration	4

Concentrations (24 credits)

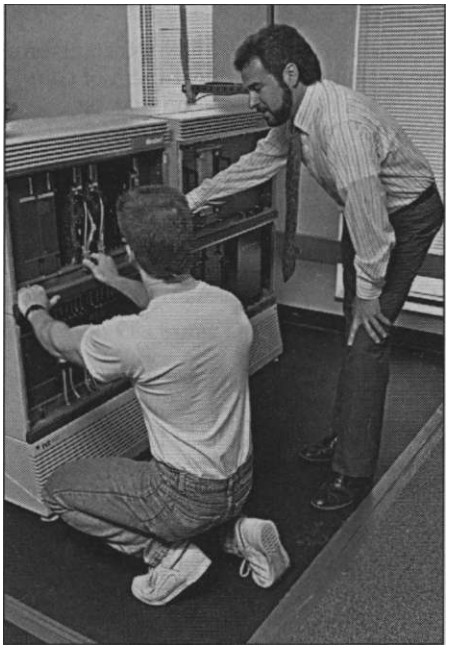
Students select two concentration areas from among the seven below. Each three-course (12-credit) concentration is designed to explore a unique aspect of information technology.

Interactive Multimedia Development		**Credits**
0604-741	Fundamentals of Interactive Multimedia	4
0604-742	Interactive Multimedia Development	4
0604-746	Programming for Interactive Multimedia	4

Training and Human Performance		
0602-722	Fundamentals of Instructional Technology	4
0602-723	Interactive Courseware	4
0602-724	Performance Support Systems Design	4

Information Technology Strategy		
0602-871	Technology in the Organization	4
0602-872	Inter-Enterprise Computing	4
0602-873	Technology & Strategic Opportunity	4

Telecommunications Management		
0602-850	Network Planning & Control	4
0602-855	Telecommunications Policy & Standards	4
0602-860	Enabling Technologies & Trends in Telecommunications	4



RIT telecommunications labs include this Meridian I equipment donated by Northern Telecom.

Telecommunications Technology		
0602-740	Switching Systems	4
0602-745	Transmission Systems	4
0602-750	Distributed Systems	4

Software Development and Management *(prerequisites must be met)*		
0602-820	Systems & Software Engineering	4
0602-830	Software Project Management	4
0602-831	Software Project Planning	4

Computer Integrated Manufacturing		
0602-730	Data Management & Communications	4
0617-842	Data Management in CIM	4
0602-750	Distributed Systems	4

Special topics

Students can use the Special Topics option to design a concentration with their adviser's consent.

Note: Courses in this option are not limited to those in information technology but may be chosen from other disciplines as well.

Electives (4 or 8 credits)

Students may choose one or two electives (four or eight credits) from courses that are related to their areas of interest. Electives are offered on an on-going basis from graduate programs in software development and management, computer integrated manufacturing and interactive multimedia development.

Some suggested electives

0602-714 Web Programming
0602-710 Software Design & Implementation
0602-720 Data Modeling & Design
0604-747 Topics in Interactive Media
0602-570 Windows Programming

Capstone experience (4 or 8 credits)

A master's project or thesis will be required to meet graduation requirements. This capstone experience should demonstrate a student's advanced knowledge in one of the IT concentration areas. Each student will assemble a capstone experience committee consisting of three faculty members who will evaluate the project or thesis.

Students will register for four credits for their capstone experience if they complete a master's project or eight credits if they choose to complete the master's thesis.

Students who choose to complete a thesis will take one less elective.

Financial aid

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

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

Advanced Certificate in Interactive Multimedia Development

Admission requirements

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

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

The curriculum

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

The program of study is as follows:

FALL/WINTER		Credits
0604-741	Fundamentals of Interactive Multimedia	4
0604-745	Theories of Interactive Computing	4
WINTER/SPRING		
0604-742	Interactive Multimedia Development	4
0604-746	Programming for Interactive Multimedia	4
SPRING/FALL		
0604-743	Interactive Multimedia Project	4
0604-744	Topics in Interactive Multimedia	4

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

Financial aid

In general, scholarships and graduate assistantships are not available for the advanced certificate programs. Information may be obtained from:

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

Note: Unlike the other programs, admission to this certificate is allowed only in the Fall or Winter quarters.

Department of Manufacturing and Mechanical Engineering Technology

Guy Johnson, *Chair*

The department offers the master of science in computer integrated manufacturing, a multidisciplinary degree offered with the colleges of Business and Engineering. The program is intended for future and current professionals in manufacturing and provides skills and study in the topics of business, engineering and computing. Graduates of this program will have a broad outlook on manufacturing activities and be able to work effectively across traditional functional lines. Students take a common core of courses and then elect a concentration in software and technology, manufacturing engineering, manufacturing quality or management of CIM.

Master of Science in Computer Integrated Manufacturing

Entrance requirements

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

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

GRE exams are required for international students. Students may submit these scores as additional information if they desire, or they may be required to do so in individual cases. A TOEFL score of 550 or better is required for those applicants with a non-English background. Applicants with a lower TOEFL score may be admitted conditionally and will take a prescribed program in English along with a reduced program course load.

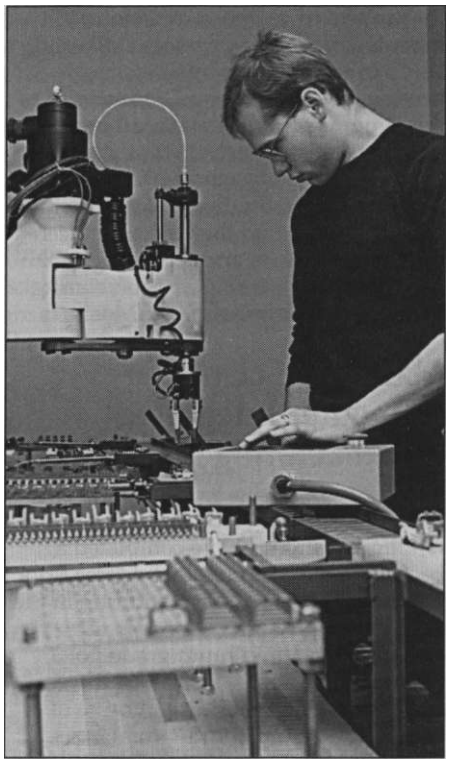
§

Curriculum

The graduate program of study consists of 52 credits composed of the core, concentration, elective and capstone groups. Prerequisite courses required for each concentration may be waived depending on a student's academic and employment background. These prerequisites may also qualify for elective credit.

Core courses (20 credits)

0303-625 Concepts of Computer-Integrated Manufacturing
0617-730 Data Management & Communication
0101-794 Cost Accounting
0303-748 Quality & Reliability
0106-749 Manufacturing Strategy & Tactics



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

Concentration options

Software and Technology Concentration (20 Credits)
Programming prerequisite equivalent to 0602-703
0617-842 Data Management in CIM
0617-845 Distributed Systems
0617-870 Flexible Manufacturing Systems
0617-850 Assembly Automation
0602-820 Systems & Software Engineering

Manufacturing Engineering Concentration (20 Credits)
Machine Processing and Materials prerequisite equivalent to 0304-343, 344
0302-801 Design for Manufacture
0303-710 Systems Simulation
0304-618 Computer-Aided Engineering
0304-615 Robotics
0303-630 Computer-Aided Manufacturing II

Management of CIM Concentration (20 Credits)
Statistics prerequisite equivalent to 0307-711, 712
0102-740 Organizational Behavior
0106-743 Operations Management
0102-742 Technology Management
0104-721 Financial Management
0106-796 Information Systems Management

Manufacturing Quality Concentration (18 Credits)
Statistics prerequisite equivalent to 0307-711, 712
0307-721 Statistical Quality Control I
0307-731 Statistical Quality Control II
0307-781 Quality Management
0307-732 Quality Engineering
0307-801 Design of Experiments I
0307-802 Statistical Quality Control II
Two electives (8-10 credits)

Capstone course (4 credits)
0617-896 Project Management in CIM
or
0617-897 Thesis

An optional cooperative educational experience is available for those students who wish to participate in order to gain industrial work experience.

Financial aid

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

Graduate Program Chair
Department of Manufacturing and Mechanical Engineering Technology
Rochester Institute of Technology
78 Lomb Memorial Drive
Rochester, N.Y. 14623-5604

Food, Hotel and Travel Management

Francis M. Domoy, *Chair*

Richard Marecki, *Graduate Program Chair*

Master of Science in Hospitality-Tourism Management

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

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

The curriculum

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

Program requirements

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

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

0625-750 Elements of Service Management: A Systems Approach
0625-760 Research Methods & Applications in Service Management: Measuring Customer Satisfaction
0624-770 Employee Relations & Training in Service Industries
0624-780 Financial Management of Hospitality-Tourism Firms
0625-790 Introduction to Graduate Research: Thesis/Project Option
0624-825 Strategic Process of Service Firms

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

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

Each of the 10 professional "cluster" courses focuses on specific hospitality-tourism issues and applications:

0624-823 Strategic Environment of the Hospitality-Tourism Industry
0624-826 Tourism Policy Analysis
0624-827 Technology Transfer in Hospitality-Tourism Industries
0624-828 Meeting Planning Management
0624-833 Policy Analysis: Food & Nutrition Issues
0624-835 Planning & Marketing of Health Care Related Services
0624-844 Hospitality Resource Analysis
0624-848 Convention & Exhibition Management
0624-867 Tourism Planning & Development
0624-868 Legal Issues & Evaluation of Events

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

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

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

Master's thesis/project

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

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

Admission requirements

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

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

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

Financial aid

Scholarships and graduate assistantships are available in food, hotel and travel management. Information may be obtained from:

Graduate Studies Program Chair
Food, Hotel and Travel Management
Rochester Institute of Technology
14 Lomb Memorial Drive
Rochester, N.Y. 14623-5604

Accelerated Program

Executive Leader MS Program

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

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

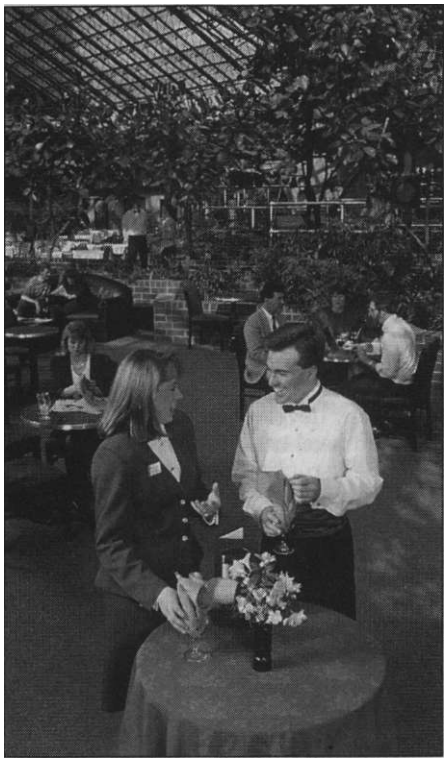
Master of Science in Service Management

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

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

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

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



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

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

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

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

Curriculum requirements

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

The student may choose elective courses with the approval of the program chair. Electives may be selected from within food, hotel and travel management or from RIT's College of Business and the department of instructional technology. Of the possible six to 12 hours of electives, students are relatively free to select courses they feel best meet their needs. The only limitations are:

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

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

Required core courses (18 credits)

		Credits
0625-750	Elements of Service Management: A Systems Approach	4
0625- 760	Research Methods & Applications in Service Management: Measuring Customer Satisfaction	4
0624-770	Employee Relations & Training in Service Industries: Developing Leadership through Teamwork	4
0624-825	Organizational Strategies of Service Firms	4
0625-790	Introduction to Graduate Research: Thesis/Project Options	2

Professional concentration (16-18 credits)

Food, Hotel and Travel Management

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

College of Business

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

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

College of Engineering—Center for Quality and Applied Statistics

Graduate Certificate in Statistical Quality

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

Facilities and equipment

- Computers: dedicated access to 17 advanced American Airlines SABRE reservation terminals (IBM/486-Windows environment); AT&T Resource Center with 20 dedicated AT&T 6310s tied to both LAN and RIT's VAX system.
- Applied software packages: business application software such as MS Office, WordPerfect, database programs such as MSAcces and FoxPro, spreadsheet programs such as Lotus 1-2-3 and Excel, graphics programs including Harvard Graphics, FreeLance, WordPerfect Presentation and PowerPoint, as well as service research application packages such as SurveyPro, Survey Tracker (including the Customer Service, Strategic Planning, Market Strength, Malcolm Baldrige, Food Services, and Lodging Resort modules) and AllClear and ABC Flow-Chart programs. RIT also maintains X-SPSS, Minitab and SAS on its VAX cluster.

Admission requirements

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

- graduate application
- baccalaureate degree or equivalent from an accredited institution
- Graduate Record Examination or Miller Analogies Test
- official undergraduate transcript(s)
- three professional recommendations
- an on-campus interview (when possible)

- undergraduate GPA of 3.0 or higher (a GPA of 2.75 will be considered, given superior recommendations, GRE or MAT scores and length of time since the candidate's college graduation)
- foundation course work with grades of 3.0 or higher (if required)
- Test of English as a Foreign Language (TOEFL) score of at least 550 for international students.

Faculty

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

Master of Science in Career and Human Resource Development

Stanley Bissell, *Program Chair*

Human resource development today

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

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

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

The program

The career and human resource development program is a 52-quarter-credit-hour program with four major curriculum components: career development, organization development, human resource development and human resource management. Students have the option of concentrating in a specific area or developing a program that best meets their interests or needs.

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

Classes are offered in the evenings, on weekends and through distance learning.

Executive leader option

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

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

Admission requirements

Admission requirements for the master of science degree include:

- successful completion of the baccalaureate degree at an accredited college or university
- a cumulative grade point average of 3.0 or above or evidence of relevant professional performance
- two letters of reference
- a recent writing sample*
- an oral presentation*
- an interview with program faculty

**Not required for executive leader*

Required for executive leader option:

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

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

Application forms are available from the Office of Part-time and Graduate Studies, or call 716-475-5062 for further information.

Financial aid

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

Degree requirements

The degree requires completion of a minimum of 52 quarter credit hours at the graduate level. Of the 52 hours, 24 are in seven required courses. Two courses are waived for executive leaders, but all students are required to complete 28 credits in techniques courses and/or electives. The degree can usually be completed in four consecutive quarters. However, the majority of students attend part time and take from two to four years to complete the degree work. Executive leaders who have 12 credits for their portfolios can complete the degree in five quarters. Students must maintain a B average and complete the degree within seven years of the first course counted toward the degree.

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

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

Curriculum

Introduction to CHRD*
Empirical Methods in CHRD*
Applied Data Analysis in CHRDt

Theories of Organizational Developments
Planning & Evaluation in Organizational Dev.
Practice of Consultation in Organizational Dev.
OD Interventions

Theories of Career Development
Career Counseling Techniques I
Career Counseling Techniques II
Information Use in Career Planning
Career Development in Business

Theories of Human Resource Developments
Techniques of Human Resource Dev.
Design & Delivery of Training
Needs Assessment & Proposal Dev.
Futures Research & Simulation

Theories of Human Resource Management
Financial Concepts in HR
Human Resource Information Systems
Compensation Concepts
Employee Workplace Programs

** Required by regular program, not executive leader option*
t Required by all programs
‡ May be waived by executive leaders with approval of their advisers

Additional Courses
Group Leadership
Computer Applications in CHRD
Evaluation of Training
Performance Technology
Applied Communications—NLP
Workforce Diversity
Psychology Tests & Measurements
Total Quality Management in Human Resources

Note: 52 credit hours for MS degree; all courses three credit hours except six-credit internship. Courses may be taken in other graduate-level programs at RIT and other institutions with permission of adviser.

Master of Science in Instructional Technology

C. ***Wallington,*** *Program Coordinator*

At RIT, instructional technology is synonymous with the design and development of training and performance improvement. The majority of instructional technology graduates hold jobs in medium or large organizations, usually in business and industry. There they work in teams on ways to improve employee performance. Some examples of the linkage between the instructional technology program and business and industry are:

- an advisory committee composed of training and performance technology professionals
- on-site offerings at major corporations
- Mager Associates' courses in Criterion Referenced Instruction, Instructional Module Development and Training the Training Manager
- participation in the RIT executive leader program (for experienced professionals)
- continuing communication with program graduates to keep abreast of best practices in training and performance technology

At RIT, instructional technology means an orientation toward training and performance improvement through highly structured, carefully designed and tested materials and performance support tools. As a field, instructional technology differs from information technology in that instructional technology focuses on the person, not the delivery system. Instructional technology (and performance technology) begins with the premise of improving an individual's performance, rather than using computers for their own sake.

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

At RIT, instructional technology also means *people skills.* Instructional designers *must* have good interpersonal communications skills. The instructional technology program requires courses in interpersonal communications and group dynamics—not theory-only courses, but process courses that prepare students for work teams.

At RIT, instructional technology includes elements of performance technology. The emphasis is always on performance improvement—sometimes through training, sometimes through job aids and on-line help, sometimes through work restructuring. The core value is that a better employee makes a better contribution to organizational success.

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

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

Admission requirements

Admission decisions for the instructional technology program are based on:

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

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

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

If a prospective student has questions about the program, job prospects or relation of the degree to any personal goals, he or she should contact the instructional technology program chair for additional information and possibly an interview—either in person or by telephone. Graduate application forms are available from the RIT Admissions Office or the instructional technology program in the department of food, hotel and travel management, College of Applied Science and Technology.

Prerequisite skills

Two sets of skills are required of every graduate—basic computer skills and basic statistical skills. Basic computer skills include using basic software tools (word processors, spreadsheets, databases). Students may show proof of these skills through previous courses or through work experience. RIT offers a graduate course (0626-750) to meet this requirement that can be counted toward the instructional technology degree.

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

Financial aid

Financial assistance is available through the following sources:

- RIT Financial Aid Office: 716-475-2186
- Instructional technology program: 716-475-2893

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

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

Degree requirements

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

Of the 18 elective hours, students are relatively free to choose those they feel best meet their needs. Restrictions are:

- all courses must be graduate level
- a maximum of nine quarter credit hours (not counted toward another degree) may be transferred from another college or university

- a maximum of 12 hours may be taken outside the instructional technology program (career and human resource development courses are counted as instructional technology courses)
- a maximum of six hours may be taken in special projects, independent study or internship courses
- a student may take a *maximum* of 14 hours in any combination of the above

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

While the student has some liberty to choose course sequence, careful attention should be given to course prerequisites. A good rule-of-thumb is to take 0627-704, 735, 755 and 756 within the first 20 hours of course work in order to prepare for 0627-771, 772 and 773 (the instructional development sequence). For answers to specific questions, the student should contact his or her adviser.

Required core courses (28 credits)		**Credits**
0627-704	Interpersonal & Group Communications	4
0627-721	Evaluation of Training	4
0627-735	Theories of Learning	4
0627-755	Criterion-Referenced Instruction & Technical Training 1	3
0627-756	Criterion-Referenced Instruction & Technical Training 2	3
0627-771	Instructional Development 1	4
0627-772	Instructional Development 2	4
0627-773	Instructional Development 3	4

Degree options

Instructional design option (four of the five electives below)

0627-711	Computer-Based Performance Improvement	4
0627-712	Computer-Assisted Instruction I	4
0627-721	Evaluation of Training & Instruction	4
0627-757	Techniques of Work Analysis	3
0627-762	Developing Instructional Modules	3
0626-733	Needs Assessment & Proposal Development	3

Note: 0626-733 is a career and human resource development course.

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

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

Department of Packaging Science

***Daniel L. Goodwin**, Department Chair*

***David L. Olsson**, Graduate Programs Coordinator*

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

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

Admission requirements

Students entering the program will have a graduate academic adviser appointed and will develop their programs of study in consultation with their adviser. They may utilize the model curriculum to complete their degree requirements, or may propose alternative course work. All programs must be consistent with the general outline of the model curriculum, and have advisory approval. In instances where the student has insufficient academic or practical preparation to study packaging at the graduate level, he or she will work out an appropriate program to correct such deficiency, generally by completing the following undergraduate courses: Packaging Principles, Materials I, Materials II, Rigid Containers, Flexible Containers, Production Systems, Packaging for Distribution, Packaging for Marketing, and/or Shock and 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 0307-711 and having completed a course in computer applications. Lacking this background, applicants will be required to take 0307-711 and/or 0607-341, or equivalent course work to remedy a background deficiency.

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

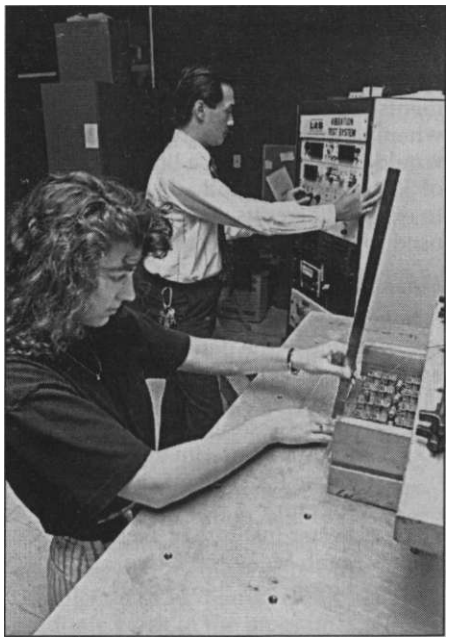
Executive leader MS program

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

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

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

The curriculum



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

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

PACKAGING CORE COURSE WORK
Completion of a minimum of 20 credits in graduate-level packaging courses, including 0607-701, Research Methods, and any four of the following:

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

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

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

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

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

Financial aid

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

David L. Olsson, Graduate Programs Coordinator
Graduate Packaging Science Program
Rochester Institute of Technology
29 Lomb Memorial Drive
Rochester, N.Y. 14623-5603

Master of Science in Environmental, Health and Safety Management

John Morelli, *Chair*

This program has been submitted to the New York State Education Department for approval and will be offered subsequent to approval.

Organizational downsizing and the need for increasing efficiency and competitiveness have driven many organizations to consolidate their environmental, health and safety functions. As a result, many individuals who work in an E,H&S capacity have a background in only environmental or health and safety. In addition, as environmental quality standards become stricter, the efforts needed to continuously improve environmental, health and safety performance will move upstream from the "end-of-the-pipe" to the production process of the organization itself. To effectively work within the organization rather than with only the waste it produces, E,H&S managers need to integrate their activities throughout the business organization.

The MS degree program in E,H&S management combines experiential and academic learning to prepare students with suitable backgrounds for leadership roles in their careers. The program is built on current and emerging strategies for managing E,H&S aspects of an organization.

Curriculum

The master of science in environmental, health and safety management consists of 48 credit hours of graduate study. The curriculum consists of a set of core courses with E,H&S electives, professional electives, graduate thesis and graduate project.

Core courses		**Credits**
0630-720	E,H&S Management	4
0102-740	Organizational Behavior & Leadership	4
0630-740	E,H&S Management Systems Design & Perf. Meas.	4
0630-760	Integrating E,H&S into Business Management	4
0630-790	E,H&S Internal Auditing	4
0630-XXX	E,H&S Electives	8

Professional electives

XXXX-XXX	Professional Electives	12

Graduate thesis/project

0630-891 Graduate Project (1-6 credits)
0630-899 Graduate Thesis (1-6 credits)

Program electives

Courses that can be used as either E,H&S electives or professional electives:

0630-610, -611 Survey of Health & Safety Management Practice & Regulatory Law (3 credits ea.)
0630-620, -621, -622 Survey of Environmental Management Practice & Regulatory Law (2 credits ea.)
0630-730 E,H&S Systems Control Technology (4 credits)
0360-770 E,H&S Risk Assessment, Management & Communication (4 credits)
0630-780 E,H&S Law & Regulation Interpretation & Negotiation
0630-799 Advanced-Level Independent Study (1-4 credits)
0630-810 Special Topics (4 credits)
0630-888 Graduate E,H&S Co-op

Courses that can be used as professional electives only (4 credits each):

0630-750 E,H&S Project Management
0101-703 Financial Accounting Systems
0101-706 Cost Accounting
0102-741 Leading a Quality Organization
0102-742 Intro, to Tech. Management
0102-760 International Management
0102-762 Managing the High-Tech Firm
0102-763 Behavioral Skills for Managers
0102-770 Research Methods
0104-721 Financial Analysis for Managers
0105-761 Marketing

With graduate committee approval, students may select other appropriate elective courses from graduate programs across the Institute. Students must have satisfied all prerequisites specified prior to enrolling in any course. Students must obtain approval from the College of Business for programs of study that include elective courses offered by that college.

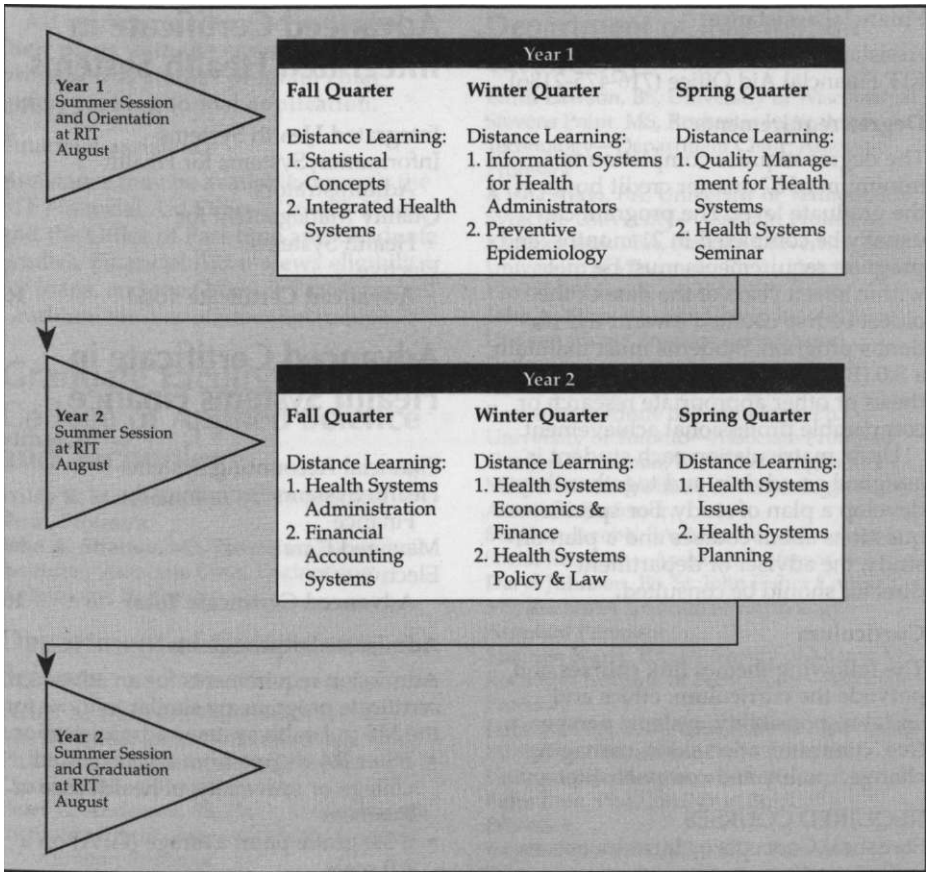
Admission requirements

Students with a baccalaureate degree from an accredited institution with a minimum grade-point average of 3.0 over the junior- and senior-level years of the undergraduate program are eligible for admission. Entering students are expected to have successfully completed at least one college-level course each in statistics and computer science and to have successfully completed 20 quarter credit hours (15 semester hours) of college-level science and math course work, with at least four quarter credit u f 5 (three semester hours) in each of the following three areas: 1) general chemistry, organic chemistry; 2) biology, microbiology, ecology, biochemistry; 3) physics, geology, hydrology, geochemistry, fluid mechanics, calculus.

Applicants will be required to submit three writing samples to demonstrate their written communication skills. International students are required to have achieved a score of 550 or higher on the Test of English as a Foreign Language and will be evaluated by RIT's English Language Center (ELC) by use of the Michigan Test of English Language Proficiency, a short written essay and the Ilyain Speaking-Listening Test.

In those cases where an applicant's undergraduate program lacks an adequate number of credit hours in math and science or where there may be some question of the capability of applicant to complete this program of study, he or she may be required to submit his or her GRE (Graduate Record Examination) scores to support the candidacy.

Generally, applicants are expected to have formal academic education or documented professional experience in management of solid waste, wastewater, air emissions and health and safety and practical knowledge of accounting and financial practices common to E,H&S management. Documented experience of appropriate type and duration may be accepted by the Admissions Committee in lieu of other requirements.



The Center for Multidisciplinary Studies

Lynda Rummel, *Director*

Master of Science in Health Systems Administration

William Walence, *Program Chair*

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

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

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

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

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

The program

Health systems administration is a 57-quarter-credit-hour distance learning program. It requires 18 months of study, but only one to two weeks each year on campus.

Teaching methodologies include computer networking, video lectures and seminars, audio-taped lectures and discussions, and teleconferences. Students attend one campus summer session each August. Each session lasts three to five days, depending on the courses taken.

Admission requirements

Admission requirements for the master of science degree include:

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

All credentials must be submitted and reviewed by the faculty prior to the completion of 12 quarter credit hours of graduate work in the program. Call 716-475-7359 for further information.

Financial assistance

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

Degree requirements

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

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

Curriculum

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

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

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

Advanced Certificates in Health Administration

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

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

Advanced Certificate in Integrated Health Systems

	Credits
Integrated Health Systems	4
Information Systems for Health Administrators	4
Quality Management for Health Systems	4
Elective	\
Advanced Certificate Total	**16**

Advanced Certificate in Health Systems Finance

	Credits
Financial Accounting Systems	4
Health Systems Economics & Finance	4
Managed Care	4
Elective	_4
Advanced Certificate Total	**16**

Admission requirements

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

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

Cross-Disciplinary Professional Studies

Lawrence Belle, *Program Chair*

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

The program

The master of science in cross-disciplinary professional studies requires completion of 48 quarter credit hours as specified in an individualized plan of study consisting of two or three professional concentrations. Each concentration consists of three to four courses drawn from an existing RIT graduate program. Graduate credits earned in other programs can be used in completing a concentration. Certain concentrations can be completed with distance delivered courses, including applied statistics, information technology and telecommunications. Besides course work in two or three concentrations, there are two required courses. Credit hours not required in a student's concentrations and required courses can be used for electives.

Required courses

Interdisciplinary Research Techniques (4 credits)

This course introduces students to interdisciplinary thinking, problem solving and research techniques and also print and electronic information resources appropriate to their plan of study.

The Capstone Project (4-8 credits)

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

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

Examples: Cross-Disciplinary Professional Studies

Plan of Study Example 1: Cross-Disciplinary Professional Studies with Two Professional Concentrations

		Credits
0699	Interdisciplinary Research Techniques	4
CONCENTRATION A: MANAGEMENT		
0102	Organizational Behavior & Leadership	4
0102	Leading a Quality Organization	4
0102	Business & Society	4
0102	International Management	4
CONCENTRATION B: ORGANIZATIONAL DEVELOPMENT		
0626	Needs Assessment	3
0626	Theory of Organizational Development	3
0626	Planning & Evaluation in Organizational Development	3
0626	Organization Restructuring	3
ELECTIVES		
0307	Quality Management	3
0625	Elements of Service Management	4
0625	Organizational Strategies of Service Firms	4
0699	Capstone Project	5
	Total	48

Example 2: Cross Disciplinary Professional Studies with Three Professional Concentrations

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

Admission requirements

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

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

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

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

Financial assistance

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

Graduate Faculty College of Applied Science and Technology

Wiley R. McKinzie, MS, SUNY at Buffalo-Dean, Professor
John A. Stratton, MS, Rensselaer Polytechnic Institute—Associate Dean, Engineering Technology; Professor

Department of Computer Science

Walter A. Wolf, BA, Wesleyan University; MS, Rochester Institute of Technology; MA, Ph.D., Brandeis University—Department Chair, Associate Professor
Peter G. Anderson, BS, Ph.D., Massachusetts Institute of Technology—Graduate Program Coordinator; Professor
Warren Carithers, BS, MS, University of Kansas—Associate Professor
Lawrence Coon, AB, University of Rochester; MA, Oakland University; MS, University of Pittsburgh; Ph.D., Ohio State University—Associate Professor
Henry Etlinger, BS, University of Rochester; MS, Syracuse University—Undergraduate Program Coordinator, Associate Professor
James Heliotis, BS, Cornell University; Ph.D., University of Rochester—Associate Professor
Fereydoun Kazemian, BS, Queen Mary College; MS, Pittsburgh State University; Ph.D., Kansas State University—Associate Professor
Andrew Kitchen, MA, University of Edinburgh; MS, Rochester Institute of Technology; Ph.D., University of Rochester—Professor
Michael J. Lutz, BS, St. John Fisher College; MS, SUNY at Buffalo—Professor
Fernando Naveda, BS, Monterrey Institute of Technology; Ph.D., University of Minnesota—Associate Professor
Stanislaw Radziszowski, MS, Ph.D., University of Warsaw—Professor
Kenneth Reek, AAS, BT, MS, Rochester Institute of Technology—Professor
Margaret Reek, BT, MS, Rochester Institute of Technology—Professor
Nan Schaller, BS, University of North Carolina; MS, Union College—Professor
Paul Tymann, BS, MS, Syracuse University—Assistant Professor
James R. Vallino, MS, University of Rochester—Assistant Professor

Department of Information Technology

Edith Lawson, BS, University of Wisconsin at Stevens Point, MS, Rochester Institute of Technology—Department Chair; Associate Professor
A'isha Ajayi, BA, University of Vermont; MS, Syracuse University—Assistant Professor
Kumiko Aoki, BA, Nanzan University; MA, University of Wisconsin; Ph.D., University of Hawaii at Manoa—Assistant Professor
John A. Biles, BA, MS, University of Kansas—Undergraduate Program Coordinator; Professor
Kevin Donaghy, BA, Holy Cross; MS, Rochester Institute of Technology; Ph.D., University of Toronto—Associate Professor
Gordon Goodman, BS, SUNY Binghamton; MS, Rochester Institute of Technology—Associate Professor
Stephen Jacobs, BA, MA, New School for Social Research—Assistant Professor
Daryl Johnson, BS, St. John Fisher College; MS, Rochester Institute of Technology—Assistant Professor
Stephen Kurtz, BA, University of Miami; MS, Rochester Institute of Technology—Associate Professor
Jeffrey Lasky, BBA, University of New York; MBS, City University of New York; MS, University of Minnesota—Professor
Peter Lutz, Ph.D., SUNY at Buffalo-Professor
Rayno Niemi, BS, MS, Ph.D., Rensselaer Polytechnic Institute—Graduate Program Coordinator; Professor
Ronald Perry, B. Tech; MS, Rochester Institute of Technology—Graduate Program Coordinator; Associate Professor
Evelyn P. Rozanski, BS, SUNY College at Brockport; MS, Syracuse University; Ph.D., SUNY at Buffalo—Professor
William Stratton, BA, Ohio State; MA, Hunter College; MS, Ph.D., SUNY at Buffalo—Associate Professor
Timothy Wells, BS, Eastern Washington State University; MBA, California State, Bakersfield—Assistant Professor
Michael A. Yacci, BS, Ithaca College; MS, Rochester Institute of Technology; Ph.D., Syracuse University—Associate Professor

Adjunct Faculty—Computer Science and Information Technology

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

Department of Manufacturing and Mechanical Engineering Technology

Ronald F. Amberger, BME, Rensselaer Polytechnic Institute; ME, Pennsylvania State University; PE—Professor
Clyde M. Creveling, B.Tech., Rochester Institute of Technology—Instructor
Charles L. DeRoller, BS, ME, Rochester Institute of Technology—Associate Professor
Louis B. Gennaro, BS, U.S. Military Academy; MS, Northeastern University—Professor
Martin Gordon, BSME, MSME, MBA, SUNY Buffalo—Assistant Professor
Guy Johnson, BS, Pennsylvania State; MS, Syracuse University—Chair, Manufacturing and Mechanical Engineering Technology; Professor
Ti-Lin Liu, MS, Tsinghua University—Associate Professor
Carl A. Lundgren, BS, Rensselaer Polytechnic Institute; MBA, University of Rochester—Professor
Robert A. Merrill, BS, Clarkson College; MS, Northeastern University; PE—Professor
S. Manian Ramkumar, BE, PSG, College of Technology-Bharathiar; ME, Rochester Institute of Technology—Associate Professor
Elizabeth A. Scholle, BSE, University of Pittsburgh; MS, Ph.D., University of Illinois; EIT Professional Certification—Assistant Professor
James E Scudder, BME, Cornell University; PE—Assistant Professor

Food, Hotel and Travel Management

Stanley Bissell, BA, Ohio Wesleyan University; MA, University of Auckland, New Zealand; MLS, SUNY College at Geneseo—Program Chair, Career & Human Resource Development, Associate Professor
Barbara Cerio, RD, BS, M.Ed., SUNY at Buffalo—Assistant Professor
David Crumb, BS, Florida State University; MBA, Michigan State University—Assistant Professor
Francis M. Domoy, BS, MA, SUNY at Buffalo; Ph.D., Michigan State University—Chair, Professor
Elizabeth Kmiecinski, RD, BS, Ohio State University; MS, University of Kentucky—Assistant Professor
Richard Marecki, BA, MA, Ph.D., SUNY at Buffalo—Professor
Dianne C. **Mau,** BS, Rochester Institute of Technology; MS, SUNY College at Brockport—Visiting Assistant Professor
Warren Sackler, BA, Michigan State University; MA, New York University—Associate Professor
Edward Steffens, BS, MBA, Rochester Institute of Technology—Assistant Professor
Edward B. Stockham, AB, Ph.D., University of Pennsylvania—Associate Professor
C. **J. Wallington,** BS, University of Missouri at Kansas City; Ph.D., University of Southern California—Graduate Program Chair, Professor
Carol Whitlock, RD, BS, MS, Pennsylvania State University; Ph.D., University of Massachusetts—Professor
Gladys W. Winkworth, BS, SUNY Albany; MS, SUNY College at Brockport—Visiting Instructor

Adjunct Faculty—Food, Hotel and Travel Management

Liesl Berger, BA, SUNY at Buffalo; MS, Rochester Institute of Technology
Albert C. Cabral, BA, Stetson University; MBA, Syracuse University; MS, Rochester Institute of Technology
Gregory J. Connor, BS, Syracuse University; MS, Rochester Institute of Technology—Assistant Professor
Donna A. Dickson, BA, State University College at Buffalo; MS, Rochester Institute of Technology
Rebecca Ferraro, BS, SUNY College at Brockport; MS, Rochester Institute of Technology
Nicholas Horney, MS, University of Chicago; Ph.D., University of South Florida
James Jacobs, MS, Troy State University; Ph.D., SUNY at Buffalo
Paul Kazmierski, BA, B.Ed., M.Ed., Duquesne University; Ph.D., Syracuse University
Edward M. Kelly, AB, Harvard University; MAT, University of Maine; Ed.D., Boston University;
Joseph M. LaCopa, MS, Rochester Institute of Technology; Ph.D., Michigan State University
Gail D. Love, BS, Southern Illinois University; MS, Rochester Institute of Technology
Edward Marecki, BS, SUNY at Buffalo; MS, Canisius College
Marcia A. Marriott, BS, MS, SUNY College at Brockport; Ph.D., Southwest University
Richard Morano, BS, Rochester Institute of Technology; MS, University of Rochester; Ed.D., University of Rochester;
Joseph W. Ostrowski, BS, MS, Rochester Institute of Technology
James M. Papero, BS, Ed.M., University of Rochester
Kevin W. Paul, BS, SUNY Buffalo
Luis A. Rivera, BA, University of Puerto Rico; MS, Rochester Institute of Technology
Dan L. Sirmans, BBA, Georgia State University; MS, Rochester Institute of Technology
J. Wixson Smith, BS, SUNY College at Geneseo; MS, Rochester Institute of Technology
Ellen J. Solomon, BA, University of North Carolina; MS, The American University/NTL Institute
Kathleen O'Brien Voelkel, BS, University of Wisconsin; MSW, Southern Connecticut State; MS, University of Wisconsin;
Clyde Vollmers, BS, Iowa State University; MBA, University of Minnesota; Ph.D., Michigan State University;
Katherine A. Welch, BS, Nazareth College; MS, Rochester Institute of Technology
Albro C. Wilson, MS, Rochester Institute of Technology
Carl Winkelbauer, Ed.D., University of Rochester

Department of Packaging Science

A. **Ray Chapman,** BS, Michigan State University; MBA, Rochester Institute of Technology—Professor
Daniel L. Goodwin, BS, MS, Ph.D., Michigan State University—Chairman, Professor
Deanna M. Jacobs, BS, SUNY College at Plattsburgh; MA, SUNY College at Geneseo; MS, Rochester Institute of Technology—Associate Professor
David L. Olsson, BS, MS, Ph.D., Michigan State University—Professor
Karen L. Proctor, BS, Michigan State University; MBA, Rochester Institute of Technology—Associate Professor
Fritz J. Yambrach, BS, Michigan State University, BS, MBA, Utah State University—Associate Professor

Center for Multidisciplinary Studies

Lawrence Belle, BA, MA, Case-Western Reserve, Ph.D., University of Rochester—Professor; Program Chair, Cross-Disciplinary Professional Studies
Thomas McCaffery, BS, University of Scranton; MHA, University of Michigan; JD, Boston College Law School—Associate Professor
William W. Walence, BA, MA, Kent State University; Ph.D., Ohio State University—Program Chair, Health Systems Administration, Deaf Studies, Associate Professor

Adjunct Faculty

Gary Austin, MBS—Manager, Financial Systems Analysis, Blue Cross and Blue Shield of Rochester
Christopher Davis, M.D.—Physician, Rochester, New York
Reese Davis, MS—Director, Education and Health Promotion, Blue Cross and Blue Shield of Rochester
James Fatula, Ph.D.—Consultant, Health Care Management, Rochester, New **York**
Arnold S. Gissin, MPH—Administrator, Jewish Home of Rochester
Sara E. Hartman, MBA, MPH—Vice President, St. Mary's Hospital
Katherine Hiltunen, MBA, BSN—Director, QM/UM Analysis, Blue Cross and Blue Shield of Rochester
Patricia Houghton, RN, MHA, CPHQ—Administrative Director of Quality, Rochester General Hospital
Michael O'Connor, MS—Executive Director, Rochester Community Individual Practice Association
Larry A. Rice, MPH—RMS Associates, Rochester, New York
Michael Tarcinale, Ph.D., RN—Vice President, Randamax, Inc., Rochester, New York
Arthur G. Tweet, Ph.D.—Consultant, CQI Associates, Rochester, New York
Beverly Voos, MS, President and Chief Executive Officer, Rochester Healthcare Information Group, Rochester, New York

Information Technology

0602-700 Computer Programming & Problem Solving
An introductory course in the use of computers, interactive environments, file systems, editor. Programming in a modern software development environment with a structured programming language such as C, covering control structures, procedures and functions, recursion, arrays, pointers, file I/O, records. Application areas cover numerical methods, sorting and searching, graphics, text processing. Programming projects will be required. (Pre-calculus) **Credit 4**

0602-703 Algorithms & Data Structures
Topics include data abstraction, data representation, data structures, such as linked lists, trees, stacks, queues, hash tables, sparse matrix techniques, searching and sorting techniques, file structure and maintenance. Programming projects will be required. (Programming proficiency in some high-level structured programming language, discrete mathematics) **Credit 4**

0602-709 Fundamentals of Computer Hardware
A study of the concepts of computer hardware design and organization needed for effective computer software design and system implementation. Topics include computer peripherals and interfacing techniques; Boolean algebra; digital logic design; integrated circuit logic families; central processing unit design; microprogramming; buses and addressing; interrupts and direct memory access; hierarchical memories; system performance evaluation; and survey of commercially available computers. (0602-700,703) Credit 4

0602-710 Software Design & Implementation
A course in the principles and techniques of designing and implementing large software systems for students who are well versed in computer programming and data structures in a structured programming language (Pascal, C, Modula-2). The Ada and C++ programming languages are used for illustrating principles and techniques. Topics include basic Ada syntax; C++ syntax; software design concepts—modularity, abstraction, information hiding and abstract data types; and software design methods—top-down functional decomposition and object-oriented design. Software design and programming projects are required. (0602-703) Credit 4

0602-714 Web Programming
An introduction to an object-oriented programming language, such as Java, for the World Wide Web. This course will cover the creation of applet and application programs. Topics include Internet concepts, basic language concepts (declaring and evaluation data, statements, expressions, control flow and input), the development environment, essentials of applet programming (URL, audio, image, text, animation), classes and objects, error handling, debugging, threads, and the client/server environment. Programming projects will be required. (0602-208 or equivalent) Credit 4

0602-716 C++ Programming Workshop
A workshop in the C++ programming language intended for students to gain programming experience. This course will focus on modern programming concepts such as reusability, data abstraction, information hiding, exception handling and object-oriented design. Programming projects will be required. (0602-710 or permission of instructor) **Credit 4**

0602-717 Information Integration
How information is defined, stored and distributed determines the organization's effectiveness. This course investigates the modern concepts of information as a strategic asset, addressing such questions as: what information currently exists? how is it defined? who uses the information and for what purpose? how can this information be managed to the organization's and the individual's benefit? Credit 4

0602-720 Data Modeling & Design
Introduction to topics in analysis and design of data representations. This includes semantic models for database applications, relational and object-oriented databases and database implementation concepts. DB design projects will be required. (0602-703, 709) **Credit 4**

0602-721 Advanced Graphics Programming in C
This course is designed for the professional animator, who is often required to know C language. It will extend the object-oriented approach developed in the prerequisite courses. Students will write C code to interface with high-level packages for rendering graphic objects. (0602-713 or permission of instructor) **Credit 4**

0602-722 Fundamentals of Instructional Technology
Information technologists will need to design small to moderately sized instructional programs that can teach skills to users. This course emphasizes an Instructional Systems Design (ISD) model of developing instruction. Students will apply the model to a selected topic and will develop and validate a unit of instruction for end users. Additionally, students will learn terminology that is common in instructional design situations. Credit **4**

0602-723 Interactive Courseware
A specialized educational change strategy involves the design of microcomputer courseware (educational software for personal computers). This is an important area of expertise for information technologists who will likely work as part of a design team with instructional designers. This course teaches the student to develop branching computer tutorials, incorporate simple instructional interactive video applications, and develop simulations for instructional purposes. The process of systematic instructional design is emphasized. The student is also encouraged to consider adaptive systems and the design benefits and constraints of non-human delivery systems. (0602-722) Credit **4**

0602-724 Performance Support Systems Design
The modern workplace requires workers to be the center of a large mass of information. Although the information is available, the worker needs to be able to access information quickly in a form that is most useful to them. Performance support systems involve on-line job aids, expert systems, databases, and tutorials integrated into a system that enables a worker to access specific information effectively and under the worker's control. This course enables the learner to create, implement, and evaluate an integrated performance support system that meets specific needs within an organization. (0602-722) **Credit 4**

0602-725 Reusable Software Design
Further study of the principles and techniques of designing and implementing large software systems, focusing on software reuse. The Ada and C++ programming languages are used to illustrate the principles and techniques. Topics include software reuse paradigms: reuse by inheritance and reuse by composition of reusable software components; inheritance-based and composition-based software design methods; wide-spectrum reusable software component libraries; and implementation of reusable software components. Software design and programming projects are required. (0602-710) Credit **4**

0602-733 Fundamentals of Telecommunications Technology
The interaction of technology, procedures, and human resources are explored against the backdrop of modern business and society. Fundamentals operating principles, applications, and strategic issues related to data communications transmissions, telecommunications facilities, common carrier offerings, and networking are explored. Credit **4**

0602-740 Switching Systems
A course in telephony and switching. Topics include an introduction to the public switched network in North America; international networking; switching of voice, data and video; call and feature processing; space and time division switches; signaling (in band, out of band, CCS7); queuing theory and modeling of switching systems; the intelligent network; error control; throughput; delay; congestion; routing and addressing; switching of cellular networks. Existing switches will be studied. Downstream processing (billing, administration, etc.) and its relevance to the switching function will also be discussed. Programming project in C will be required. (0602-733) Credit **4**

0602-745 Transmission Systems
This course focuses on details of transmission in telephone networks. Included are discussions on analog and digital modulation (PCM, ASK, FSK, PSK), signal-to-noise ratios, sampling theory, transmission via copper (including different types of copper systems, such as T carriers), microwave, satellite, RF broadcast and fibre optics. SONET will be discussed when studying fibre systems. Different types of transmission media will be compared with respect to band width, error rates and cost effectiveness. (0602-733) Credit **4**

0602-750 Distributed Systems
The course in distributed systems centers around multitasking and the use of tasks as an implementation mechanism for objects. OSI protocols above the network layer are studied and different means of sharing information in a distributed environment are explored (electronic mail, network file systems, distributed database systems, remote access to facilities, etc.). Also included in this course is a discussion of the unique needs and standards of the telecommunications industry, as regards reliability, maintainability, and integration of software. (0602-733) **Credit 4**

0602-820 Systems & Software Engineering
A high-level examination of the system development process. Topics include historical perspectives, software development worldwide, the nature of complex systems, life cycle models, software reuse, project estimation models, risk assessment, software quality, software safety and emerging trends. Credit 4

0602-821 Specifications & Design of Information Systems
An examination of current methods and techniques used in the specification and design of information systems. The course examines the use of models to define system context, domain analysis (entities and events), functional behavior, system timing, and database definition and design. Strategies for building design models that realize the specification are presented along with evaluation criteria for assessing design quality. Emphasis is placed on decisions made during the development process, with discussion of how various methodologies represent those decisions. Students will be required to demonstrate a practical mastery of the techniques presented. (0602-710, 720) Credit 4

0602-825 Analysis & Design of Embedded Systems
Study of large real-time embedded systems: computer systems that have critical response time requirements and that sense and control external hardware. The Ada and C++ programming languages are used for illustrating the principles and techniques. Topics include embedded system design issues; concurrent software concepts; methods for specifying large embedded system functional and performance requirements; methods for designing large embedded systems as a group of cooperating, communicating, concurrent processes, or, alternatively, as a group of nonconcurrent subprograms. Program design projects will be required. (0602-725) Credit 4

0602-830 Software Project Management
An examination of approaches and methods used for software project management. Topics include software quality engineering, project scheduling, cost and staffing models, process and product measurement and emerging trends. (0106-781,0602-820) Credit 4

0602-831 Software Project Planning
A study of the strategic issues involved in the management of software projects. The course examines the use of models and management techniques in the areas of project goals, development environment, configuration management, team organization and development's role in corporate structure. (0602-820) Credit 4

0602-835 Software Testing & Inspections
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. (0602-820) Credit 4

0602-850 Network Planning & Control
An overview of analyzing a network from the global level, this course examines network traffic analysis, growth predictions, growth options and issues in the control of an operating network. Included will be a discussion of corporate networks, including virtual private networks, Centrex vs. PBX considerations, the business case for ISDN and other issues from the client's perspective. Also to be discussed are the importance of international telecommunications issues and problems of interfacing to the international switched network. (0602-745) Credit 4

0602-855 Telecommunications Policy & Standards
This course studies forces on the telecommunications industry from outside. These come from two principal directions: public policy and standards organizations. Public policy refers to the regulatory agencies that govern the industry. Both North American and European systems will be covered. Standards bodies and their role in the international standards arena will be discussed. Included will be CCITr, ANSI, ISO and NIST. (0602-733) Credit 4

0602-860 Enabling Technologies & Trends in Telecommunications
This course endeavors to predict the effects of future technological innovations. To facilitate this, a number of new and promising technologies in transmission, switching, mass storage, processing and other areas are studied. Included will be study of new software technologies such as systems integration strategies, software reusability and object-oriented design methodologies. (0602-733) Credit 4

0602-871 Information Technology & Organization Processes
If organizations are to remain competitive they will need to reevaluate their basic business processes. The topic of process reengineering has become an intriguing issue as it places information technology solely as a key enabling technology within organizations. Information technology offers new opportunities to integrate and improve the effectiveness of an organization's internal work process. This course discusses a variety of types of organizations and the ways that technology can be used for strategic advantage. (MSIT core or equivalent background/experience)

0602-872 Interenterprise Computing
Managers and technologists both need to be aware of the variety of new means of doing business. Information technology has made it possible for multiple businesses to work together as an extended enterprise, sharing full access to vital information that enables them to do business more effectively. This course presents an in-depth study of alternative ways for organizations to conduct business electronically. Additionally, business can take advantage of current means of sharing information, via Internet and functioning as extended enterprises, and ways in which they are using Internet for commercial advantage. (MSIT core or equivalent background/experience)

0602-873 Information Technology & Strategic Opportunities
Using a variety of futuring techniques and exercises, this course prepares students to identify new strategic opportunities created by advances in information technology. The course looks at service organizations, manufacturing organizations, and also information organizations as described by Drucker. The course attempts to predict trends in technology within these types of environments, by looking for parallels in history, by mapping trends, and by examining the characteristics of new technologies according to their innovative characteristics. (MSIT core or equivalent background/experience)

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

0602-891 Seminar: Telecommunications Software Technology
The faculty of the MS in telecommunications software technology program will offer regular seminars on topics of interest to themselves and students. These will be guided self-study courses, requiring a degree of self-direction on the part of the student. The credit load and prerequisites for each seminar will vary with the topic and will be specified by the instructor at time of course offering. Each seminar will require of the student a written report and/or an oral presentation as a major part of the grade. Seminars from the computer science master's degree program will be allowed with consent of the program chair. Credit 1-4

0602-895 Software Engineering Project
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. (0602-821 or 825,0602-835) Credit 4

0602-897 MS Thesis
Interdisciplinary thesis on CIM research area to be monitored and advised by committee of three faculty. This thesis work may serve as the capstone course of the CIM degree. (Defense of thesis requires completion of all required courses) Credit 0-4

0602-898 MS Project
This capstone course will be a software development project in telecommunications. The project will address a major design or implementation issue and will be carried out by the student in consultation with a committee. The committee will consist of a member of the faculty and another member who may be a practicing professional in the telecommunications industry. The student may be part of a team working on a large project as part of his or her employment, for example. The committee is responsible for ascertaining how much of the project was the student's responsibility and ensuring that the project meets the norms for both quantity and quality of work. (Completion of required courses in telecommunications software technology curriculum) Credit 4

0602-899 Independent Study
Faculty-directed study of appropriate topics on 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 variable 2-4

0602-999 Graduate Co-op Education
An optional cooperative educational experience is available for those students who wish to participate in order to gain industrial experience. Students must have completed the Bridge Program in addition to five core software development and management courses, including 0602-710 and 0602-725. Credit 0

0604-741 Fundamentals of Interactive Multimedia
Creating interactive multimedia requires familiarity with a wide variety of hardware and software tools as well as basic principles for the design and structure of multimedia. This course introduces students to typical tools for creating multimedia such as authoring systems, hardware for digitizing, tools for editing sound, images and video. Through hands-on use of these tools and development techniques such as needs analysis and storyboarding, students design and develop several interactive elements such as navigational interface, introduction and index and help system with textual and mediated information. Class 4, Credit 4

0604-742 Interactive Multimedia Development
The development of interactive multimedia requires principles garnered from a variety of disciplines. Through readings, critiques, exercises and discussions, students will explore what makes an interactive multimedia application (or component of an application) successful and what types of applications are best suited to interactive multimedia. This course provides an introduction to the design of interactive multimedia drawing upon user interface design, task analysis, analysis of audience characteristics, and usability testing as well as design and editing principles from animation and video production. Using the hardware and software tools learned in the Fundamentals course, students will implement and test designs as individual components and as integrated elements of interactive multimedia for interactive and instructional applications. (0604-741,0604-745)

0604-743 Interactive Multimedia Project
The project course is a capstone experience. Having achieved some proficiency with the tools and concepts of interactive multimedia, students are expected to produce a significant work that can be used as a portfolio piece. Examples of interactive multimedia are examined and discussed. As CD-ROM is increasingly the medium of choice for distribution of interactive multimedia, design constraints for using read-only media are discussed. Techniques and principles for managing larger and more complex projects involving teams are examined. (This course is a capstone course that generally requires completion of all courses except 0604-747.) **Class 4, Credit 4**

0604-745 Theories in Interactive Computing
This course is a selected survey of a variety of theories from several disciplines such as cognitive psychology, human factors, computer-human interaction and instructional design that are relevant to the design of interactive multimedia. By examining the process of communication between people and between people and machines, we can learn to design interactions that optimize the communication process and lower the demands on the communicators. These interactions are therefore more effective, less prone to error and more efficient. Class 4, Credit 4

0604-746 Programming Interactive Multimedia
The goal of this course is to advance the student's programming skills for implementing multimedia. This course will include programming the computer to control graphics, text, audio and video images as well as implement navigational strategies, indexing of information, import and export of data. The course will look at both event-driven and time-driven models of interaction. Upon completion of the course, students will achieve an understanding of basic programming concepts such as control structures, variables and procedures as well as design strategies such defining requirements, top-down and bottom-up design using applicable software engineering principles and iterative design involving users. Learning will be project-based and, whenever possible, directly related to ongoing projects. (0604-741) **Class** 4, **Credit** 4

0604-747 Topics: Interactive Multimedia
Interactive multimedia is a rapidly evolving field that is significantly influenced by changes in theory, storage media, computing hardware, authoring/presentation software and communication capabilities such as local and wide-area networks. In this course, students will be exposed to recent trends by hands-on development of interactive media projects. These will include development of interactive multimedia for use on multiple platforms, developing multimedia that can be accessed via the Internet, real-time interaction between users using networked multimedia and development of interactive CD-ROM-based multimedia. (0604-746) Class 4, Credit 4

Computer Science

0603-704 Computer Organization
A continuation of 0603-708. Topics include instruction fetching, decoding and execution, CPU specification through a descriptive language, bus structures, microprogramming, interrupts, architectural differences, the assembly process, addressing, storage allocation, subroutines, parameter passing, looping, address modification, floating point presentation, and simple I/O. Programming projects will be required. (0602-700,0603-708) **Credit 3**
Alternative RIT offering: 0603-352
MCC: CSC-102
St. John Fisher: CSC-241
Nazareth College: CIS-243

0603-705 Discrete Computer Structure
The fundamental concepts of discrete mathematics that 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

0603-707 Advanced Programming
An introductory course in the life-cycle issues of large and single/multi programmer programs. Structures and modular programming, data abstraction and information hiding. Specific focus on modern programming practices (specification, design and prototyping, coding and verification, integration and maintenance) and tools (software engineering environments such as Unix and software engineering with languages such as C++). Programming projects will be required. **(0602-703) Credit 4**

0603-708 Introduction to Digital Design
An introduction to computer architecture and implementation. Topics include number systems, boolean algebra, combinatorial and sequential circuit design, flip-flops and adders, and storage mechanisms and their organization. Laboratory experiments introduce elementary integrated circuit building blocks including gates, flip-flops, register, counters, and elementary sequential circuits. (0602-703) **Credit 3**
MCC: CSC-106
U of R: CSC-250 or-450

0603-709 Programming Language Concepts
A study of a variety of programming languages; their descriptions in terms of syntax and semantics; language and compiler/interpreter design issues; selection and evaluation for various applications. Programming projects will be required. (0603-707) **Credit 4**
Alternative RIT offering: 0603-450

0603-713 Operating Systems
A general survey of operating system concepts. Topics include process synchronization, interprocess communication, deadlock, multiprogramming and multiprocessing, processor scheduling and resource management, memory management, overlays, static and dynamic relocation, virtual memory, file systems, logical and physical I/O, device allocation, I/O processor scheduling, process and resource protection. (0602-703,0603-704) **Credit 4**
Alternative RIT offering: 0603-440
MCC: CSC-212

0605-700 Foundations of Computer Theory
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. **(0603-705,0603-709) Credit 4**

0605-701 Computability
Computability is the heart of theoretical computer science for it is the theory that 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. **(0605-700) Credit 4**

0605-702 Computational Complexity
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. **(0605-700) Credit 4**

0605-703 Coding Theory
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 distribution. **(0605-700) Credit 4**

0605-709 Seminar: Science of Programming
Current topics in the field. The format of this course is a combination lecture and seminar. Students may register for this course more than once. Topics covered in the past include arithmetic algorithms, data encryption, the Fast Fourier Transform, combinatorial optimization, logic. Programming projects may be required. (Permission of the instructor) **Credit variable 1-4**

0605-710 Programming Language Theory
An introduction to the basic concepts of programming language design. It begins with a survey of the issues that are involved in the design and implementation of languages. Specific tools for the description of syntactic and semantic structure are introduced. The balance of the course is an analysis of programming language structure, using these descriptive tools to give precise form to the discussion. Programming assignments will be required. (0603-705, 0603-709) **Credit 4**

0605-711 Compiler Construction
The structure of language translators, lexical and syntactic analysis, storage allocation and management, code generation, optimization, error recovery. Programming projects will be required. (0605-700,710) **Credit 4**

0605-712 Theory of Parsing
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. (0605-700) **Credit 4**

0605-719 Topics in Programming Languages
Current topics in the field. The format of this course is a combination lecture and seminar. Students may register for this course more than once. Topics covered in the past include: logic programming; data flow, functional or applicative, and object-oriented languages; programming language semantics; formal verification. Programming projects will be required. (Permission of the instructor) **Credit variable 1-4**

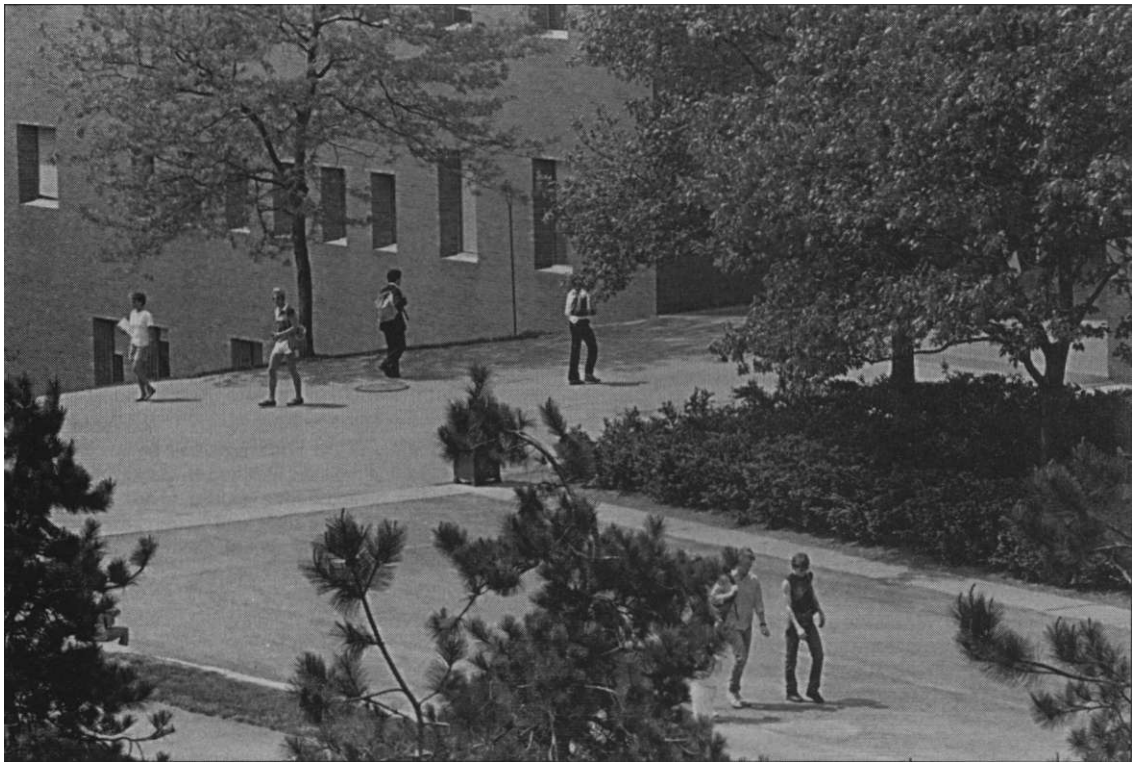
0605-720 Computer Architecture
Review of classical computer architectures, the design of operation codes and addressing modes, data formats, and their implementation. Analysis of internal and external bus structures. Architectural features to support virtual storage and page-replacement policies, high-level language features and operating systems. Speed-up techniques. Future directions. Programming projects will be required. (0603-707,0603-708,0603-713) **Credit 4**

0605-729 Topics in Computer Architecture
Current topics in the field. The format of this course is a combination lecture and seminar. Students may register for this course more than once. Topic covered in the past: neural networks. Programming projects will be required. (Permission of the instructor) **Credit variable 1-4**

0605-730 Distributed Operating Systems I
An introduction to the study of the hardware and software issues affecting the design of a distributed operating system. This course begins with an overview of processor networks and network protocols. It continues with the discussion of the issues that must be addressed in the design of a distributed operating system. The remainder of the course focuses on protocols and algorithms for handling process communication and synchronization. (0603-709, 0603-713) **Credit 4**

0605-731 Distributed Operating Systems II
This course addresses the practical issues involved in the design of a distributed operating system. The following topics are discussed: implementations of the process environment, processor scheduling, file systems, and the management of distributed memory. Examples of specific implementations will be discussed. Other topics (e.g., security) may be covered, at the discretion of the instructor. A group project, involving the design and implementation of one or more components of a distributed operating system, will be a major component of this course. (0605-730) **Credit 4**

0605-735 Introduction to Parallel Computing
A study of the hardware and software issues in parallel computing. Topics include an introduction to the basic concepts, parallel architectures, parallel algorithms, parallel languages, network topology, coarse- versus fine-grained parallelism, applications, parallel programming design and debugging. Programming projects will be required. (0605-710,0605-730) **Credit 4**



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

0605-736 **Parallel Algorithms & Program Design**
A study of the principal trends in parallel algorithm design, through the analysis of algorithms used in various areas of application. Specific techniques that have gained widespread acceptance will be highlighted. The course will investigate the interplay between architecture and algorithmic structure and will discuss the effect that these issues have on the complexity and efficiency of parallel algorithms. Each student will be required to research an area of parallel **program** design and then implement a parallel computing project for an application within this area of study. A term paper and programming projects will be required. (0605-735, Introduction to Parallel Computing) **Class** 4, **Credit** 4

0605-739 Topics in Operating Systems
Current topics in the field. The format of this course is a combination lecture and seminar. Students may register for this course more than once. Topics covered in the past include Unix internals, concurrency methods, Petri nets, parallel programming and algorithms, security, operating systems performance, software environments, communicating sequential processes ("CSP"). Programming projects will be required. (Permission of the instructor) Credit **variable 1-4**

0605-740 **Data Communication & Networks I**
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, queuing theory and delay analysis; the fundamental protocols for computer communication. (Statistics, 0603-708) Credit 4

0605-741 **Data Communication & Networks II**
A second course in 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. (0605-730,0605-740) Credit 4

0605-749 **X-Windows Seminar**
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**

0605-750 **Introduction to Artificial Intelligence**
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 expert systems, theorem provers, natural language understanding systems and other artificial intelligence projects. Programming projects will be required. (0603-707, 0603-709) Credit 4

0605-751 **Knowledge-Based Systems**
An introduction to the issues and techniques of building knowledge-based systems. Topics will include a survey of existing expert system architectures and implementations, knowledge representation techniques, expert system building tools, and knowledge acquisition. In addition to examining existing expert systems, students will implement expert systems or expert system building tools in a LISP or Prolog environment. Programming projects will be required. **(0605-**750) Credit 4

0605-755 **Neural Net & Mach Learning**
Neural networks, systems with massively connected parallel primitive computing elements, are, metaphorically, computers structured after natural brains. Such systems promise much better performance than classical computers at pattern recognition and related areas. In this seminar, we will present several neural network models, introduce the current research activity, and develop some underlying mathematics. Students will have the opportunity to develop and present models, both paper and software simulated, and to utilize canned simulators. Students will be exposed to the current research literature. Programming projects will be required. (0605-700,0605-710) Credit 4

0605-756 **Genetic Algorithms**
Genetic algorithms provide a powerful approach for searching large, **ill-**behaved problem spaces. In this course, we will study the theoretical foundations of genetic algorithms as well as their application to a variety of search and optimization problems. The course will cover topics from the current research literature, and students will be expected to do a library research review and perform an experimental project. Programming projects will be required. **(0605-700,** 0605-710) Credit 4

0605-759 Topics in Artificial Intelligence
Current topics in the field. The format of this course is a combination lecture and seminar. Students may register for this course more than once. Topics covered in the past include speech processing, logic programming, natural language processing, pattern recognition, genetic algorithms, AI programming paradigms. Programming projects will be required. (Permission of the instructor) Credit variable 1-4

0605-761 Fundamentals in Computer Graphics
An introduction to the hardware and software principles of interactive raster graphics. Topics will include the basic concepts, two-dimensional modeling and transformations, viewing transformations, projections, rendering techniques, graphical software packages and graphics systems. Programming projects will be required. (0602-703) Credit 4

0605-769 Topics in Computer Graphics
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. (0605-761) Credit variable 1-4

0605-771 Database Systems
The storage and processing of formatted data using database management systems. Topics include objectives of database management, file and indexing structures, database system architectures, normalization theory, database machines and distributed databases. Several existing and experimental systems will be studied. (0602-703) Credit 4

0605-772 Database Systems Implementation
An examination of the technical issues related to the implementation of shared access databases. Topics include concurrency control, transaction processing, reliability and recovery. Extensions to the distributed processing environment also are covered. Programming projects will be required. (0605-771) Credit 4

0605-800 Theory of Computer Algorithms
A study of algorithms from the point of view of time and space complexities (average and worst case, using various models of computation); techniques for analyzing algorithms; structural, probabilistic, and transformational; partial and total correctness, loop invariants, pre- and post-conditions. The concepts will be illustrated by in-depth analysis of a few chosen algorithms. An introduction of the concepts and theory of NP-completeness. The course will make students aware of a large number of classical algorithms and their complexities, introduce them to the literature. Programming projects will be required. (0603-705,0603-709) 1-i Credits

0605-890 MS Thesis
Capstone of the master's degree program. Student must submit an acceptable thesis proposal in order to enroll. (Permission of the Graduate Program Committee) Credit variable 1-4

0605-891 MS Project
Alternative capstone of the master's degree program. Student must submit an acceptable project proposal in order to enroll. (Permission of the graduate studies committee) Credit 5

0605-898 Independent Study
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

0605-899 Seminar
Current advances in computer science. Previous topics have included data encryption, arithmetic algorithms, natural language processing, robotics, computer animation, speech processing, syntactic pattern recognition. (Permission of the instructor) Credit variable 1-4

0605-999 Co-op
Six months of full-time, paid employment in the computing field. See the CS graduate program coordinator or RIT's Office of Cooperative Education for further details. (Good standing; completion of Bridge and 16 graduate credits) 0 Credits

Packaging Science

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

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

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

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

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

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

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

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

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

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

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

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

Manufacturing and Mechanical Engineering Technology

0617-730 Data Management & Communication
The first part of this course will discuss elementary data management topics such as data storage and retrieval, the use of commercial DBMSs, and the relational model. It will also discuss the data representation problem in CIM and the melding of representation schemes used by CAD systems, robotics systems, CNC/DNC machines and commercial DBMSs. The second part of the course will focus on data communications. This will introduce the student to concepts such as synchronous and asynchronous communications, parallel and serial communications, modulation, point-to-point and broadcast networks, and baseband and broadband networks. Emphasis will be placed on standards employed by CIM and other areas on which CIM depends. (0602-710) Credit 4

0617-740 Advanced Manufacturing Processes
Presents a comprehensive treatment of the manufacturing processes and their role in the changing manufacturing environment. Special emphasis on mechanical, electrical, thermal and chemical processes. (Manufacturing Processes) Class 4, Credit 4

0617-810 Machine Vision
The course will deal with the principles and application of machine vision systems in manufacturing processes. Topics will include the state-of-the-art in manufacturing automation, the need for machine vision in industry, principles of digital image processing, image acquisition, lighting and viewing techniques, camera systems, solid state image sensors, computer approaches to vision image understanding, role of vision in robotics, model machine vision systems, use of vision in such applications as assembly, welding, painting, material handling, gaging, and inspection, economics of machine vision, issues in the implementation of machine vision in the industry, and case studies. Class 3, Lab 2, Credit 4

0617-820 Lasers in Manufacturing
The course will deal with the fundamentals of lasers; lasering materials; characteristics of lasers; categories of lasers; effects of lasers on materials; applicability of lasers in manufacturing; laser beam and metal interaction; reflectivity, heat flow; phase change; laser-based process systems; application of lasers on such processes as micromachining, drilling, marking, welding, cladding, heat treating, and inspection; safety issues in laser-based manufacturing systems; role of lasers in flexible manufacturing systems; and case studies of flexible manufacturing systems with lasers. (Manufacturing Processes) **Class 4, Credit 4**

0617-830 Computer Aided Process Planning
The course deals with the practical aspects of developing and implementing automated process planning systems in computer-integrated manufacturing environments. Topics will include design representation in CIM, group technology coding and classification, traditional approaches to process planning, automated approaches to process planning, developing automated process planning using variant and generative approaches, survey of various process planning systems, and issues in the development and implementation of process planning systems. The lab projects will involve implementing a process planning system in the real-world environment. (Manufacturing Processes) Class 3, Lab 2, Credit 4

0617-840 CIM Implementation
The course deals with the technical and management aspects of implementing CIM systems. Major topics will include strategic thinking, conceptual planning, system design, system implementation and case studies in CIM implementation. (0617-475 or equivalent) **Class 4, Credit 4**

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

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

0617-850 Assembly Automation
The course deals with the concepts in the design of products for assembly, state-of-the-art in the general purpose assembly systems and software for automated assembly. **Class 4, Credit 4**

0617-870 Flexible Manufacturing Systems
This course deals with the design and operation of FMS. Topics covered include components of FMS, distribution processing in FMS, integration of CAD and CNC, processing machines, tooling and tool management, part-holding devices, material handling systems, robots, AGVS, coordinate measuring machines, sensors, system controls, design of FMS and management issues in FMS. (Manufacturing Processes) **Class 4, Credit 4**

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

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

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

0607-899 Independent Study
Faculty-directed study of appropriate topics on a tutorial basis. This course is generally used to allow an individual to pursue topics in-depth under faculty sponsorship. **Credit 1-4**

0607-999 Graduate Cooperative Education
Work experience in manufacturing position appropriate to selected major in graduate program. Position to be obtained through interviewing process with the assistance of Co-op Education and Career Services Office. **Credit 0**

Food, Hotel and Travel Management

Hospitality-Tourism Management

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

0624-780 Financial Management for Hospitality-Tourism Firms
Financial performance forecasting at both the individual and multiunit levels of operation is examined. Emphasis on financing, including operating leverage, short- and long-term financing alternatives and tax considerations within a service organizational context. **Credit 4**

0624-823 Strategic Environments of Food System
The strategic environments of the hospitality-tourism system are examined as a whole and from the perspectives of major segments: consumers, producers, regulatory agencies, distributors and retailers, including food service operators. Specific issues examined include the use distribution systems, international government policies, consumer expectations and the impact of these on the producer and end user. Credit 4

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

0624-899 Independent Study
An opportunity for the advanced student to undertake independent investigation in a special area under the guidance of a faculty member. A written proposal is to be forwarded to the sponsoring faculty member and approved by the director of the program 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**

Service Management

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

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

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

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

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

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

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

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

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

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

0625-899 Independent Study
An opportunity for the advanced student to undertake independent investigation in a special area under the guidance of a faculty member. A written proposal is to be forwarded to the sponsoring faculty member and approved by the graduate coordinator 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**

Career and Human Resource Management

0626-700 Introduction to Career & Human Resource Development
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**

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

0626-710 Theory of Organizational Development
Examines organization development theories and their applications in typical interventions performed in organizational settings as part of the change process. **Credit 3**

0626-711 Futures Research & Simulation
Participants analyze the relationship between a simulation model and the real world—understanding the underlying principles—and build a procedure and evaluation plan for a game; operate a game, and debrief. (0626-710) **Credit 3**

0626-712 Planning & Evaluating Organizational Development
Introduces participants to a strategic planning model, which they then use to develop a strategic plan for an organization. (0626-710) **Credit 3**

0626-713 Practicum in Consulting & Organizational Development
Explores the role and skills of the consultant. Participants engage in an assessment of an organization's needs, write a proposal, and, from the assessment data, make recommendations for interventions. They also explore their interests and aptitudes as consultants. (0626-710) **Credit 3**

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

0626-720 Theories of Career Development
Examines theories of career development as applied to the process an individual uses in making career decisions. **Credit** 3

0626-721 Career Counseling Techniques
Introduces participants to theories and techniques used in individual career counseling situations. Participants plan, practice, and analyze non-clinical techniques used in career counseling. (0626-720) **Credit 3**

0626-722 Career Counseling Techniques II
Focuses on the application of counseling theories and techniques to non-clinical group counseling situations. (0626-721) Credit 3

0626-723 Information Use in Career Planning
Focuses on career planning models, selection and use of standardized tests and personal assessment instruments, career information data resources, research, and community resources. (0626-707,0626-720) **Credit** 3

0626-730 Theories in Human Resource Development
Examines theoretical and empirical investigations of human learning and practical procedures for instructional design and human resource development. Credit 3

0626-731 Techniques in Human Resource Development
Increases the student's knowledge of the role training plays in human resource development. The course re-emphasizes the delivery of training, focusing on use of instructional aids, design modifications and platform skills. (0626-730) Credit 3

0626-732 Design & Development of Training
Emphasizes the techniques used for design and development of instruction. During the course, participants design a training module, deliver a portion of it, and evaluate its success. (0626-730,0626-731) **Credit** 3

0626-733 Needs Assessment/Proposal Development
Shows participants how to develop and conduct a needs assessment, design an evaluation and write a proposal to do a needs analysis or evaluation. **Credit 3**

0626-740 Group Leadership Skills
Combines theory and practice to give participants the skills needed to use interactive techniques for training, to facilitate meetings and to take leadership responsibility as a participant. Credit 3

0626-750 Computer Applications in Career & Human Resource Development
Using a hands-on approach, the course acquaints participants with the use of PC technology and software having HRD applications. Primary software includes Microsoft Office and HR packages. **Credit** 3

0626-777 Internship
The internship is required of all students. This course consists of four parts: at least 200 hours of professional accomplishment in an appropriate setting, attendance at a seminar, an oral presentation, and formal summary report. Students will work with their advisers to complete all necessary arrangements. Students should plan to meet with their advisers at least two months before planning to take the internship. Proposals for the internship must be approved and on file before registration. **Credit 6**

0626-850 Special Projects
Provides for designing and carrying out a project for academic credit. 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 six credit hours. **Credit variable 1-3**

0626-890 Independent Study
Provides for independent study or research activity in subject matter areas not included in any existing course in the degree program, but having specialized value to students. Proposals approved by a supervising faculty member and the department director are required prior to registration. This course may be taken more than once, but for no more than a total of six credit hours. **Credit 1-3**

0626-891 Selected Topics
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 six credit hours. **Credit** 3

Instructional Technology

0627-704 Interpersonal & Group Communication
Activities and experiences in human communication, specifically within groups. The course discusses theory and research underlying the communication process and the application of principles to practical situations. Required for graduation. **Credit 4**

0627-707 Presentation Design
An overview of the process of designing and giving training presentations. Included are principles of presentation design, selection and production of presentation media, basic research on presentation design and presentation media. Required for graduation. **Credit 2**

0627-709 Training the Training Manager
A service course explaining the management of the training process, instructional design and development, and performance technology. Includes principles of needs assessment and evaluating the worth of training as well as trends in instructional design and training delivery systems. Not for instructional technology majors except those in the training manager option. **Credit** 3

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

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

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

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

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

0627-736 Interview & Information Gathering
The course distinguishes between counseling, coaching and training, stressing task-related interpersonal and cognitive skills such as working with a subject-matter expert for job counseling. Includes methods of interaction to maintain communications and to shape behavior. **Credit** 3

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

0627-756 Criteria & Technical Training II
See description for 0627-755. Required for graduation. **Credit** 3

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

0627-759 Technical Writing Instructional Development
This course introduces instructional developers to the process of writing technical manuals and reports. Indicates an overview of the production process, content and audience analysis, information layout. Two major writing projects and other exercises required. (Writing skills and experience, 0627-755, 756, 758) **Credit 3**

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

0627-763 Development of Instructional Modules II
In this extension of Developing Instructional Modules I (0627-762), the student completes an additional course module and develops course control documents for both the course manager and the student. (0627-755,756,762) Credit 2

0627-765 Individual Learning Styles
The course examines the ways different individuals learn. It relates instructional strategies to learning styles. Covers cognitive style mapping and various test and measures as each relates to individual learning style. (0627-735) Credit 4

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

0627-772 Instructional Development II
Second of a required three-course sequence (0627-771, 772, 773). The instructional development principles are applied in an actual project selected by the student. Includes more sophisticated means of development as well as module and test development. Required for graduation. (0627-735,755,56,771) **Credit 4**

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

0627-775 Seminar: Attracting Technology in Future of Human Resource Development
Training and development, especially in business and industry, and human resource development exist within the larger context of national 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. (Prerequisites or corequisites: all core courses and 40 hours of course work) **Credit** 3

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

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

The Center for Multidisciplinary Studies

Health Systems Administration

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

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

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

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

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

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

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

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

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

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

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

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

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

0635-890 Health Systems Administration Independent Study
Provides for independent study or research activity in subject areas not included in any existing course in the degree program, but having special value to students. Proposals approved by a supervising faculty member and the program chair are required prior to registration. This course may be taken more than once. **Credit 4**

0635-896 Health Systems Administration Thesis
An independent research project on a specific health system administration topic or problem, developed by the student with input from a faculty thesis adviser. The research must culminate in a formal written thesis and oral defense. Approval by the program chair and a faculty thesis adviser is required for this course. **Credit 4**

0699-705 Interdisciplinary Research Techniques
This course introduces students to interdisciplinary thinking, problem solving and research techniques and also print and electronic information resources appropriate to the student's plan-of-study. **Credit 4**

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

RIT was the first university to offer a graduate degree in software development and management.

College of Business

Lyn D. Pankoff, Dean

RIT is noted for its long history of commitment to quality career education.

It's curriculum prepares students to enter the employment marketplace with expertise in their chosen area built upon a solid foundation of mainstream business knowledge. In addition, many of our students elect to take advantage of internship and cooperative education opportunities to further enhance their education and value to employers.

The College of Business has earned a reputation as a leader in the area of total quality education. It is home to the RIT/*USA Today* Quality Cup, which is awarded annually to teams whose contributions have significantly improved quality in their organization. The college and *USA Today* conduct the competition as a cooperative academic-industry effort.

One of the strengths of RIT's College of Business is its commitment to technological leadership. Those graduates who can demonstrate technical proficiency increase their value to business organizations. The award of a $1.3 million TQM grant from IBM ensures that our students will enjoy the advantages of the latest technology available to business students today.

We also believe in continuous improvement and fulfilling the needs of today's business environment, such as the need for managers with multi-disciplinary skills. Our recently revised MBA program, for example, emphasizes a rigorous foundation in the core areas of business and provides enough flexibility so students can specialize in two areas of concentration.

> *"Undoubtedly one of the nation's leaders in bringing Total Quality principles to the university. In effect, the college's approach to continuous improvement is the embodiment of the spirit of the AACSB standards."*
>
> —Reaccreditation team, American Assembly of Collegiate Schools of Business

The Traditional Master of Business Administration

The purpose of the traditional MBA program is to enhance the depth and breadth of general management capabili ties of the student. This is accomplished by providing the student with a basic core of course work in the disciplines of management, economics and statistics. Functionally oriented courses include

PROGRAMS

MASTER OF BUSINESS ADMINISTRATION

EXECUTIVE MASTER OF BUSINESS ADMINISTRATION

MASTER OF SCIENCE DEGREES IN:

- Finance
- International Business
- Manufacturing Management and Leadership

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

accounting, finance, marketing and operations. These are followed by advanced courses, some of which are directed toward an area of concentration. Concentration areas include corporate accounting, public accounting, finance, marketing, management, the management of technology, manufacturing management and international business. Elective areas are designed to provide breadth to the student's program. Students can use some of the elective courses to develop a secondary concentration of study within the College of Business or in another college at RIT. An optional cooperative education experience at the graduate level further develops 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.

The MBA program requires 72 quarter credit hours (18 courses) and is designed so that a student will progress through the program in a logical sequence while having 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. Students entering the MBA program have widely varied academic backgrounds. To assure that students are adequately prepared in the area of mathematics, a diagnostic test is administered to all new students. Those students who need to review mathematics will be required to successfully complete preparatory course work in algebra and statistics during the first quarter of study.

Facilities

The College of Business is housed in the Max Lowenthal 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, microcomputer labs, state-of-the-art software support and an up-to-date collection of business texts, periodicals and reference services in the Wallace Library.

Admission requirements

RIT operates on a quarter system calendar, thus part-time students may apply for entry into the MBA program in the fall, winter, spring, or summer. However, it is recommended that applicants planning full-time study or those entering an MS program 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 professional career development and through the results of the Graduate Management Admission Test.

All applicants who are admitted prior to the conclusion of their baccalaureate programs are required to submit their final transcripts by the end of the first quarter of graduate work. Students who have been accepted into a program are allowed to defer their enrollment (admission) for up to one year. If a student wishes to defer enrollment beyond one year, a new application must be submitted, and 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 and descriptive statistics, plus spreadsheet competency, to undertake graduate business courses. The mathematics skills of all entering students are assessed prior to the first day of classes by means of a diagnostic exam. Students who need further preparation will be required to successfully complete formal review courses in mathematics during their first quarter of study.

International students

International applicants are encouraged to apply for admission for the fall quarter. Applicants from international 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 with two letters of recommendation, submit transcripts of all previous undergraduate and graduate work, submit results of the Graduate Management Admission Test and provide an up-to-date resume. 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, N.J., 08540. The test is usually given four times a year in convenient locations, including RIT.

Orientation

All new students are required to attend an orientation session prior to enrolling in courses. At orientation students receive information from faculty regarding their expectations of graduate students and from college staff regarding course selection, career planning, program planning and academic advising. Student handbooks and registration materials are also distributed at this time. A more extended second orientation introduces students to the library and the computer system.

Nonmatriculated students

Students may apply to take a limited number of courses on a nonmatriculated 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 nonmatriculated students who wish to be admitted to the MBA program.

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

Financial aid

Outstanding full-time candidates with the desire and ability to work supporting faculty and administrative staff are eligible to compete for research assisfantships. Such awards typically cover 50 to 75 percent of a student's tuition costs.

In return for their tuition remission, all graduate assistants are required to work for the College of Business (8 to 12 hours per week) either supporting the faculty on research projects or assisting administrative units. Individuals interested in this merit-based financial aid program should write to the Graduate Business Programs office. Assistantships for full-time students are made for an entire academic year. Renewal is subject to academic competitiveness, job performance and available funds. Applications for assistantships are reviewed annually.

An adviser will work closely with you to tailor your courses to your professional needs.

Promising full-time candidates are eligible for partial tuition scholarships. Scholarships are merit-based and are awarded to full-time students for the entire academic year. Applications are available from the Office of Part-time and Graduate Enrollment Services, 716-475-2229.

Quarterly scholarships are also available to outstanding part-time graduate students and are administered through the same office.

Need-based forms of financial aid, such as loans and grants, should be investigated through 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, 72 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 records, up to six foundation courses may be waived. 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. There is a $50 administrative fee charged per exam.

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 assistant director of graduate students.

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 "The Steps Toward Earning Your Degree" (page 8) in this Bulletin. Students are urged to pay careful attention to that policy.

Program scheduling

Classes for full-time students are scheduled weekday mornings and afternoons and some weekday evenings. Classes for part-time students are offered in the evening. Classes meet once a week, 11 times during the quarter. Full-time students take 8 required classes in the daytime while choosing concentration courses and electives from the evening offerings. Generally, full-time students complete the program in six quarters. However, if students elect to go on a co-op, completion of the program may necessarily be extended. 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. Course requirements, faculty and admission procedures correspond to the full-time program.

Program completion requirement

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

The co-op program

Optional 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 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 and a substantial portion of their concentration 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.

Course offerings

Information concerning courses to be offered in a given quarter will be available through the Student Services 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.

The traditional master of business administration (MBA) curriculum foundation courses: required courses that provide a depth and breadth of knowledge in business concepts, tools and functions.

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

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

Concentration courses: Concentrations are offered in public and corporate accounting, finance, marketing and sales management, marketing research, international business, management and leadership, technology management, quality and organizational improvement, human resource management, manufacturing management, quality and applied statistics, quantitative decision making and information systems. Concentration courses are listed on this and the following page.

Dual option course work: This MBA program has eight required core courses and 10 electives for option courses and electives. Most option areas are restricted to four courses. Students may not use their additional electives for courses in their chosen option area. However, they may elect to take a second option area. Graduate-level courses from other RIT colleges also may be taken with prior approval of the assistant director of graduate students.

The ability to develop a dual option area of study is consistent with the needs of industry for employees with cross-functional expertise. If a student elects to develop a dual option, in most cases, he or she will have two open electives, neither of which can be in the two chosen option areas.

Accounting		**Credits**
0101-704	Accounting Theory I	4
0101-705	Accounting Theory II	4
0101-706	Cost Accounting	4
One additional accounting course from:		
0101-708	Auditing	4
0101-709	Basic Taxation	4
0101-721	Advanced Cost Accounting	4

Recommended First-Year Courses for Full-time MBA Students

Fall Quarter

0101-703	**Financial Accounting Systems**
0102-740	**Organizational Behavior**
0103-705	**Economics for Managers**

Winter Quarter

0104-721	**Financial Analysis for Managers**
0106-782	**Statistical Analysis for Decision Making**
	Business Elective

Spring Quarter

0105-761	**Marketing for Customer Satisfaction**
0106-743	**Operations Management and Process Improvement**
	Business Elective

** Students completing the traditional master of business administration degree with a public accounting concentration follow a modified form of the schedule above. Students should consult an adviser in the Graduate Business Office.*

One additional non-accounting course from:		
0101-730	Business Law I	4
A second economics course		4
A second finance course		4

The accounting option qualifies students to sit for the Certified Management Accountant (CMA) examination offered by the Institute of Management Accountants.

Qualifying to sit for the Uniform CPA Examination

Students wishing to take the CPA examination in New York State upon graduation from the MBA program must take 23 graduate courses rather than 18. (Note: Up to 11 courses may be waived.) The State of New York requires that a graduate degree for CPA candidates who do not have an undergraduate degree in accounting must include at least 60 semester hours (i.e., 90 quarter hours) of course work. Furthermore, the curriculum must include a specified number of hours in accounting, economics, finance, law and business electives. The 15 courses the CPA candidates should take beyond the eight MBA core courses are:

		Credits
0101-704	Accounting Theory I	4
0101 705	Accounting Theory II	4
0101-706	Cost Accounting	4
0101-707	Advanced Accounting Theory	4
0101-708	Auditing	4
0101-709	Basic Taxation	4
0101-710	Advanced Taxation	4
0101-725	Advanced Auditing	4
0101-730	Business Law I	4
0101-731	Business Law II	4
Finance elective		4
Economics elective		4
Business electives		12

Notes: New York CPA Licensure Requirements

Note A: Students who have an undergraduate degree in accounting must take a graduate level course in each of the following areas: advanced accounting theory (0101-707), tax (0101-709 or 710) and auditing (0101-708 or 725).

Note B: Students who do not have an undergraduate degree in accounting must take a graduate-level course in each of the following areas: advanced accounting theory (0101-707), tax (0101-709 or 710), auditing (0101-708 or 725) and cost (0101-706 or 721).

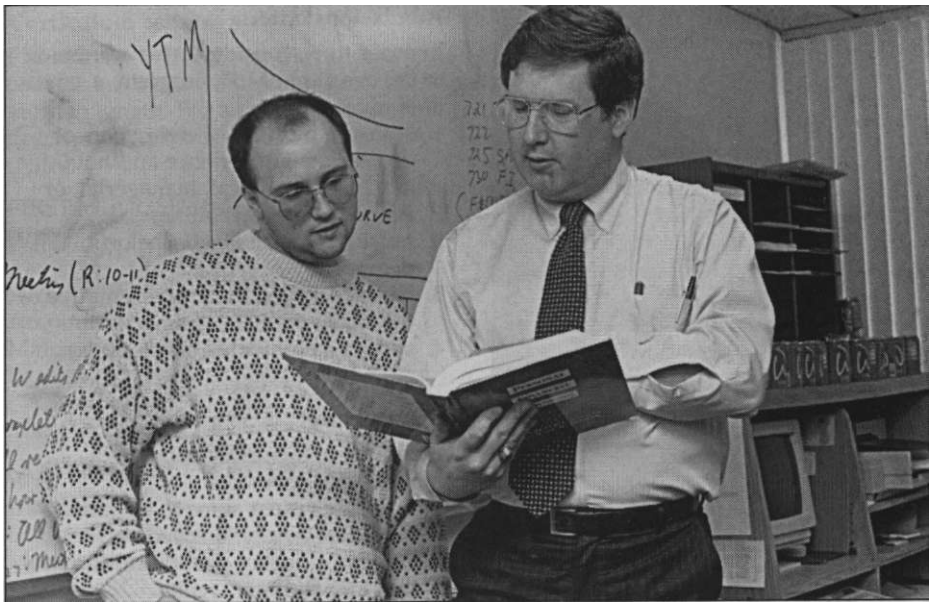
Note C: All students must have the equivalent of two undergraduate finance courses plus one finance course at the graduate level. Students who took no finance at the undergraduate level must correct this deficiency by taking one additional finance course. This extra finance course can be counted as a business elective.

Note D: All students must have the equivalent of two undergraduate economics courses plus one economics course at the graduate level. Students who took no economics at the undergraduate level must correct this deficiency by taking one additional economics course. This extra economics course can be counted as a business elective.

Waiver of One-Year Experience Requirement

The State of New York requires two years of public accounting experience to be licensed as a CPA. One year of this experience requirement will be waived if:

1. The CPA candidate does not have an undergraduate degree in accounting and takes the full 23-course sequence described above,
   or



Professor Walter Woerheide, right, exemplifies the college's commitment to applying technology in business. He is conducting research on the Internet as a personal finance tool.

2. The CPA candidate has an undergraduate degree in accounting (or the equivalent) plus a master's degree that meets the requirements specified in Notes A (with a selection of 0101-725 Advanced Auditing), C and D above.

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

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

Marketing and Sales Management		Credits
0105-764	Channel Management	4
0105-762	Advanced Marketing Management	4
Choose two from the following:		
0105-767	Marketing Communications	4
0105-765	Sales Management	4
0105-758	Seminar: Marketing: various topics	4
0105-771	Customer Satisfaction Research Methods	4
0105-770	Professional Selling	4
0105-766	International Marketing	4
Suggested free electives from management, accounting or finance.		

Marketing Research		Credits
0105-771	Customer Satisfaction Research Methods	4
0105-762	Advanced Marketing Management	4
Choose two from the following:		
0105-764	Channel Management	4
0105-765	Sales Management	4
0105-766	International Marketing	4
0105-770	Professional Selling	4
0105-758	Seminar: Marketing: various topics	4
Suggested free electives from information systems, statistics and/or CQAS courses.		

International Business		Credits
0102-780	Multinational Business Operations & Environment	4
0102-782	Seminar in International Business	4
Choose two from the following:		
0102-758	Seminar: various topics	4
0102-760	International Management	
0104-760	International Finance	
0105-766	International Marketing	4
Suggested free elective: Issues & Trends in International Business.		

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

Human Resource Management		Credits
0102-750	Human Resources Management	4
0102-763	Behavior Skills for Managers & Professionals	4
Choose any two management electives		8

Technology Management		Credits
0102-742	Introduction to Technology Management	4
0102-762	Managing the High-Tech Firm	4
Choose any two of the following electives		8
0106-744	Project Management	
0102-741	Leading a Quality Organization	
0106-749	Manufacturing Strategy & Tactics	
0102-761	Strategic & Global Factors in the Management of Technology	
0102-745	Social & Political Environment of Business	

Quality and Organizational Improvement		Credits
0102-741	Leading a Quality Organization	4
0106-745	Quality Control & Improvement	4
Choose two from the following:		
0105-771	Customer Satisfaction Research Methods	4
0307-782	Quality Engineering	3
0307-721	Statistical Quality Control I	3
0307-731	Statistical Quality Control II	3
0625-841	Benchmarking & the Process of Continuous Improvement	4

Manufacturing Management		Credits
0106-744	Project Management	4
0106-745	Quality Control & Improvement	4
0106-749	Manufacturing Strategy	4
Choose one from the following:		
0102-742	Introduction to Technology Management	
0102-760	International Management	
0101-794	Cost Accounting in the Manufacturing Environment	4
0102-741	Leading the Quality Organization	4
0307-781	Quality Management	3
0307-782	Quality Engineering	3
0307-721	Statistical Quality Control I	
0307-731	Statistical Quality Control II	
0303-690	Seminar in Computer Integrated Manufacturing	

Information Systems		Credits
	One Programming course*	4
0106-751	IS Theory & Practice	4
0106-752	Analysis & Logical Design I	4
Choose one from the following:		
0106-754	Network Technologies	4
0106-796	Information Systems Management	4
0106-750	Information Technology Hardware & Software	4
0106-753	Analysis & Logical Design II	4

** Anyone entering with programming experience may replace this course with an IS elective from the above list.*

Quality and Applied Statistics		Credits
0106-745	Quality Control & Improvement	4
0307-782	Quality Engineering	3
Choose three from the following:		
0307-721	Statistical Quality Control I	3
0307-731	Statistical Quality Control II	3
0307-801	Design of Experiments I	3
0307-802	Design of Experiments II	3

Executive MBA

Donald Zrebiec, *Director*

Today's global manufacturing and service environments require executives to possess skills different from those needed a few years ago. A stronger focus on leadership, customer satisfaction, productivity and a world-class approach are essential to success.

Our executive MBA was designed, by a team of RIT faculty and executives from all sectors, for professionals with substantial career experience. The program's strengths are strategic decision making, organizational leadership and Total Quality. Completion of the executive MBA will enable candidates to increase business results and their personal productivity.

Executive MBA and traditional MBA: The differences

Executive MBA students must have a minimum of eight years of professional experience and are in most cases sponsored by their employers. Executive MBA courses are conducted on alternate weekends—Friday and Saturday each weekend—during the academic year and will be completed within two years. Executive MBA students work in teams, studying a curriculum that focuses on developing top management skills.

The topics covered are those taught in our traditional MBA program—accounting, marketing, statistics, finance and operations. The Executive MBA curriculum is structured in a modular fashion and the emphasis is on cross-functional integration.

Admissions requirements and procedures

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

Rochester Institute of Technology
Executive MBA Office
Max Lowenthal Building
107 Lomb Memorial Drive
Rochester, NY 14623-5608
716-475-7435 (phone)
716-475-6441 (fax)

Admissions criteria

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

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

Sponsorship

Employer sponsorship includes a number of dimensions:

- A sponsor must agree to permit the candidate to attend scheduled Friday/Saturday classes and the two required summer weeks.
- The sponsor must agree to provide information about expectations for the candidate and to help with his or her personal development plan.
- A sponsor normally pays all or a major portion of the tuition, which includes course books and a laptop computer.

Some candidates, such as CEOs of small organizations, may be able to sponsor themselves.

Program structure

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

The focus of each quarter is:

First year

August	Kick-off week
Fall	Organizational Purpose & Goals
Winter	Understanding the External Environment
Spring	Continuously Improving Internal Operations
Summer	**No Classes**

Second year

Fall	Innovation & Organizational Contingencies
Winter	Building a Competitive Advantage
February	Quality-in-Action Project (one week)
Spring	Building a World-Class Organization
May	Graduation

Curriculum content

Please keep in mind that the following courses are treated in modules of varying length. For a more complete description, contact the Executive MBA Office.

FIRST YEAR, SUMMER

Week-long Orientation

QUARTER ONE, FALL

Accounting & Organizational Goals
Managerial Accounting
Leadership Styles—Their Impact on the Organization
Microeconomics

QUARTER TWO, WINTER

Data Analysis
Statistics for Decision Making
Macroeconomics
Managing Change

QUARTER THREE, SPRING

Valuation & Capital Budgeting
Financial Analysis & Planning
Research Methods & Customer Satisfaction
Modeling for Business Decisions

SECOND YEAR, SUMMER

Week-long Introduction to Cross-Functional Thinking

QUARTER FOUR, FALL

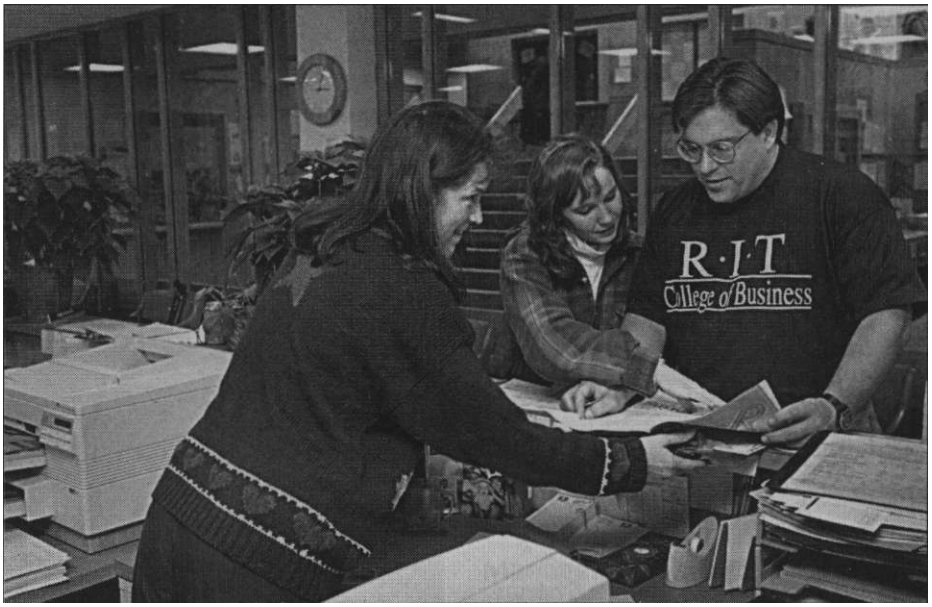
Strategic Thinking
Organizational Design & Change
Marketing Strategy
Business & Public Policy

QUARTER FIVE, WINTER

Tools for Total Quality
Manufacturing Strategy
Technology Management
Developing the Quality Project

QUARTER SIX, SPRING

Current Business Topics/Issues
Managing Human Resources
International Business
Strategic Uses of Information Systems



The remodeled student services area in the College of Business offers a single station for graduate students seeking academic information or advice.

Master of Science in International Business

Admission requirements

Applicants should have baccalaureate degrees from accredited programs. To be considered for admission it is necessary to file an application with two letters of recommendation, submit official transcripts of all previous undergraduate and graduate work and results of the Graduate Management Admissions Test and provide an up-to-date resume. The program is designed for both students whose undergraduate education is in business administration as well as those with other backgrounds.

Curriculum

The interdisciplinary master of science program in international business combines related professional concentration courses with breadth-of-field electives and a thesis or practicum, enabling candidates to focus on unique international business issues and concerns. Candidates will be able to improve their skills and understanding of global business operations.

Full-time students may complete the program in 12 months based on Fall Quarter start; part-time students in 18 to 24 months.

The graduate program of study consists of 10 courses plus a thesis or practicum:

0102-780 Multinational Business Operations & Environment
0102-782 Seminar in International Business

Select two of the following:

0102-760 International Management
0105-766 International Marketing
0104-760 International Finance

The four breadth-of-field courses for the MS are often concentrated in marketing, finance, management, management information systems, technology management, accounting, and Issues & Trends in International Business. This breadth is necessary since most MSIB graduates obtain professional employment in a functional area with an international assignment.

Two courses in research tools and thesis or practicum related to international business issues and concerns will be required of each candidate.

Master of Science in Finance

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

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

Admission requirements

Applicants should have baccalaureate degrees from accredited programs. To be considered for admission it is necessary to file an application with two letters of recommendation, submit official transcripts of all previous undergraduate and graduate work and results of the Graduate Management Admissions Test and provide an up-to-date resume.

Curriculum

The graduate program of study consists of 12 courses. The courses are:

0104-721 Financial Analysis for Managers
0104-722 Financial Management II
0104-725 Securities & Investment Analysis
0104-730 Financial Institutions & Markets
0101-703 Financial Accounting Systems
0106-782 Statistical Analysis for Decision Making

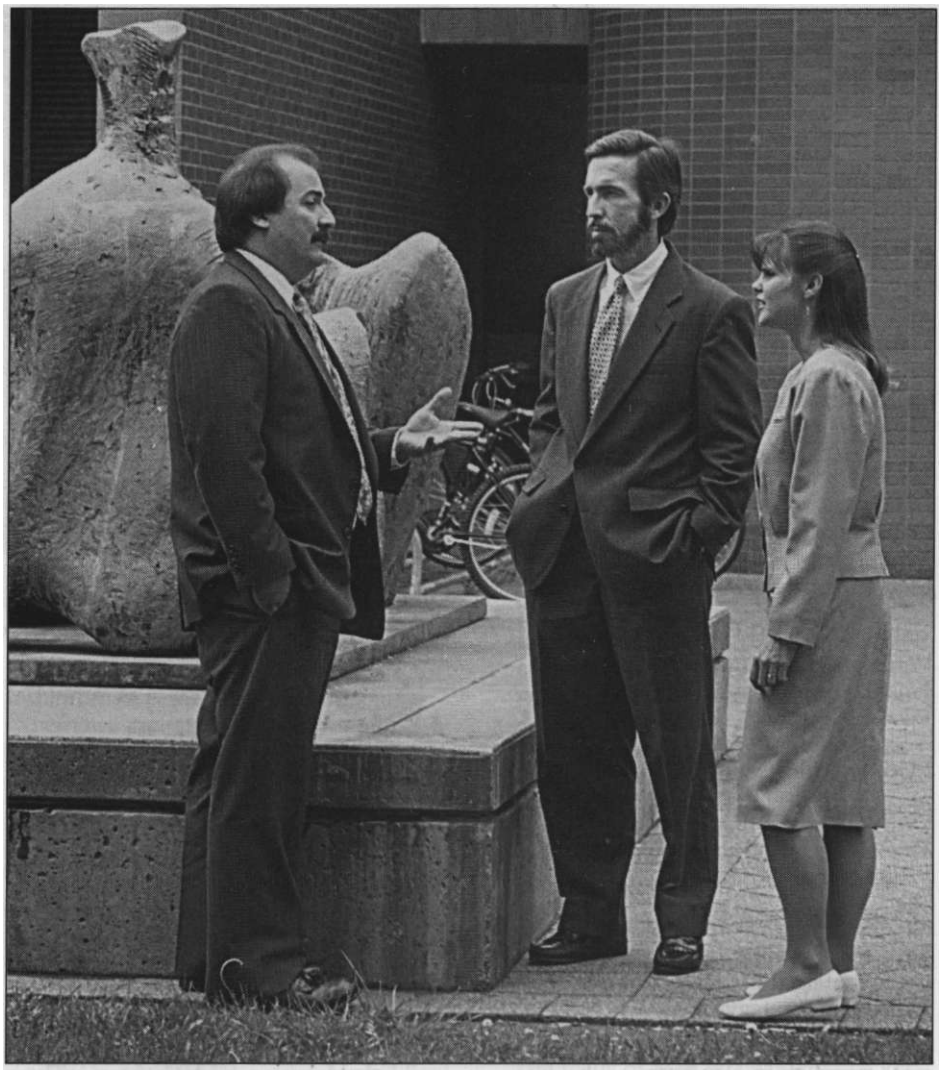
Two economics courses:

0103-711 Microeconomics
0103-712 Macroeconomics

Two finance electives
Two breadth electives

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

The candidate must successfully complete a comprehensive field exam from the finance curriculum.



Availability beyond the classroom is a characteristic of College of Business faculty.

Master of Science in Manufacturing Management and Leadership

Joint Program: College of Business and College of Engineering

The MS in manufacturing management and leadership was developed jointly by the College of Business and the College of Engineering to educate graduates to lead manufacturing teams and organizations for successful competition in a global economy. The program involves business and engineering courses with a strong emphasis on integration. Unifying themes are: leadership and teaming; total quality; manufacturing engineering; total cost; and manufacturing strategy. A required seminar series is an integral part of the program. This program is designed to accommodate part-time students and may be completed in two academic years. A required capstone project will be individual or team based and oriented to the solution of manufacturing management problems.

Admission requirements

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

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

Applicants whose native language is other than English must take the TOEFL examination; a score of at least 550 is required.

Prerequisite knowledge

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

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

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

The curriculum

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

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

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

Program of study

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

Graduate Faculty College of Business

Accounting Faculty

Francis E. Kearns, BD, Harvard University; MBA, Ph.D., SUNY at Buffalo—Assistant Professor

Bruce L Oliver, BBA, MBA, University of Cincinnati; Ph.D., University of Washington—Professor

Jose A. Rullan, MS, Rochester Institute of Technology

Daniel D. Tessoni, BSBA, St. John Fisher College; MS, Clarkson University; Ph.D., Syracuse University—Assistant Professor

Robert J. Warth, BS, Rochester Institute of Technology; MBA, University of Rochester—Assistant Professor

Decision Science Faculty

George A. Johnson, BS, University of Rochester; MBA, DBA, Indiana University—Professor

A. Erhan Mergen, BS, Middle East Technical University, Turkey; MS, Ph.D., Union College—Professor

Lyn D. Pankoff, BS, MS, Case Institute of Technology; MBA, Ph.D., University of Chicago—Dean

Thomas F. **Pray,** BS, MS, Clarkson University; Ph.D., Rensselaer Polytechnic Institute—Professor

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

TTiomas A. Williams, BS, Clarkson College of Technology; MS, Ph.D., Rensselaer Polytechnic Institute—Professor

Finance and Economics Faculty

Steven C. Gold, BA, BS, Rutgers University; MA, Ph.D., SUNY Binghamton—Associate Professor

Chun-Keung (Stan) Hoi, BS, MS, University of North Texas; Ph.D., Arizona State University—Assistant Professor

Jeffrey P. Lessard, BSBA, University of New Hampshire, MBA, Plymouth State College; MA, Ph.D., University of Arkansas—Associate Professor

Ashok J. Robin, MBA, Ph.D., SUNY Buffalo-Associate Professor

Richard N. Rosett, MA, Ph.D., Yale University—Professor; Director of Quality Cup Programs

Walter J. Woerheide, BA, Brown University; MBA, Ph.D., Washington University—Professor

International Business Faculty

Marca M. Bear, BSBA, MS, Ph.D., Ohio State University—Assistant Professor

Management Faculty

Robert J. Barbato, BA, LeMoyne College; Ph.D., Michigan State—Associate Dean; Associate Professor

Janet C. Barnard, BS, Nazareth College, Ed.D., University of Rochester—Associate Professor

Andrew J. DuBrin, AB, Hunter College; MS, Purdue University; Ph.D., Michigan State University—Professor

Walter E. McCanna, BS, Marquette University; Ph.D., University of Wisconsin, Madison—Professor

Donald O. Wilson, BS, Oklahoma State University; MS, MPA, University of Southern California; Ph.D., University of California at Irvine—Assistant Professor

Management Informations Systems Faculty

Delvin Grant, BS, New York Institute of Technology; MBA, Ph.D., SUNY Binghamton—Assistant Professor

Bernard J. Isselhardt Jr., BS, MS, Southern Illinois University; Ph.D., University of Iowa-—Assistant Professor

Daniel A. Joseph, BS, Niagara University; MA, SUNY Albany; MBA, Ph.D., SUNY Buffalo—Associate Professor

Victor J. Perotti, BS, MS, MA, Ph.D., Ohio State University—Assistant Professor

Marketing Faculty

Eugene H. Fram, BS, ML, University of Pittsburgh; Ed.D., SUNY Buffalo—Professor

Patricia A. Sorce, BS, Kent State University; MS, Ph.D., University of Massachusetts—Associate Dean, Associate Professor

Philip R. Tyler, BS, Rochester Institute of Technology; MBA, DBA, Michigan State University—Associate Professor

Stanley M Widrick, BS, Clarkson College of Technology; MBA, SUNY Buffalo; Ph.D., Syracuse University—Professor

Julian E. Yudelson, BS, University of Pennsylvania; MBA, Emory University; Ph.D., Northwestern University—Associate Professor

Special Appointments

Paul E. Petersen, Ph.D., Michigan State University—Dean, College of Engineering; Professor

Albert J. Simone, Ph.D., Massachusetts Institute of Technology—President, Rochester Institute of Technology; Professor

Donald A. Zrebiec, MBA, Syracuse University—Distinguished Lecturer in Management

Accounting

0101-703 Financial Accounting Systems
An introduction to financial and managerial accounting concepts, with particular emphasis placed on their use for decision making. Topics covered will include financial statements, transaction analysis, measuring economic values, responsibility accounting, budgeting, decentralized and divisional performance measurement. Credit 4

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

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

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

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

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

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

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

0101-721 Advanced Cost Accounting
This course will allow further study of issues facing accountants in industry. Cases, problems and research assignments will be used to cover topics that will include the design of cost systems, the theory of constraints, activity-based costing, transfer pricing issues, the use of cost data in making short-run operating decisions and other current areas of interest to students. (0101-706) Credit 4

0101-725 Advanced Auditing
An expanded study of the theory and practice of modern auditing. Topic covered will vary depending on the instructor. Specific content for a particular quarter will be announced prior to course offering. (0101-708) Credit 4

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

Management

0102-740 Organizational Behavior & Leadership
This is the basic management course that introduces students to seminal concepts in management and organizations. As such it covers the basic aspects of managing quality in today's organizations. Topics include the concepts of total quality, the antecedents of quality in modern organizations, a systems approach to organizing for total quality, productivity and quality, organizational learning, developing a total quality culture, team management and organizational change. Credit **4**

0102-741 Leading a Quality Organization
Total quality has become a catalyst for change, and astute leadership recognizes the need to embrace the principles of this international movement to remain competitive. Managers are confronted with an overwhelming number of models for implementing total quality in their respective organizations. This can result in confusion, a disillusioned workforce and even ultimate derailment of a quality program. To meet this challenge, many successful organizations are introducing innovative approaches to building and sustaining a culture committed to quality. Successful total quality initiatives are tailored to specific organizational needs. In addition to introducing the principles of total quality, the course will also focus on the characteristics of organizational change agents and their role in this movement. **Credit 4**

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

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

0102-753 Entrepreneurial Field Studies
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. (0101-703,0104-721,0105-761) **Credit 4**

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

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

The MS in finance offers you opportunities in the financial headquarters of the world.

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

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

0102-761 Strategic & Global Factors in the Management of Technology
This course deals with the relationship of technology to the strategic positioning of a company in a global competitive environment. The technology-strategy relationship is examined from the perspective of the individual firm, an entire industry and the industrial policy of a nation. Also discussed are technological partnerships such as strategic alliances, the role of government in developing technology and cross-country comparisons of the technology development process. (0102-740 for business majors; permission of instructor for students in other colleges) Credit 4

0102-762 Managing the High-Tech Firm
The course deals with the internal organizational challenges faced by managers of technology-intensive companies. Particular attention is given to management techniques for successfully developing and introducing into the marketplace new products and services. Also discussed is the management of technical groups and project teams, cross-functional integration, organizational support of innovation and creativity and organizational alternatives such as matrix management and skunk works. (0102-740 for business majors; permission of instructor for students in other colleges) Credit 4

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

International Business

0102-760 International Management
An analysis of business behavior and organization in the European Community, Eastern Bloc countries, the Pacific Basin, and the U.S., with particular emphasis on values, authority, individual and group relations, labor-management ties, risk tolerance, and motivational techniques. In all cases, the differential effect of culture on management will be carefully appraised. (0102-740) Credit 4

0102-780 Multinational Business Operations & Environment
This is a survey course designed to expose students to the complexities of international business. Topics include trade theory; evolving political, regulatory, and economic environments; the multinational corporation; host country relations; direct foreign investment; and managing across national boundaries. (0102-740) Credit 4

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

0102-890 Thesis
The thesis is designed to expose the candidate to procedures of research methodology, data gathering and data analysis. A conceptual and theoretical research project will be designed by the candidate and his or her adviser to explore a salient international business-oriented issue. The candidate must obtain the approval of an appropriate faculty member to guide the thesis before registering for the thesis. Credit variable 4-8

0102-891 **Graduate Project**
This course number is used to fulfill the graduate paper requirement under the non-thesis option for the MS degree in international business. The candidate must obtain approval from an appropriate faculty member to supervise the paper before registering for this course. A practitioner-corporate-oriented research project designed by the candidate and his/her adviser to explore a salient international business-related issue. **Credit variable 4-8**

0104-760 **International Finance**
This course is concerned with the monetary aspects of international economic relations. It deals with the following topics: the balance of payments, foreign exchange rates and markets, plant location, capital asset allocation, flexible exchange rates system, international capital movements, exchange, restrictions, and international monetary experience. (0101-703,0103-711,0104-721) **Credit** 4

0105-766 **International Marketing**
Global implications of marketing functions. Analysis of specific marketing environments for the development of competitive advantages in marketing strategies. Effect of national/cultural forces on product adoption and use. Political, legal, technological, financial and geographic aspects of international marketing. (0105-761) **Credit 4**

Human Resources Development

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

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

Environment of Business

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

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

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

0102-763 **Behavioral Skills for Managers & Professionals**
The course provides the opportunity to develop individual and interpersonal skills that enhance managerial performance in today's high-performance organization. Each participant is given the opportunity to perform in each of the major skill dimensions, given evaluative feedback and given the opportunity to incorporate the implications of that feedback into additional performance opportunities. Course participants are also provided with the opportunity to assess their career work preferences and to compare them with the performance expectations of managerial positions. The administrative styles of each participant are also assessed, and the impact of the behaviors that flow from each style on the perceptions and performance of others in the organization is clarified. (0102-740) Credit 4

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

Economics

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

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

0103-712 **Macroeconomics**
This is an intermediate macroeconomic theory course with applications. A basic framework of product and money market equilibrium is explored with applications in fiscal and monetary policy. An understanding of major aggregate economic relationships is developed, as well as economic policy. (0103-711) **Credit** 4

0103-716 **Seminar in Economics**
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

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

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

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

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

Presentations are an essential component of many graduate classes.

0104-729 Seminar in Finance
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. (0104-721, 722, and permission of instructor) Credit 4

0104-730 Financial Institutions & Markets
An examination of the role of financial intermediation in the economy. The existence of regulations and the expanding level of competition among intermediaries are discussed. The importance of interest rate risk and hedging such risk is extensively covered. Topics include regulatory laws, gap analysis, hedging duration gap exposure, bank performance, pension funds, insurance companies and mutual funds. (0104-721, 722) Credit 4

0104-731 Problems in Investments
This course is designed to give the student greater in-depth understanding of contemporary problems in finance. Learning and problems will correspond to the three levels of the chartered financial analysts examination. Topics will include fixed income securities, equity analysis, efficient markets, capital market theory, asset allocation, derivative securities and portfolio management. (0104-725) Credit 4

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

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

0104-795 Financial Management in the Manufacturing Environment
A broad coverage of business finance in the manufacturing environment with emphasis on the analytical techniques of resource allocation and asset management. Covers risk assessment, capital structures, analysis of financial statements, financing business operations, cost of capital, theories of leverage, capital budgeting, and working capital management. (0101-794) Credit 4

0104-796 Introduction to Financial Management
This course is an introduction to financial management for the non-MBA graduate student. The objective is to present the overall financial knowledge necessary to understand the financial management of a firm. Topics include interpreting financial statements, financial analysis and planning, capital budgeting decisions, valuing securities and understanding risk and return. Credit 4

RIT's suburban campus was designed with an eye on accessibility—its academic buildings are in a central location.

Marketing

0105-758 **Seminar in Marketing**
This course will take on different content depending on the instructor and the quarter when offered. Titles will appear in the course listing each quarter when the seminar is offered. The course may be taken more than once as topics change.
Database Marketing: This course provides the student with the application of database management to the challenges of relationship marketing. Training on ACCESS software after which students will apply the information from analysis of the database to design a relationship marketing plan.
World Class Customer Service: The objective is to examine and understand the marketing aspects of nonmarketing areas and to further understand the activities involved with nontraditional marketing.
Marketing on the Internet: Students will learn about customer communications, research tools of the Internet, marketing potential of the WWW and the importance of cross media marketing. **Credit 4**

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

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

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

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

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

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

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

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

Decision Sciences Quantitative Methods

0106-780 Management Science
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. **Credit 4**

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

Computers/Management Information Systems

0106-750 Information Technology Hardware & Software
This course presents the issues of rapid computer system changes, increased computer power and speed, reduced computer size, new peripherals and changes in user interaction—issues of computing systems architectures and operating system software—using a systems view. Credit 4

0106-751 Information Systems Theory & Practice
This course provides an understanding of the decision process and how information is used for decision support in organizations. It covers decision theory, information theory and practice essential for providing viable information to the organization. Credit 4

0106-752 Systems Analysis & Design I
This course provides students with fundamental knowledge and skills required for successful analysis of problems and opportunities and the design and implementation of information systems. Provides students with knowledge and experience that will be useful in determining systems requirements and developing a logical design. Skills in project management will be learned and used throughout the course to facilitate team accomplishments. Credit 4

0106-753 Systems Analysis & Design II
This course builds on Analysis and Design 1. It discusses issues associated with data capture, organization, storage, extraction and modeling for planned and ad hoc reporting. Enables students to model data by developing conceptual and semantic data models. (0106-752) **Credit 4**

0106-754 Network Technology
This course is designed to give students basic knowledge of the networking strategies that are utilized within the corporate IS environment. Emphasis is on the current trends in local-area networking as they relate to business needs. Class sessions are composed of lectures and discussions. Credit 4

0106-796 Information Systems Management
This course involves the study of information systems (IS) management with emphasis on manufacturing. It focuses on issues and problems faced by managers of information technology. Topics include information systems planning, computer-integrated manufacturing, systems development, establishment of IS standards, and other management principles relevant to IS and manufacturing. The course utilizes Harvard cases and research papers to illustrate important concepts. **Credit 4**

Production/Operations Management

0106-743 Operations Management & Process Improvement
Study of production operations management. Topics include quality control and improvement, forecasting, resource planning, scheduling, materials and capacity management, inventory management, project management, just-in-time/total quality management (JIT/TQM), international operations, strategic considerations, and current issues. (0106-782 or equivalent) Credit **4**

0106-744 Project Management
A study in the principles of project management. This course focuses on the leadership role of the project manager, roles and responsibilities of the project management team members, and various tools and techniques for project planning and control. Considerable emphasis is placed on statements of work and work breakdown structures. This material is presented using a combination of lecture/discussion, group exercises, and case studies. (This course is for matriculated and non-matriculated graduate students with approval from the graduate business office.) Credit **4**

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

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

College of Engineering

Paul E. Petersen, Dean

N. Richard Reeve, *Associate Dean*

The College of Engineering offers comprehensive, innovative graduate programs in a range of engineering disciplines. Programs include the traditional master of science degree and the master of engineering degree as well as two interdisciplinary degrees with the College of Business and the College of Science.

Traditional MS and ME degrees, plus unique programs offered jointly with other RIT colleges, provide students with several options for advanced education in engineering.

The master of science degree leads to employment in engineering in an industrial environment or to further graduate study at the doctoral level. The master of engineering degree is primarily a terminal master's program leading to industrial employment. An industrial internship or an engineering case study replaces a traditional thesis.

Classes are flexible, with day, late afternoon and evening classes designed to meet the needs of both working professionals and full-time students.

Details of specific programs, including courses, research activities, thesis requirements and assistantships, follow. For information about the master of science degree in materials science and engineering, offered jointly with the College of Science, see page 125. For details about the master of science degree in manufacturing management and leadership, offered jointly with the College of Business, see page 54.

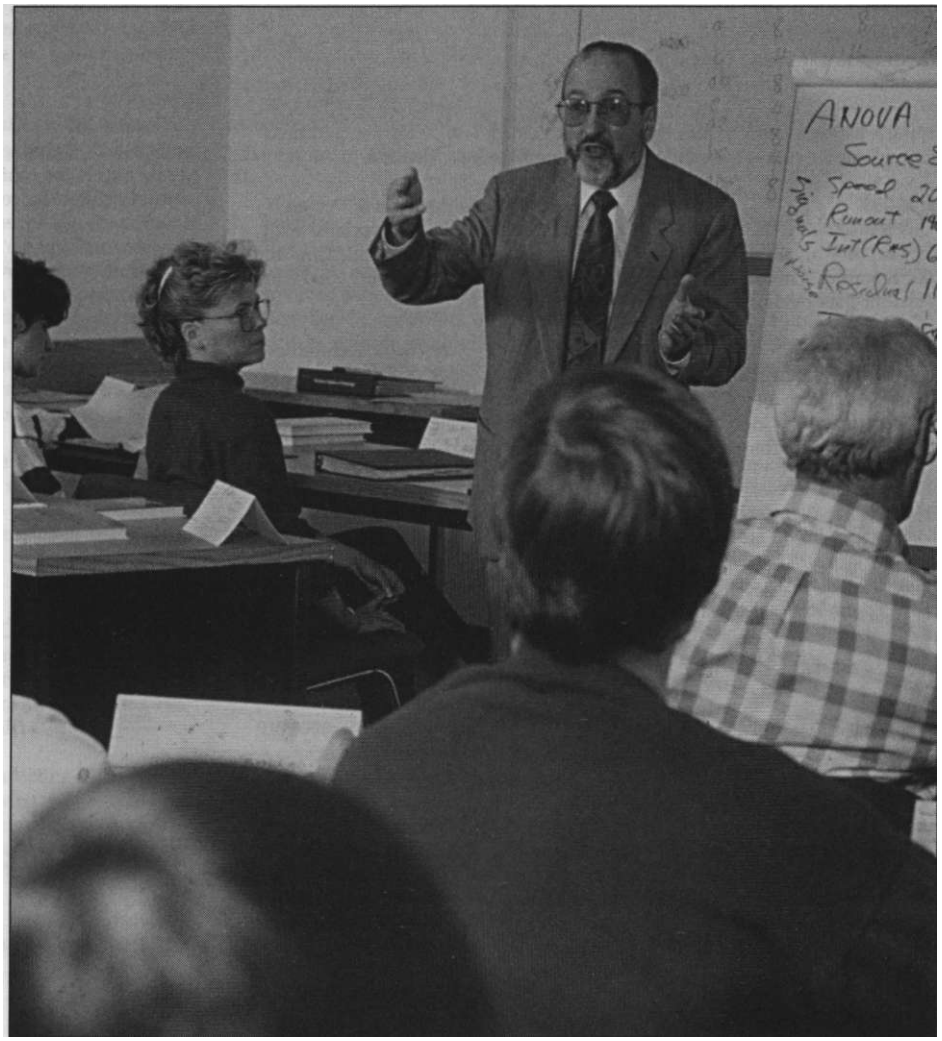
PROGRAMS

MASTER OF SCIENCE DEGREES IN:

Applied and Mathematical Statistics
Computer Engineering
Electrical Engineering
Manufacturing Management and Leadership (offered with the College of Business)
Materials Science and Engineering (offered with the College of Science)
Mechanical Engineering
Microelectronics
Manufacturing Engineering

MASTER OF ENGINEERING DEGREES IN:

Engineering Management
Industrial Engineering
Manufacturing Engineering
Mechanical Engineering
Microelectronics
Manufacturing Engineering
Systems Engineering



The Center for Quality and Applied Statistics, which offers a graduate degree in applied and mathematical statistics and extensive non-credit seminars, is an integral part of the College of Engineering.

Study Options

Part-time study

The College of Engineering encourages practicing engineers in the greater Rochester industrial community to pursue a program of study leading to the master of science or master of engineering degree without interrupting their work at their place of employment. Consequently, many of the courses in the graduate programs in engineering are normally scheduled in the late afternoons or early evenings.

Students employed full time in industry are limited to a maximum of two courses or eight credits each quarter. A student who wishes to register for more than eight credits while employed in full-time industry must obtain the permission of his or her adviser and the approval of the department head.

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

A student in the master of engineering degree program may earn academic credits for industrial experience that will be treated as internship experience while the student is enrolled in the program.

Full-time study

Even though graduate programs in engineering serve the needs of a large number of practicing engineers who wish to pursue a part-time program, the different programs may also enroll full-time graduate students. A full-time student may take up to 18 credits per quarter.

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

Students in the master of engineering program in microelectronics manufacturing engineering are expected to attend full time during fall, winter and spring terms. The internship is completed during the following summer and fall.

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 requirements

Any student who wishes to become a candidate for the master's degree must first be formally admitted to the appropriate graduate program. Formal admission to a graduate program gives matriculated status to a student.

An applicant is admitted as a graduate student if he or she has received a bachelor's degree 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.

Nonmatriculated status

An applicant is permitted to take graduate courses as a nonmatriculated student if he or she has a bachelor's degree from an approved undergraduate school and the necessary background for the specific courses in which he or she wishes to enroll. The courses taken for credit can usually be applied toward the master's degree when the student is formally admitted to the graduate program at a later date. However, the number of credits that will be transferred to the degree program from courses taken at RIT as a nonmatriculated student will be limited to an absolute maximum of 12 credits.

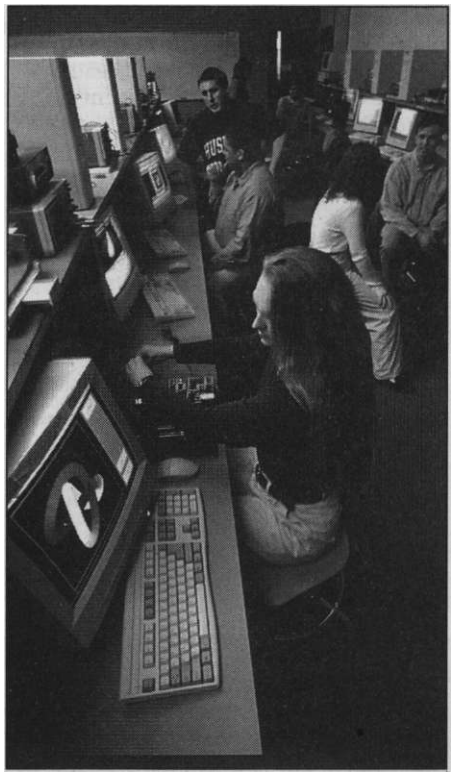
An applicant who wishes to enroll in a graduate course as a nonmatriculated student must obtain permission from the person in charge of the graduate program in each department and the appropriate faculty member.

Graduate Record Examination

The College of Engineering does not require graduate applicants to take the Graduate Record Examination.

Plan of study

The programs are flexible and afford students an opportunity to plan a course of study suited to their own interests and directed toward their own objectives. Each graduate student should submit a plan of study to the department office within the first year after admission as a graduate student. To assure a coherent program and one which reflects the student's maturing capacities and aims, the plan may be revised on request.



Advanced computing facilities support graduate research and projects.

Transfer credits

A maximum of nine quarter credits in a 45 credit hour program or 12 quarter credits in a 48 credit hour program can be transferred from graduate courses taken outside the Institute. To be considered for transfer credit, the course must have been taken within a five-year period prior to the date of the student's initial entry into a graduate program in engineering at RIT as a nonmatriculated or regular student. Courses taken at another institution after the student's initial entry into a graduate engineering program at RIT are also eligible for transfer credit. However, to ensure transferability, prior approval should be obtained. The student should contact the individual department office about the procedure for obtaining transfer credits.

Faculty adviser

A member of the graduate faculty is appointed as a faculty adviser for each graduate student. The faculty adviser supervises the progress of the student towards the master's degree. For the master of engineering student, a second adviser (for the internship) will be assigned at the time that an internship proposal is submitted. This adviser will monitor and evaluate the student's internship experience (in cooperation with the student's industrial supervisor) and recommend to the department head the number of academic credits to be

awarded for the experience. Nonmatriculated students should direct their questions to either the department head or the chairperson of the department's Graduate Committee.

Grade requirements

The average of the grades for all courses taken at the Institute and credited toward the master's degree must be at least a "B" (3.0). Transfer credits from other institutions and internship credits are not included in the computation of the cumulative grade point average. The policy on probation and suspension is explained in the section "Steps Toward Degree" in this bulletin. The student must pay careful attention to that policy. If a student fails any required examination, the student's adviser may recommend to the dean that the student's performance be reviewed and appropriate action taken.

Thesis

For the MS student the thesis requirements vary among the different departments. The requirements of an individual department are stated in the sections describing each department's programs.

The thesis must comply with the following regulation:

Three copies of the thesis must be submitted to the departmental office before the certification date of the quarter in question. These copies are for transmittal to the Institute library, the departmental office and the student's thesis adviser. For detailed instructions about the organization of the thesis, the student should consult the brochure "Thesis Format," available at the departmental office.

Internship

For the ME student, an industrial internship of duration equivalent of up to two academic quarters in a full-time engineering position is an integral part of the program. A minimum of eight and a maximum of 16 credits may be earned through the student's internship experience. The internship is selected to reflect each student's primary professional interest and is integrated with his or her curriculum.

In a limited number of cases, where a regular internship is not practical due to extraordinary circumstances, case studies may be substituted for internship. Such a substitution has to have the prior approval of the department head.

Maximum limit on time

The required credits for the master's degree must be completed within seven years after the student's initial registration in graduate courses at the Institute as a regular or nonmatriculated student.

Courses of instruction

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

Financial aid

A limited number of teaching assistantships, research assistantships and tuition scholarships are available for graduate students. Detailed information is available from the appropriate department head.

Computer Engineering Department

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 five-course core curriculum. The requirements also include an area of concentration, graduate electives subject to faculty adviser's approval and nine quarter credits of master's thesis. Both the area of concentration and the thesis project must be approved by a student's graduate committee consisting of at least three faculty members, the majority of whom are computer engineering faculty. This allows a student to pursue an area of specialization in the field of computer engineering by completing a cohesive set of two courses apart from the background core requirements. The chairman of the student's graduate committee will normally serve as the student's faculty adviser. The intent is to allow students reasonable creativity in articulating an area of concentration.

Master's degree in computer engineering core courses:

0306-722	Advanced Computer Architecture (W)
0306-740	Analytical Topics for Computer Engineers (F)
0306-759	Principles of Digital Interfacing (F)
0306-756	Multiple Processor Systems (S)
0603-709	Programming Language Survey (F, W, S)

The graduate curriculum will require the following courses above a BS degree in computer engineering:

5 courses in core (20 quarter credits)
2 courses in graduate electives (8 quarter credits)
2 courses in concentration (8 quarter credits)
9 credits in master's thesis project
45 quarter credits total

The area of concentration builds some expertise in preparation for conducting a successful graduate thesis project in an area within the discipline of computer engineering. The student may choose graduate electives subject to the approval of his or her faculty adviser. The total of all graduate courses transferred from other appropriate institutions of higher learning may not exceed nine quarter credits and the total of 600-level courses applicable to the program will not exceed eight quarter credits. No graduate credit will be considered for courses below the 600 level. The usual RIT graduate school requirements will apply, such as a grade of B or better for all transfer courses as well as the maintenance of a grade point average of 3.0 or better.

For information

For specific questions on the individual department programs contact:

Computer Engineering	475-2987	(Czernikowski)
Electrical Engineering	475-2165	(Unnikrishnan)
Industrial Engineering	475-2598	(Shealy)
Mechanical Engineering	475-2153	(Budynas)
Microelectronic Engineering	475-6065	(Fuller)
Applied and Mathematical Statistics	475-6990	(Baker)

Questions on course schedules and registration:

Computer Engineering	475-2987
Electrical Engineering	475-2164
Industrial Engineering	475-2598
Mechanical Engineering	475-5788
Microelectronic Engineering	475-6065
Applied and Mathematical Statistics	475-2033

Electrical Engineering Department

R. Unnikrishnan, *Department Head*

Admission requirements

Admission into graduate studies leading to the MS degree in electrical engineering requires a BSEE degree from an accredited program.

An applicant with a strong undergraduate record and a bachelor of science degree in another branch of engineering (mechanical, chemical, industrial, etc.) also will be considered for admission. In this case the student must complete a certain number of undergraduate courses in order to bridge over to electrical engineering. Additional information is available from the department.

Focus areas

Within electrical engineering, a student can specialize in one of six separate areas for the MS degree: *control systems, communications, digital systems, integrated electronics, signal and image processing* and *optics.*

The boundaries between some of the areas are not as sharp as they were in the past, and students are urged to discuss the significance of their choices with graduate advisers in the department.

Plan of study

At the beginning of the program, every matriculated student must arrange to prepare a plan of study in consultation with his or her adviser.

Policies

The following general rules apply to all students:

- All students seeking the MSEE degree must satisfactorily complete the two core courses, 0301-754, Analytical Techniques I, and 0301-755, Analytical Techniques II. Students are expected to take these courses immediately after entering the program, since they are prerequisites for many of the other graduate courses.
- Those students who have selected focus areas in control systems, communications, or signal and image processing must also take 0301-756, Analytical Techniques III. Students who want to develop minors in the above areas are also encouraged to take Analytical Techniques III.
- Each student must take at least four courses from the EE department in the chosen focus area.
- Each student may take three courses from a related area.

Suggested Schedule for the MSEE Program*

Focus Area	Fall '97/'98	Winter '97/'98	Spring '97/'98
Communications	Analytical Techniques I Analytical Techniques III Information Theory	Analytical Techniques II Stochastic Estimation & Control	Error Correction & Detection
Control Systems	Analytical Techniques I Analytical Techniques III Machine Vision	Analytical Techniques II Modern Control Theory Stochastic Estimation & Control	Optimal Control Digital Control System Design
Signal and Image Processing	Analytical Techniques I Analytical Techniques III Machine Vision	Analytical Techniques II Modern Control Theory Stochastic Estimation & Control	Digital Image Processing
Integrated Electronics	Analytical Techniques I Physics of Bipolar Devices VLSI Design	Analytical Techniques II Physics and Scaling of CMOS Devices Analog IC Design Microelectronics Mfg. I	Solid State Physics CMOS Advanced Analog IC Design
Optics	Analytical Techniques I Electro-Optics	Analytical Techniques II Optical Engineering I	Fiber Optics
Digital Systems	Analytical Techniques I Design for Testability	Analytical Techniques II Analog IC Design	VLSI Design

Focus Area	Fall '98/'99	Winter '98/'99	Spring '98/'99
Communications	Analytical Techniques I Analytical Techniques III Information Theory	Analytical Techniques II	Error Correction & Detection
Control Systems	Analytical Techniques I Analytical Techniques III Machine Vision	Analytical Techniques II Modem Control Theory Nonlinear Control	Optimal Control Digital Control System Design
Signal and Image Processing	Analytical Techniques I Analytical Techniques III Machine Vision	Analytical Techniques II Modem Control Theory Pattern Recognition	Adaptive Signal Processing Special Topics
Integrated Electronics	Analytical Techniques I Physics of Bipolar Devices VLSI Design	Analytical Techniques II Physics and Scaling of CMOS Devices Analog IC Design Microelectronics Mfg. I	Solid State Physics CMOS Advanced Analog IC Design
Optics	Analytical Techniques I Electro-Optics	Analytical Techniques II Optical Engineering I	Fiber Optics Special Topics
Digital Systems	Analytical Techniques I Design for Testability! VLSI Design Adv. Microprocessor Software	Analytical Techniques II Analog IC Design	Special Topics

* *Check with your adviser for complete course selections. Additional courses are offered on an occasional basis. Course offerings are subject to sufficient enrollment,*

t *Offered every other year*

- All course selections must be approved by one of the graduate advisers. All courses must be at 700-level or above with one exception: a student is allowed to take a maximum of two 600-level courses for full credit in the graduate program.
- All students must satisfy a research component through one of the following activities:

1. Graduate thesis (6-12 credit hours)

   The inclusion of a thesis (0301-890) as a formal part of the MS degree program in electrical engineering is optional but strongly encouraged. Students who decide to write a thesis can earn a minimum of six credits and a maximum of 12 credits toward their degrees from the thesis, nine being the most common number of credits earned. Typically, students take nine approved courses for 36 credits to meet the course requirements.

   Thesis work is done under the supervision of a faculty adviser and presented and defended before a thesis committee when complete. Thesis may be done in absentia.

2. Graduate research paper (five credit hours)

   A student may choose to write a "graduate paper" in lieu of a thesis. The graduate paper is an extensive

term paper on a topic of professional interest. The objective of the graduate paper is to enable the student to undertake an independent and in-depth literature search and write a report summarizing the findings. A faculty member interested in the paper's topic will serve as the student's supervisor and direct the scope and depth of the paper as well as the format of the final written version. The student must first consult a faculty member about a suitable topic for the paper and obtain consent. The course 0301-800, Graduate Paper, is used to register for the paper. *The student should plan to take at least five credit hours in 0301-800. The student choosing this option also is required to take a minimum of 10 courses for 40 credits.*

3. Comprehensive examination
   In this option, a student completes a total of 12 courses and passes a comprehensive exam given once every year.

- All graduate work must be completed within a seven-year period starting from the first course applied toward the MSEE degree. Also, a student who is pursuing thesis/project options may be required to register for continuation of thesis/project credits if he or she is not enrolled for any credits in a given quarter. For complete details, please consult the continuation of thesis/project/dissertation policies on page 9.

Transfer credits

A maximum of nine credit hours can be earned from courses available from other departments within RIT with the prior approval of the faculty/department adviser. For students transferring credits from other universities (limited to a maximum of nine hours), the total number of credits transferred from all sources outside the electrical engineering department may not exceed nine.

Under some extraordinary circumstances, a resident full-time student may appeal the EE department and the Graduate Council for additional transfer credits.

Those electrical engineering students who have an interest in computer science as a minor area are encouraged to pay special attention to certain specific policies. The bridge courses 0602-701, 702, 703, 704 and 705 will be treated as advanced undergraduate courses; therefore, the total number of credit hours generated from these cannot exceed eight. Also, electrical engineers with interest in computer science are encouraged to complete certain sequences of appropriate courses (within the limits of allowable transfer credits) rather than take one or two courses at random. Please consult the department for more details.

Graduate student advising

All new students will be assigned a graduate adviser. The student generates a plan of study in consultation with his or her faculty adviser. That faculty member will continue to be the student's adviser until a research topic has been chosen. From that time, the thesis/paper adviser assumes the role of academic adviser as well.

Graduation requirements

The master of science degree in electrical engineering is awarded upon the successful completion of an approved graduate program consisting of a minimum of 45 credit hours. Those who choose the comprehensive examination option must complete 48 credit hours of course work. Under certain circumstances a student chooses or is required to complete more than the minimum number of credits.

Schedule of graduate courses in electrical engineering

EVERY FALL QUARTER

0301-754 Analytical Techniques I
0301-755 Analytical Techniques III
0301-794 Information Theory
0301-741 Design for Testability*
0301-715 Machine Vision
0301-776 Electro-Optics
0301-711 Physics of Bipolar Devices
0306-727 VLSI Design

EVERY WINTER QUARTER

0301-755 Analytical Techniques II
0301-763 Stochastic Estimation & Control
or
0301-762 Nonlinear Control
0301-749 Speech & Image Compression
or
0301-770 Pattern Recognition
0301-761 Modern Control Theory
0301-712 Physics & Scaling of CMOS Devices
0301-775 Optical Engineering I
0301-788 Advanced Signal Processing
0301-726 Analog IC Design

EVERY SPRING QUARTER

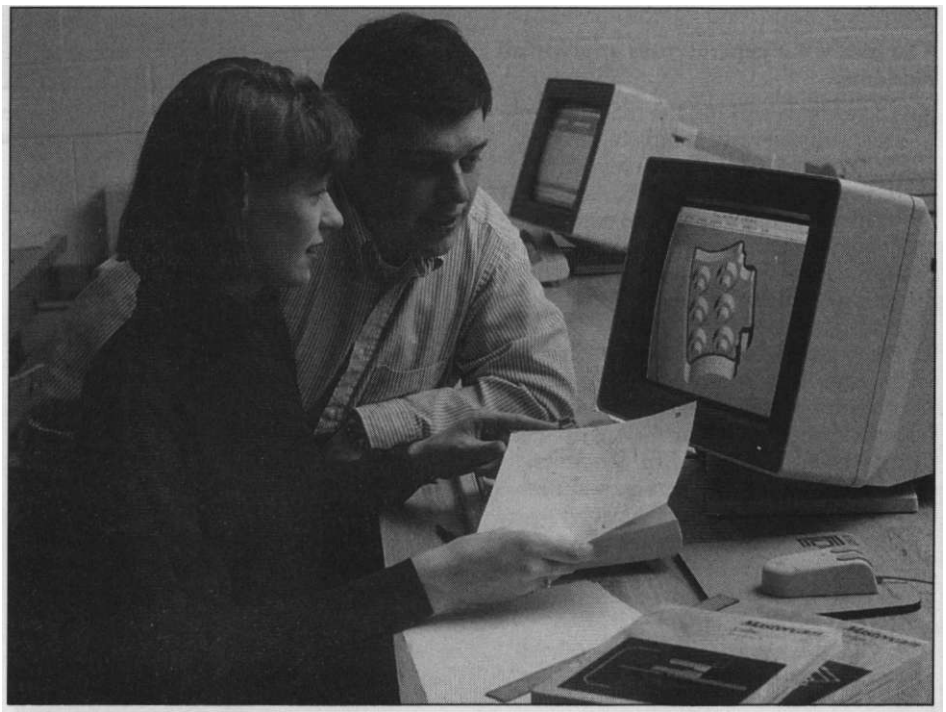
0301-793 Error Correction & Detection
0301-765 Optimal Control
0301-764 Digital Control Systems
0301-778 Fiber Optics
0301-779 Digital Image Processing
or
0301-768 Adaptive Signal Processing
0301-713 Solid State Physics
0301-730 Advanced Analog IC Design

** Offered every other Fall Quarter*

SUMMER QUARTER

A selected number of 700-level courses and 600-level courses will be available during the Summer Quarter. Consult the department for details.

Courses other than those listed in this bulletin are developed and offered periodically by the department of electrical engineering. Information will be available from the departmental office about a



Teamwork and collaboration in engineering courses reflect workplace realities.

Graduate Course Offerings
Department of Industrial and Manufacturing Engineering

Even Years (e.g., 98/99, etc.)

FALL	WINTER	SPRING
0303-715 Statistical Analysis for Engineering I	0303-730 Biotechnology & Human Factors I	0303-729 Computer-Integrated Manufacturing
0303-625 Concepts in Manufacturing	0303-710 Systems Simulation	0303-734 Systems Safety Engineering
0303-702 Mathematical Programming	0303-757 Reliability	0303-720 Production Control
0303-750 Management of Quality Control Systems	0303-756 Decision Analysis	0303-725 Technological Forecasting
	0303-755 Multicriteria Decision Making	0303-776 Case Studies
		0303-731 Biotechnology & Human Factors **II**

Odd Years (e.g., 97/98, etc.)

FALL	WINTER	SPRING
0303-715 Statistical Analysis for Engineering I	0303-716 Statistical Analysis for Engineering II	0303-729 Computer-Integrated Manufacturing
0303-625 Concepts in Manufacturing	0303-620 Engineering Economy	0303-734 Systems Safety Engineering
0303-758 Design of Experiments	0303-730 Biotechnology & Human Factors **I**	0303-701 Principles of Operations Research **I**
0303-775 Data Structures Using C	0303-710 Systems Simulation	0303-601 Value Analysis
	0303-747 Microprocessor Applications	0303-731 Biotechnology & Human Factors **II**
		0303-776 Case Studies

The following are courses that may be taught upon demand:

0303-723 Facilities Planning
0303-732 Biotechnology & Human Factors III
0303-733 Biotechnology & Human Factors IV
0303-740 Numerical Control & Manufacturing
0303-741 Applied Robotics in Manufacturing Systems
0303-742 Artificial Intelligence
0303-748 Quality & Reliability

month before the beginning of each academic quarter. Course offerings are subject to minimum enrollment requirements.

Industrial and Manufacturing Engineering Department

Jasper E. Shealy, *Department Head*

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 other engineering departments and the College of Business assures the master of engineering candidate of a wide selection of courses and a unique opportunity to build a program tailored to her or his professional interests and goals. The practice of applying computer methods to realistic problem solving is employed in all the above specialties.

Industrial engineering option

Industrial engineering is concerned with the design, improvement and installation of integrated systems of people, material, equipment and energy. Those choosing this option may develop a program of study to suit their interests in one or more of the following areas: operations research, ergonomics, computer-aided manufacturing or production systems. An engineering internship, usually eight credit hours, is also required.

Engineering management option

Those choosing this option may develop a program of study to suit their interests. This program combines traditional industrial engineering course work with selected (maximum three) courses from the College of Business, such as organizational behavior, accounting or finance. An engineering internship, usually eight credit hours, is also required.

Manufacturing engineering option

This option is jointly administered with the mechanical engineering department. The program consists of a required course in Design for Manufacture, plus at least one course in each of the following core areas: computer-aided design, manufacturing systems, computer-aided manufacturing, probability and statistics. Additional courses chosen by the student in the areas of operations research, ergonomics, computer-integrated manufacturing, production systems or statistical analysis, along with an 8 to 16-credit-hour internship (8 typically) complete the requirements of this concentration.

Systems engineering option

Systems engineering is concerned with improving the decision making process by utilizing statistics, simulation, optimization and computer science. Students choosing this option are required to take the following courses in addition to two electives:

0303-758 Design of Experiments
0303-771 Data Structures Using C
0303-716 Statistical Analysis for Engineers II
0303-747 Microprocessor Applications
0303-701 Operations Research I
0303-729 Computer-Integrated Manufacturing
0303-702 Mathematical Programming
0303-750 Management of Quality Control Systems
or
0303-757 Reliability Engineering
0303-776 Case Studies

Admission requirements

Admission into the graduate ME program within industrial engineering requires a BS degree in an engineering discipline and a 3.0/4.0 grade point average. Exceptions are made for the related fields of math and physics. Students with other backgrounds are considered for admission only after completing significant undergraduate course work in the engineering sciences. All applicants should have a fundamental knowledge of computers and probability/statistics.

Program of study

The student, in conjunction with his or her adviser, formulates a program of study based on the individual's academic background, professional goals, master of engineering degree requirements and the schedule of course offerings.

Internships

The industrial engineering, engineering management and manufacturing engineering options require an internship of 8 to 16 credit hours (usually eight credit hours). The internship may be a work-related project conducted under faculty supervision or a project completed within the industrial and manufacturing engineering department. Students initiate the internship by developing a proposal, which is submitted to the graduate adviser, describing the nature of the project, how it fits with their course work, timelines and deliverables. Upon approval of the project, students work closely with a faculty adviser to complete the proposed project.

Mechanical Engineering Department

Charles W. Haines, *Department Head*

The graduate faculty of the mechanical engineering department is dynamic and committed to professional growth. Some of the current research activities include finite elements, vibrations, robotics, cardiovascular signal processing and system modeling, turbomachinery flows, laser-based flow measurement, applications of computational fluid dynamics, heat transfer, and computer-aided design and manufacturing. Research also is conducted in areas such as thermal stresses, boiling heat transfer and thermal simulation of heat exchangers and electronic devices, non-linear dynamics, and fracture mechanisms in materials. Also, there is interest in software design and development for engineering applications, experimental heat transfer, developing techniques for airfoil optimization, flow in time-varying boundaries, two-phase heat transfer, heat and moisture transport in porous media, mechanical properties of nano crystalline thin films, characterization of intermetallic materials, flow boiling and fluid mixing. The department houses several laboratories, which support vibration and modal analysis, robotics, industrial fluids applications, thermal analysis, biomedical systems analysis and materials science.

Extensive computing facilities include a large network of workstations, personal computers, VAX and Alpha minicomputers, UNIX systems, laboratories equipped with Windows-based and Macintosh personal computers, and dial-in facilities. Students have access to a vast array of software packages, which include most programming languages and utilities, various word processing software, analytical and statistical data analysis, graph generation and spreadsheet packages. Software specifically used for mechanical engineering applications includes IDEAS, ALGOR and Mechanica (finite element analysis); Working Model and ADAMS (mechanical modeling and analysis); ACSL (dynamic simulation); FLUENT, FIDAP, FLOW3D, PMARC and TODOR (fluid/thermal analysis); SOCRATES (heat transfer and structures); MATLAB/ Simulink and Lab VIEW (data acquisition and control system analysis); OptdesX (optimization); DFMA by Boothroyd/Dewhurst (designing for manufacturing assembly); and AUTOCAD, CADKEY and McDonnell Douglas Unigraphics (CAD/CAE software).

Schedule of Graduate Courses in Mechanical Engineering

OFFERED EVERY YEAR		OFFERED EVEN YEARS (e.g., 98/99, etc.)		OFFERED ODD YEARS (e.g., 97/98, etc.)	
FALL		FALL		FALL	
0304-758	Engineering Vibrations	0304-810	Introduction to Continuum Mechanics	0304-835	Grid Generation
0304-838	Ideal Flows	0304-852	Advanced Turbomachinery	0304-842	System Identification
0304-840	Signal Processing	WINTER		0304-865	Computer Implementation of Finite Elements
0304-870	Mathematics for Engineers I	0304-811	Theory of Elasticity & Plasticity	WINTER	
WINTER		0304-834	Boiling & Condensation	0304-833	Heat Exchanger Design
0304-801	Design for Manufacture	SPRING		0304-844	Nonlinear Dynamical Systems
0304-821	Advanced Vibrations	0304-820	Advanced Optimal Design	SPRING	
0304-823	Systems Modeling	0304-864	Production Tool Design	0304-827	Computer Graphics in Design
0304-851	Convective Phenomena	0304-872	Analytical Mechanics	0304-831	CFD Applications
0304-871	Mathematics for Engineers II	0304-875	Advanced Aerodynamics	0304-846	Modal Testing & Signal Processing
0304-874	Numerical Analysis				
0304-885	Advanced Mechanics of Solids				
SPRING					
0304-743	Control Systems				
0304-816	Finite Elements				
0304-830	Introduction to CFD Analysis				

Master of science degree program

The master of science degree in mechanical engineering is awarded upon successful completion of an approved graduate program consisting of a minimum of 45 quarter credit hours. A minimum of 36 credits are to be earned in course work, while independent capstone work carries a minimum of three credits and a maximum of nine credits.

A maximum of nine quarter credits may be transferred from graduate courses taken outside the Institute provided such courses will complement a student's proposed graduate program in the mechanical engineering department.

Upon matriculation into the MS program, the student should formulate a plan of study in consultation with the associate department head, graduate studies.

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 associate department head for graduate studies will recommend which undergraduate courses must be taken in order to acquire an acceptable background. At least a 3.0 grade point average in the recommended undergraduate courses is required before admission is granted to the mechanical engineering graduate program.

Program requirements

The four elements of study within the program include core courses, courses required within an elected focus area, selected elective courses and a capstone thesis/project with paper option.

Core courses

All graduate students in the MS program are required to complete:

0304-870 Mathematics for Engineers I (F)
0304-871 Mathematics for Engineers II (W)

Focus area courses

All graduate students in the MS program are required to select one of the following focus areas and complete the following specific courses within that area:

GROUP A—MECHANICS/DESIGN

0304-758 Engineering Vibrations (F)
0304-885 Advanced Mechanics of Solids (W)
0304-816 Finite Elements (S)

GROUP B—SYSTEMS/CONTROLS

0304-823 Systems Modeling (F)
0304-840 Signal Processing (W)
0304-743 Control Systems (S)

GROUP C—THERMO/FLUIDS

0304-838 Ideal Flows (F)
0304-851 Convective Phenomena (W)
0304-830 Introduction to Computational Fluid Dynamic Analysis (S)

Students may select courses outside their focus area for electives.

Elective courses

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

0304-743 Control Systems (every year, S)
0304-758 Engineering Vibrations (every year, F)

0304-801 Design for Manufacture (every year, W)
0304-810 Introduction to Continuum Mechanics (even year, F)
0304-811 Theory of Elasticity & Plasticity (even year, W)
0304-816 Finite Elements (every year, S)
0304-820 Advanced Optimal Design (even year, S)
0304-821 Advanced Vibrations (every year, W)
0304-823 Systems Modeling (every year, F)
0304-827 Computer Graphics in Design (odd year, S)
0304-828 Special Topics in Applied Mechanics (TBA)
0304-830 Introduction to Computational Fluid Dynamic Analysis (every year, S)
0304-831 Computational Fluid Dynamics (CFD) Applications (odd year, S)
0304-833 Heat Exchanger Design (odd year, W)
0304-834 Boiling & Condensation (even year, W)
0304-835 Grid Generation (odd year, F)
0304-838 Ideal Flows (every year, F)
0304-840 Signal Processing (every year, W)
0304-842 System Identification (odd year, F)
0304-844 Nonlinear Dynamical Systems (odd year, W)
0304-846 Model Testing & Signal Processing (odd year, S)
0304-848 Special Topics in Thermo Fluid Systems (TBA)
0304-851 Convective Phenomena (every year, W)
0304-852 Advanced Turbomachinery (even year, F)
0304-864 Production Tool Design (even year, S)
0304-865 Computer Implementation of Finite Elements (odd year, F)
0304-872 Analytical Mechanics (even year, S)
0304-874 Numerical Analysis (every year, W)
0304-875 Advanced Aerodynamics (even year, S)
0304-885 Advanced Mechanics of Solids (every year, W)
1028-701 Introduction to Materials Science (F)
1028-705 Experimental Techniques (S)
1028-710 Materials Properties & Selection (TBA)
0307-712 Fundamentals of Statistics II

Students deficient in computational techniques are strongly advised to take 0304-874, Numerical Analysis, as an elective.

Based on the students' particular program needs, he or she may, with department approval, elect to take up to 12 credits from other departments in the Institute. Graduate students are allowed to take a maximum of two upper-level undergraduate (0304-6XX) electives in mechanical engineering specified in the course description section of the *Undergraduate Bulletin.* Some examples are:

0304-610 Topics in Mechanical Engineering Design (TBA)
0304-615 Robotics (F, W)
0304-618 Computer-Aided Design (S)
0304-620 Introduction to Optimal Design (F, W)
0304-635 Heat Transfer II (S)
0304-638 Design of Machine Systems (TBA)
0304-640 Internal Combustion Machines & Air Quality (F)
0304-641 Stationary Source Emissions & Controls (W)
0304-642 Air Pollution Dispersion Modeling (S)
0304-644 Introduction to Composite Materials (S)
0304-652 Fluid Mechanics of Turbomachinery (F, W)
0304-660 Refrigeration & Air Conditioning (S, Su)
0304-671 Aerostructures (S or Su)
0304-672 Dynamics of Machinery (S, Su)
0304-675 Aerodynamics (S or Su)
0304-678 Propulsion (F or W)
0304-682 Flight Dynamics (F or W)
0304-694 Stress Analysis (S, Su)

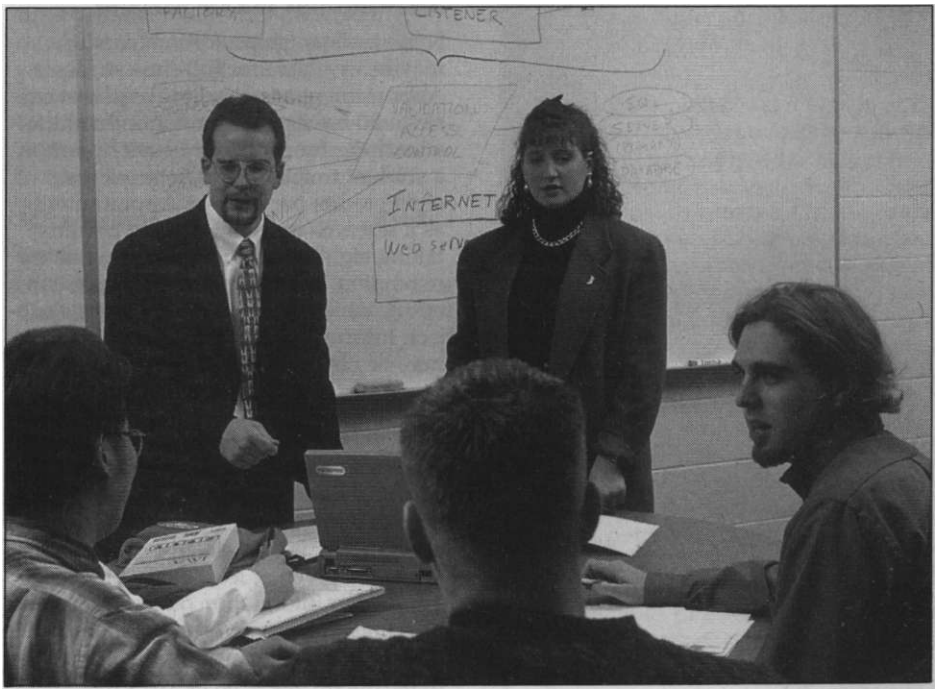
A student also may earn a limited number of credits by doing an independent study with guidance from a member of the graduate faculty. Some of the areas for independent study are selected topics in applied mathematics, energy methods in mechanics, analytical mechanics, nonlinear mechanics, fracture mechanics, convective and radiative heat transfer, fluid mechanics, thermodynamics, control systems, optimal control, thermal stresses, composite materials, biomechanics and viscoelasticity.

Independent capstone options

Once a student has completed about 20 quarter credit hours of graduate work, he or she should consider selecting one of the two options offered by the department with regard to completing the requirements of the master of science degree. The options are: 1) a five- to nine-credit-hour thesis, where thesis and course work total a minimum of 45 quarter credit hours or 2) a three-credit-hour project with paper, where the paper and course work total a minimum of 47 quarter credit hours. A student selecting either option is required to deliver a successful written and oral presentation of the work.

Master of engineering degree program

This is a post-baccalaureate internship program leading to the professional degree of master of engineering. The objective of the program is to provide the engineering BS graduate the means for earning a terminal master's degree, substituting a well-organized and carefully chosen industrial internship for the conventional thesis requirement of an MS degree.



Presenting the results of your research is an important aspect of the research process.

An industrial internship of duration equivalent to two academic quarters in a specially developed engineering position is an integral part of the program. A minimum of eight and a maximum of 12 credits may be earned by the student from his or her internship experience. The internship position is selected to reflect each individual student's primary professional interest and is integrated with his or her curriculum.

The program, although rooted in engineering, will be significantly interdisciplinary. By design, a student's program may range over several colleges of the Institute in assembling courses that will best help him or her meet his or her professional objectives. The credits for this program are distributed as follows:

Core Courses	8 credits
Concentration Courses	16 credits
Elective Courses	12-16 credits
Internship	12-8 credits

At least 20 credit hours of graduate-level course work, including the core (0304-870 and 0304-874), must be taken in the mechanical engineering department. Some possible concentration areas are in business, controls, manufacturing, materials science, statistics and design engineering. A minimum of 48 credits are required for the master of engineering degree.

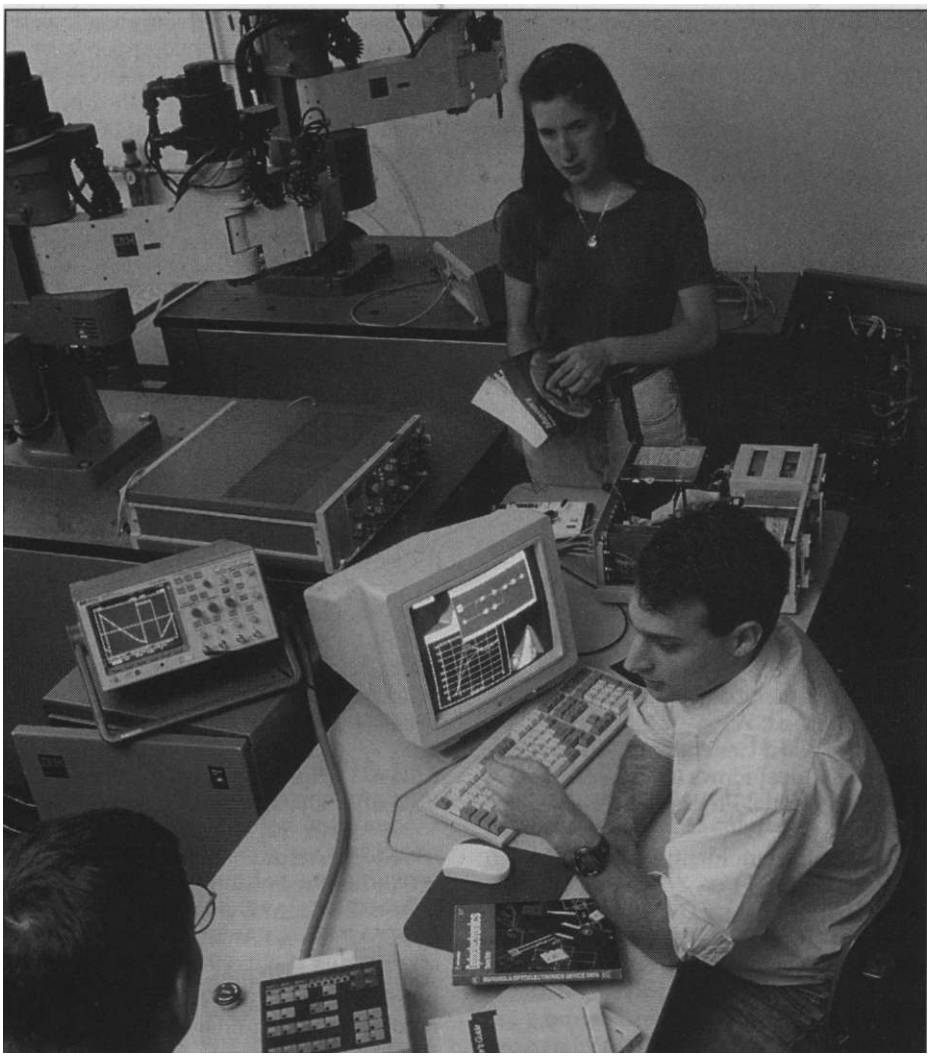
Admission requirements for the master of engineering degree

The admission requirements, general standards and selection procedures for admission to the engineering program are similar to those for the MS degree program.

The manufacturing engineering program for the master of engineering degree

This program is offered jointly by the departments of mechanical engineering and industrial engineering. In this program, the student is required to take one course each from four different groups: computer-aided design, manufacturing systems, computer-aided manufacturing, and probability and statistics. In addition, the student is required to take a core course: 0304-801 Design for Manufacture. The balance of the course work can be completed by selecting appropriate courses from the course offerings in industrial and mechanical engineering.

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



A robotic vision laboratory is one of several specialized laboratories available for graduate research.

Assistantships and scholarships

Some assistantships and scholarships may be available for full-time students. Appointment as a teaching assistant carries a 20-hour per week commitment to a teaching function and usually permits a student to take graduate work for eight credits per quarter. Appointment as a research assistant usually permits taking eight credits per quarter while the remaining time is devoted to the research effort, which often serves as a thesis subject. Information on tuition scholarships may be obtained from the Office of Part-time and Graduate Admissions, 475-2229.

Course calendar

The core and focus area courses are offered every year, which enables a student to fulfill the core requirements in one academic year. The elective courses are generally given at least every other year. For further information on current course offerings, the student should contact the office of the mechanical engineering department, 475-5788 or 475-2163.

Microelectronic Engineering Department

Lynn Fuller, *Department Head*

The College of Engineering is proud to offer two master's programs in the area of microelectronics manufacturing. The *master of engineering* in microelectronics manufacturing engineering is a full-time intensive classroom- and laboratory-oriented program culminating with an internship. The *master of science* in microelectronics manufacturing engineering is a research-oriented program that includes the master's thesis. Both programs are intended to prepare students for a career in the semiconductor industry.

Students in these programs have hands-on experience in the design and processing of integrated circuits—the vital component in almost every advanced electronic product manufactured today. The undergraduate and

graduate laboratories at RIT, designed for the microelectronics engineering program, are among the best in the nation.

The worldwide semiconductor industry is expected to double—growing from $100 billion to $200 billion—over the next five years. RIT graduates will provide a valuable resource to the semiconductor industry. The microelectronics engineering programs at RIT offer an unparalleled opportunity for students to prepare for professional challenge and success in one of the leading areas of engineering of our time.

The ME program

The master of engineering degree in microelectronics manufacturing engineering is awarded upon the successful completion of an approved graduate program consisting of a minimum of 48 credit hours: one transition course, seven core courses, two elective courses and eight credits of internship. Under certain circumstances, a student may be required to complete more than the minimum number of credits. The transition course is in an area other than that in which the BS degree was earned. For example, a chemistry major may be required to take a two-course sequence in circuits and electronics; an electrical engineer may be required to take an organic chemistry course.

The core courses are Microelectronics I, II, III; Microlithography I, II; and Microelectronics Manufacturing I, II. Elective courses may be selected from a list including CMOS, Defect Reduction and Yield Enhancement, Electronic Properties of Materials, Statistical Design of Experiments and others.

The program also requires an internship, which is paid employment in the semiconductor industry. The internship can be completed in industry or at RIT. It will involve the investigation of some problem or process directly related to microelectronics manufacturing engineering. This is not a thesis but usually requires a report and oral presentation at the end of the project.

Microelectronics

The Microelectronics I, II, III sequence covers all aspects of integrated circuit manufacturing technology such as oxidation, diffusion, ion implantation, chemical vapor deposition, metalization, plasma etching, etc. These courses emphasize modeling and simulation techniques as well as hands-on laboratory verification of these processes. Students use the SUPREM software tools for these processes.

In the laboratory students design and fabricate silicon MOS and Bipolar integrated circuits. They learn how to operate all of the semiconductor processing equipment and how to create a process and manufacture and test their own integrated circuits.

Microlithography

The microlithography courses are advanced courses in the chemistry, physics and processing of microlithographic systems. Optical lithography will be studied through diffraction, Fourier and image assessment techniques. Scalar diffraction models will be utilized to simulate aerial image formation and influences of imaging parameters. Positive and negative resist systems, as well as processes for IC application, will be studied. Advanced topics will include chemically amplified resists; multiple layer resist systems; and electron beam, x-ray and deep UV lithography.

Laboratory exercises include projection system design, resist materials characterization, process optimization, electron beam lithography and excimer laser lithography.

Manufacturing

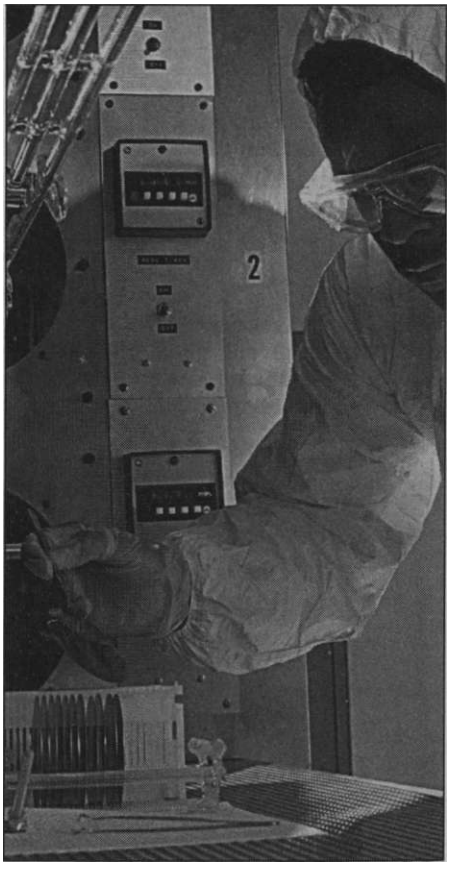
The manufacturing courses include topics such as scheduling, work-in-progress tracking, costing, inventory control, capital budgeting, productivity measures and personnel management. Concepts of quality and statistical process control are introduced to the student. The laboratory for this course is the student-run factory. Measurement of yield, defect density, wafer mapping, control charts and other manufacturing measurement tools are introduced to the student in the lecture and laboratory. Computer integrated manufacturing is also studied in detail. Process modeling, simulation, direct control, computer networking, database systems, linking application programs, facility monitoring, expert systems applications for diagnosis and training and robotics are all introduced and supported by laboratory experiences in the integrated circuit factory at RIT.

ME schedule		Credits
FALL		
0305-701	Microelectronics I	4
0305-721	Microlithography I	4
Transition		4
Transition		4
WINTER		
0305-702	Microelectronics II	4
0305-722	Microlithography II	4
0305-731	Microelectronics Manufacturing I	4
Elective		4
SPRING		
0305-703	Microelectronics III	4
0305-732	Microelectronics Manufacturing II	4
Elective		4
SUMMER		
Internship		8

The MS program

The objective of the master of science program is to provide an opportunity for students to perform a master's level research project as they prepare for entry into the semiconductor industry or a Ph.D. program. The program requires strong preparation in the area of microelectronics, takes two years to complete and requires a thesis.

The prerequisites include a BS in engineering (such as electrical or microelectronics engineering), including one year of study of device physics, 1½ years of study of semiconductor fabrication technology, including lecture and laboratory, one course in microlithography and one course in VLSI:SI design. Students from RIT's BS in microelectronics engineering will meet these prerequisites. Students with a BS in electrical engineering may already have the VLSI Design course, the device physics and the semiconductor fabrication technology. Students who do not have all of the prerequisites can take those courses at RIT and still complete the master of science program in two years. The prerequisite courses will be completed during the first few quarters



Manufacturing facilities in microelectronics manufacturing engineering include a diffusion furnace.

at RIT and will not count toward the 36 credits worth of graduate courses required for the MS degree.

The program consists of eight master's level (700 or higher) courses, including five from microelectronics engineering (0305). A variable-credit (1 or 0 credits) seminar/research course will be taken by all graduate students in this program each quarter that they are at RIT. Up to 4 credits will be allowed to count toward the required 36 hours. A nine-credit thesis will be required of all students in this program. The total number of credits needed for the master of science in microelectronics manufacturing engineering is 45.

Sample MS schedule		Credits
(For those who are not *graduates of RIT's microelectronics engineering program)*		
FALL		
0305-701	Transition IC Technology	4
0305-721	Transition Microlithography	4
0305-560	Transition Device Physics	4
0305-801	Seminar/Research	1
WINTER		
0305-702	Transition IC Technology	4
0305-731	Microelectronics Manufacturing	4
0305-722	Microlithography II	4
0305-801	Seminar/Research	1
SPRING		
0305-703	Transition IC Technology	4
0305-732	Microelectronics Manufacturing	4
0305-801	Seminar/Research	1
0305-899	Thesis	3
SUMMER		
Research		
FALL		
0301-723	Semiconductors	4
0305-XXX	Elective	4
0305-801	Seminar/Research	1
	Full-time Equivalency	3
WINTER		
0301-724	Semiconductor Devices I	4
0305-801	Seminar/Research	1
0305-899	Thesis	3
0305-XXX	Elective	4
SPRING		
0301-725	Semiconductor Devices II	4
0305-801	Seminar/Research	1
0305-899	Thesis	3
	Full-time Equivalency	4

Sample MS schedule		Credits
(For RIT microelectronics engineering graduates)		
FALL		
Research		
WINTER		
0305-731	Microelectronics Manufacturing	4
0305-722	Microlithography II	4
0305-801	Seminar/Research	1
	Full-time Equivalency	3
SPRING		
0305-732	Microelectronics Manufacturing	4
0305-XXX	Elective	4
0305-801	Seminar/Research	1
0305-899	Thesis	3
SUMMER		
Research		
FALL		
0301-723	Semiconductors	4
0305-XXX	Elective	4
0305-801	Seminar/Research	1
	Full-time Equivalency	3
WINTER		
0301-724	Semiconductor Devices I	4
0305-801	Seminar/Research	1
0305-899	Thesis	3
	Full-time Equivalency	4
SPRING		
0301-725	Semiconductor Devices II	4
0305-801	Seminar/Research	1
0305-899	Thesis	3
	Full-time Equivalency	4

Assistantships and fellowships

Some assistantships and fellowships may be available for full-time students. Appointment as a teaching assistant carries a 12-hour-per-week commitment to a teaching function and permits a student to take graduate work at the rate of 12 credits per quarter. Appointment as a research assistant also permits taking 12 credits per quarter while the remaining time is devoted to the research effort. Appointments provide full or partial tuition and stipend. Applicants for financial aid should write directly to the department head for details.

Applied and Mathematical Statistics Department

Donald D. Baker, *Director*
The John D. Hromi Center for Quality and Applied Statistics

Statistics today is sometimes 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 science degree in applied and mathematical statistics is offered by the College of Engineering through the Center for Quality and Applied Statistics. Several options, including thesis and non-thesis options, are available.

The faculty and staff of the Center for Quality and Applied Statistics is a distinguished group that includes two members who are fellows of both the American Statistical Association and the American Society for Quality Control. A third member of the faculty is a fellow of the American Society for Quality Control. The center's faculty includes a past president of the American Society for Quality Control as well as the only person ever to win the prestigious ASQC Shewhart Medal and its 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.

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 intelligently.

BS/MS programs

The Center for Quality and Applied Statistics has agreements with the departments of mathematics and industrial and manufacturing engineering to combine the requirements for the respective degrees and allow students to receive combined BS and MS degrees in less time and fewer courses than would be needed if both programs were pursued separately. Entry into these programs is through the undergraduate departments.

Advanced certificate in statistical quality

An 18-credit advanced certificate program, consisting of a subset of six courses from the MS program, is available. The course topics cover the statistical techniques used for on-line and off-line quality control in industry. These courses are available in a distance learning format.

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 including one academic year of calculus. Applicants who fail to meet the latter requirement may, at the discretion of the department, be required to complete two or three undergraduate mathematics courses before being able to matriculate in the regular graduate program. Admission to

the certificate program requires a baccalaureate degree without the calculus requirement.

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 ensure 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.

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.

Cooperative education program

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 in an industrial concern. This pattern can be repeated until the student completes the MS degree.

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

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 Library and Media Resource Center, which 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.

No entrance exam required

Courses are offered on an open enrollment basis that is supportive of the RIT commitment to recurrent education. There are no entrance exams.

Requirements

For the advanced certificate in statistical quality the satisfactory completion of the following courses is required.

THREE BASIC COURSES:

(These may be waived by the department upon evidence of equivalent learning, experience or competency)

0307-711 and 712 — Fundamentals of Statistics I & II
Data Analysis Using Computer Software, a two-day, noncredit course in statistical computing

SIX CORE COURSES:

0307-721 and 731 — Statistical Quality Control I & II
0307-781 — Quality Management
0307-782 — Quality Engineering
0307-801 and 802 — Design of Experiments I & II

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

TWO FUNDAMENTALS COURSES:

(These may be waived by the department upon evidence of equivalent learning, experience or competency.)

0307-711 and 712 — Fundamentals of Statistics I & II

FIVE CORE COURSES:

0307-801 and 802 — Design of Experiments I & II
0307-821 and 822 — Theory of Statistics I & II
0307-841 — Regression Analysis I

Four standard career options:

A special 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 four specialized career options are:

QUALITY CONTROL IN INDUSTRY

0307-721 — Statistical Quality Control I
0307-731 — Statistical Quality Control II
0307-781 — Quality Management
0307-782 — Quality Engineering

INDUSTRIAL STATISTICS

0307-856 — Interpretation of Data
0307-862 — Reliability Statistics I
0307-875 — Empirical Modeling
0307-883 — Quality Engineering by Design

STATISTICAL THEORY AND METHODS

0307-824 — Probability Models
0307-830 — Multivariate Analysis I
0307-831 — Multivariate Analysis II
0307-842 — Regression Analysis II

RELIABILITY

0307-762 — Reliability Management
0307-824 — Probability Models
0307-862 — Reliability Statistics I
0307-863 — Reliability Statistics II

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

Selected Graduate Theses and Internship Paper Topics

"Biomechanics of Corneal Wound Healing"

"Vibration Analysis of a Thin Moving Web and Its Finite Element Implementation"

"Robotized Welding Cells Planning and Implementation Model"

"Investigation of Cell Mapping and Off-Line Programming with a Flexible Assembly System"

"Practical Application of Modal Analysis Techniques"

"Transition through Resonance in Linear and Nonlinear Systems"

"Simulation of a Morphological Image Progressor Using VHDL. Part I: Mathematical Components. Part II: Control Mechanism"

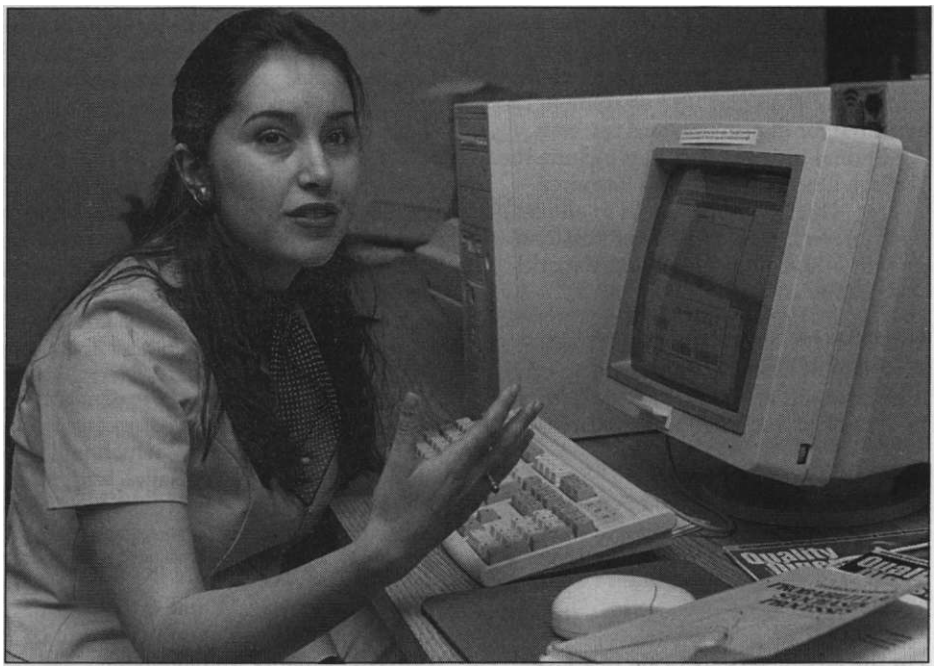
"The Design and Implementation of an 8-bit CMOS Microprocessor"

"An Al-Based Generative Cost Estimation System for Rotational Parts"

"A Field Emission Transistor Array for Writing Applications"

"Process Development of an Analog/Digital Mixed-Mode BiCMOS Process at RIT"

"Fabrication of Thin Film Transistors in As-Deposited and Si-Implanted Polysilicon"



Dina Hessissert lives in exotic Casablanca but spends her days grappling with very practical issues at the textile plant where she is the quality manager. So she searched the world for answers and found them at RIT's Center for Quality and Applied Statistics. "What I wanted to do at my company was just what they were doing here," said the Fulbright winner. "I didn't know how to apply the theories until I came here. Now I am eager to go home and implement total quality management, statistical process control and experimental design."

achieve individual professional objectives. This should be done before the end of the student's first quarter of study after matriculation.

SIX ELECTIVES:

These are 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 three quarter credits, comes to 45 or 51 credits depending on whether the fundamentals 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.

Levels of courses

There are 700- and 800-level 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. A minimum of 24 credits in the 800 series is required in the MS degree program.

Faculty adviser

A member of the graduate faculty is appointed as a faculty adviser for each graduate student. This adviser supervises the progress of the student toward the master's degree. Nonmatriculated students should direct their questions to the department head.

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
60 Lomb Memorial Drive
Rochester, NY 14623-5604

Transfer and interdisciplinary credits

Credit for courses of graduate stature in statistics, mathematics, computer programming, operations research and other quantitative fields related to statistics may be accepted toward fulfillment of degree requirements at the discretion of the department with due regard to the candidate's objectives. A maximum of nine graduate credits can be accepted toward the MS degree, and three may be accepted toward the certificate. Transfer credits for the certificate must be from a course covering the same subject as the course being waived. To ensure credit toward the degree, the candidate should write the department indicating courses for which he or she would like transfer credit 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 adviser or the department at various times during the advisement process, it is essential that all agreements be documented in writing. A letter to the department will ensure proper recognition of outside work accomplished toward the degree.

Nonmatriculated 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 nonmatriculated student. Those who are not matriculated may be admitted to courses in fields of their special interest by consent of the department.

Grades, exams and theses

The certificate candidate must attain for graduation an overall average grade of 3.0 (B). The MS candidate must attain for graduation an overall average grade of 3.0 (B), with no more than three grades of C or lower. Successful completion of each 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 and to use the computer as ways to improve their knowledge. Master's degree core courses are expected to be completed within the first 30 hours of a student's program. A written examination is required upon completion of those courses. During the last quarter of the program, an oral examination is required to demonstrate subject matter and verbal proficiency as well as the ability to perform as a statistician in a working environment.

Plans of study

Students may, with the permission of the department, 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 prior to registration. A letter outlining the project and requesting this approval must be addressed to the department 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. The registration number used for thesis work is 0307-896.

Faculty

Seven full-time and 20 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. 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 Engineering

Paul E. Petersen, BS, MS, Ph.D., Michigan State—Dean; Professor
N. Richard Reeve, BS, MS, Ph.D., SUNY Buffalo—Associate Dean; Professor

Computer Engineering Department

Roy Czemikowski, BEE, ME, Ph.D., Rensselaer Polytechnic Institute—Professor and Department Head, Real-Time Computation, Computer Architecture and Distributed Systems
Tony Chang, BS, Jiao Tong University, Shanghai; Ph.D., Chinese Academy of Science, Beijing—Professor, System Design Methodology, Communication and Computation

Kenneth Hsu, BS, National Taiwan Normal University; MS, Ph.D., Marquette University—Professor, VLSI Design, Microcomputers and Control Systems
Pratapa Reddy, BE.M. Tech., Osmania University, India; Ph.D., Indian Institute of Technology, Madras—Professor, Digital Systems

Muhammed E. Shaaban, BS, MS, University of Petroleum and Minerals, Saudi Arabia; Ph.D., University of Southern California—Assistant Professor, Computer Architecture, Parallel Computation

Electrical Engineering Department

Raman M. Unnikrishnan, BS, MSEE, Ph.D., University of Missouri—Professor and Department Head, Control Systems
Edward C. Chung, BS, MS, Ph.D., Ohio University—Assistant Professor, Digital Systems, Microprocessors, Multimedia Computer Networks, Artificial Intelligence
Soheil A. Dianat, BS, Aria-Mehr University, Iran; MS, Ph.D., George Washington University—Professor, Control Systems, Signal Processing

Lynn F. Fuller, BS, MS, Ph.D., SUNY Buffalo-Professor, Microelectronic Engineering
Roger Heintz, BS, Michigan Technological University; MS, Ph.D., Syracuse University—Professor, Electronics, Electromagnetics, Laser Integrated Optics

Mark Hopkins, BS, Southern Illinois University; MS, Ph.D., Virginia Polytechnic Institute—Associate Professor, Control Systems
Guifang Li, BS, Tianjin University; MS, Ph.D., University of Wisconsin—Associate Professor, Gleason Professor in Photonics, Devices and Systems, Optical Communications
Swaminathan Madhu, MA, University of Madras; MS, University of Tennessee; Ph.D., University of Washington—Professor, Signal Processing

Athimoottil V. **Mathew,** BEE, Jadavpur University, India; M. Tech., Indian Institute of Technology; Ph.D., Queen's University (Ontario)—Professor, Control Systems, Robotic Vision
Norman Miller, BSEE, London University—Assistant Professor, Circuits and Electronics
Ponnathpur R. Mukund, BS, MS, Ph.D., University of Tennessee—Associate Professor, VLSI Design, Electronic Devices and Circuit Design

James E. Palmer, BS, University of Western Ontario; MS, University of Pennsylvania; Ph.D., Case Institute of Technology—Professor, Control Systems, Digital Design
David Perlman, BS, MS, Cornell University—Professor, Electronics
Paul E. Petersen, BS, MS, Ph.D., Michigan State University—Professor, Semiconductor Devices

Mysore Raghuveer, BS, Mysore University, India; ME, Indian Institute of Science, Bangalore, India; Ph.D., University of Connecticut—Associate Professor, Image and Signal Processing
Sannasi Ramanan, BS, BE, M.Tech., Ph.D., Indian Institute of Technology—Associate Professor, Semiconductor Devices
V. C. V. **Pratapa Reddy,** BE, M.Tech., Osmania University, India; Ph.D., Indian Institute of Technology, Madras—Professor, Digital Systems and Microprocessors
David Sumberg, BA, Utica College of Syracuse University; MS, Ph.D., Michigan State University—Associate Professor, Optics
Albert H. Titus, BS, MS, SUNY Buffalo; Ph.D., Georgia Institute of Technology—Assistant Professor, Analog VLSI Design, Electronics

Fung-I Tseng, BS, Taiwan University; MS, Chiao-Tung University; Ph.D., Syracuse University—Professor, Electromagnetics, Optics
Renan Turkman, Diplome d'lngenieur (MS); Docteur-Ingenieur (Ph.D.), Institut Nationale des Sciences Appliques, Toulouse, France—Professor, Integrated Circuits, Semiconductor Devices and Processing
Jayanti Venkataraman, BS, MS, Bangalore University; Ph.D., Indian Institute of Science, Bangalore, India—Professor, Electromagnetics

Adjunct Faculty in Electrical Engineering

James Moon, Ph.D., University of California, Berkeley—Electronic Devices

Industrial & Manufacturing Engineering Department

Jasper E. Shealy, BS, MS, Ph.D., SUNY Buffalo—Professor and Department Head, Human Factors

Jacqueline Reynolds Mozrall, BS, Rochester Institute of Technology; MS, North Carolina State; Ph.D., SUNY Buffalo—Assistant Professor, Industrial Engineering, Human Factors
Madhu Nair, BS, Rochester Institute of Technology; MS, Lehigh University—Instructor, Computer-Aided Manufacturing
Nabil Z. Nasr, BS, Helwan University, **Egypt;** MS, Rutgers University; M.Eng., Pennsylvania State University; Ph.D., Rutgers University—Associate Professor, Brinkman Professor of Screw Machine Technology, Robotics, NC Programming, Manufacturing
Sudhakar R. Paidy, BS, Osmania University, India; MS, Ph.D., Kansas State University—Professor, Statistics, CIM, Reliability, and Operations Research
N. Richard Reeve, BS, MS, Ph.D., SUNY Buffalo—Professor, Applied Operations Research

Paul H. Stiebitz, BS, ME, Rochester Institute of Technology—Assistant Professor, Simulation and Operations Research
Brian K. Thorn, BS, Rochester Institute of Technology; MS, Ph.D., Georgia Institute of Technology—Associate Professor, Applied Statistics, Behavior Science
Kathryn Woodcock, BS, MASc., Ph.D., University of Waterloo, Canada—Visiting Assistant Professor, Ergonomics, Human Factors, Safety, Organizational Behavior

Mechanical Engineering Department

Charles W. Haines, AB, MS, Ph.D., Rensselaer Polytechnic Institute—Professor and Department Head, Applied Mathematics
Richard G. **Budynas,** BME, Union College; MS, University of Rochester; Ph.D., P.E., University of Massachusetts—Professor and Associate Department Head, Applied Mechanics, Vibrations

Family fun can include a visit to RIT's ice rink for skating, cheering on the Tigers hockey team or shaking hands with a friendly mascot.

Taking a break. . .

Robert A. Ellson, BME, City College of New York; MS, Ph.D., P.E., University of Rochester—Professor, Fluid Mechanics, Thermodynamics
Jon E. Freckleton, BS, University of Rochester; MS, P.E., Nazareth College—Associate Professor, Manufacturing
Hany A. Ghoneim, BS, MS, Cairo University, Egypt; Ph.D., Rutgers University—Associate Professor, Finite Elements, Vibrations
Amitabha Ghosh, B.Tech., M.Tech., Indian Institute of Technology, India; Ph.D., Mississippi State University—Associate Professor, Computational Fluid Dynamics, Aerodynamics
Surendra K. Gupta, B.Tech., Indian Institute of Technology, India; MS, University of Notre Dame; Ph.D., University of Rochester—Professor, Materials Science, Computer Software, Image Processing
Michael P. Hennessey, BS, University of Minnesota; MS, Massachusetts Institute of Technology; Ph.D., University of Minnesota—Assistant Professor, Dynamics, Robotics, Control of Mechanical Systems
Richard B. Hetnarski, MS, Gdansk Technical University; MS, Warsaw University; Dr. Tech. Sci., P.E., Polish Academy of Sciences—Gleason Professor, Thermoelasticity, Applied Mechanics
Satish G. Kandlikar, BE, Marathwada University, India; M.Tech., Ph.D., Indian Institute of Technology—Professor, Thermal Systems and Energy
Bhalchandra V. **Karlekar,** BE, MS, University of Baroda, India; MS, Ph.D., P.E., University of Illinois—Professor, Heat Transfer, Energy
Mark Kempski, BS, Purdue University; MS, Ph.D., SUNY Buffalo—Professor, Biomechanics
Kevin Kochersberger, BS, MS, Ph.D., Virginia Polytechnic Institute and State University—Visiting Assistant Professor, Signal Processing, Structural Dynamics, Design
Chris Nilsen, BS, Rochester Institute of Technology; MS, Worcester Polytechnic Institute; Ph.D., P.E., Michigan State-Professor, Metallurgy and Materials Science
Alan H. Nye, BS, MS, Clarkson College; Ph.D., University of Rochester—Professor, Solar Physics, Lasers
Ali Ogut, B.Ch.E., Hacettepe University, Turkey; MS, Ph.D., University of Maryland—Associate Professor, Fluid Mixing, Thermal Fluid Sciences
Marietta R. Scanlon, BS, Tufts University; MS, Massachusetts Institute of Technology; Ph.D., Johns Hopkins University—Assistant Professor, Materials Science, Mechanical Properties, Thin Films
Frank Sciremammano Jr., BS, MS, Ph.D., University of Rochester—Associate Professor, Geophysical Fluid Dynamics and Environmental Engineering
Robert L. Snyder, BS, Rochester Institute of Technology; Ph.D., P.E., Iowa State—Professor, Materials Science, Chemistry
Dave Tomer, BS, ME, Pennsylvania State University—**Sr.** Lecturer, Materials Processing, Mechanics
Josef S. Torok, BS, University of Akron; MS, Ph.D., Ohio State University—Associate Professor, Theoretical and Applied Mechanics, Applied Mathematics, Dynamic Systems
P. Venkataraman, B.Tech., Indian Institute of Technology; MS, Ph.D., Rice University—Assistant Professor, Optimal Control, Fluid Mechanics, Optimal Design
Wayne W. Walter, BE, State University of New York Maritime College; MS, Clarkson College; Ph.D., P.E., Rensselaer Polytechnic Institute—Professor, Applied Mechanics, Robotics, Vibrations

Microelectronic Engineering Department

Lynn F. Fuller, BS, MS, Ph.D., SUNY Buffalo—Motorola Professor and Department Head, Analog I.C. Design, Semiconductor Manufacturing, Process Integration
Karl Hirschman, BS, MSEE, Rochester Institute of Technology—Visiting Assistant Professor, Semiconductor Manufacturing, Process Integration
Michael A. Jackson, BS, MS, Ph.D., SUNY Buffalo—Associate Professor, Surface Analysis, Integrated Circuit Metrology, Solid State Devices, Materials
Santosh Kurinec, BS, MS, Ph.D., University of Delhi, India—Professor, Materials, Solid State Devices, Sensors
Richard L. Lane, BS, Ph.D., SUNY Alfred-Professor, Materials, Chemical Vapor Deposition, Plasma Processing, Crystal Growth
Robert E. Pearson, BS, MS, Rochester Institute of Technology; Ph.D., SUNY Buffalo—Associate Professor, Digital I.C. Design, Process Modeling and Simulation, Testing, Semiconductor Manufacturing, Process Integration
Bruce W. Smith, BS, MS, Ph.D., Rochester Institute of Technology—Associate Professor, Microlithography
Renan Turkman, Diplome d'Ingenieur (MS); Docteur-Ingenieur (Ph.D.), Institut Nationale des Sciences Appliques, Toulouse, France—Professor, Process Modeling and Simulation, Solid State Devices, Power Semiconductor Devices, Process Integration

Center for Quality and Applied Statistics

Donald D. Baker, BA, Trinity College; M.Ed., MBA, Ph.D., University of Rochester—Professor, Director, Quality Standards, Problem Solving, Reengineering, Auditing Quality Systems
Anne M. Barker, BA, Nazareth College; MS, Rochester Institute of Technology—Assistant Professor, Statistics, Taguchi Methods, Design of Experiments, Statistical Process Control, Regression Analysis
Thomas B. Barker, BS, MS, Rochester Institute of Technology—Associate Professor, Design of Experiments, Taguchi, Regression Analysis, Management of Experiments
John T. Burr, Ph.D., Purdue University—Assistant Professor, Quality Engineering Technologies, Quality Management, IS09000/QS9000 Standards and Auditing
John D. Hromi, BS, Carnegie-Mellon University; BEE, Clemson University; M. Litt., University of Pittsburgh; D. Engr., University of Detroit—Professor Emeritus, Statistical Quality Control, Quality Engineering, Quality Management, Human Resource Development
Daniel R. Lawrence, BA, BS, University of Akron; MA, Ball State University; MS, Rochester Institute of Technology; Ph.D., University of Toronto—Assistant Professor, Dual/Optimal Scaling, Analysis of Categorical (survey) Data, Statistical Theory
Edward G. **Schilling,** BA, MBA, MS, Ph.D., Rutgers University—Statistical Process Control, Acceptance Sampling, Troubleshooting and Interpretation of Data
Joseph G. **Voelkel,** BS, Rensselaer Polytechnic Institute; MS, Northwestern University; Ph.D., University of Wisconsin-Madison—Associate Professor, Statistics, Quality Control, Statistical Process Control, Design of Experiments, Regression, Statistical Reliability, Nonparametrics
Hubert D. Wood, BS, George Washington University; MS, University of Rochester—Assistant Professor, Quality Control, Multivariate Analysis, Time Series, Surveys

Note: Prerequisites are within parentheses at the end of the course description.

Electrical Engineering

0301-711 Physics of Bipolar Devices
An advanced-level course in electronic transport in semiconductors and the operation of bipolar devices (pn junction diodes, bipolar junction transistors and semiconductor-controlled rectifiers). Topics include electron drift, diffusion and carrier lattice interactions, energy band diagrams in nonuniformly doped semiconductors, continuity equations, impact ionization, tunneling, advanced static and dynamic analysis of diodes and bipolar transistors, design of bipolar devices. Credit 4 (F)

0301-712 Physics & Scaling of CMOS Devices
An advanced-level course on MOSFET's and submicron CMOS devices. Topics include MOS capacitators, gated diodes, long channel MOSFET, subthreshold conduction and offstate leakage, short channel effects, ion-implanted channels, buried-channel PMOS, CMOS scaling and structural design of submicron CMOS, advanced well technologies and latch-up immunity, CCDs and memory devices (EPROMs, EEPROMs including Flash EEPROMs, SRAMs, DRAMs). **Credit 4 (W)**

0301-713 Solid State Physics
An intermediate-level course on the physical properties of semiconductors for engineering students. The emphasis is on semiconductor materials and fundamental solid state physics. Topics include electronic structure of atoms, crystal structures, direct and reciprocal lattices, Bragg diffraction, Bloch electrons, energy band theory, effective mass theory, energy-momentum relations in direct and indirect band gap semiconductors, intrinsic and extrinsic semiconductors, statistical physics applied to carriers in semiconductors, density of states, and lattice vibrations. **Credit 4 (S)**

0301-715 Machine Vision
The course introduces both high- and low-level digital image processing techniques with emphasis on applications. The major topics are binary images (orientation and center calculations, projections, run-length coding, morphological filters, optimal binary filters), gray-level images (enhancement, nonlinear filters, segmentation, object identification, discriminators), time varying images, motion analysis, 3-D information. Credit **4 (F)**

0301-726 Analog IC Design
A course in the analysis and design of bipolar analog integrated circuits. Topics include device models, amplifiers, current sources and active loads, output stages, operational amplifiers, precision reference design and analog circuit design in bipolar LSI. Course will involve circuit design and computer simulation projects. Credit 4

0301-727 VLSI Design
A course in the design of very large scale integrated circuits at the level of Mead and Conway's VLSI Design. Topics include MOS devices and circuits, n-channel MOS process, data and control flow in systematic structures, implementing integrated system design, system timing and examples of LSI computer systems. (0301-724,670 and a course in computer architecture) Credit 4

0301-730 Advanced Analog IC Design
An advanced course in analog integrated circuit design. Students will study bipolar and MOS realization of operational amplifiers, analog multipliers, A to D and D to A convertors, switched capacitor filters and more. The students will participate in design projects including circuit design, layout and SPICE simulation. (0301-726) Credit 4

0301-731 Design of High Performance Digital Systems
This course deals with the practical aspects of modern packaging techniques for assembly of electronic systems and the effects of these techniques on electronic and thermal performance characteristics. The stress is on system and subsystem packaging rather than on component packaging and includes both surface-mount and through-hole printed circuit boards as well as multichip modules. Design for assembly, design for test, design for reliability, and embedded microprocessor systems are all considered. Along with the usual examinations, a paper or project will be required. Will include presentations by experienced industrial professionals. A project similar to a term paper will be required along with an oral and a written presentation of the project results. Projects are supported by Sun workstations and commercial CADENCE software. (0301-650 or equivalent) **Credit 4**

0301-732 Digital Systems Design with VHDL
This course deals with the practical aspects of digital system design using the IEEE-standard VHSIC Hardware Description Language (VHDL) and a modem commercial development system. The course begins with a brief summary of the syntax of VHDL followed by several examples of hardware modeling. Simulation of VHDL models with test benches is discussed, and the applications of VHDL to top-down design methodology are presented. Two projects will be required. The first is primarily to attune the student to the VHDL development system, while the second is a real subsystem designed and implemented on programmable devices. The course will be supported by the Altera-VHDL software and hardware and/or by the Xilinx-VHDL hardware and software. (0301-650 or equivalent) **Credit 4**

0301-741 Design for Testability
This course deals with the design systems for testability and for maintainability. A survey of criteria for testability is given. A discussion of fault simulation and test pattern generation is included. Random test pattern generators and associated data compression schemes such as signature analysis are also described. Scanning techniques (both scan path and boundary scan) are discussed. The trade-offs between built-in testing capacity and additional silicon structures are weighed. A small project, usually involving simulation, will be required. (0301-650) **Credit 4**

0301-742 Advanced Microprocessor Software Design
An introduction to the theory and application of top-down design, structure, abstraction, segmentation, high-level languages, and operating systems to real-time programs for microprocessors. Students will become proficient in a structured high-level language. Topics include structure diagrams, separate module compilation, data types, data structures, self-documenting code, procedures, meaningful variable names, linkage with other languages, object code libraries, operating system calls, multi-tasking concurrent and re-entrant programs, and symbolic debugging. (0301-365 or a high-level programming language) Credit **4**

0301-749 Speech & Image Compression
Modem compression techniques used in efficient digital transmission and storage of speech and image waveforms are dealt with. Topics include digital communication channels, sampling and reconstruction of one-dimensional and two-dimensional signals, coding concepts, bit rate, coder complexity, rate distortion and information-theoretic bounds, characteristics of speech and image waveforms, quantization techniques, uniform nonuniform, logarithmic, optimum (Max), entropy coding, adaptive, pulse code modulation (PCM) of audio and video waveforms, DPCM, ADPCM, and delta modulation, linear prediction, transform coding, optimum (Karhunen-Loeve) transform and its gain, sub-optimum transforms, DFT, DCT, DST, DHT, and DWHT, special coding schemes, run-length coding, block truncation coding, sub-band coding, vector quantization, comparative performance of various schemes. Computer assignments and demonstrations are involved. **Credit 4**

0301-754 Analytical Techniques I
Required of all graduate students, this course provides an understanding of complex variables and transform calculus. Topics include theory of complex variables; transformations; analyticity; singularities; complex integration; Cauchy's and residue theorems; series expansions. Taylor and Laurent series; conformal mapping; advanced topics in continuous-time Fourier series and transforms; Laplace transforms (existance, inversion integral, branch points, and applications), Z-transform (ROC, inversion integral, properties and applications to discrete-time systems), Fourier analysis of discrete-time signals (discrete Fourier transform (DFT), fast Fourier transform (FFT) and applications of the FFT algorithm. **Credit 4**

0301-755 Analytical Techniques II
This course is required of all graduate students. It deals with the elements of linear algebra and states variables as applied to continuous and discrete-time systems. Topics include linear vector spaces, matrices, matrix transformations, Cayley-Hamilton theorem, state variables, canonical realizations of state equations, state transition matrix, solution of state equations, stability analysis and applications. Credit **4 (W)**

RIT engineering students have successfully competed in prestigious Society of Automotive Engineers-sponsored racing events, including the Formula SAE and the GM Sunrayce USA road race.

0301-756 Analytical Techniques III
In this course the student is introduced to random variables and stochastic processes. Topics covered are probability theory, conditional probability and Bayes' theorem, discrete and continuous random variables, distribution and density functions, moments and characteristic functions, functions of one and several random variables, Gaussian random variables and the central limit theorem, estimation of a random variable, random processes, stationarity and ergodicity, autocorrelation, cross-correlation and power spectrum density, response of linear systems to stochastic inputs, introduction to linear prediction, Wiener filtering, elements of detection, matched filters. (Graduate standing) **Credit 4**

0301-761 Modern Control Theory
An advanced course in control theory, topics covered include review of state-space formulation of SISO systems, solution of state equations, STM and its properties, application of state-space concepts, state variable design, multivariage systems, preliminaries, systems of lease order, stability and control. (0301-754, 755,513) Credit 4

0301-762 Nonlinear Control Systems
This course is an introduction to the physical nature and mathematical theory of nonlinear control systems' behavior using phase plane techniques. Liapunov theory (including Aizerman's method, variable gradient methods and the Lure forms), perturbation methods, describing function techniques, and Papov's criterion and analysis of switching and relays are discussed. These are applied to both piecewise-linear and analytical nonlinear systems. (0301-761) Credit 4

0301-763 Stochastic Estimation & Control
This course is concerned with the control of systems in the presence of uncertainties. Topics to be discussed: modeling of stochastic processes, estimation theory, least squares estimation, maximum-likelihood estimation, MAP estimation, optimum filtering and prediction, optimum smoothing and interpolation, the Wiener-Hopf equation, solution to casual and non-casual cases, state estimation, Kalman filtering, discrete and continuous time filters, Riccati equation, optimum feedback control in presence of noise, LQC problem and applications. (0301-756,761) Credit 4

0301-764 Digital Control Systems
An introduction to the analysis and design of control systems in which the microcontroller plays a principal role. Topics include sampled data systems, Z and W-place analysis and design, algorithm generation and the effect of computer word length on noise and stability. The student will be expected to make use of the digital computer in the implementation of design procedures. (0301-755) **Credit 4**

0301-765 Optimal Control
An introduction to the calculus of variations. Topics covered include conditions of optimality; optimizing transient performance by statistical and variational procedures, dynamic programming and Pontryagin's maximum principle; and the design of optimal linear systems with quadratic criteria. (0301-761) **Credit 4**

0301-767 Power Semiconductor Circuits
The objective of this course is to provide an adequate application-oriented knowledge to those interested in the areas of control, power and power electronics. Topics to be discussed: preliminaries, basic principles of static switching thyristor theory, triggering, commutations; rectifiers; principles of controlled rectification, analysis of single- and three-phase controlled rectifiers; inverters; series and parallel SCR inverters, design of inverters, sine wave filters; forced commutation inverter, McMurray inverter, DC systems, principles of AC-DC conversion, choppers, DC motor drives, dual converter; cyclo-converter, controls. Modeling and simulation of thyristor circuits; thyristor models approximations, digital simulation of choppers, inverters and cyclo-converters, areas of further research. Demonstration experiments will be set up. Also, individual projects by interested students will be encouraged. Credit **4.**

0301-768 Adaptive Signal Process
An introduction to the fundamental concepts of adaptive systems; open and closed loop adaptive systems; adaptive linear combiner; performance function and minimization; decorrelation of error and input signal. Adaptation algorithms such as steepest descent, LMS and LMS/Newton algorithm. Noise and misadjustments. Applications will include system identification, deconvolution and equalization, adaptive arrays and multipath communication channels. (0301-756 or permission of instructor) **Credit 4**

0301-770 Pattern Recognition
This course introduces the mathematical techniques applied to the recognition of patterns in signals. It deals with classical techniques as well as treating the more recent strategies of neural networks. Although the techniques are described in a general way, the course eventually applies these methods to the recognition of patterns in images. Topics include Bayes' decision theory, parametric and non-parametric techniques, the use of linear discriminant functions and the use of neural networks in pattern recognition. Methods of feature selection also will be discussed. Applications to images will include image preprocessing for edge detection and edge following algorithms. Applications will also deal with the use of Fourier, Cosine and Moment image descriptors. **Class** 4, **Credit** 4

0301-772, 773, 774 Special Topics in Electrical Engineering
Topics and subject areas that are not among the courses listed are frequently offered under the title of Special Topics. Such courses are offered in a normal format, that is, regularly scheduled class sessions with an instructor. **Credit 4 (No regular course schedule)**

0301-775 Optical Engineering I
An introduction to the properties of optical components and their combination into systems, primarily from a geometrical optics point of view. The course develops paraxial matrix method with application to zoom lens design and extends the matrix method to meridional rays and skew rays and develops FORTRAN programs for the reduction of spherical aberration, coma, astigmatism and curvature of field. It also covers aspherical surfaces, Schmidt system, photometry and the design of projection and achromatic systems. Credit 4

0301-776 Electro-optics
This course deals with the principles of the laser and its operation. It covers ray tracing in an optical system, Gaussian beams, optical resonators, interaction of radiation and atomic systems, theory of laser oscillation, Q-switching and mode-locking. It also covers some specific laser systems and electro-optic modulation of laser beams. (0301472 or equivalent) Credit 4

0301-778 Fiber Optics
This course introduces the basic concepts of wave propagation in fibers. It reviews basic waveguide equations and applies the theory to dielectric slab waveguide, step-index and graded-index fibers. It covers the techniques of source coupling and splicing and discusses optical sources such as semiconductor lasers and LED. Applications to communication systems also will be discussed. (0301-472 or equivalent) Credit 4

0301-779 Digital Image Processing
This is an introductory course in digital image processing which begins with a study of two-dimensional signal processing and transform methods with applications to images. Image sampling is discussed followed by gray-level description of images and methods of contrast manipulation including linear/nonlinear transformation and histogram equalization and specification. Image smoothing methods are considered including spatial and frequency domain low-pass filtering, AD-HOC methods of noise removal and median filtering. Following this, methods of image sharpening are studied including derivative methods and high-pass filtering. Edge and line detection methods are discussed using masks and hough transforms, methods of image segmentation and degradation and image restoration, including deblurring. Several extensive computer and DSP lab assignments are required. (0301-755, 554 or permission of instructor) Credit 4

0301-780 Independent Study
This course number should be used by students who plan to study a topic on an independent study basis. The student must obtain the permission of the appropriate faculty member before registering for the course. Credit 4

0301-788 Advanced Topics in Digital Signal Processing
This course covers signal processing techniques that are widely used but not covered in fundamental signal processing courses. Topics include review of random processes, spectral estimation, periodgram, Blackman-Tudey spectral estimation, rational transfer function models, AR, MA and ARMA spectral estimators, maximum likelihood spectral estimation, two-dimensional spectral estimation, multirate DSP, sampling and signal reconstruction, decimators and interpolators and quadrature mirror filters (QMF), homomorphic signal processing, multiplicative homomorphic systems for convolution, homomorphic image processing and complex cepstrum, effects of finite register length in DSP, effect of number representation on quantization, quantization in sampling analog signals, finite-register-length effects in realizations of FIR and IIR filters, introduction to higher order spectra. (0301-756) Credit 4

0301-790 Random Signals & Noise
Topics covered in this course include functions of two random variables, mean square estimation, orthogonality principles, 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. (0301-755,756) Credit **4**

0301-793 Error Detecting & Error Correction
This course covers linear block codes and convolutional codes. The major linear block codes to be covered are Hamming, BCH, Golay and Reed-Solomon codes. The fundamental structure of linear block codes will be developed and applied to performance calculations. The structure of cyclic codes will be developed and applied to encoders and decoders. The major error correction methods, including error trapping, majority logic decoding and the BCH algorithm will be developed and the Biterbi and sequential decoding algorithms will be studied. Questions of system performance, speed and complexity will be examined. (0301-756) Credit **4**

0301-794 Information Theory
This course introduces the student to the fundamental concepts and results of information theory. This is a very important course for students who want to specialize in signal processing, image processing, or digital communication. Topics include definition of information, mutual information, average information or entropy, entropy as a measure of average uncertainty, information sources and source coding, Huffman codes, run-length constraints, discrete memoryless channels, channel coding theorem, channel capacity and Shannon's theorem, noisy channels, continuous sources and channels, coding in the presence of noise, performance bounds for data transmission, rate distortion theory. (0301-756) Credit **4**

0301-795 Optical Engineering II
This course emphasizes the application of wave optics to optical systems. It covers various applications of wave optics to optical systems. Topics include Michelson interferometer, Fourier transform spectroscopy, Fabry-Perot interferometer, thin films, methods of synthesis for dielectric multilayer filters, Fraunhofer and Fresnel diffraction, Fourier optics, spatial filtering and holography. (0301-472 or equivalent) **Credit** 4

0301-800 Graduate Paper
This course number is used to fulfill the graduate paper requirement under the non-thesis option for the MS degree in electrical engineering. The student must obtain the approval of an appropriate faculty member to supervise the paper before registering for this course. Credit **5**

0301-890 Thesis
An independent engineering project or research problem to demonstrate professional maturity. A formal written thesis and an oral defense are required. The student must obtain the approval of an appropriate faculty member to guide the thesis before registering for the thesis. A thesis may be used to earn a minimum of six credits and a maximum of 12 credits. The usual is nine credits. Credit variable

Industrial and Manufacturing Engineering

0303-701 Principles of Operations Research I
Applied linear programming. Computational techniques for solving constrained optimization problems. Linear programming, the Simplex method and variations, duality and sensitivity testing. Credit **4**

0303-702 Mathematical Programming
An introduction to the mathematical foundations of nonlinear optimization techniques. Development of programming algorithms and computer-aided solutions of nonlinear optimization problems. **Credit 4**

0303-710 Systems Simulation
Methods of modeling and computer simulation of stochastic and dynamic manufacturing systems are discussed. A high-level simulation language such as ProModel will be used to model the system and examine system performance. Model validation, design of simulation experiments, variance reduction techniques and random number generation will be discussed as time permits. (0303-715,775 or equivalent) Credit 4

0303-715 Statistical Analysis for Engineering I
A basic 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

0303-716 Statistical Analysis for Engineering II
A first course in least squares linear regression. Topics covered include estimation of model parameters, significance testing of model parameters, detection and treatment of influential observations, model adequacy checking and variable selection techniques. (0303-715) Credit 4

0303-720 Production Control
A systems approach to the design of production control operations. Investigation of forecasting, operations planning, inventory control and scheduling. Case studies and the design of actual production systems are encouraged. (0303-701,0303-715) Credit 4

0303-723 Facilities Planning
Principles of plant layout and material handling. Topics covered include criterion selection, cost elements, the layout design process, SLP, computerized plant layout and quantitative plant layout and material handling techniques relating to operations research. Credit 4

0303-725 Technological Forecasting
Technological forecasting is concerned with the Delphi method, SOON charts, trend extrapolation, relevancy trees, cross input analysis, internally consistent scenarios and decision matrices. The course will provide a thorough introduction to the basic concepts and techniques of technological forecasting. Credit 4

0303-729 Computer Integrated Manufacturing
This course introduces concepts and techniques needed to specify, design and implement computer-integrated manufacturing systems. Students will become familiar with real-world data acquisition problems and will work with interface electronics for process monitoring and control. (0303-775) Credit 4

0303-730 Ergonomics & Human Factors
A survey course of human factors emphasizing a systems approach in looking at human capacity for physical and mental work versus the demands placed upon the human by the task, machine and environment. Various models of human performance are covered. Credit 4

0303-731 Advanced Topics in Ergonomics/Human Factors
Advanced topics are selected based on current ergonomic and human factors issues and interests of students. Course is taught using a seminar format. (0303-730 or equivalent) Credit 4

0303-732 Work Physiology & Biomechanics
Theoretical fundamentals of human body physiology and mechanics applied to work. Development applications of biomechanics and biomechanical models. Kinematics of the link system of the body and extremity joints. (0303-730 or equivalent) Credit 4

0303-733 Cognitive Engineering
Measurements of human performance. Fundamentals of human information processing and how they relate to the design of human-machine systems. (0303-730 or equivalent) Credit 4

0303-734 Systems Safety Engineering
Study of the human component in occupational systems from a failure analysis. Product systems safety analysis. Approaches in accident prevention. Current OSHA standards. Credit 4

0303-740 Numerical Control & Manufacturing
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. (Permission of instructor) Credit 4

0303-741 Applications of Robotics in Manufacturing Systems
This course introduces the fundamentals of robotics and robotics applications in manufacturing systems. The course deals with analysis of robotic systems, robotic selection and feasibilities, integration of robots in manufacturing systems, design of robot work stations, materials handling, programming, control and safety. (Permission of instructor) Credit 4

0303-742 Artificial Intelligence Applications in Manufacturing
An introductory course in the development and application of "intelligent" (knowledge-based) systems within the realm of manufacturing. Students will be exposed to various programming languages (e.g., LISP and/or ProLog) and expert system development shells. Topics to be explored include knowledge representation schemes, search strategies and their implementation, computer-aided process planning, robot/AGV path planning, automated scheduling, pattern recognition, knowledge-based systems and neural networks. Credit 4

0303-747 Microprocessor Applications
Automated manufacturing processes demand effective computer-microprocessor interfacing. This course will provide the necessary knowledge of assembly language programming and digital hardware interfacing techniques. The role of macro-assemblies, high-level languages and systems software aids to develop efficient modular programs will be discussed. One or more specific manufacturing related applications will be implemented. Microprocessor architectures and interfacing to several hardware elements such as VART, PIA, A/D, D/A and other LSI chips will be covered. A greater emphasis will be placed on software aspects such as modularity, data structure, interrupt handling, and communication protocols to design efficient hierarchical control systems for computer-integrated manufacturing. Credit 4

0303-748 Quality & Reliability
A first course in applied statistical analysis for quality and reliability analysis. Topics include control charts, sampling plans, analysis of failure data and systems reliability models. For CIM majors only. (0303-715 or equivalent). Credit 4

0303-750 Management of Quality Control Systems
This is a survey course designed to expose upper-level students to managerial aspects of quality control systems. Ideas from a number of quality consultants (Juran, Gryna, Crosby, Taguchi, etc.) will be covered to give students an overview of topics such as fitness for use, quality costs, quality planning, statistical quality control and experimental design for quality improvement. (Graduate standing or consent of the professor; 0303-715) Credit 4

0303-755 Multicriteria Decision Making
Decision making is the process of selecting a possible course of action from all available alternatives. In most real-world problems, multiplicity of criteria for judging the alternates is unavoidable. This course explores some of the multiple objective and attribute methods to analyze conflicting and incommensurate criteria. (0303-701,0303-702) Credit 4

0303-756 Decision Analysis
This course presents the primary concepts of decision analysis. Topics important to the practical assessment of probability and preference information needed to implement decision analysis are considered. Decision models represented by a sequence of interrelated decisions, stochastic processes and multiple criteria are also considered. (0303-715 or equivalent) Credit 4

0303-757 Reliability
This course deals with mathematical concepts and techniques for modeling and analyzing the reliability of systems. (0303-715 or equivalent) Credit 4

0303-758 Design of Experiments
This course presents the primary concepts of experimental design. Its applied approach uses theoretical tools acquired in other mathematics and statistics courses. Emphasis is placed on the role of replication and randomization in experimentation. Numerous designs and design strategies are reviewed, and implications on data analysis are discussed. (0303-715 or equivalent) Credit 4

0303-771, 772, 773, 774 Special Topics in Industrial Engineering
These are variable credit, variable topics courses that can be in the form of regular courses or independent study under faculty supervision. Credit variable (maximum 4 per course number)

0303-775 Data Structures Using C
An introductory course in data structures and algorithms using the C programming language. Topics include sorting, searching and lists. This course can be used as a foundation for many computer-based courses in engineering. Credit 4

0303-776 Case Studies
The analysis and solution of complex systems problems for students enrolled in the systems engineering option. Credit 4

0303-777 **Engineering Internship**
This course number is used by students in the master of engineering degree program for earning internship credits. The actual number of credits is to be determined by the student's faculty adviser and is subject to the Graduate Committee of the College of Engineering. **Credit variable**

0303-799 **Independent Study**
This course number should be used by students who plan to study a topic on an independent study basis. The student must obtain the permission of the appropriate faculty member before registering for the course. **Credit 4**

Mechanical Engineering

0304-743 **Control Systems**
Introduces the student to the study of linear control systems, their behavior and their design and use in augmenting engineering system performance. Topics include control system behavior characterization in time and frequency domains, stability, error and design. This is accomplished through classical methods that employ the use of Laplace transforms, block diagrams, feedback control, root locus, Nyquist plots, and Bode diagrams. A companion laboratory will provide students with significant "hands-on" experience. **(0304-543** or equivalent) **Class 4, Credit 4 (every year, S)**

0304-758 **Engineering Vibrations**
This is a course on the theory of mechanical vibrations with an emphasis on design applications and instrumentation. Fourier analysis techniques, numerical and experimental analysis and design methods are presented in addition to theoretical concepts. Vibrations of single-degree of freedom systems are covered including free damped and undamped motion; harmonic and transient forced motion, including support motion, machinery unbalance, and isolation. Modal analysis of multi-degree of freedom systems is introduced. In addition to laboratory exercises on vibration instrumentation, an independent design project is assigned. **(0304-543** or equivalent) **Class 4, Credit 4 (every year, F)**

0304-801 **Design for Manufacture**
This is a required course in the manufacturing option of the master of engineering degree program. The course is offered jointly by the departments of industrial and manufacturing engineering and mechanical engineering and presents an overview of the factors influencing product design and the manufacturing cycle. Topics include component design and analysis, design for manufacturability as well as function and design for manual and automated assembly. Students will gain hands-on experience with the Boothroyd/ Dewhurst system to quantify design efficiency through a term project. The various manufacturing processes as they relate to modem trends in DFM are covered in detail. **Class 4, Credit 4 (every year, W)**

0304-810 **Introduction to Continuum Mechanics**
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, thermoelasticity, viscoelasticity and fluid mechanics. **(0304-871) Class 4, Credit 4 (even** year, **F)**

0304-811 **Theory of Elasticity & Plasticity**
Stress-strain relationships 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 (even year, W)**

0304-816 **Finite Elements**
This is an introductory course on the modem theory of finite element analysis. Although the necessary mathematics will be kept to a minimum, the course content has been designed to provide the skills necessary to write an F. E. program and to understand the structure and capabilities of commercially available codes. Applications to problems in structural mechanics, heat transfer and fluid mechanics. **(0304-870) Class 4, Credit 4 (every year, S)**

0304-820 **Advanced Optimal Design**
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. Linear programming, Quasi-Newton's method, Newton's method and direct methods for constrained problems. Applications to the solution of practical nonlinear optimization problems will be required through available software on the mainframe computer. **(0304-871,874) Class 4, Credit 4 (even year, S)**

In a joint effort of the colleges of Business and Engineering, the manufacturing management and leadership program prepares leaders to manage both processes and people.

0304-821 Advanced Vibrations
Vibration of discrete multimass systems using matrix methods. Normal mode theory and matrix eigenvalue extraction procedures. Matrix forced response. Practical examples using two-and-three degrees of freedom. Vibration of continuous systems. Computer simulations. (0304-758) Class 4, Credit 4 (every year, W)

0304-823 Systems Modeling
Designed to introduce the students to state-space system modeling techniques and response characterization. Both lumped and distributed parameter systems will be considered. Bond-graph theory will be used extensively. System performance will be assessed through numerical solution using MATLAB/Simulink, Traditional closed-form solution methods utilizing Laplace and Fourier transforms. Transfer functions are also discussed. (0304-543 or equivalent) Class 4, Credit 4 (every year, F)

0304-827 Computer Graphics in Design
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 multidimensional graphic display, pre- and post-processing modelers for finite element analyses and three-dimensional solids modeling. (Graduate standing) Class 4, Credit 4 (odd year, S)

0304-828 Special Topics—Applied Mechanics
In response to student and/or faculty interest, special courses that are of current interest and/or logical continuations of regular courses will be presented. These courses will be structured as ordinary courses with specified prerequisites, contact hours and examination. (Graduate standing) **Credit variable up to 4 (TBA)**

0304-830 Introduction to CFD Analysis
This graduate core course covers basic numerical techniques applicable to equations in fluid mechanics and heat transfer. Numerical methods required for programming partial differential equations are introduced. Course work involves analytical programming and design examples. Commercial software is also explored **(0304-838,851) Class 4, Credit 4 (every year, S)**

0304-833 Heat Exchanger Design
This course presents an overview of the different heat exchangers used in industry including shell-and-tube, plate, tube-fin, and plate-fin heat exchangers. Analytical modeling of recuperators, regenerators, and transient performance is also covered. Thermal design methods for designing shell-and-tube and compact heat exchangers are presented. Students are required to carry out a major design project in the course. **(0304-514; 0304-550** or **851) Class 4, Credit 4 (odd years, W)**

0304-834 Boiling & Condensation
This course provides a basic understanding of the phase change phenomena associated with boiling and condensation heat transfer. This knowledge is applied in the design of industrial systems such as evaporators, condensers and distillation columns. Students are required to undertake a major design project in the course. **(0304-514,550) Class 4, Credit 4 (even years, W)**

0304-835 Grid Generation
This is a graduate elective course that introduces modern topics in the theory of grid generation techniques. Although the primary focus will be on the topics of thermal/fluid sciences, the applicability of the theory holds in other fields of interest as well. Topics include algebraic and elliptic grid generation, structured and unstructured grids, and boundary element methods. Some commercially available software will be introduced. **(0304-830) Class 4, Credit 4 (odd years, F)**

0304-838 Ideal Flows
This graduate core course covers the fundamental topics in the theory of aerodynamics and high-speed flows. The course discusses modern aerodynamic applications in the areas of wing and airfoil design, wind tunnel testing and compressible flows. **(0304-415) Class 4,** Credit **4 (every year, F)**

0304-840 Signal Processing
Designed to introduce the student to discrete-time signal processing fundamentals, analog-to-digital conversion, and computer-based data analysis. Analytical mathematical developments are supplemented with hands-on computer-based laboratory and homework assignments that promote practical understanding. Topics covered include continuous-time and discrete time convolution, correlation, Fourier transformation, and power spectral estimation. Coverage includes the DFT, FFT, z-transform, autocorrelation and cross correlation functions, and an introduction to statistical data processing via ARMA models for spectral estimation. **(0304-870) Class 4, Credit 4 (every year, W)**

0304-842 System Identification
Introduces the student to continuous-time and discrete-time system identification from input-output data series. Practical aspects of the "synthesis" of system character will involve data conditioning, analog-to-digital conversion, and computer-based system analysis using MATLAB. Analytical mathematical developments are supplemented with hands-on computer-based laboratory and homework assignments that promote practical understanding. Topics covered include system response functions, non-parametric and parametric model estimation, model definition and validation, and system response prediction. Builds on topics covered in **0304-840,** Signal Processing, and supplements this material as appropriate. **Class 4, Credit 4 (odd years, F)**

0304-848 Special Topics—Thermo Fluid Systems
In response to student and/or faculty interest, special courses that are of current interest and/or logical continuation of regular courses will be presented. These courses will be structured as ordinary courses with specified prerequisites, contact hours and examination. A listing of topics for special courses is found at the end of this section. (Graduate standing) **Credit variable (maximum of 4 credits/ quarter) (TBA)**

0304-851 Convective Phenomena
This course introduces the student to the flow of real incompressible fluids. The differential approach is used to develop and solve the equations governing the phenomena of mass, momentum, and heat transfer. The material in the course provides the necessary background for a study of computational fluid dynamics. **(0304-415,514)** Class **4,** Credit **4** (every year, **W)**

0304-852 Advanced Turbomachinery
This course introduces the students to some of the advanced topics in turbomachinery. Topics include airfoil theory, two-and three-dimensional flow analysis in radial and axial turbomachines, and turbomachinery flow stability characteristics. Students are expected to do a design project using FLUENT Computational Fluid Dynamics code. **(0304-550,652) Class 4, Credit 4 (even years, F)**

0304-864 Production Tool Design
This is a course in the core group, CAD, of the manufacturing engineering option in the master of engineering degree program. Design of production tooling, jigs and fixtures for the economical manufacture of modern parts is covered in detail. The student must do research in current publications, and complete and present a project. Project selection can usually be arranged to incorporate an assembly of parts from the student's normal work. There will be field trips to local specialty firms. (Graduate standing) **Class 4, Credit 4 (even years,** S)

0304-865 Computer Implementation
This is a course in the core group, **CAD,** of the manufacturing engineering option in the master of engineering degree program. It emphasizes the application of the finite element method to problems in the area of static and dynamic structural analysis, heat transfer, and analogous solution. **A** standard commercial software package is used for these applications where the general structure, operating characteristics and use of a complex program are presented. Topics include the finite element method; shape factors, element formulation, and the element library; program sequencing; general modeling methods (loads, constraints, material factors, mesh generation, interactive graphics, model conditioning); convergence, error analysis and the "patch" test, vibration and heat transfer analysis, and analogous analysis such as acoustics, illumination, etc. **(0304-816) Class 4, Credit 4 (odd years, F)**

0304-870 Mathematics for Engineers I
A concise introduction to the concepts of matrix and linear algebra, including determinants, eigenvalues, systems of linear equations, vector spaces, linear transformations, diagonalization, orthogonal subspaces and the Gram-Schmidt orthonormalizing procedures. The use of complex exponentials in differential equations is introduced. Fourier series, Laplace and Fourier Transforms are also presented. **Class 4, Credit 4 (every year,** F)

0304-871 Mathematics for Engineers II
Topics covered are orthogonal functions including Fourier Series, Fourier Integrals, Bessel functions, Legendre Polynomials, Sturm-Liouville problems and eigenfunction expansions; an introduction to calculus of variation including problems with constraints; vector analysis including the directional derivative, the gradient, Green's Theorem, the Divergence Theorem and Stokes' Theorem; Laplace transform methods. **Class 4 (every year, W)**

0304-872 Analytical Mechanics
Advanced dynamics and vibration are emphasized. Newtonian vector mechanics and energy formulations are applied to two- and three-dimensional problems involving discrete and continuous dynamical systems. The concepts of Virtual Work, Hamilton's Principle, and Lagrange's equations and Eider angles are covered. The course also includes an introduction to the calculus of variations. **(0304-543,871) Class 4, Credit 4 (even years,** S)

0304-874 Numerical Analysis
This course emphasizes the development and implementation of methods available to solve engineering problems numerically. Specific topics include root finding for algebraic and transcendental equations, systems of linear and nonlinear equations, ordinary differential equations and partial differential equations. **(0304-870) Class 4, Credit 4 (every year, W)**

0304-875 Advanced Aerodynamics
This course covers the fundamental topics of aerodynamics and high-speed flows. The course discusses modern aerodynamic applications in the areas of wing and airfoil design, wind tunnel testing and compressible flows. **(0304-550, 675) Class 4, Credit 4 (every year,** S)

0304-877 **Internship**
This course number is used by students in the master of engineering degree program for earning internship credits. The actual number of credits is to be determined by the student's faculty adviser and is subject to the Graduate Committee of the College of Engineering. **Credit variable**

0304-880 **Independent Study**
An opportunity for the advanced student **to** undertake an independent investigation in a special area under the guidance of a faculty member. A written proposal is to be forwarded to the sponsoring faculty member and approved by the department head prior to the commencement of work. (Graduate standing) **Credit variable (maximum of 4 credits per quarter) (every year, F, W, S)**

0304-885 **Advanced Mechanics of Solids**
This course extends the student's knowledge of stressed mechanical components covered in Mechanics of Materials and lays the foundation for a follow-on course in finite elements. The basic relationships between stress, strain, and displacements are covered in more depth. Stress and strain transformations, plane elastic problems, and energy techniques are covered. Topics from Advanced Strength of Materials include beam bending and torsion problems not covered in Mechanics of Materials. **(0304-347) Class 4, Credit 4 (every year, W)**

0304-888 **Project with Paper**
The student must demonstrate an acquired competence in an appropriate topic within mechanical engineering. The topic is chosen in conference with a faculty adviser. The work may involve an independent research and/or a design project and/or a literature search with a demonstration of acquired skill. A written paper, approved by the adviser and the department, and an oral presentation of the work are required. Credit 3 **(F, W,** S, Su)

0304-890 **Research & Thesis**
In conference with a faculty adviser, an independent engineering project or research problem is selected. The work may be of a theoretical and/or experimental and/or computational nature. A state-of-the-art literature search in the area is normally expected. A formal written thesis and an oral defense with a faculty thesis committee are required. **Credit variable (5 to 9 credits total) (F, W, S, Su)**

Microelectronic Engineering

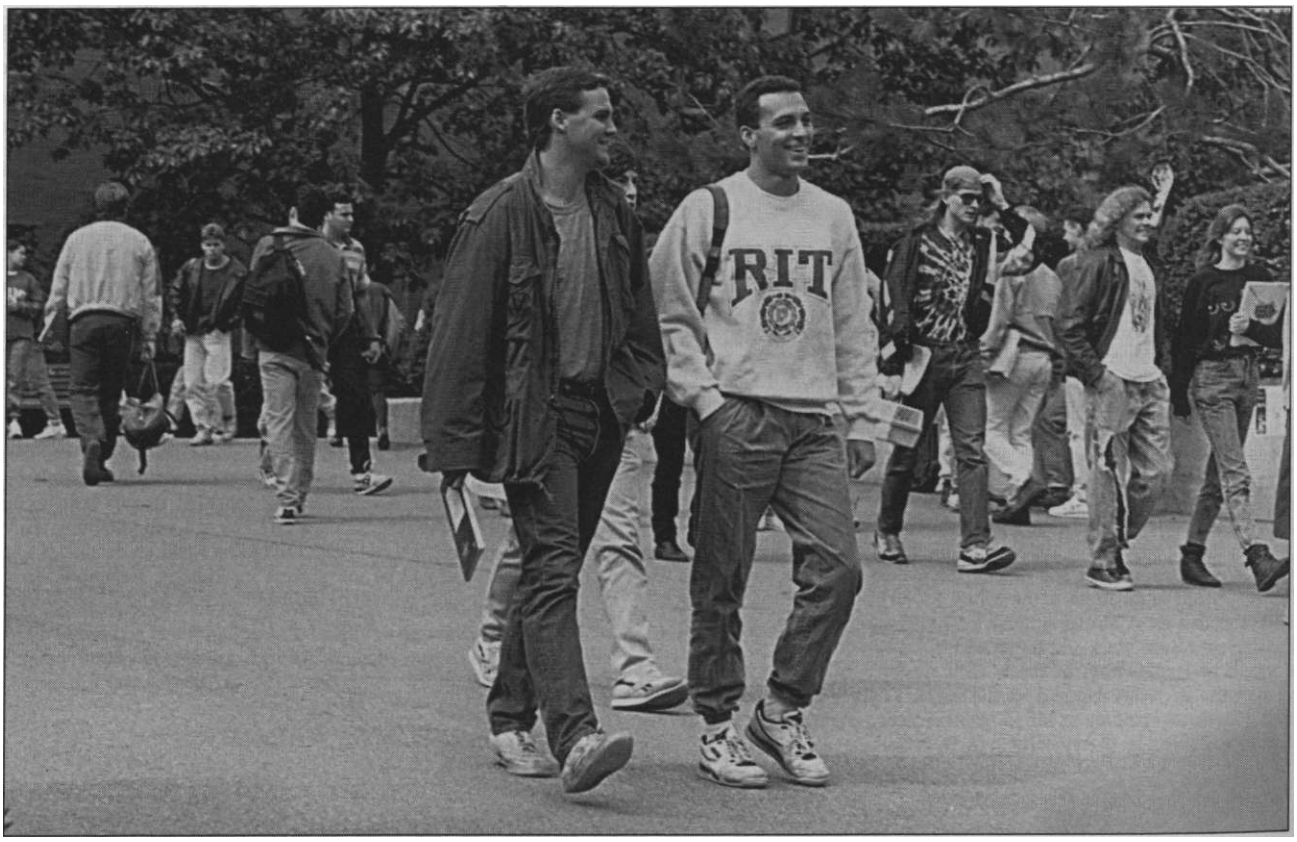
0305-701 **Microelectronics I**
An intermediate course in the study of integrated circuit processing. Topics include diffusion, ion implantation, bipolar and MOS processes. Extensive use of CAE tools such as SUPREM. Laboratory work includes the fabrication of MOS integrated circuits providing an introduction to all I.C. fabrication processes and safety. **Class 3, Lab 3, Credit 4 (F)**

0305-702 **Microelectronics II**
An intermediate course in the study of integrated circuit processing. Topics include atomic models for diffusion, oxidation and ion implantation. Process integration for bipolar and MOS device fabrication is studied in detail. Students learn how to design processes to realize a variety of device structures and properties. Extensive use of CAE tools such as SUPREM. Class **3, Lab 3,** Credit **4 (W)**

0305-703 **Microelectronics III**
A selection of topics related to thin film materials and processes that are important to the manufacture of integrated circuits including chemical vapor deposition, plasma etching, physical vapor deposition (sputtering), planarization by chemical-mechanical polishing, and rapid thermal processing. Students design processes and model them using SUPREM and DEPICT. Students participate in the design of experiments to characterize thin films and processes utilizing techniques such as emission spectroscopy, EDAX, ellipsometry, mass spectroscopy, and interferometry. **Class 3, Lab 3,** Credit **4** (S)

0305-710 **CMOS**
A course in advanced CMOS processing. Topics include design issues such as latch-up, advanced processes such as low doped drain or SALICIDE, BiCMOS, test structures, manufacturing. The laboratory involves the student in the manufacture of CMOS integrated circuits and test structures. **(0305-520,640, 650** or **701,702) Class 3, Lab 3, Credit 4** (S)

0305-713 **Electronic Properties of Materials**
An in-depth study of materials emphasizing those used in the integrated circuit industry. Laboratory will focus on materials evaluation techniques and surface analysis, including SEM and EDAX. **Class 3, Lab 3, Credit 4 (W)**



Students find that course work relevant to current issues in industry often prompts enthusiastic discussion outside of, as well as in, class.

0305-721 Microlithography I
Selected topics from organic, polymer, physical and photographic chemistry important to the understanding of photoresists and optical lithography. Photoresist processes such as negative, positive, reversal, dyed, antireflective coatings, image stabilization and modeling and simulation of photographic processes. Laboratory course topics emphasize photolithographic process characterization techniques and statistical design of experiments. Class 3, Lab 3, Credit 4(F)

0305-722 Microlithography II
A course covering advanced resist systems for optical lithography including anti-reflective coatings, bi-layer resists, tri-layer resists, and silylation. Election beam lithography, x-ray lithography, and deep-UV lithography will also be covered. Technologies will be studied from both chemical and physical standpoints. Process characterization will be studied through experimental design techniques. (0305-721) Class 3, Lab 3, Credit 4 (W)

0305-731 Microelectronics Manufacturing I
A manufacturing course. Topics include 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. Lot tracking, data collection, lot history, cycle time, turns, and statistical process control are introduced to the students. (0305-701) Class 3, Lab 3, Credit 4 (W)

0305-732 Microelectronics Manufacturing II
A course in computer integrated manufacturing as it applies to microelectronics manufacturing. Process modeling, simulation, direct control, computer networking, database systems, linking application programs, facility monitoring, expert systems applications for diagnosis and training, and robotics are all introduced to the student. Laboratory experiences are related to the operation of the student-run integrated circuit factory. Class 3, Lab 3, Credit 4 (S)

0305-770 Independent Study
This course number should be used by students who plan to study a topic on an independent basis. The student must obtain the permission of the appropriate faculty member before registering for the course. Credit variable

0305-777 Internship
This course number is used to fulfill the internship requirement. The student must obtain the approval of an appropriate faculty member to supervise the paper before registering for this course. Credit variable

0305-801 Seminar/Research
Weekly seminar series intended to present the state of the art in microelectronics research. Other research-related topics will be presented such as library search techniques, patent considerations, ethics, small business opportunities, automated data collection, thesis writing, effective presentations, etc. Required of all MS microelectronic engineering students for one credit each up to four credits. After four credits, graduate students are required to register each quarter for zero credits. (Graduate standing in MS in microelectronic engineering) Credit 0 to 1 (F, W, S, Su)

0305-890 Special Topics
In each case, consult instructor before registering. Examples: Advanced Process and Device Simulation (W, odd years); Integrated Circuit Test Methodologies (F, even years); Microelectromechanical Devices and Sensors (F, odd years); Smart Power Integrated Circuits and Devices (W, odd years); Compound Semiconductors and Devices (W, even years); Automation in Semiconductor Manufacturing (Su, even years); Monolithic Microwave Integrated Circuits (W, odd years) Class 4, Lab 0, Credit 4

0305-899 Thesis
The master's thesis in microelectronic engineering requires the student to prepare a written thesis proposal for approval by the faculty; select a thesis topic, adviser and committee; present and defend thesis before a thesis committee; submit a bound copy of the thesis to the library and to the department; prepare a written paper in a short format suitable for submission for publication in a journal; complete course work and thesis within a seven-year period; register for one credit of continuation of thesis each school term (except Summer Quarter) after the 45 credits required for the master's degree until the thesis is completed. (Graduate standing in MS in microelectronic engineering) Class 0, Lab 0, Credit variable 6 to 12 (typically 9) (F, W, S, Su)

0306-720 Electronic Design Automation
The creation of large, complex electronic systems has grown beyond the capabilities of any number of people without computer support; successful completion of large design projects requires that computers be used in virtually all aspects of design. This course will investigate some of the basic design automation tools and algorithms in order to understand their capabilities, limitations and internal operations. Topics covered will be the VHDL hardware description language, simulation techniques, design synthesis, placement and routing, and design verification methods. Laboratory projects in the use and creation of design automation tools will be required. (0306-561 or equivalent; 0306-630/730 also suggested) Class 4, Credit 4 (F, W)

0306-722 Advanced Computer Architecture
This course will emphasize the impact of VLSI and communication issues on computer architecture. Topics covered will include highly concurrent, multiprocessor and fault-tolerant computer systems as well as data flow architectures. Modeling techniques for system verification will also be included. (0306-551 or 0605-720) Class 4, Credit 4 (W)

0306-730 VLSI Design
An introduction to the design and implementation of Very Large Scale Integration (or VLSI) including NMOS and PMOS devices, CMOS circuits and digital subsystems. The procedures for designing and implementing digital integrated systems will be covered including the Mead and Conway structured design approach consisting of the use of stick diagramming, scaling of CMOS design rules and techniques for estimating time delays. Emphasis will be placed on the use of static CMOS circuits and regular structures such as programmed logic arrays in custom and standard cell-based designs. The use of workstations with Mentor Graphics design tools for circuit simulation and physical layouts will be stressed. Graduate-level laboratory design projects will be required. Class 4, Credit 4 (F, S, Su)

0306-731 VLSI Design Projects
A second course in the design and implementation of Very Large Scale Integration (VLSI) circuits and systems. Emphasis will be placed on the design and use of dynamic precharge and precharge-evaluate CMOS circuitry including Domino, NORA and Zipper CMOS logic, and subsystems. Basic requirements of a clocking system and a general clocking strategy for timing design in both static and dynamic CMOS circuits will be investigated. Topics on the design and use of a standard cell library in the implementation of large system designs will be covered. The use of workstations with Mentor Graphics design tools and Synopsys synthesis tool suite will be required in laboratory projects leading to the design, VHDL synthesis and testing of an integrated circuit device. (0306-630 or 730) Class 4, Credit 4 (W, S)

0306-740 Analytical Topics for Computer Engineers
This course begins by reviewing signal and system analysis techniques for analyzing linear systems. It includes Fourier techniques and moves on to present fundamental computational techniques appropriate for a number of applications areas of computer engineering. A section on numerical linear algebra will include techniques for analyzing discrete time signals and systems. Other major course areas are symbolic logic and discrete optimization techniques, including computer representations of networks, shortest-path problems and minimum spanning tree problems. (1016-265 or 0602-705 and preferably 0605-700) Class 4, Credit 4 (F)

0306-741 Design for Testability
This course will introduce the concepts of failure mechanisms and fault modeling in digital circuits. It describes various test strategies for the digital systems. Techniques to integrate design and test for VLSI circuits will be included. Design for autonomous test, SCAN-PATH concepts and testability analysis will be discussed. Built-in self-test (BIST) techniques will be detailed. Concepts of easily testable logic will be introduced. In addition, testability bus and the boundary-scan techniques will be included for system-level testability. Class 4, Credit 4 (F)

0306-756 Multiple Processor Systems
Basic concepts in parallel and high-performance computing are introduced, and current methodologies and trends involved in the design and programming of multiprocessor systems are presented. Theoretical models of parallel computing and performance metrics are studied and contrasted with practical parallel systems architectures, programming environments and benchmarking techniques. Parallel architectures are classified according to the mode and degree of parallelism, memory organization, and type and topology of interconnection networks utilized in the design. In addition, the suitability of various architectures in meeting the demands of today's computationally-intensive applications is studied in depth, including the detailed study of several representative examples of current commercial machines. Students are expected to complete a number of programming assignments on a parallel computer, illustrating practical issues. A student review and analysis of a commercial parallel processor system or an active research area are required also. This written review is presented in class. **(0306-722)** Class **4,** Credit **4** (S)

0306-758 Fault Tolerant Digital Systems
Formal models and concepts in fault diagnosis. Test generation. Design for testability techniques. Design techniques to achieve fault tolerance. System evaluation techniques. The design of practical fault-tolerant systems. Fault-tolerant design of VLSI circuits and systems. **(0603-400** or **0301-650** or **0301-750** or **0306-561,0306-550** or **0603-720) Class 4, Credit 4**

0306-759 Principles of Digital Interfacing
The objective of this course is to give students basic concepts of interfacing to microcomputer bus systems, including familiarity with various peripheral components currently available. Students will gain experience in the actual implementation of microcomputer systems. The course is hardware oriented, but some high-level software will be required to make the experimental systems operational. **(0306-561** or equivalent) Class **3, Lab 3,** Credit **4 (F)**

0306-761 Engineering Design of Software
An advanced course moving the student beyond computer programming to the engineering of software. Topics will include design of software from an engineering perspective based on software construction from reusable software components; methods for predicting, measuring and controlling a software artifact's time and space characteristics; mathematical models of software and their analysis including call graph models and flow graph models; software metrics and their uses including size metrics and complexity metrics. Software projects and a short research paper will be required. (Knowledge of software engineering process models and related activities, basic familiarity with C++) Class **4,** Credit **4 (F, W)**

0306-762 Concurrent & Embedded Software Design
Methods for designing concurrent software, which consists of many cooperating processes, and embedded software, which senses and controls variables in the external environment. Topics include alternative techniques for constructing concurrent and embedded software, employing tasks, cyclic executives and reusable software components, mathematical models of concurrent software and their analysis, including Petri net models and rate monotonic scheduling theory. Software projects will be required. **(0306-761,** graduate-level standing) **Class 4, Credit 4 (S)**

0306-772 Special Topics in Computer Engineering
Topics and subject areas that are not among the courses listed here are frequently offered under the title of Special Topics. Such courses are offered in a normal format, that is, regularly scheduled class sessions with an instructor. **Credit variable (no regular course schedule)**

0306-784 Digital Image Processing Algorithms
This is a graduate-level course that emphasizes the computational and algorithmic techniques required for processing digitized pictorial images. The acquisition and quantization of digital images are described, followed by analysis and filtering techniques. Segmentation, projection and reconstruction techniques are discussed. Finally, bi-level image processing is discussed, including contour filling and thinning techniques. Programming projects will be required. (Competence in calculus, engineering math and structured programming is required) **Class 4, Credit 4**

0306-890 Thesis
An independent engineering project or research problem to demonstrate professional maturity. A formal written thesis and an oral defense are required. The student must obtain the approval of an appropriate faculty member to guide the thesis before registering. The thesis may be used to earn a minimum of five and a maximum of nine credits. **Credit variable**

Applied and Mathematical Statistics

0307-701 Statistical Concepts
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. Credit **3 or 4**

0307-711 Fundamentals of Statistics I
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. (Consent of department) **Credit 3 or 4**

0307-712 Fundamentals of Statistics II
Continuation of **0307-711.** Topics: concepts and strategies of statistical inference for making decisions about populations on the basis of sample evidence; tests for independence and for adequacy of a proposed probability model; 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. **(0307-711** or consent of department) Credit **3 or 4**

0307-721 Statistical Quality Control I
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. (Consent of department) **Credit 3**

0307-731 Statistical Quality Control II
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. (Consent of department) **Credit 3**

0307-742 Statistical Computing
Course in statistical computing using SAS and Minitab statistical software. The course will cover basic procedures; the creation, manipulation and analysis of data bases; graphical display techniques; and the development and writing of custom numerical analysis procedures. Class sessions **1-8** will deal with SAS, and **9-11** with Minitab. Students may register for one credit and attend the Minitab sessions; for two credits and attend the SAS sessions; or for three credits and attend all sessions. **(0307-712** or consent of department) **Credit 1,2 or 3**

0307-751 Mathematics for Statistics
This course will survey various mathematical techniques useful in statistical analyses and present illustrations of their applicability. Emphasis will be on a variety of calculus techniques together with selected topics from linear algebra central to the understanding and application of various statistical methods. Reference will be made to relevant available software. This course assumes the calculus prerequisites for the program have been met; it is not a substitute for the calculus requirements. **(0307-712) Credit 3**

0307-762 **Reliability Management**
An introduction to current procedures used by industry to implement reliability engineering into the design of complex systems. Topics include reliability requirements; reliability modeling and prediction; design reviews; failure modes, effects and criticality analysis; fault tree analysis; vendor selection and surveillance; reliability testing; screening and burn-in; failure definitions; critical item lists; maintainability requirements and techniques. (0307-711, 712) Credit 3

0307-781 **Quality Management**
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. (Consent of department) **Credit** 3

0307-782 **Quality Engineering**
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. (Consent of department) **Credit** 3

0307-784 **Statistical Consulting**
A course to prepare the MS student for real-world use of the analytical and planning tools learned in other courses. The course will rely heavily on role playing and videotaped client-consultant interviews to emphasize the interpersonal communications involved in consulting. Other topics include report writing, lecture note preparation and database search. While the course for the most part will consider the consultant as a company employee rather than as an external paid consultant, some attention will be given to proposal writing and other aspects of outside consulting. (0307-802) Credit 3

0307-801 **Design of Experiments I**
How to design and analyze experiments in any subject matter area; what to do and why. Topics: basic statistical concepts, scientific experimentation, completely randomized design, randomized complete block design, nested and split plot design, Latin Square, incomplete block designs, general factorial designs. (0307-712) Credit 3

0307-802 **Design of Experiments II**
Continuation of 0307-801. Topics: factorial experiments; fractional, three-level and mixed factorial designs; response surface exploration; EVOP. (0307-801) Credit 3

0307-803 **Design of Experiments III**
A continuation of the DOE sequence. Topics: analysis of unbalanced designs; variance components and mixed models; split-plot designs; analysis of general unreplicated designs; optimal designs for nonstandard cases. (0307-802, 841) Credit 3

0307-821 **Theory of Statistics I**
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. (0307-712 or consent of department) Credit 3

0307-822 **Theory of Statistics II**
Continuation of 0307-821. 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. (0307-821) Credit 3

0307-824 **Probability Models**
An introduction to probability theory and stochastic processes. Topics include: random variables, conditional probability and expectation, Markov chains, renewal theory, queuing theory and reliability. (0307-821) **Credit 3**

The James E. Gleason Building is home to both engineering and engineering technology programs.

0307-830 Multivariate Analysis I
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. (0307-802,841) **Credit 3**

0307-831 Multivariate Analysis II
A continuation of 0307-830, 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. (0307-830) **Credit** 3

0307-841 Regression Analysis I
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. (0307-801) **Credit 3**

0307-842 Regression Analysis II
A continuation of 0307-841. Topics: selection of best linear models, regression applied to analysis of variance problems, non-linear estimation, and model building. (0307-841) **Credit** 3

0307-851 Nonparametric Statistics
Distribution-free testing and estimation techniques with emphasis on application. Topics: sign tests, Kolmogorov-Smirnov statistics, runs tests, Wilcoxon signed-rank test, Mann-Whitney test, chi square tests, rank correlation tests; quick tests. (0307-712) **Credit** 3

0307-856 Interpretation of Data
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. (0307-801) **Credit** 3

0307-862 Reliability Statistics I
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. (0307-822,841) **Credit** 3

0307-863 Reliability Statistics II
Continuation of Reliability Statistics I. Some topics from Reliability Statistics I are covered in more depth. Topics useful in the analysis of failure data will be added, and the topic of repairable systems will be introduced. (0307-862) **Credit** 3

0307-864 Advanced Acceptance Sampling
An advanced course in acceptance control techniques including basis of acceptance sampling; attributes plans; variables plans for process parameters; variables plans for proportion non-conforming; 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. (0307-731) Credit 3

0307-865 Repairable Systems
Most reliability courses and texts cover techniques applicable only to non-repairable items. This course is intended to clarify some common misconceptions about repairable systems and provide techniques appropriate for use in systems that are improving or degrading with age. Topics include review of probability concepts; stochastic processes applied to repairable systems; misconceptions about repairable systems; statistical analysis of repairable systems failure data; reliability growth models; tests for reliability growth or deterioration; examples and case studies; Cox's proportional Hazard Model. (0307-824, 861) **Credit 3**

0307-867 Decision Making with Bayesian Methods
Statistical decision analysis. Topics: how to make the best decision under conditions of uncertainty; utilities, risk, decision diagrams; Bayesian statistics; assessment of probabilities. Case studies and applications include marketing, oil exploration, portfolio selection, medical testing, and research programs. (0307-712) Credit 3

0307-871 Sample Theory & Applications
An introduction to sample surveys in many fields of applications with emphasis on practical aspects. Topics: review of basic concepts, sampling problem elements; random, stratified, ratio, cluster, systematic, two-stage cluster sampling; wild life populations, questionnaires, sample sizes. (0307-712) Credit 3

0307-873 Time Series Analysis
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, Box-Jenkins models, transfer function models, case studies. (0307-841) Credit 3

0307-875 Empirical Modeling
A course in model building based on the application of empirical data gathered through appropriate experimental design and analyzed through regression techniques. Topics: response variable construction, experimental design methods and related analysis techniques. (0307-802,841) **Credit** 3

0307-883 Quality Engineering by Design
The Taguchi Method of off-line quality control, including parameter design and tolerance design leading to improved products and processes at lower costs. (0307-802) **Credit** 3

0307-886 Sample Size Determination
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. (0307-712,801) **Credit** 3

0307-889 Independent Study Project
One, two, three, six or nine credit hours. Credit will be assigned at the discretion of the candidate's adviser and will depend on the character and involvement of the project. A written proposal setting forth the character and procedures involved will be required of the candidate and may be changed or augmented at the discretion of the candidate's adviser before approval is given for the candidate to proceed. **Credit 1,2,3,6 or 9**

0307-891 Special Topics in Applied Statistics
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. Section 72, Mixture Designs; Section 78, Time Series Analysis II. (Consent of department) **Credit 3 each course**

0307-895 Statistics Seminar
This course or sequence of courses provides for one or more quarters of independent study and research activity. This course may be used by other departments 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**

0307-896 Thesis
Thesis for students working for the MS degree in applied and mathematical statistics for three, six or nine credits. (Consent of department) **Credit 3,6, or 9**

0307-899 Individual Achievement Project
Research project under faculty supervision for students working for the MS in applied and mathematical statistics. (Consent of department) Credit variable **1 to 9**

College of Imaging Arts and Sciences

The College of Imaging Arts and Sciences offers the most comprehensive graduate imaging programs in the world, encompassing design, science, technology, engineering, management, crafts and fine arts. The college is a diverse, world-class collaboration of four schools: the School of Art and Design, School for American Crafts, School of Photographic Arts and Sciences and School of Printing Management and Sciences. Its scope gives students a perspective that can be found nowhere else—a place where students create fine art using centuries-old methods and push the edges of digital creativity. At no other university can you explore so many different interests in the imaging fields to such a level of professional excellence. In addition, RIT—as a career-oriented university—offers expertise in the professional aspects of running an art or photography studio or gallery.

PROGRAMS

MASTER OF FINE ARTS IN IMAGING ARTS IN:

- Photography Concentration
- Computer Animation Concentration

MASTER OF FINE ARTS IN:

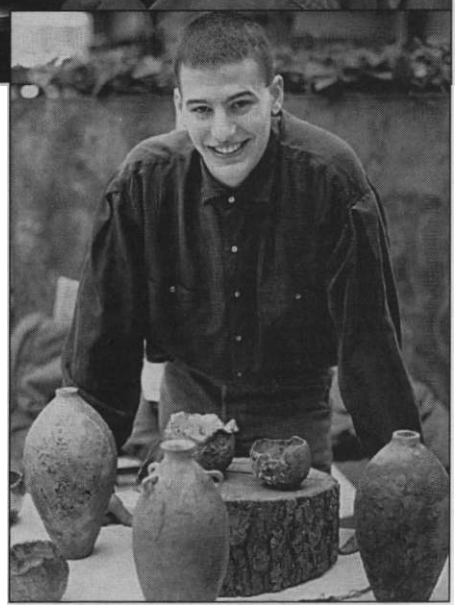
- Ceramics and Ceramic Sculpture
- Computer Graphics Design
- Glass and Glass Sculpture
- Graphic Design
- Industrial Design
- Interior Design
- Medical Illustration
- Metals/Jewelry Design
- Painting
- Printmaking
- Weaving and Textile Design
- Woodworking and Furniture Design

MASTER OF SCIENCE FOR TEACHERS

MASTER OF SCIENCE IN:

- Graphic Arts Systems
- Graphic Arts Publishing
- Printing Technology

***RIT has been named the top university in the nation for graduate education in photography and among the leaders in graduate art programs by* U.S. News & World Report.**



Graduate students in art, design and crafts can earn either the master of fine arts or the master of science in teaching degree.

RIT's world-class faculty are noted for their excellence, from creating award-winning sculptures and visual communications to receiving international recognition as innovators in their fields. They excel in the practice of their profession, using state-of-the-art equipment and studio facilities that can support both course work and research. Their role as mentors is evidenced in the national awards won by their students. In 1996, for example, graduate students in the college received the prestigious Graduate Film Honorarium of the Princess Grace Award; an emerging filmmaker was awarded the overall grand prize in the Adobe Flash Point Student Design Contest for multimedia projects. Students also received a "finalist" designation in the People's Choice Awards at the Macromedia International User Conference and Exhibition. Fourteen woodworking alumni and faculty are featured in the prestigious *Design Book Seven* produced by *Fine Woodworking* magazine.

With this practical, professional experience, graduates' success upon employment is excellent. Their achievements represent what our programs are about: excellence through exploration and experimentation.

School of Art and Design and School for American Crafts

These two schools provide a center for advanced study in the fields of design, crafts and fine arts in an environment that stimulates creativity, the exploration of ideas and high quality. Students who possess a baccalaureate degree in art, crafts or design will increase their skills in the field of their major interest or broaden their skill base in a related field under the guidance of accomplished professional artists and craftspeople. The master's programs also enable students to broaden their practice and understanding of art in areas other than their majors. The college sponsors many guest lectures, seminars and exhibits to encourage such personal and professional growth.

The Master of Fine Arts

The MFA is a professional, terminal degree for practicing artists, craftspersons or designers who desire to leave a lasting impression on their fields by devotion to their work and high standards of discipline and artistic ideals. The MFA is generally a two-year, full-time program that involves the presentation of a thesis. The thesis includes written documentation and formal exhibition of a body of work.

Majors

Ceramics and ceramic sculpture

Drawing from its Bauhaus roots, the ceramics studio embraces the contemporary spectra of aesthetic ideas and innovative techniques to educate and train professional artists/craftspeople. It strives to support students' career goals with pragmatic information and suitable facilities and equipment.

Our structured courses address specific issues inherent to utilitarian pottery, vessel aesthetics, ceramics sculpture and mixed media. The ceramics program also receives substantial reinforcement from the other craft studios because they, too, explore similar formats and concerns that face artists and craftspeople about to enter the 21st century.

Computer graphics design

The master of fine arts degree program in computer graphics design is at the center of a revolution in which visual communications are planned, designed, coordinated and produced by means of electronic media. This exciting, graduate-level professional program combines knowledge of design methodology and aesthetics with skills in the application of recent software and hardware developments that have vastly expanded the designer's creative capabilities.

The impact of digital systems technology has changed how society communicates and how designers integrate knowledge and skills with technology. The digital age has turned the computer into both medium and tool. A strong understanding of design principles, visualization, semiotics and digital technology is required to be successful at developing computer graphics applications.

Extending beyond traditional graphic design for print media, the computer graphics design program represents and fosters a multidisciplinary approach to the design of electronic communications that synthesizes electronic publishing, digital illustration, digital photocomposition, computer animation, three-dimensional modeling, digital video and sound, interactive media design, authoring languages, human factors and interface design. Our students focus primarily on unique and creative approaches to the design of interactive digital multimedia, including interactive exhibits, training and educational modules, and Web site development.

Glass and glass sculpture

This two-year program is structured on the basis of individual needs, interests and professional preparation as they may be determined through individual/group discussions. A rapid series of exploratory works is developed during the first year with emphasis on broadening technical and aesthetic understanding. The second year's focus will be on developing a body of work based on a sustained interest from the first year's investigation. The final work must be supported by a written thesis, a high quality portfolio and an exhibition.

Graphic design

Graphic design is a professional major that consists of a sequence of courses addressing advanced visual communication problems and emphasizes meaning, form and function. In a professional studio setting, students work with faculty on the understanding and implementation of design theory, history and criticism; research methods; visual aesthetics; typography; imagery; systems design; information design; ethics and values; and project development and evaluation.

Course and thesis projects incorporate both theory and application in the solution of hypothetical or actual design problems. Courses within this major evidence a balanced approach toward the application of electronic media and traditional processes. Final design outcomes may range from two-dimensional, printed artifacts to electronic, time-based and/or interactive applications. Special lectures, guest speakers, exhibits and workshops complement the studio work experience. Student projects also utilize other campus resources such as the Center for Digital Media, the Graphic Design Archive and the Cary Graphic Arts Collection.

Ceramist Vesta E. Adu-Gyamfi, MFA '88, School for American Crafts, returned to campus for "Celebrating Womanhood Through Pottery," a part of RIT's Distinguished Alumni Colloquia Series. A native of Ghana, Adu-Gyamfi draws her work from the mystique of women in her world, in matrilineal societies "I try to project the great responsibilities of being female, from birth to death. How the earth, the sea, everything, is related to woman." A 1995-96]. William Fulbright Senior Scholar, she has exhibited her work around the world.

Industrial design

The master of fine arts degree program is available for students pursuing specialized study in industrial design at the graduate level for the purpose of career enhancement or redirection. The educational experience is project-oriented, requiring research into design methods and technologies. Industry collaboratives provide an experiential dimension.

The first year of study includes major emphasis in equipment design, consumer product design and furniture design, as well as computer-aided design using Alias software. In the second year, students develop a thesis project, which is presented in the graduate thesis exhibition and is documented in a written thesis report.

Interior design

The master of fine arts degree program is available for students pursuing specialized study in interior design at the graduate level for the purpose of career enhancement or redirection. The educational experience is project-oriented with formal instruction in supporting areas such as environmental controls, construction systems, and codes and regulations.

Study includes major emphasis on the design of hospitality, retail and office environments and multistory design as well as computer-aided design. In the second year, students develop a thesis project of their own selection, which is presented in the graduate thesis exhibition and is documented in a written thesis report.

Medical illustration

The master of fine arts program in medical illustration enables students to exhibit thought and problem solving in their portfolio through accurate translations of medical and scientific concepts into effective visual support for instruction or advertisement. Students learn to demonstrate effective research techniques and efficient use of time and resources during concept and development of projects to satisfy course assignments.

Metals/jewelry design

This program is structured on the basis of individual needs, interests and background preparation as they may be determined through faculty counseling. All aspects of metalsmithing are explored. The program gives the student a broad exposure to metal working techniques, expands the student's knowledge of applied design, strengthens perceptual and philosophical concepts and develops an individual mode of expression. This sequence leads to the master's thesis, inaugurated by the student and overseen by the faculty.

Painting

The master of fine arts degree program is a studio program with intensive study in painting and related media leading to mastery in the field on a professional level. Faculty guidance focuses upon research strategies that support sequential studio production leading to individual solutions. Critical discussion is developed from both the tradition of painting and contemporary directions in our culture.

Printmaking

The MFA program in printmaking presents contemporary and historical concepts 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 nonsilver 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.

Weaving and textile design

The master of fine arts degree program is structured on the basis of individual needs, interest and background preparation as they may be determined through faculty counseling. Techniques offered over the two-year period of study include computer loom design and weaving, computer machine knitting, quilting, crochet, natural basketry, rug techniques, multiple layer weaving, plangi/ikat weaving and various surface design processes, including computer design and basic garment construction.

Design concepts are addressed in the selection of an appropriate process for completion. The courses are in preparation for the master's thesis, proposed by the student and approved by the faculty.

Woodworking and furniture design

This program leads to the terminal degree in the studio arts. Men and women come to the program from diverse backgrounds such as architecture, interior design, industrial design, art history, law, teaching, etc., as well as undergraduate wood programs. In the first year, students identify gaps in their technical and/or aesthetic background and, along with faculty, devise a program of study to develop these areas. Simultaneously, they discover directions in their work that are promising for further exploration. Based upon this experience, they develop a thesis proposal and, in the second year, create a comprehensive body of work. This work culminates in the end-of-the-year graduate thesis exhibition in the college gallery and a written thesis in support of the work.

Requirements for admission to the MFA degree programs

For U.S. and Canadian students, applicants should hold the baccalaureate degree in a field of the arts, sciences or education from a regionally accredited college in the United States or Canada and demonstrate, in the quality of the undergraduate record and creative production, a genuine, professional potential. (See also section regarding nonmatriculated students.) The undergraduate degree should include 75 quarter credit hours (50 semester hours) in studio courses.

International students need a minimum TOEFL score of 550. Those coming from countries where the baccalaureate degree is not given for programs in the practice of art may be admitted to graduate study if the diploma or certificate received approximates the standards of the BFA, BA or BS degrees and if their academic records and portfolios indicate an ability to meet graduate standards.

	MFA	**MST STUDIO** For MFA candidates and nine quarter credits (six semester hours) for MST candidates in one of the 10 areas	**MST ART EDUCATION**
Major	30 credits	24 credits	22 credits
Minor	15	9	
Humanities	10	10	20 Social Sci.
Graduate Forum	3		
Electives	18	5	6
Thesis	14		
	90 credits	48 credits*	48 creditst

**One year or summers*
tSeptember start only

Master of fine arts program

The master of fine arts program includes six categories of study:

	Credits
1. MAJOR CONCENTRATION Designed to give depth of experience in the area of the student's major interest and chosen from one of the 12 areas: ceramics and ceramic sculpture, metalcrafts and jewelry, woodworking and furniture design, weaving and textile design, glass, industrial design, interior design, graphic design, fine art (painting), fine art (printmaking), medical illustration and computer graphics design.	30
2. MINOR CONCENTRATION From the previous list, to consist of studio and related electives other than major	15
3. Electives	18
4. Graduate Forum	3
5. Forms of Inquiry	2
6. Humanities, art history	8
7. Thesis	14
Total credits	90

§ *In certain cases the minor concentration or courses may be taken elsewhere in the Institute (photography, printing) when related to the objectives of the student. Such courses must be approved in advance, normally after arrival on campus, by the adviser and the deans of the colleges involved. The minor supports the spirit of the MFA degree.*

The Master of Science for Teachers

This one-year program may be taken in one of 10 studio areas and, in addition, art education. The MST-art education concentration leads toward permanent art N-12 certification to teach in the public schools of the State of New York and features pedagogical studies and student teaching. Classes begin in September and end in May.

The MST-Studio offers a concentration in a studio art program with supporting courses, if desired, from graduate offerings in other schools and departments of the Institute.

The studio concentration may be taken in graphic design, industrial design, interior design, painting, printmaking, ceramics and ceramic sculpture, glass, metals/jewelry, weaving and textile design, and woodworking and furniture design. In addition, this MST also may lead to certification if provisional or temporary certification was earned as an undergraduate. This program may be completed in one year and may start or be completed in summer sessions.

Requirements for admission to the MST degree programs

The applicant should have received the baccalaureate degree in a field of the arts from a regionally accredited college or university in the United States or Canada with a major concentration in art, art education or industrial arts education. Applicants with different backgrounds should refer to the section on nonmatriculated students. The undergraduate studies should include a minimum of 54 quarter credit hours (36 semester hours) in drawing, painting, design or the crafts. If the applicant for admission holds the BA or BFA degree and seeks the MST degree in art education, the undergraduate program must have included the studio course distribution required by the New York State Education Department. For those holding the BS degree in art education and provisional certification, the graduate concentration should be in one of the studio areas, and the program must include a minimum of 10 quarter credit hours in liberal studies or humanities.

A student is accepted into the program with the understanding of full-time status unless granted part-time status at admission.

Teacher education and certification

The teacher of arts and crafts in college or high school, the teacher or administrator of art programs in schools and community centers, the instructor in occupational skills and the private teacher of art will find in the depth and breadth of the master's program a way of extending and improving the skills and content background necessary for effective teaching. The student who possesses a baccalaureate degree with provisional certification for the teaching of art or industrial arts in the State of New York can achieve permanent certification within the structuring of the master of science for teachers program (in one of the 10 studio areas) or the master of fine arts.

Master of science for teachers program

The master of science for teachers program requirements include two categories of studies:

1. MST ART EDUCATION
   Master of science for teachers in *art education* for those holding the BFA or BA (art major) degree and seeking permanent certification for teaching in public schools. The degree offers a concentration consisting of background courses in:

	Credits
Education, Psychology and Sociology	20
Art Education Concentration: Methods and Materials in Art Education, Seminar in Art Education, Practice Teaching	22
Studio electives	6
Total credits	48

2. MST STUDIO
   The master of science for teachers degree in the area of the student's major interest and chosen from one of the 10 areas (ceramics and ceramic sculpture, glass and glass sculpture, metals/jewelry, weaving and textile design, woodworking and furniture design, graphic design, interior design, fine art [painting], fine art [printmaking] and industrial design) is for those holding the BS degree in art education or industrial arts education who desire permanent certificates or for the BA or BFA student wishing advanced study The degree offers a major concentration of studies designed to meet the needs of individual students and may include appropriate or relevant courses from other schools and departments of the Institute.

   The following general pattern of studies covers degree requirements:

MAJOR CONCENTRATION:	Credits
Studio art or crafts	24
Humanities, art history	8
Forms of Inquiry	2
Minor Concentration	9
Electives	5
Total credits	48

General Information

Acceptance for graduate study

Students are admitted to graduate study by action of the Graduate Committee. Enrollment in graduate courses does not constitute admission to the graduate program and credit is not given for courses taken prior to acceptance unless the grade received in the course is a "B" or higher; in such a case the student, if admitted to graduate study, may petition for a grant of credit, but not in excess of 12 quarter credit hours.

A student may be admitted who needs additional undergraduate study requirements. This study will be structured for breadth or increased performance in areas designated and will be determined at the time of acceptance.

Such prerequisites must be satisfied as defined in the letter of acceptance, which applicants will receive prior to admission as graduate students. Extended study may require additional time on campus.

Human Gross Anatomy and biology or equivalent content is necessary for the MFA in medical illustration. 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.

Admission as a nonmatriculated student

Students who have a baccalaureate degree and who wish to take particular courses may be admitted as nonmatriculated students to courses for which they are qualified. They may receive graduate credit, but it may not be submitted toward degree requirements. Students deficient in admission requirements or competence may take undergraduate courses, as advised, to qualify for admission.

Those coming from foreign countries where the baccalaureate is not given for programs in the practice of art may be admitted to graduate study if the diploma or certificate received approximates the standards of the BFA, BA or BS degrees, and their academic records and portfolios indicate an ability to meet graduate standards.

Studio residence program

The School for American Crafts offers a craft residence program. Residence will be accepted in ceramics and ceramic sculpture, glass and glass sculpture, metals/jewelry design, weaving and textile design, and woodworking and furniture design. This is an opportunity for the development of craft skills and aesthetic concepts.

Residence positions are limited and will be awarded by portfolio, transcript references and a statement of purpose. An interview is required. Accepted candidates are required to enroll for at least six credits of audit per quarter, be present in the studio during class hours and contribute up to six hours of work in the studio area. In exchange, the school will provide work space, major equipment and supportive tutorial instruction. The resident is invited to participate in visiting artists sessions, lectures and all other studio activities.

Participants may be graduates continuing preparation for graduate study, early career professionals developing techniques and designs for production in their own future studios or teachers on leave who wish to work again in an academic environment.

Inquiries should be made to Residence Program, College of Imaging Arts and Sciences, School for American Crafts, Rochester Institute of Technology, 73 Lomb Memorial Drive, Rochester, N.Y. 14623-5603.

Admission procedure

To apply for admission to graduate study a student must submit the following items:

- Application: Submit your graduate application for admission accompanied by the application fee to the Office of Admissions in the envelope provided in the application packet. When making your program choice, do so by indicating the major on page two of the application. Applicants should indicate for which degree they are applying: the master of fine arts (MFA) or master of science in teaching (MST)

  Some programs are sequential in nature and begin in Fall Quarter only.* Art education is a full-time program offered only during the regular three quarters of the academic year.

  ** Major courses for art education, computer graphics design and medical illustration are offered only during Fall, Winter and Spring quarters. Art education applicants should arrange a personal interview. Call 716-475-2666 to arrange the interview.*
- Transcripts: Evidence of a baccalaureate degree is required, so request that official transcripts be sent to the Admissions office from all colleges and universities previously attended.
- Recommendations: Submit two letters of recommendation from individuals familiar with your education and/or work experience.
- Personal statement: Submit a personal statement of objectives as indicated on the fourth page of the admissions application. This statement should indicate in what manner the Institute's graduate program would assist in attaining these goals. See the application form for directions.
- Portfolio: See guidelines below

GRE and TOEFL exams

The GRE exam is not needed for the School of Art and Design/School for American Crafts. International students must have a TOEFL score of at least 550.

Portfolio guidelines for graduate applicants

Graduate students applying for admission into the School of Art and Design and the School for American Crafts are required to present a portfolio of art/design/craft work that is used in totally assessing the performance and academic capabilities of the applicant.

1. The portfolio should consist of at least 20 to 40 pieces of the applicant's best work. 35mm slides are preferred, displayed in 8½ " x 11" vinyl slide protector pages. (Additional computer files for video or interactive media samples should be stand-alone files that will preferably run on Macintosh operating systems.)
2. Slide portfolios will be kept by the school until the graduate application and scholarship process is complete. Slides will be returned by the school only when return postage is enclosed.
3. While every precaution will be taken to ensure proper care and handling, the Institute assumes no responsibility for loss or damage to slides. Label your slides with your name and address. Projects/slide content should be identified.

Please send portfolio and application materials to:

Rochester Institute of Technology
Office of Admissions
60 Lomb Memorial Drive
Rochester, NY 14623-5604
716-475-6631

Any correspondence concerning applications, catalogs and portfolios should be addressed to the Office of Admissions.

Combining the traditional and the contemporary is the theme of the Web pages for RIT's art schools. (Image downloaded from Web site)

Bevier Gallery

During the year, the Bevier Gallery presents a continuing series of important exhibitions planned to present new directions in the fields of the arts, design and the crafts, as well as to honor the 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 Shows and Student Honors Show are annual events on the gallery calendar.

Transfer of credit

Graduate work pursued to the extent of 12 quarter hours (nine semester hours; refer to table below*) may be applied at the discretion of the Graduate Committee to specific course requirements, depending on the nature of the student's program and major, if completed within the five preceding years. This evaluation will be made after one quarter of full-time study.

Policy regarding student work

The School of Art and Design and School for American Crafts reserve the right to retain student work for educational use or exhibition for a period of time not to exceed one and one-half quarters beyond the year the object has been made.

Attendance regulations

The programs of the college utilize the studios and shop experiences as an essential part of the educational program; therefore it is imperative that the student regularly attend all classes unless specifically excused for special projects or activities by the instructors. Failure to attend classes, and to complete assignments, will be taken into consideration in grading.

Graduate scholarships, assistantships and other financial aid

If interested in being considered for a graduate scholarship through the School of Art and Design/School for American Crafts, fill out the graduate scholarship application form in the graduate application packet and submit with the other required materials by March 1.

Applications for graduate and teaching assistantships are usually mailed out in early spring to applicants and current graduate students. If you have questions, contact the School of Art and Design/School for American Crafts main office at 716-475-2646.

Need-based forms of financial aid such as loans and grants may be investigated through the Office of Financial Aid.

Graduate Faculty School of Art and Design and School for American Crafts

Deborah Beardslee, BFA, Syracuse University; MFA, Virginia Commonwealth University—Associate Professor, Graphic Design, School of Art and Design

Philip W. Bornarth, BAE, MFA, MAE, School of the Art Institute of Chicago—Professor, Painting, School of Art and Design

Wendell Castle, BFA, MFA, University of Kansas—Artist-in-Residence, Chair; Professor, School for American Crafts

Nancy A. Chwiecko, BA, St. Lawrence University; MFA, Rochester Institute of Technology—Assistant Professor, Interior Design, School of Art and Design

Nancy A. Ciolek, BFA, MFA, Indiana State University—Associate Professor, Graphic Design; Chair, Graphic Design, School of Art and Design

Douglas Cleminshaw, BSME, Case Institute of Technology—Associate Professor, Industrial Design, School of Art and Design

Glen R. Hintz, BA, Lafayette College; MS, The Medical College of Georgia—Assistant Professor, Medical Illustration; School of Art and Design

Richard Hirsch, BS, SUNY College at New Paltz; MFA, Rochester Institute of Technology—Associate Professor, Ceramics, School for American Crafts

Robert M. Kahute, BID, BFA, Syracuse University; MFA, Rochester Institute of Technology—Professor

Robert P. Keough, BFA, MFA, Rochester Institute of Technology—Professor, Computer Graphics Design, School of Art and Design

Max L. Lenderman, BS, MS, Indiana State University; MFA, University of Kansas—Professor, Weaving and Textile Design, School for American Crafts

Margaret O. Lucas, BS, Hampton University; MA, Virginia Commonwealth University; D.Ed., Pennsylvania State University—Professor, School of Art and Design

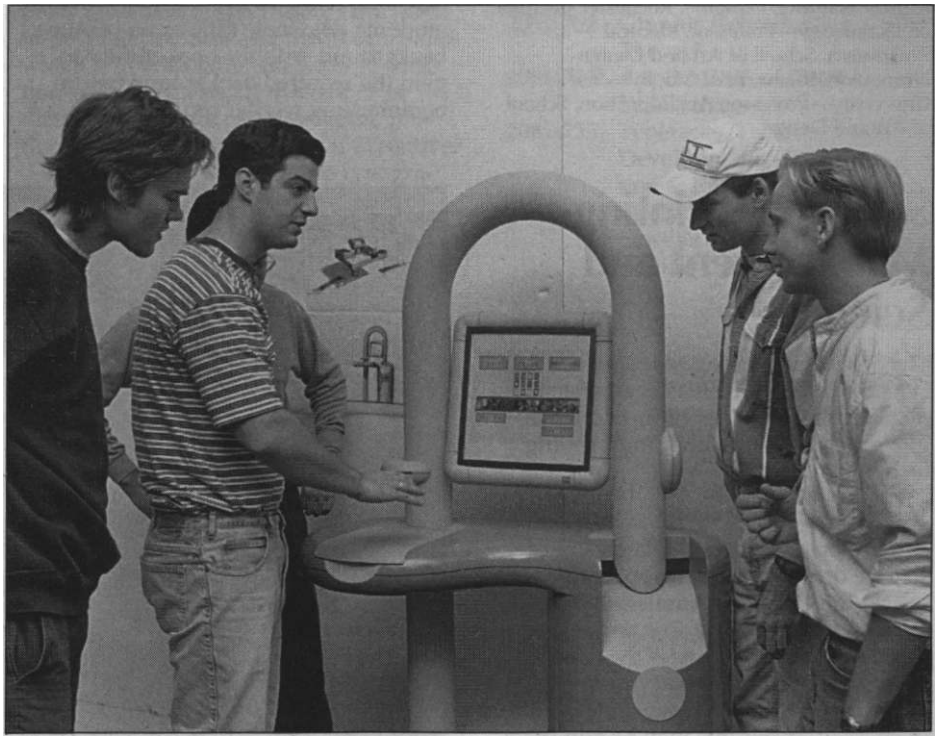
Charles F. Lewis, B.Arch., Pratt Institute; M.Arch., SUNY Buffalo—Professor

Thomas R. Lightfoot, BA, BFA, University of Connecticut; MFA, Instituto Allende, San Miguel de Allende, Gto.; Mexico; Ed.D., Columbia University—Associate Professor, Fine Arts, School of Art and Design; Chairperson, Fine Arts

Craig J. McArt, BID, Syracuse University; MFA, Rochester Institute of Technology—Professor, Industrial Design, School of Art and Design

Edward C. Miller, BFA, SUNY at Buffalo; MFA, University of Illinois—Professor, Painting, School of Art and Design

Robert C. Morgan, BA, University of Redlands; Ed.M., Northeastern University; MFA, University of Massachusetts; Ph.D., New York University—Professor, School of Art and Design



Fourteen teams of seniors and graduate students worked for weeks on an intensely team-driven RIT/Kodak design collaboration to create life-size models of image kiosks for three markets. "Working with Kodak on such a challenging project was a great experience in teamwork and synergy," said Bob Kahute, professor of industrial and packaging design.

Albert Paley, BFA, MFA, Tyler School of Art, Temple University; Ph.D. (honorary), University of Rochester—Artist-in-Residence, Charlotte Fredericks Mowris Chair in Contemporary Crafts; Professor, School for American Crafts

R. Roger Remington, BFA, Rochester Institute of Technology; MS, University of Wisconsin—Professor, Graphic Design, School of Art and Design

Robert Schmitz, BS, East Carolina University; MFA, University of Wisconsin; MS, Alfred University—Professor, Ceramics, School for American Crafts; Chair, School for American Crafts

James H. Sias, BFA, MA, Michigan State University—Professor, Industrial Design, School of Art and Design

Douglas Sigler, BFA, MFA, Rochester Institute of Technology—Professor, Woodworking and Furniture Design, School for American Crafts

Mark Stanitz, BFA, MA, Kent State University—Associate Professor, Metals/Jewelry Design, School for American Crafts

Richard Tannen, BS, Cornell University; Cert, of Mastery, Boston University—Associate Professor, Woodworking and Furniture Design, School for American Crafts

Michael Taylor, BS, Middle Tennessee State University; MA, MFA, East Tennessee State University—Professor, Glass, School for American Crafts

Leonard A. Urso, BFA, MFA, SUNY College at New Paltz—Associate Professor, Metalcrafts and Jewelry, School for American Crafts

James C. **Ver Hague,** BS, Massachusetts Institute of Technology; MS, Rensselaer Polytechnic Institute; BA, MFA, SUNY at Buffalo—Professor, Computer Graphics Design, School of Art and Design

Robert Wabnitz, Diploma, Rochester Institute of Technology—Professor, Medical Illustration, School of Art and Design

Norman Williams, BFA, MS, Syracuse University—Professor, Art Education, School of Art and Design

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 RJT 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, those applicants who do not have a printing background should complete the admissions procedures before April 10,1995, to allow sufficient time to make arrangements to attend the Foundation Program. Applicants who hold an undergraduate degree in printing and meet all foundation course requirements should apply before July 24,1995. Students are permitted to begin their regular graduate classes only in September.

Foundation Program

The Foundation Program is common to all three graduate programs within the School of Printing Management and Sciences. It begins in June and provides students who have little or no printing background with the opportunity to gain the required background before commencing regular courses in the fall quarter. During the admissions process, graduate coordinators evaluate the background of an applicant to his or her program to determine whether a section of the Foundation Program might be waived because of prior course work or work experience.

The Foundation Program involves the following course work. The seven technical courses listed below are offered in the School of Printing Management and Sciences during the summer. Most applicants who do not have printing backgrounds take these courses at RIT because they are usually not offered elsewhere.

- Accounting—Grad (Systems Only)
- Science (Chemistry)—Grad
- Typography/Design—Grad
- Composition Technology—Grad
- Graphic Arts Imaging Techniques—Grad
- Printing Processes—Grad
- Planning and Finishing—Grad

Two courses—computers and technical writing—in the Foundation Program are not offered in the summer session, but are required. Many applicants have taken them as part of their undergraduate curriculums. However, if an applicant has not taken these courses, he or she should arrange to take them either at RIT or at some other institution.

In addition to the above Foundation Program courses, two courses—Organizational Behavior, Economics—must be completed by graphic arts systems students. These two courses are required, but are not taught in the Foundation Program summer session. Graphic arts systems students need to have completed these courses in their bachelor's

Graphic arts professionals strive to exceed customer expectations of the finished product.

degree work, or they will need to complete them, most appropriately before beginning the Foundation Program.

Students may begin their graduate courses in the fall if they are lacking no more than two Foundation courses. It is possible for them to complete these during the academic year.

The seven Foundation courses are scheduled during a 12-week period beginning the last week in May. The courses are sequential—students complete one course before beginning the next one. Classes begin at 8 a.m. and end at noon or 3 p.m., depending on the class.

If an applicant has had a particular subject area waived, he or she will be excused from that section of the Foundation Program. A student must complete the Foundation Program with an overall B average before he or she can begin required courses in the graduate program to which he or she has been accepted.

Cary Library

The School of Printing Management and Sciences maintains a close relationship with the Melbert B. Cary Jr. Library, housed in Wallace Library. The Cary Library is composed of more than 14,000 volumes, including many rare books and other materials detailing the history of printing and illustrating past and present fine printing, book design and illustrations, papermaking, binding and other aspects of the graphic arts. The Frederic W. Goudy-Howard W. Coggeshall Memorial Workshop contains letters, papers and memorabilia of Mr. Goudy along with cases of Goudy type 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

Marie Freckleton, *Coordinator*
716-475-5835

Today's printing and publishing industry is the seventh largest industry in the country, producing more than $168 billion in products in 1990. 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 1.5 percent from now 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, which produced $40 billion in products during 1991. This 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 program addresses publishing from the technological/production viewpoint (including its management) and considers its interrelationships with the historical, advertising, circulation and fulfillment functions. The program is open to students with a variety of undergraduate degree backgrounds. Therefore, the 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 two options.

The typography and printing design 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 prepress 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 reproduction processes are thoroughly explored. The goal is to build within each student a firm foundation of reproduction technology on which sensitive, precise and practical aesthetic judgment will rest.

The electronic publishing 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 is startling, escalating to an estimated $50 billion by the year 2000. 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 prepare 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 systems. Like the other graphic arts publishing options, a thesis, research paper or project is required for graduation.

Thesis requirements

Both options in the graphic arts publishing program 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 chosen by the students with the guidance and consent of their advisors. The thesis may take on different forms: 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.

Required graduate degree courses

Typography and Printing Design

FALL		Credits
2081-702	Graphic Reproduction Theory*	4
2081-713	Applications of Digital Typesetting	4
2081-725	Typefaces, Their Development, Classification & Recognition	3
	Elective	4
	Elective	3
	Total Credits	18

WINTER		
2081-722	Ink, Color, & Substrate*	4
2081-723	Contemporary Publishing	3
2081-729	Computer-Aided Printing Design & Copy Preparation	4
2081-730	History of the Book	3
	Elective	4
	Total Credits	18

SPRING		
2081-727	Typographic Style Development	3
2081-785	Creative Print Finishing	4
2081-890	Thesis	4
	Elective	3
	Total Credits	14

Electronic Publishing

FALL

2081-702	Graphic Reproduction Theory*	4
2081-713	Applications of Digital Typesetting	4
2081-741	Color Image Processing System	4
	Elective	3
	Elective	3
	Total Credits	**18**

WINTER

2081-742	Document Processing Languages	4
2081-722	Ink, Color & Substrates*	4
2081-723	Contemporary Publishing	3
2081-745	Management Strategies for Corporate & Commercial Publishing Enterprises	4
	Total Credits	**15**

SPRING

2081-743	Markets for Electronic Publishing	4
2081-890	Thesis	4
	Elective	4
	Elective	4
	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 $33 million. This equipment is available to all graduate students for class work and research purposes.

Students in both the typography and printing design and the electronic publishing options will work with traditional reproduction methods and the latest in electronic equipment, including Macintosh and DOS platforms using Ethernet, CD ROM and Syquest drives, Agfa Selectset 5000 image setter, Agfa Horizon color scanner, 3M digital color proofer, SuperMac digital color proofer and numerous high-end digital image processing systems.

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 present a portfolio to 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 the foundation program.

Master of Science Degree in Graphic Arts Systems

Len Leger, *Coordinator*
716-475-6026

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.

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 nonprinting undergraduates, such as journalism, English, business, history, psychology and other liberal arts and technical majors. Abilities developed in undergraduate work, such as analyzing and communicating, 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 to understand and control the processes for which they are responsible.

The curriculum

The graphic arts systems 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.

Project design (Course 840)
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, which must include a written report documenting the project work.

Required graduate degree courses

		Credits
2081-702	Graphic Reproduction Theory	4
2080-707	Estimating & Analyzing in Graphic Arts Systems	4
2080-712	Operations Management in the Graphic Arts	
	or	
0106-743	Operations Management	4
2080-717	Marketing & Economic Applications in Graphic Communications	
	or	
0105-761	Marketing Concepts	4
2081-709	Trends in Printing Technology	4
2081-711	Tone & Color Analysis	4
2081-713	Applications of Digital Typesetting Procedures	4
2081-722	Ink, Color & Substrates	4
	Elective	12
2080-840	Project Design	4
	Total Credits	**48**

A typical schedule of courses

FALL

2081-702	Graphic Reproduction Theory	4
2081-709	Trends in Printing	4
2081-713	Applications of Digital Typesetting	4
	Elective	4
	Total Credits	**16**

WINTER

2080-712	Operations Management in Graphic Arts	
	or	
0106-743	Operations Management	4
2080-707	Estimating & Analyzing In Graphic Arts Systems	4
2081-722	Ink, Color & Substrates	4
	Elective	4
	Total Credits	**16**

SPRING		
2081-711	Tone & Color Analysis	4
2080-717	Marketing & Economic Applications in Graphic Communications	
	or	
0105-761	Marketing Concepts	4
	Elective	4
2080-840	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 noncommunicative 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 research 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.

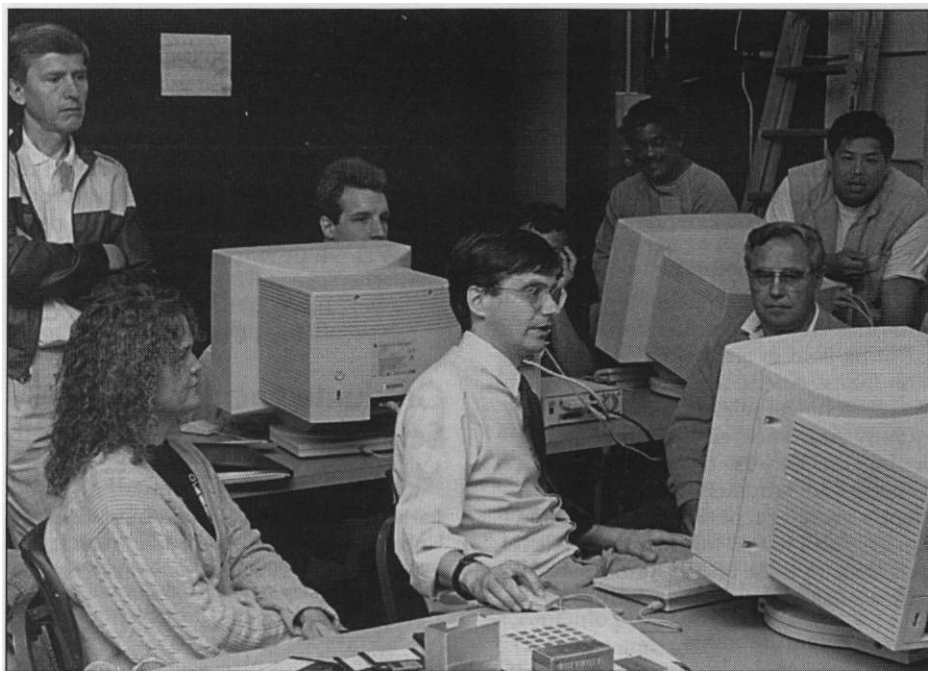
This graduate program recognizes the value of aesthetics in the graphic arts and allows opportunity for the student to bring technology to bear on design and aesthetic forms. Those students whose interests run heavily in this aspect of printing, such as in book design, are encouraged to master the technology 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 curriculum

The printing technology curriculum leading to a master of science degree in the School of Printing Management and Sciences is designed to provide graduate education in printing for students whose undergraduate majors were in the arts, sciences, education, or other nonprinting areas, as well as for graduates with a major in printing. Candidates who do not have adequate undergraduate work in printing must take the foundation program 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 to 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 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 the foundation program. With foundation course work completed, the candidate will start the core graduate program sequence with the Fall Quarter.



Professor Frank Cost (center) demonstrates electronic imaging techniques in the Electronic Prepress Laboratory.

Selected Graduate Theses Topics School of Printing Management and Sciences

- "SGMI-Based Publishing"
- "FrameMaker Software Application Handbook"
- "Line Reproduction in Mapping Utilizing the Four-Color Process Model"
- "Jan Tschichold—Contrast in Theory"
- "A Catalog of the Wood Type at Rochester Institute of Technology"

Selected Graphic Arts Systems Projects

- "Investigation of the Adhesive Strength of Envelope Gums on Recycled Paper"
- "Typeface Training Software As an Example of Computer Training Systems"
- "A Study of Print Brokering in the U.S."
- "A Study on Special Accessories for Sheetfed Offset Presses"

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 provides 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.

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		Credits
2081-701	Research Methods	4
2081-709	Trends in Printing Technology	4
2081-702	Graphic Reproduction Theory	4
2081-703	Statistical Inference	4
2081-713	Applications of Digital Typesetting	4
2081-711	Tone & Color Analysis	4
2081-722	Ink, Color & Substrates	4
	Electives	12
2081-890	Thesis	8
	Total Credits	48

A typical schedule of courses

FALL		
2081-702	Graphic Reproduction Theory	4
2081-709	Trends in Printing Technology	4
2081-713	Applications of Digital Typesetting	4
	Elective	4
	Total Credits	16

WINTER		
2081-701	Research Methods	4
2081-703	Statistical Inference	4
	Elective	4
2081-722	Ink, Color & Substrates	4
	Total Credits	16

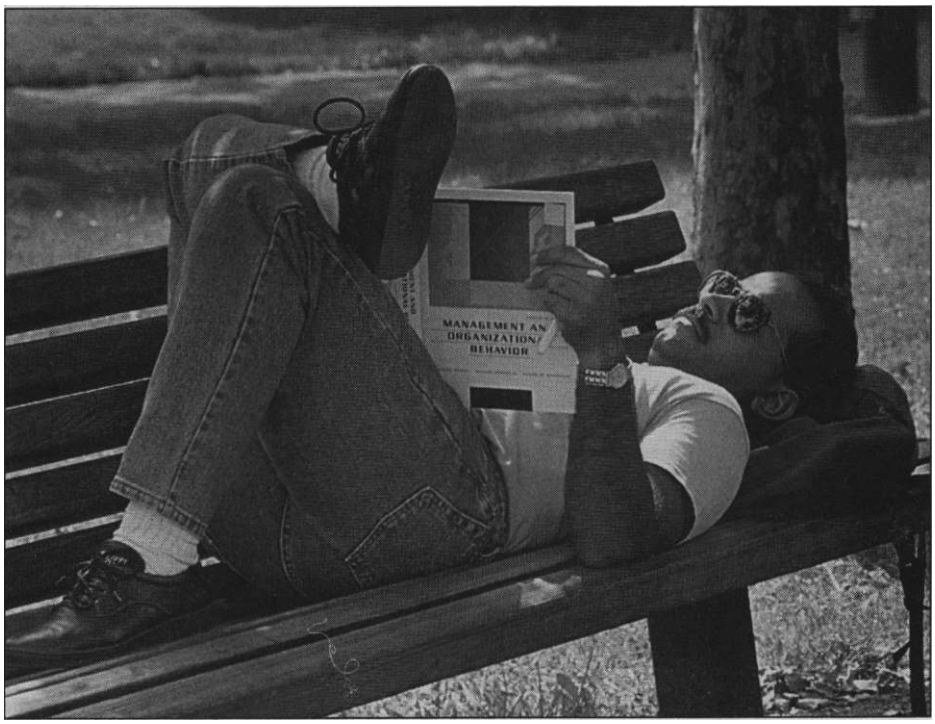
SPRING		
2081-711	Tone & Color Analysis	4
2081-890	Thesis	8
	Elective	4
	Total Credits	16

Graduate Faculty School of Printing Management and Sciences

Barbara Birkett, BA, Aquinas College; MBA, University of Michigan; MBA, Rochester Institute of Technology; CPA, Maryland—Associate Professor, Financial Controls
William H. Birkett, BS, University of Illinois; MBA, University of Michigan, CMA—Professor, Printing Management
Robert Y. **Chung,** BA, Eastern Washington State University; MS, Rochester Institute of Technology—Professor, Color Management
Frank J. Cost, BS, Eisenhower College; MS, Rochester Institute of Technology—Professor, Imaging Technology Management
Marie Freckleton, BFA, MST, Rochester Institute of Technology—Associate Professor, Printing Design; Graduate Program Coordinator of Graphic Arts Publishing
Robert G. **Hacker,** BS, Illinois State; MS, South Dakota State; Ph.D., Iowa—Professor, Newspaper Management, Computer Applications
Samuel B. Hoff, BA, MA, California State University—Associate Professor, Screen Printing/Image Assembly
Barry Lee, BS, Rochester Institute of Technology—Visiting Instructor
Len Leger, BS, SUNY College at Potsdam; MS, University of Rochester—Associate Professor, Printing Management
Joseph L. Noga, BS, Central Connecticut State University; MS, University of Bridgeport—Professor, Electronic Color Imaging, Graduate Program Coordinator of Printing Technology
David Pankow, MLS, Columbia University, New York City—Curator, Melbert B. Cary Jr. Graphic Arts Collection
Archibald D. Provan, BS, Rochester Institute of Technology; M.Ed., University of Rochester—Professor, Typography
Emery E. Schneider, BS, Southern Illinois University; M.Ed., University of Rochester—Professor, Electrical Composition Technology
Owen Smith, BS, Jackson State University; MS, Rochester Institute of Technology—Professor
Franz Sigg, MS, Rochester Institute of Technology—Research Associate
J. A. Stephen Viggiano, MS, Rochester Institute of Technology—Printing Technology; Sr. Imaging Scientist, RIT Research Corp.

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
Frank J. Romano, BA, City University of New York—Melbert B. Cary Distinguished Professor in the Graphic Arts



School of Photographic Arts and Sciences

The School of Photographic Arts and Sciences offers one graduate program: the master of fine arts in imaging arts.

Master of Fine Arts Degree in Imaging Arts

Angela M. Kelly
Coordinator, MFA Program
716-475-2711

Maria Schweppe
Coordinator, MFA Program, FilmMdeo Animation
716-475-2780

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 two areas of academic concentration: photography and computer animation. 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.

Program goals

1. Provide students the opportunity to use photography, filmmaking and other imaging arts as a means to pursue a career and earn a livelihood.
2. Provide students the opportunity to use photography, filmmaking and other imaging arts as a means to enrich their personal lives and society as a whole.
3. Provide an environment that encourages a sense of community, creativity, scholarship and purpose.

Electives

Elective courses are available in animation, video, multimedia, screen writing, printmaking, painting, sculpture, communications design, museum studies, crafts, bookmaking, typography, color photography, mixed media, studio photography, advertising photography, perception, sensitometry, computer graphics, art history and 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 concentration consists primarily of courses in motion picture making taught in the Film/Video Department and computer graphics programming courses offered by the Department of Information Technology. Course work includes exercises and major projects in both two- and three-dimensional computer animation as well as support courses in motion picture technique and interactivity.

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 Management and Sciences, School of Art and Design and School for American Crafts and from the College of Liberal Arts.

Admission requirements

Students with a baccalaureate degree or equivalent from an accredited college or university, or equivalent, are eligible for admission provided they present a portfolio of work that demonstrates their skills, visual sophistication and aesthetic awareness. Acceptance depends on the strength of portfolios as judged by the graduate faculty, past academic performance, letters of recommendation and personal statements of purpose.

There are no examination requirements (e.g., GRE) for admission to these MFA programs. Personal interviews are encouraged but not required. Applicants who are capable of good academic work as well as artistic visual expression and who demonstrate an interest in the exploration of new artistic ideas and experiences will be favored. The graduate faculty will make recommendations 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 admission to graduate study, a student must submit evidence of his or her undergraduate degree, an acceptable portfolio (slides, videotape, CD, etc.), a statement of purpose and references. All correspondence concerning applications or catalogs 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 18 quarter credit hours (12 semester hours) of B or better 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 his or her skills and visual sophistication.

Applicants to the photography concentration should send 20 slides representing a cohesive body or bodies of recent work. *Detailed instructions for labeling and packaging slide portfolios are given on the following page.*

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.

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. Applicants should be certain that portfolios are postmarked no later than March 15 to ensure review of their application. Admission to the program occurs only once a year. For further information or advice contact the MFA coordinator directly.

Portfolio instructions

- Submit your portfolio in the form of 35mm slides only.
- Submit no more than 20 slides in one poly page with 20 2" pockets.
- Place a red dot in the lower left corner of each slide mount.
- Label each slide with your name, title of work, date, size of work.
- Do not use glass slide mounts or thick tape to label or mask slides.
- Number slides 1 to 20 in the order you wish them projected and place in poly page with the top of the work in each slide at the top of the slide mount.
- You may include an optional separate page with additional information about the work on your slides.
- Include a self-addressed, STAMPED envelope for the return of your slides. We cannot return slides lacking sufficient postage or adequate packaging.

Send your portfolio postmarked by March 15 to:

Chairperson
Fine Art Photography Dept.
School of Photographic Arts and Sciences
Rochester Institute of Technology
70 Lomb Memorial Drive
Rochester, N.Y. 14623-5604.

Degree requirements

The MFA degree in imaging arts normally requires a minimum of two years of full-time resident graduate study. A minimum of 90 quarter credit hours of graduate work is outlined below. These minimums may be exceeded through the intent of the candidate or as a result of necessity to cover certain areas of study.

The 90 hours do not include undergraduate work required by action of the MFA admission committee in accepting a particular applicant, or undergraduate course prerequisites for graduate courses.

The Master of Fine Arts in Imaging Arts

The MFA degree encompasses work in three areas of study:

	Credits
1. MAJOR CONCENTRATION: Designed to give depth of experience in the area of the student's major interest and chosen from one of three concentrations: photography, museum studies, or computer animation. All students will complete 16 of these hours in required courses. Other course work is selected from many flexible alternatives.	40
2. History and Aesthetics of Imaging Arts and related art forms	15
3. Electives	19
4. Thesis Seminar and Research & Thesis	16
Total Credits	90

Distribution of work within these guidelines is subject to modification based upon the candidate's background, abilities and interests. An individualized course of study will be prepared with the help of the MFA coordinator and made a matter of record. Modifications in this prescribed program thereafter must be approved and recorded.

Grades and time limit

The *average* of all grades for graduate credit taken at the Institute must be at least a "B" (3.0) to qualify for the MFA imaging arts degree.

Thesis hours are usually taken over several quarters. Only the letter "R" is recorded, indicating a thesis in process. No letter grade is assigned. Acceptance or rejection of the thesis is made by the candidate's thesis board and the MFA faculty.

All course work, including an accepted thesis, must be completed within seven years of entrance into the program.

Photo gallery

The photo gallery is used to exhibit graduate thesis work, student work and works of contemporary imagemakers.

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.

Policy regarding student work

The School of Photographic Arts and Sciences reserves the right to retain at least one original piece of work from a student's MFA Thesis Show for inclusion in the MFA Collection to be used for educational and exhibition purposes. Graduates must also leave the school one set of not less than 20 slides or a videotape or CD of thesis work completed for the master's degree.

The animation laboratory has been the birthplace of many award-winning student projects.

Cultural influences

Rochester is a unique place for anyone seriously interested in a broad pursuit of photographic studies. Fine-art imaging at RIT is keeping pace with some of the newer visual imaging methods through 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 Imaging Arts and Sciences at RIT, there are resources to be found in two major additional institutions heavily involved in photographic education and innovation: the International Museum of Photography at the George Eastman House and the Visual Studies Workshop.

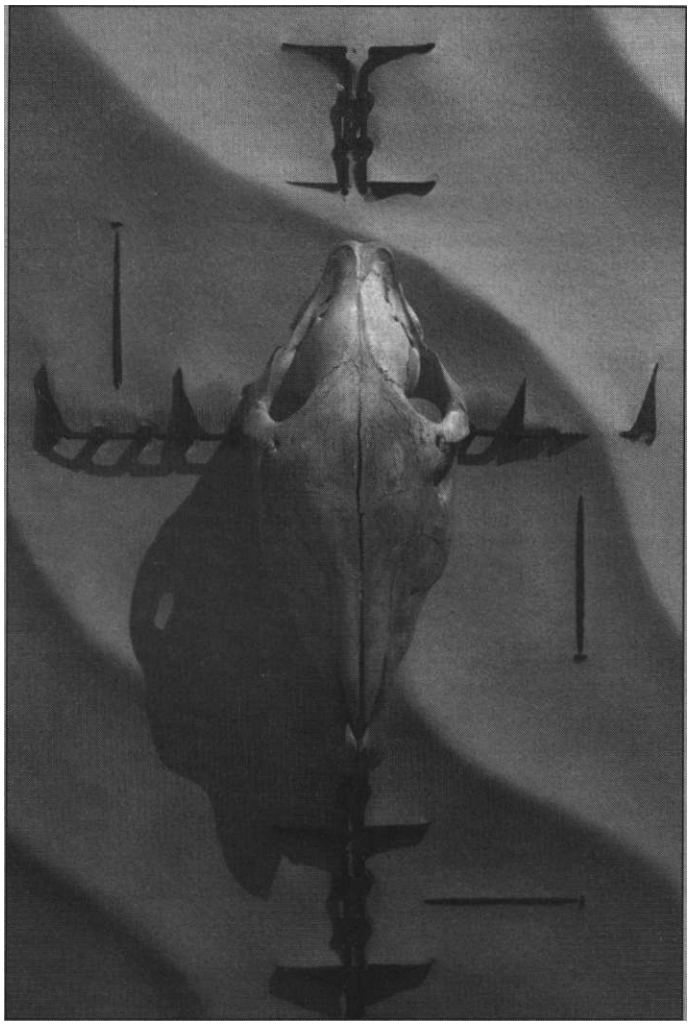
The MFA program in imaging arts at RIT is unique in that it is the only such program housed in a School of Photographic Arts and Sciences with a support faculty of 45 highly specialized and diverse instructors. The program is designed to reflect this diversity.

Graduate Faculty School of Photographic Arts and Sciences

Patti Ambrogi, MFA, Visual Studies Workshop—Associate Professor, Fine Art Photography
Angela M. Kelly, MA, Columbia College—Associate Professor
Elaine O'Neil, BFA, Philadelphia College of Art; MS, Illinois Institute of Technology—Professor
Elliott Rubenstein, MFA, SUNY Buffalo; MA, St. John's University—Professor, Fine Art Photography
Maria Schweppe, MA, Ohio State University—Associate Professor
Erik Timmerman, MFA, USC—Associate Professor, Film/Video Department
Jeff Weiss, BS, University of Michigan—Associate Professor, Fine Art Photography
Ken White, BA, Princeton University; MA, MFA, University of New Mexico—Associate Professor, Chair, Fine Art Photography

Associates of Graduate Faculty
Carl Battaglia—Associate Professor
Howard Lester—Associate Professor
Michael Starenko, BA, Kalamazoo College; MA, University of Chicago—Lecturer, Fine Art Photography

STUDENT PROFILE



"Three Stages of the Machine" © Gregory R. North

"Technology is only a tool—it can't be allowed to dictate the creative process," says Greg North. His image, "Three Stages of the Machine," is part of a series called "Horsepower," which explores how the stages of mechanical development have directly affected society's behavior.

"The rapid advancement of digital technology in the arts and publishing is creating a new era of speed and creative flexibility for an increasingly large user base. This technology has had a profound effect in merging several conventional disciplines and is beginning to mold a more singular definition of what we are used to calling fine, applied and graphic arts. This new era promises empowerment of the individual as artist and publisher, creating new opportunities for mass communication of ideas and images, limited only by imagination."

Greg North
BFA, Photography; MFA, Printing: Electronic Prepress

Note: Prerequisites are within parentheses at the end of the course description.

School of Art and Design

Art History/Graduate Studies

These courses are taken by all School of Art and Design/School for American Crafts MFA students.

2037-785 Forms of Inquiry
The exploration and organization of forms of inquiry in the fields of art, craft and design. Class 2, Credit 2 (offered every year)

2037-790 Graduate Forum
The presentation and discussion of issues in aesthetics, criticism, creativity and perception as they relate to art, design and craft will be undertaken. Points of view to be clarified through critical writing. Required for MFA; to be taken prior to Thesis. Class 2, Credit 3

Graphic Design

2010-711 Theory & Methods Seminar
This seminar is a core experience for all graduate graphic design majors. The course is composed of a series of guest presenters on topics related to pertinent theory (i.e. sign theory, communication theory, whole systems theory, information theory, visual rhetoric, perception, human factors/ergonomics, etc.) and methodology (i.e. brainstorming approaches, research and evaluation methods, implementation considerations, cross-disciplinary methods, etc.). The course is multi-disciplinary in nature. Ongoing assignments and a final course project are required. Studio 6, Credit 3

2010-712 Graduate Typographic Design
This course is centered on learning about typographic variables organization methods. Focused decision making related to visui hierarchy, readability and communication is stressed. Projects involve the process of creating a thematic, sequential typographic design application. Studio 6, Credit 3

2010-713 Design History Studies
This course involves ongoing lectures about graphic design history and a studio application which centers upon relevant content from these lectures. Discussion of appropriate theory and criticism is included. The archives and special collections at Wallace Library are used for research and analysis purposes. Studio 6, Credit 3

2010-716 Image Forms
This introductory course investigates formal visual aesthetics related to graphic design. Emphasis is on the process of image analysis, ideation and synthesis. Applied use of imagery focuses upon clear message-making and audience understanding. Image-generation tools range from traditional to electronic media as appropriate for specific projects. An extended studio project in form analysis and articulation is the primary activity. Lab 6, Credit 3

2010-717 Graduate Systems Design
This course investigates various approaches toward visually and conceptually organized components of graphic design problems (i.e. words, photographs, illustrations, diagrams, abstract shapes, textures, lines, colors, etc.) for the purpose of clear, unified communication. Projects may include the creation of multiple components within a common framework. Lab/Studio 6, Credit 3

2010-718 Graduate Information Design
This course stresses the importance of reader and user responses to written and visually presented information. Projects stress clarity and accessibility while investigating a variety of formats (i.e. charts, diagrams, business forms, tables, maps, instructional materials, wayfinding systems, graphic user interfaces, etc.)

2010-721 Project Development & Evaluation
This course involves the application of theory and methods to the planning of a design project. Each student is responsible for formulating a comprehensive project development plan, including the use of evaluation method(s) during appropriate stages of the project. Lab/Studio 6, Credit 3

2010-722 Graduate Graphic Design Applications
This is an advanced course in which the students apply formal aesthetic principles in systematically solving applied problems on thematic, content-intensive topics. Emphasis is placed on the relationship between form and communication. Projects are defined, structured and implemented by the student. Lab/Studio 6, Credit 3

2010-724 Graduate Graphic Design Topics
This course is tailored to the specific needs of the students enrolled. Potential topics may include: design planning, human factors, interface design, writing and design, design for electronic media, and application of new technologies. The course involves research and design applications relevant to the selected course topic. **Studio/Lab 6, Credit 3**

2010-726 Ethics & Values—Design
This course stresses the impact of the designer's role in society and emphasizes the need for social awareness and critical thinking. Projects are centered around controversial issues, design for non-profit, and topics related to accessibility. Classroom discussions support and enhance studio involvements related to these topics. **Lab/Studio 6, Credit 3**

2010-761 Graphic Design Elective
Please refer to description for Graphic Design (MFA Major) below. **Lab 6, Credit 3 (offered every quarter)**

2010-890 Thesis—Graphic Design
The development of a thesis project initiated by the student and approved by a faculty committee. Primarily a creative production, the thesis must also include a written report and participation in a graduate thesis show. **Lab 9-42, Credit 3-14 (offered every quarter)**

Art Education

2011-701 Art Education Methods/Materials
Intensive study of curriculum in terms of teaching materials for both studio and appreciation aspects of elementary, early secondary, and high school art education. Includes studio and elementary school teaching experience. **Class 2, Lab 9, Credit 5 (F, W) (offered on** sufficient **demand)**

2011-820 Seminar in Art Education
Evaluation and study of the practice teaching experience. Discussion of the professional role of the art teacher in terms of professional associations, supervision, teacher training and research. A final project on some intensively studied aspect of art education is required. **Lab 25, Credit 3 (S) (offered on sufficient demand)**

2011-860 Practice Teaching
A seven-week, full-time practice teaching experience in secondary school, including professional duties of the art teacher in humanities courses, publication advising, audiovisual work and supervision. Supplements the studio-theoretical education. Meets the state education requirements. **Credit 9 (S) (offered on sufficient demand)**

Computer Graphics Design

2014-780 Introduction to Computer Graphics
An introduction to computer graphics hardware and software. Basic familiarity with using the keyboard, mouse, disk drive, printer, scanner and video digitizer to create imagery. **Lab** 6, **Credit** 3 **(offered every year)**

2014-781 2D Computer Graphics Design
Exposure to computer graphic algorithms, design heuristics, design methodology and program structures of two-dimensional imagery for multimedia design. Projects involve programming in an authoring language. **Lab 6, Credit 3 (offered every year)**

2014-782 3D Computer Graphics Design
Extension of previous experience to include three-dimensional objects with hidden lines and surfaces, rotations, solid modeling, perspective, texture mapping and ray tracing. **Lab** 6, **Credit** 3 **(offered every year)**

2014-783 Visual Semiotics
The application of semantic, syntactic and pragmatic levels of visual design activities. These concepts will be applied to creative projects, using the computer as the primary tool. **Lab 6, Credit 3 (offered every year)**

2014-784 Digital Typography
A study of today's digital typography. Hands-on experiences in production typesetting, prepress planning for accurate typographic reproduction, as well as type used as a visual image. This course also deals with typography for animation and multimedia environments. **Lab 6, Credit 3 (offered every year)**

2014-785 Instructional Multimedia (MFA Major)
Interactive and other software packages will be used to create instructional programs for different age groups. Course work will include subject matter research; developing objectives; creating graphics, sound and interactivity; and program evaluation. Each student will produce an instructional multimedia program. **Lab** 6, **Credit** 3 **(offered every year)**

2014-786 Computer-Generated Animation (MFA Major)
Keyframe, film loop, real-time recording and other digital techniques to automatically create computer animation applications for film, video, interactive or multimedia presentations. **Lab** 6, **Credit** 3 **(offered every year)**

2014-787 Advanced Computer Graphics Design (MFA Major)
Advanced exploration of computer graphics applications. Projects could include such topics as interactive multimedia presentations, internet applications, computer-generated layout, digital type development, computer-aided instruction lessons, TV and electronic mail promotions and virtual reality animation. **Lab** 6, **Credit** 3 **(offered every year)**

2014-890 Thesis—Computer Graphics Design
The development of a thesis project initiated by the student and approved by a faculty committee. Primarily a creative production, the thesis must also include a written report and participation in a graduate thesis show. **Lab 9-42, Credit 3-14 (offered every quarter)**

Interior Design

2015-780 Interior Design Applications—Graduate
Selected projects in interior design that 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 for graduate majors only)**

Sculpture

2019-761 Illustration Elective—Graduate
Traditional sculptural concepts will evolve through a variety of processes and materials—predominately clay, plaster, cement, stone, paper and metal. The human figure is presented as a subject for study and for use as a springboard to invention. **Lab** 6, **Credit** 3 **(offered every year)**

Medical Illustration

2020-781 Medical Illustration Topics I
This is an introductory course, designed to acquaint the illustration student with art techniques commonly used in medical illustration and with the medical library and audio-visual television supporting milieu in which the medical illustrator works. **Lab** 6, **Credit** 3 **(offered every year)**

2020-782 Medical Illustration Graphics
A course emphasizing the use of computer software and hardware as a resource for generating titles, charts and graphs, schematics and illustrations as vehicles to meeting instructional and communicative needs. Students will learn the various techniques available and will apply those techniques while designing pamphlets, in-house publications and poster exhibits. **Lab** 6, **Credit** 3 **(offered every year)**

2020-783 Anatomical Studies
Sketches drawn from human dissection are translated into instructional illustrations using watercolor wash and pen and ink. Emphasis will be on rapid, but accurate sketching and observation in the laboratory, with a representation of form and structure in living tissue for publication. **Lab 6, Credit 3 (offered every year)**

2020-784 Medical Illustration Topics II
A continuation of Anatomical Studies **I** with students translating sketches drawn from human dissection into full-color instructional illustrations. Techniques studied include watercolor, color pencil, airbrush and mixed media. Emphasis will be on rapid, but accurate sketches leading to the description of living tissue for the preparation of surgical illustration. **Lab 6, Credit 3 (offered every year)**

2020-785 Surgical Procedures I
The application of creating instructional aids designed to increase learner understanding of surgical procedures and concepts. Sketches are to be drawn while observing the surgery, consulting with the surgeon for accuracy of detail and development. The final preparation of the art work will match its intended use (e.g., publication, slide graphic, computer graphic, etc.) **Lab** 6, **Credit** 3 **(offered every year)**

2020-786 Surgical Procedures II
A continuation of the concepts begun in 2020-785; 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 art work will meet the demands of reproduction. **Lab** 6, **Credit** 3 **(offered every year)**

2020-890 Thesis—Medical Illustration
The development of a thesis project initiated by the student and approved by a faculty committee. Primarily a creative production, the thesis must also include a written report and participation in a graduate thesis show. **Lab 9-42, Credit 3-14 (offered every quarter)**

Painting

2021-761 Painting (Elective, Minor)
Study of present techniques and concepts in painting and the relation to the tradition of painting. Development of painting skills in a chosen medium. **Lab 6, Credit 3 (offered every quarter)**

2021-761 Painting (Graduate Elective)
Individual drawing projects related to graduate students' major area of study. Opportunity to refine drawing skills at the graduate level. **Lab 6, Credit 3 (offered every year)**

2021-780 Painting (Graduate)
Development of a variety of mixed media, including painting medium and related preparatory study. Examination of ideas and relationships in the field with emphasis upon intelligent and knowledgeable creative solutions. **Lab 9-27, Credit 3-9 (offered every quarter)**

2021-890 Thesis—Painting
The development of a thesis project initiated by the student and approved by a faculty committee. Primarily a creative production, the thesis must also include a written report and participation in a graduate thesis show. **Lab 9-42, Credit 3-14 (offered every quarter)**

Printmaking

2022-761,762, 763,764 Printmaking (Graduate Elective)
Advanced techniques in etching, lithography and woodcutting, as well as in many experimental areas including color processes, photo transfer process and expression, and combination printing. Students are expected to develop along independent lines, and direction is offered in contemporary thought and concept, with emphasis upon developing a complete respect for the printmaking craft and profession. Lab fee required. **Lab** 6, **Credit** 3 **(offered every quarter)**

2022-780 Printmaking (Graduate)
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 photo transfer processes 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)**

2022-890 Thesis—Printmaking
The development of a thesis project initiated by the student and approved by a faculty committee. Primarily a creative production, the thesis must also include a written report and participation in a graduate thesis show. **Lab 9-42, Credit 3-14 (offered every quarter)**

Industrial Design

2035-761, 762,763,764 Industrial Design (Graduate Elective)
The reasoned application of theoretical and practical background to advanced projects in industrial and interior design. **Lab 6, Credit 3 (offered every quarter)**

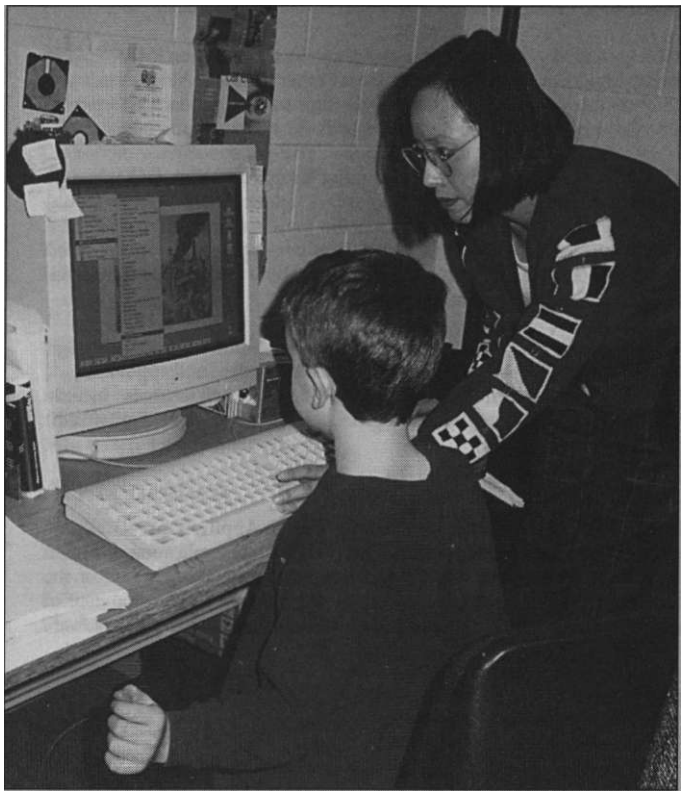
STUDENT PROFILE

Graduate theses can take many forms. For Kristine Hye Jung Hwang and Daniela Jorge, their joint CD-ROM thesis project is now being used to teach children about art and the collections at Rochester's Memorial Art Gallery.

"Yes, it was very demanding, more than we thought," Hwang says. "I would do it again with Daniela though; as a team, we enjoyed the challenge and the real-world application."

Susan Dodge Peters, gallery education director, asked them to create the interactive CD-ROM . "The most difficult part overall was designing for the wide age range—kindergarten through sixth grade," relates Hwang. But actual design of screen and navigation—with 50 movies in nearly 200 megabytes—proved the hardest conceptual part, believes Jorge. **"We** *really ivanted to avoid cartooning to keep the sense of fine art."*

The duo designed Destination Imagination in seven sections, including animals in art, pictures of children and puzzling pairs.



2035-780 Industrial Design Graduate Applications
Selected projects in industrial design that 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 for graduate majors only)**

2035-890 Thesis—Industrial Design
The development of a thesis project initiated by the student and approved by a faculty committee. Primarily a creative production, the thesis must also include a written report and participation in a graduate thesis show. **Lab 9-42, Credit 3-14 (offered every quarter)**

2037-785 Forms of Inquiry
The exploration and organization of forms of inquiry in the fields of art, craft, and design. **Class 2, Credit 2 (offered every year)**

School for American Crafts

Thesis

2040/41/42/43/44-890 Thesis—School for American Crafts
Research and presentation of an acceptable thesis with a focus on technique, design and/or production. The thesis subject will be chosen by the candidate with the approval of the faculty adviser. The thesis will include a written report of the research and participation in the graduate thesis show. **Lab 9-42, Credit 3-14 (offered every quarter)**

Ceramics and Ceramic Sculpture

2040-761, 762, 763, 764 Ceramic (Graduate Elective)
Basic instruction and experience in ceramic design, fabrication and production of ceramic forms is undertaken. This study provides ceramic technology and terminology and gives experience with clays along with fundamental forming techniques. The development of design awareness is encouraged through lectures and critiques. Lab fee required. **Lab 6, Credit 3 (offered every quarter)**

2040-780 Ceramics (Graduate Studio)
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 fee required. **Lab 9-27, Credit 3-9 (offered every quarter)**

Glass and Glass Sculpture

2041-701 Corning Glass: Graduate Glassform
This survey art course introduces students to the properties, history, and techniques of glass. Casting, fusing, stained glass, glass-blowing and sandblasting techniques are taught at the Corning Museum of Glass studio. Students will become familiar with the permanent collection and the Rakow Library. (Graduate glass elective **761** or permission of the instructor) **Lab 6, Credit 3**

2041-711 Corning Glass: Graduate Studio I
Students will work at the glass furnace and study from the permanent collection of the Corning Museum of Glass and Rakow Library to create a body of personalized work. This work will employ the aesthetic, style and technique of the Venetian master glass artisans. The working properties of colored borosilicate glasses will be fully explored in this study of flameworking techniques. The focus of the body of work will be guided by the conceptual concerns of the thesis. (Graduate glass major status) **Lab 6, Credit 3**

2041-761, 762, 763, 764 Glass (Graduate Elective)
Collaborative work in the student's major area of study and glass fabrication is encouraged. Various techniques, both hot and cold, will be considered in different quarters: casting, slumping, fusing, blowing, neon, engraving, sand carving, cutting, electroplating, lamp working and sculptural construction. Course emphasis on personal, independent development encouraging contemporary thought and concept. Lab fee required. **Lab 6, Credit 3 (offered every quarter)**

2041-780 Glass (Graduate)
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 creativity 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. Materials fee required. Lab 9-27, Credit 3-9 (offered every quarter)

Metals/Jewelry Design

2042-761,762,763, 764,771,772, 773,774 Metals (Elective/Minor)
This is the study and manipulation of metals for hollowware/jewelry. Design sensitivity and concepts are approached through the raising, forming and planishing, or casting, forging and fabricating techniques. Materials fee required. Lab 6, Credit 3 (offered every quarter)

2042-780 Metals (Graduate)
A program structured on the basis of individual needs, interests and background preparation as they may be determined through faculty counseling. Both hollowware 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. Materials fee required. Lab 9-27, Credit 3-9 (offered every quarter)

Weaving and Textile Design

2043-761, 762, 763, 764, 773 Textiles (Graduate Elective)
This is the study and appreciation of weaving and textile techniques, soft sculpture, off-loom weaving and printing. Design approaches are stressed. Materials fee required. Lab 6, Credit 3 (offered every quarter)

2043-780 Textiles (Graduate)
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, finnweave, Ikat, multiple layer, dyeing, nonloom, pile rug, surface design, silk screen printing, computer design, silkscreen, 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. Materials fee required. Lab 9-27, Credit 3-9 (offered every quarter)

Woodworking and Furniture Design

2044-761,762,763,764 Wood Elective (Graduate Elective)
This is a course in woodworking techniques and procedures. It enables the student to gain design competency through wood and an individual solution to wood projects based on suggested needs. Materials fee required. Lab 6, Credit 3 (offered every quarter)

2044-780 Wood (Graduate)
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 and 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)

School of Photographic Arts and Sciences

Master of Fine Arts in Imaging Arts

2065-701 Film History
An extended comparative survey of the history and aesthetics of film that will explore the four basic forms of the medium: fiction, documentary, animated and experimental. Emphasis is on determining the unique characteristics of the medium and how those characteristics are used as a means of interpretation and expression. Credit 4

2065-711 Photography Core
Major emphasis is placed on the individual's learning to generate and intensify his or her personal statement through creative projects. Some of the projects are assigned, while others are selected by the candidate. Work is critiqued weekly by the instructor. Credit 4

2065-721 Animation & Graphic Film Production I
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)

2065-722 Animation & Graphic Film Production II
A continued introduction to the techniques and practice of graphic and animated film production. This course provides training and practical experience in a number of approaches to single-frame film making in addition to those covered in 2065-721. Some techniques covered in the course are three-dimensional animation; optical printing; computer animation; and hand-drawn sound. Screenings of professionally made films will illustrate each technique. Proficiency in drawing is not required. (2065-721) Class 2, Discussion 1, Lab 2, Credit 4 (W, S)

2065-723 Animation & Graphic Film Production III
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. (2065-722) Class 2, Discussion 2, Lab 2, Credit 4 (S, F)

2065-727 Scriptwriting for Animation
This course explores the principles of dramatic structure and storytelling in both fiction and nonfiction animated film and video. Students prepare short scripts suitable for production and prepare finished storyboards from those scripts. Credit 4

2065-731 Film/Video Tools & Technology
An intensive tools and technology course that will allow the student to work in the 3/4" video format. The course will examine the technical concerns of single-system portable video production and off-line editing. Production skills in camera work, editing and sound recording will be covered. (2065-203) Credit 5 (F)

2065-737 2D Computer Animation I
Students in this course create animated sequences and projects using a commercial animation software package for a popular microcomputer. In addition to mastering specific software, students learn the principles of digital computer operation and how those principles apply to the problems of animation with computers. Credit 4 (W)

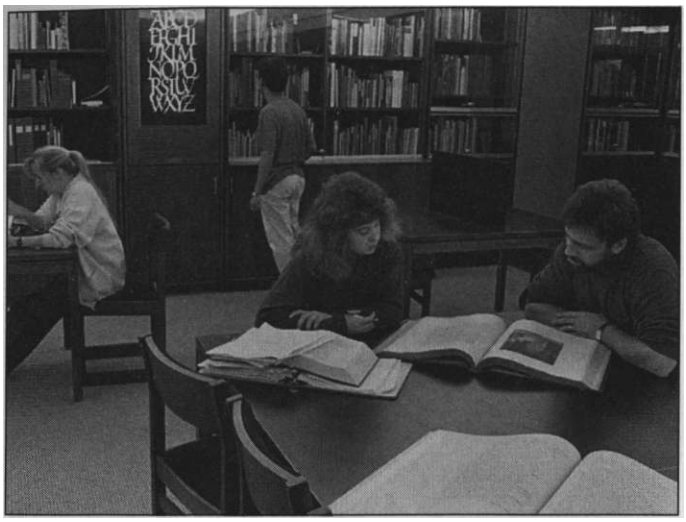
2065-738 2D Computer Animation II
This course focuses on the integration of computer animation into film and video. Students produce a finished animated project on film or videotape with sound, which can be used as a portfolio piece. Emphasis is placed upon various postproduction strategies which involve such techniques as combining computer animation with live action, the addition of film and video special effects and combining computer animation with existing film or video imagery. (2065-713) Credit 4 (S)

2065-747 3D Computer Animation I
Students begin work in modeling three-dimensional space and manipulating objects within that space with particular attention to the role of color and color effects in animation. Emphasis is on color as a vehicle of expression and the techniques used to model, shade, display and record three-dimensional objects. Credit 4

2065-750 Special Topics—Graduate
Advanced topics of current or special interest designed to broaden and intensify the student's ability to use photography or film/video as a means of communication and expression. Credit 3-9

2065-756 Photographic Workshop
Each faculty member offers a different opportunity for students to explore the multiplicity of ways that photography or filmmaking can be used as a vehicle for expression and communication. Visual research, group critiques, field trips, studio and laboratory practice are used. Credit 4

2065-757 Photographic Workshop
Each faculty member offers a different opportunity for students to explore the multiplicity of ways that photography or filmmaking can be used as a vehicle for expression and communication. Visual research, group critiques, field trips, studio and laboratory practice are used. Credit 4



Graduate printing students have access to the Melbert B. Gary Jr. Graphic Arts Collection, one of the finest collections in the world on the history of printing.

2065-758 **Photographic Workshop**
Each faculty member offers a different opportunity for students to explore the multiplicity of ways that photography or filmmaking can be used as a vehicle for expression and communication. Visual research, critiques, field trips, studio and laboratory practice are used. Credit **4**

2065-771 **Graduate Seminar**
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 other's photographs or films, to meet with visiting artists on campus and to participate in a thesis sharing from time to time. **Credit 2**

2065-781 **Alternative Processes**
An advanced course in the production and presentation of still or moving images using historical and contemporary visual imaging processes. Emphasis is on extending the students' experience in image making by incorporating alternatives to conventional photography or filmmaking 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**

2065-782 **Alternative Processes**
An advanced course in the production and presentation of still or moving images using historical and contemporary visual imaging processes. Emphasis is on extending the student's experience in image making by incorporating alternatives to conventional photography or filmmaking 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**

2065-783 **Alternative Processes**
An advanced course in the production and presentation of still or moving images using historical and contemporary visual imaging processes. Emphasis is on extending the student's experience in image making by incorporating alternatives to conventional photography or filmmaking into their work. Processes to be covered include various light-sensitive emulsions, the production of visual books and generative systems such as electostatics and offset lithography. **Credit 4**

2065-786 **Contemporary Issues**
A study of current issues relevant to fine art photography and filmmaking, how they relate to broader historical/cultural issues and how they might suggest future directions. Credit **2**

2065-787 **Contemporary Issues**
A study of current issues relevant to fine art photography and filmmaking, how they relate to broader historical/cultural issues and how they might suggest future directions. **Credit 2**

2065-788 **Contemporary Issues**
A study of current issues relevant to fine art photography and filmmaking, how they relate to broader historical/cultural issues and how they might suggest future directions. **Credit 2**

2065-799 **Independent Study**
Learning experiences not provided by formal course structure may be obtained through the use of an independent study contract. **Credit 1-9**

2065-841 **Research Seminar**
The seminar serves as a planning stage for preparing a research thesis proposal and for an ongoing critique and discussion of the research in progress. Issues related to exhibitions, publications, copyright and gallery also are covered. Credit 2

2065-842 **Research Seminar**
The seminar serves as a planning stage for preparing a research thesis proposal and for an ongoing critique and discussion of the research in progress. Issues related to exhibitions, publications, copyright and gallery also are covered. Credit 2

2065-843 **Research Seminar**
The seminar serves as a planning stage for preparing a research thesis proposal and for an ongoing critique and discussion of the research in progress. Issues related to exhibitions, publications, copyright and gallery also are covered. **Credit 2**

2065-890 **Research Thesis Film/Video**
The thesis is designed and proposed by the candidate. It is considered his or her culminating experience in the program, involving research, a creative body of work, an exhibition or suitable presentation and a written illustrated report. **Credit 1-12**

2066-701 **History & Aesthetics of Photography**
The course will survey the major issues throughout the development of the medium: prehistory up to the 19th century; fin de siecle to present. **Credit** 3

2066-702 **History & Aesthetics of Photography**
The course will survey the major issues throughout the development of the medium: prehistory up to the 19th century; fin de siecle to present. **Credit** 3

2066-703 **History & Aesthetics of Photography**
The course will survey the major issues throughout the development of the medium: prehistory up to the 19th century; fine de siecle to present. **Credit** 3

2066-711 **Photography Core**
Major emphasis is placed on the individual's learning to generate and intensify his or her personal statement through creative projects. Some of the projects are assigned, while others are selected by the candidate. Work is critiqued weekly by the instructor. Credit 4

2066-712 **Photography Core**
Major emphasis is placed on the individual's learning to generate and intensify his or her personal statement through creative projects. Work is self-assigned in consultation with the core faculty and is critiqued weekly by the instructor. **Credit 4**

2066-713 **Photography Core**
Major emphasis is placed on the individual's learning to generate and intensify his or her personal statement through creative projects. Work is self-assigned in consultation with the core faculty and is critiqued weekly by the instructor. **Credit 4**

2066-750 **Special Topics Workshop**
Advanced topics of current or special interest designed to broaden and intensify the student's ability to use photography or film/video as a means of communication and expression. **Credit 3-9**

2066-754 **Museum Studies**
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. This cannot be selected as a minor concentration. (Graduate status as museum major) Credit 4

2066-756 Photographic Workshop
Each faculty member offers a different opportunity for students to explore the multiplicity of ways that photography or filmmaking can be used as a vehicle for expression and communication. Visual research, group critiques, field trips, studio and laboratory practice and critical readings are used. Credit 4

2066-757 Photographic Workshop
Each faculty member offers a different opportunity for students to explore the multiplicity of ways that photography or filmmaking can be used as a vehicle for expression and communication. Visual research, group critiques, field trips, studio and laboratory practice and critical readings are used. Credit 4

2066-758 Photographic Workshop
Each faculty member offers a different opportunity for students to explore the multiplicity of ways that photography or filmmaking can be used as a vehicle expression and communication. Visual research, group critiques, field trips, studio and laboratory practice and critical readings are used. Credit 4

2066-760 Photographic Workshop for Teachers
A graduate course in the principles and practices of photography designed especially for the high school or community college teacher, counselor, or adviser, who may be involved in instruction or career guidance in photography or film/video. Both black-and-white and color photography are presented and applied in actual picture-making experiences. Both the aesthetic and the technical aspects of photography are stressed. Teaching methods, course development and ideas in visual communications are examined. Teaching technique relevant to the instruction of photography will be stressed. Career opportunities in photography will be explored. Credit 6 (not offered every year)

2066-762 Dadaism, Surrealism & Photography
A first-year course that examines the work of a group of artists, know as the Dadaists, who rejected the social order and values that produced World War I. The student will, in turn, explore surrealism, the art movement that moved beyond the "destructive program of Dada" and replaced it with a more creative approach to human values and life. Credit 3

2066-764 Minor White Seminar
A study of the photography and philosophy of Minor White and his contribution to photographic publications, photographic education and photography as an art form. Credit 3 (not offered every year)

2066-765 Photography Extensions
Strip photography, slit/scan photography and stroboscopy are used to probe and artistically manipulate spatial and temporal dimensions in order to create unseen poetic expressions of a space/time continuum. Perceptual principles and technical problems associated with the production and exhibition of such images are studied. Credit 4

2066-768 Conservation Procedures
The principles of photographic conservation and archival practice in a museum context will be presented through lecture, practical demonstration and field visits to local museums. Included are the methods for examining photographs, stabilizing them and restoring them. Special emphasis will be given to proper techniques for display and storage of photographs, together with instruction on how to gain access to information and materials pertinent to those activities. Credit 4

2066-770 Photography in the Desert Southwest
An unusual extended workshop for students to photograph and travel in the Four Corners region of the American Southwest with an instructor leading a camping tour through New Mexico, Utah, Colorado and Arizona. Federal and state campgrounds are used exclusively. Students participate in day trips and hikes or make their own daily itinerary. No darkroom facilities are available during the trip. Maps and reading assignments introduce students to the geology, climate, history and cultures of the Southwest. (Basic photography experience) Credit 3-9

2066-771 Graduate Seminar
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 other's photographs or films, to meet with visiting artists on campus and to participate in a thesis sharing from time to time. Credit 2

2066-772 Teaching Photography
A graduate course concerned with the art and craft of teaching photography in formal and informal settings and in accordance with accepted learning principles. Credit 4 (not offered every year)

2066-774 Landscape as Photographs
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 diverse group of historical and contemporary image makers. (No prerequisite; open as an elective pending enrollment by majors) Credit 3

2066-775 Early Photographic Processes
This is a non-laboratory technical course that surveys the structure and deterioration mechanisms of major historical photographic processes. It examines the technical basis of preservation strategies within a museum archive, and presents an approach to preservation that is integral with collection management and curatorial function. Prerequisites: none Class 3, Credit 3

2066-778 Modernism: Photographic Art & Culture
Modernism is a term used to describe how life in Europe and America from the 1880s to the 1960s was transformed by 20th century science, technology, and principles and practices of art and culture through the past century. Students will study how pioneers Picasso and Duchamp abandoned the conventions of their perspective and construction of the figure then replaced these traditions with new methods of representation. Prerequisites: none Credit 3, Class 3

2066-781 Alternative Processes
An advanced course in the production and presentation of still or moving images using historical and contemporary visual imaging processes. Emphasis is on extending the students' experience in image making by incorporating alternatives to conventional photography or filmmaking 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

2066-782 Alternative Processes
An advanced course in the production and presentation of still or moving images using historical and contemporary visual imaging processes. Emphasis is on extending the students' experience in image making by incorporating alternatives to conventional photography or filmmaking into their work. Processes to be covered include various light-sensitive emulsions, the production of visual book and generative systems such as electrostatics and offset lithography. Credit 4

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2066-786 Contemporary Issues
A study of current issues relevant to fine art photography and filmmaking, how they relate to broader historical/cultural issues and how they might suggest future directions. Emphasis is placed on the critical discourse that forms practice. Credit 2

2066-787 Contemporary Issues
A study of current issues relevant to fine art photography and filmmaking, how they relate to broader historical/cultural issues and how they might suggest future directions. Emphasis is placed on the critical discourse that forms practice. Credit 3

Recent Shows in RIT's Gallery of the School of Photographic Arts and Sciences

- Graduate Student Exhibit, School of Photographic Arts and Sciences and the Visual Studies Workshop
- "Photographic Assemblages, Prints and Drawings," artist/ photographer Gary Graves and printmaker/painter Jamie Gruzska
- "Double Focus," David Teplica, M.D., MFA
- "The White Oak Dance Project," Annie Leibovitz

2066-788 **Contemporary Issues**
A study of current issues relevant to fine art photography and filmmaking, how they relate to broader historical/cultural issues and how they might suggest future directions. Emphasis is placed on the critical discourse that forms practice. **Credit 2**

2066-799 **Independent Study**
Learning experiences not provided by formal course structure may be obtained through the use of an independent study contract. **Credit 1-9**

2066-841 **Research Seminar**
The seminar serves as a planning stage for preparing a research thesis proposal and for an ongoing critique and discussion of the research in progress. Issues related to exhibitions, publications, copyright and gallery also are covered. **Credit 2**

2066-842 **Research Seminar**
The seminar serves as a planning stage for preparing a research thesis proposal and for ongoing critique and discussion of the research in progress. Issues related to exhibitions, publications, copyright and gallery also are covered. **Credit 2.**

2066-843 **Research Seminar**
The seminar serves as a planning stage for preparing a research thesis proposal and for an ongoing critique and discussion of the research in progress. Issues related to exhibitions, publications, copyright and gallery also are covered. **Credit 2.**

2066-890 **Research & Thesis**
The thesis is designed and proposed by the candidate. It is considered his or her culminating experience in the program, involving research, a creative body of work, an exhibition or suitable presentation and a written illustrated report. **Credit 1-12**

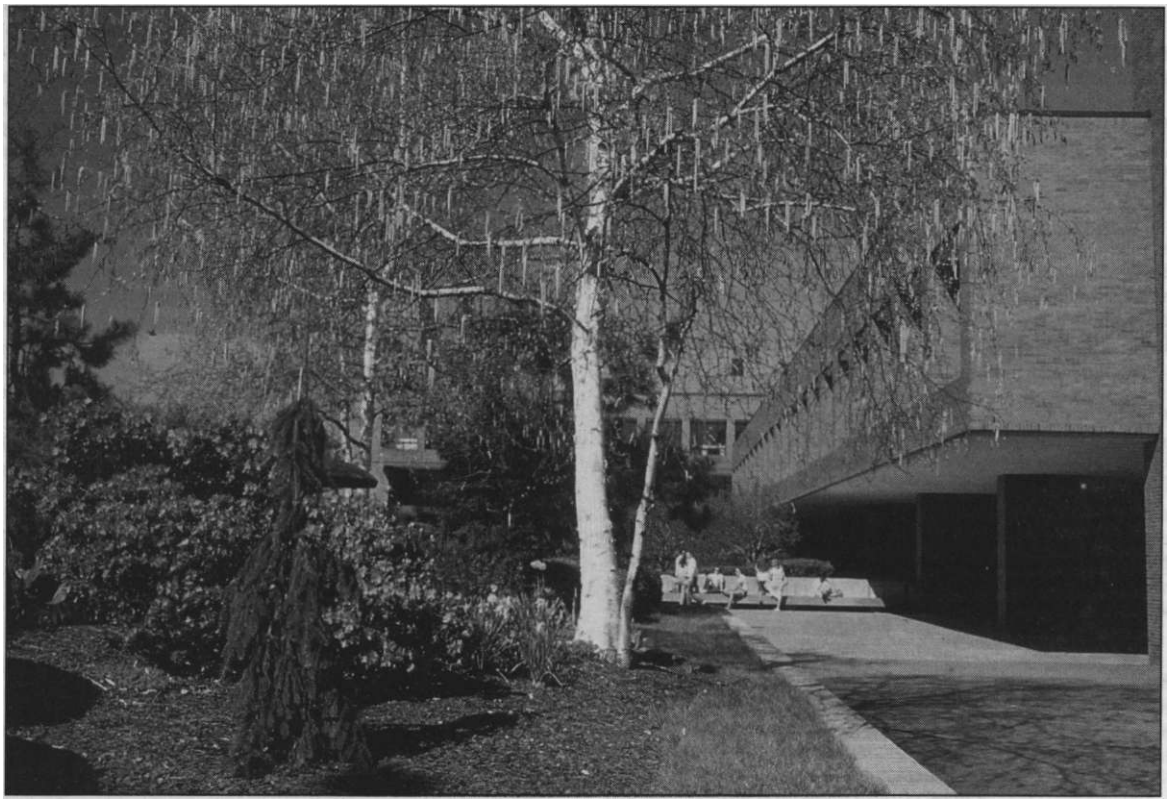
School of Printing Management and Sciences

2080-705 **Accounting Systems—Graduate**
Consideration of financial and managerial accounting systems and related topics as they pertain to the needs of the printing firm. Lectures on selected accounting topics; class discussions of assignments from textbooks and other assigned readings. **Class 4, Credit 2**

2080-707 **Estimating & Analyzing in Graphic Arts Systems**
Course content covers the application of information from other management and technical courses to comprehensive situations in estimating. Its aim is to provide the student with an understanding of the relationships between estimation, pricing and the supply and demand forces which occur in the marketplace and to expose students to several printing specialties so they may appreciate the various cost advantages and disadvantages involved in the use of particular technologies. Class sessions include lectures, discussions, labs and project presentations by students. In addition to normal reading assignments, the student will be required to prepare and deliver an oral report or a written term paper on a topic related to an estimating, pricing, time study, or some other cost-related problem of special interest to the student. **Class 4, Credit 4**

2080-712 **Operations Management in Graphic Arts**
Designed to give the student a broad perspective of the many topics related to managing a printing facility. Topics include an examination of the systems approach to production management, the use of statistics and other quantitative techniques in methods and decision analysis, the cost-volume-price relationship in printing production and the effect of organizational structure on decision making, line-staff relationships and management personnel. **Class 4, Credit 4**

2080-717 **Marketing & Economic Applications in Graphic Communications**
The role, importance and principles of marketing are combined with selected topics from microeconomics that relate to a printing company's plans for the future. Extensive outside reading is required to facilitate the use of class time for practice and discussion of the materials. **Class 4, Credit 4**



Entrance to the Gannett Building. Most of the college's facilities are contained in this and the adjoining Booth Building.

2080-840 Project Design
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**

2081-700 Science & Math—Graduate
A study of the fundamentals of science and math with an emphasis on relationship of printing science and technology. The basics of chemistry and physics are selected for study in depth needed to appreciate the roles played in the past and expected in the future. Emphasis is on materials in relation to the printing process and quality. Topics in math are selected to support the chemistry and math to be studied. Class **2,** Credit **2**

2081-701 Research Methods in the Graphic Arts
The theory and applications of the principles of scientific research in the graphic arts will be covered, including a systematic study of the scientific method, hypothesis generation, the nature of theory, types of research, research design and measurement. The study of problems in the graphic arts including ink and paper, reproduction methods and quality control. **Class 4, Credit 4**

2081-702 Graphic Reproduction Theory
Analysis of the basic theories of graphic reproduction and study of the principles underlying prevalent and proposed printing processes; special topics include present and proposed systems of printing based on electrostatics; lasers; study of hybrid systems and the significance and application of interdisciplinary methods. The case study approach is used. **Class 4, Credit 4**

2081-703 Statistical Inference
The purpose of this course is to provide graduate students in the School of Printing Management and Sciences with an introduction to the field of statistics and its application to graduate research projects. In addition, current uses of statistics in the printing industry are examined. **Class 4, Credit 4**

2081-708 Introduction to Systems Analysis
Problems of system analysis in printing operations for the highest quality product at the minimal cost, including optimal floor designs and methods of study. (2080-301 or equivalent) **Class 4, Credit 4**

2081-709 Trends in Printing Technology
An examination of the environmental and social forces that have affected the development of printing technology to the present time, as well as those forces, present and predicted, that will affect the state of printing technology in the future. **Class 4, Credit 4**

2081-711 Tone & Color Analysis
A study of the methods and instrumentation necessary for the evaluation of printed materials for product quality assurance. The ultimate objective: the optimization and control of the production processes. **Class 4, Credit 4**

2081-713 Applications of Digital Typesetting
An introductory graduate course designed to acquaint the student with the mechanics of typography. The course builds upon skills to develop an awareness of the presentation of the printed word. The ability to solve problems is developed by utilizing exercises ranging from simplified ads and PostScript coding to complex publications. The skills developed in individual projects are incorporated into the production of a group project. The lectures include aesthetic and technical information pertaining to present day prepress technology. **Class 3, Lab 3, Credit 4**

2081-722 Ink, Color & Substrates
A study of the physics of light and color, basic color theory, color measurements and color systems. Included are applications of color theory to the graphic arts. The chemistry and physics of ink and substrates and their interaction, are covered. Emphasis is given to the problem of ink, color and substrates in each printing process. **Class 4, Credit 4**

2081-723 Contemporary Publishing
An overview of contemporary book, magazine and newspaper publishing with emphasis on comparative editorial, production, circulation and marketing strategies. Advantages and disadvantages of the various kinds of publishing are discussed relevant to meeting the needs of society. Cost structures of the various publishing industries are explored as are strategies of new acquisitions. **Class 3, Credit 3**

2081-725 Typefaces: Their Development, Classification & Recognition
This in-depth course deals with the historical development of typeface to the present time. Proposed classification systems are discussed. Students will be encouraged to develop a system to suit their own needs. A system for substitution 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. (2081-713) **Class** 3, **Credit** 3

2081-727 Typographic Style Development
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 manuals and show examples of their implementation. Categories will include, but need not be limited to "looks," editorial style, terminology, typefaces, illustrations and document structures. Extensive library research will be expected. Examples of style manual implementation will be produced during the lab time. (2081-713,2081-729) Class 2, Lab **4,** Credit **3**

2081-729 Computer-Aided Printing Design & Copy Preparation
A prerequisite to 2081-727, this course introduces the student to the aspects of developing a corporate identity for internal and external publications. Design and produce a corporate-style manual that identifies and specifies all typographic considerations for the publications. Produce samples that demonstrate the application of the corporate style specifications. Extensive use of the desktop computer and appropriate software (i.e., "draw" and "page makeup" programs) is included. Reproduction and transmission concerns are also addressed. The second part of the class continues the development of the manual to its completion. (2081-713) **Class** 2, **Lab 3, Credit 3**

2081-730 History of the Book
The "book" or 'codex, in manuscript and printed form, has served for over a thousand years as the principal record of human imagination and achievement. This course will begin with a discussion of early methods of preservation of information, but will concentrate on post-15th century developments in the techniques and technology of printing and illustrating books. An important printer will be selected from each century (beginning with the 15th and concluding with the 20th) and thoroughly discussed, including an analysis of the cultural and technological influences which shaped the products of his press, as well as those of his contemporaries. **Class 3, Credit 3**

2081-733 The History & Technology of 20th Century Fine Printing
A follow-up course to History of the Book (2081-730) in which students will explore the growth of the private press movement in Europe and America and its influence on commercial printing. The course will begin with a survey of the seminal English private presses of the late 19th century and conclude with an examination of the England Collection of modern American private presses. Particular emphasis will be given to the technological and philosophical aspects of private press printing, including a comparison of the perceived aesthetics of the hand press vs. the machine press. (2081-730) **Class 3, Credit 3**

2081-737 Book Production
The many-faceted role of production is explored in the examination of the publishing cycle from manuscript to bound books. Emphasis is placed on an understanding of the production and editorial systems and the interaction between them. Production and cost requirements for composition, printing, binding and distribution for trade books, textbooks, journals and special editions are thoroughly discussed. **Class 3, Credit 3**

2081-741 Color Image Processing Systems
This course will introduce the student to the concepts underlying the digital representation and manipulation of images. Students will be evaluated based on examinations and a term project. **Class 3, Lab 3, Credit 4**

2081-742 Document Processing Languages
This course will introduce the student to the concepts underlying modem document processing systems. Students will be evaluated by examination and will be required to complete a term research project. **Class 4, Credit 4**

2081-743 Markets for Electronic Publishing
An examination of the various product and market segments of the electronic publishing industry from corporate, commercial and vendor viewpoints, along with the effects of market forces upon the various segments. Course conducted by lecture and discussion. **Class 4, Credit 4**

2081-745 **Management Strategies for Corporate & Commercial Publishing Enterprises**
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**

2081-761 Introduction to Multimedia Publishing
This foundation course introduces students to the various concepts, tools, and techniques of multimedia publishing. It includes an overview of applications, plus an introduction to various programs for creating and producing presentations. A basic introduction to scripting and program development will be presented. Projects will be assigned regularly, and will be presented in the form of problems to be solved by the student using tools and instructions provided by the instructor. **Class 3, Lab 3, Credit 4**

2081-771 Typography/Design—Graduate
The study of typographic and design terminology and guidelines for combining typographic variables and other copy elements to communicate visually a message within a given context. Also the study of the basic use of color and reproduction technology and its implications and interaction with the printed page. Methods of idea building for varying client needs and format variations are included. Class 2, **Lab** 3, Credit 3

2081-772 Composition Technology—Graduate
A graduate foundation course designed to give a broad overview of the underlying concepts of composition/typesetting technology. **Class 2, Lab 3, Credit 2**

2081-773 Graphic Arts Imaging Techniques—Graduate
This required professional course is designed to give students a basic understanding of the various printing processes, the application of photography to each with an emphasis on materials and equipment currently used in industry for the reproduction of monochromatic images. **Class 3, Credit 3**

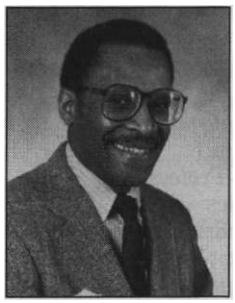
2081-785 Creative Print Finishing
The first part of the course gives the student an unusual opportunity to gain a better understanding of the structures, methods, materials and tools available to create attention-getting printed pieces. The second part of the course covers electronic publishing and printing, including an introduction to on-demand printing and custom book technologies. On-demand items must be processed into an attractive, marketable form, whether it is a single volume or small edition. Creative binding capabilities combined with electronic printing offer a competitive advantage that conventionally printed books cannot provide. (2081-775) **Class 3, Lab 3, Credit 4**

2081-840 Research Projects
Individual research projects in which independent data are collected by the student, followed by analysis and evaluation. A comprehensive written report is required. Consent of adviser is required. **Credit variable 1-4**

2081-890 Thesis
An experimental survey of a problem area in the graphic arts. Credit 8

Tojo Gardens, adjacent to the College of Imaging Arts and Sciences, offers a peaceful respite at the heart of campus.

College of Liberal Arts



William J. Daniels, Dean

The (specialist level) master of science degree in school psychology is designed for graduate students who desire a career focusing on the psychological evaluation of, and intervention for, children in school settings. Students who complete the two-year academic program and the 1,200-hour full year internship have excellent placement opportunities as psychologists who evaluate and counsel children in school and agency settings.

In addition, a joint program offered with RIT's National Technical Institute for the Deaf allows students to complete the specialist degree in school psychology and an advanced graduate certificate in school psychology in deafness in a three-year period, including two summer sessions. That program is described on page 140.

PROGRAMS

MASTER OF SCIENCE IN SCHOOL PSYCHOLOGY

Specialist Level

MASTER OF SCIENCE IN SCHOOL PSYCHOLOGY WITH ADVANCED GRADUATE CERTIFICATE IN SCHOOL PSYCHOLOGY IN DEAFNESS

Specialist Level

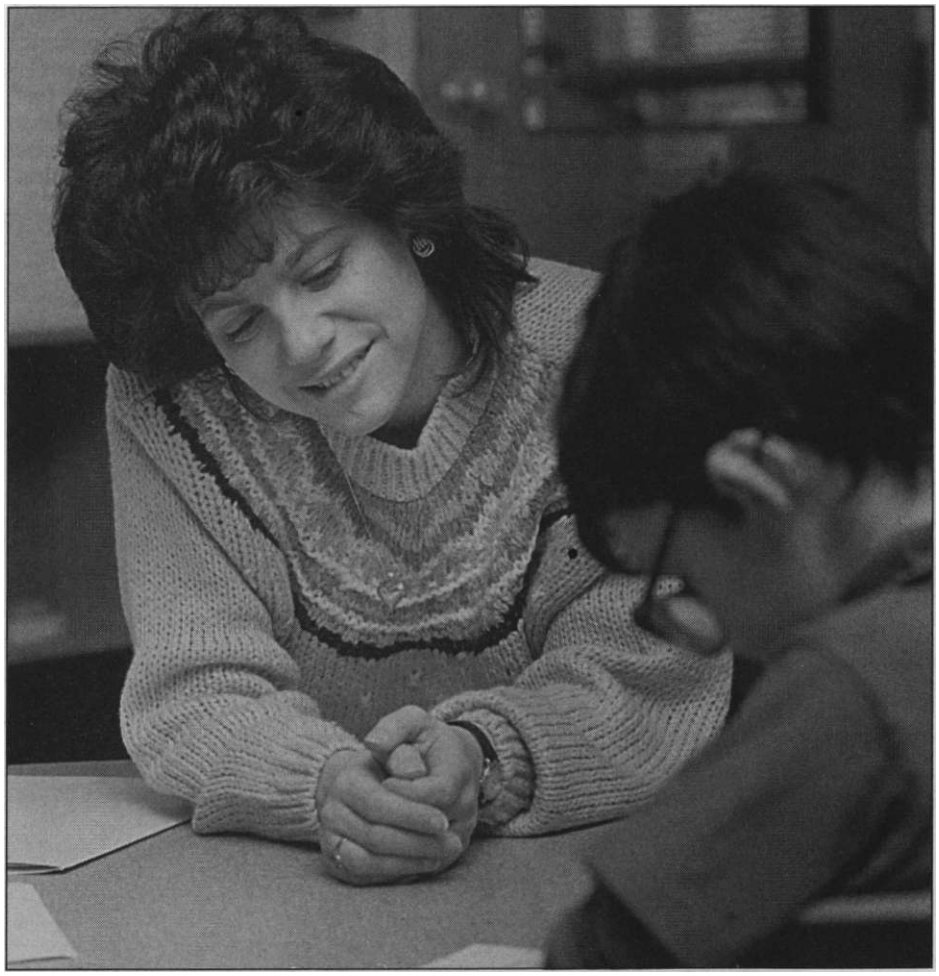
The College of Liberal Arts serves two roles in graduate education: offering the MS degree in school psychology and providing humanities electives for graduate programs across campus.

The college provides a number of graduate courses that serve as electives for some of the master's degree programs offered by other colleges at RIT. These elective graduate courses complement the professional emphasis of the degree programs by exploring the broader human knowledge and social implications embodied in these areas of study. By providing this humanistic perspective, these courses play an integral role in the professional education, making a direct and distinctive contribution to the student's preparation for a specialized career.

Master of Science Degree in School Psychology

V. ***K. Costenbader,*** *Director, School Psychology 716-475-6701*

The College of Liberal Arts offers a nationally accredited graduate program leading to the master of science degree in school psychology. The program prepares students for provisional certification as school psychologists in New York



Early intervention through testing, evaluation and counseling is the philosophy of treatment programs administered by school psychologists.

State. It is designed to provide students with a strong background in psychological foundations and to develop their professional skills and competencies in counseling, evaluation and consultation.

School psychologists work with young children (birth-age five); elementary, junior high and high school students; teachers and administrators; parents; and professionals. They offer services that lead to the amelioration of existing student difficulties and they attempt to prevent school problems. Through diagnostic testing, counseling, consultation and intervention, school psychologists help students deal with learning and behavioral difficulties and help improve students' adjustment to school and community.

Admission requirements

Admission to the program is based on the following criteria:

- Successful completion of the baccalaureate degree at an accredited college or university
- Cumulative grade point average of 3.0 or above
- Completion of at least 18 semester hours in behavioral sciences with a grade of B or above
- Prerequisite courses:
  General Psychology
  Elementary Statistics
  Child or Developmental Psychology
  Abnormal Psychology
- Minimum Graduate Record Examination (GRE) scores:
  Verbal—550
  Quantitative—500
  Analytic Reasoning—500
  Foreign students—minimum TOEFL score of 580
- Evidence of professional commitment and potential for developing effective relationships with children, youth and adults:
  Letters of reference
  Student essay about goals, related experience and future plans
- An individual interview

All credentials must be submitted and reviewed by the staff before the student completes 16 quarter credit hours of graduate work in the program. Applications are due by March 1. Later applications will be reviewed on a space-available basis.

Course numbers and titles		Credits
Required Psychological Foundation and Professional Courses		*20*
0514-701	Advanced Developmental Psychology	4
0514-702	Psychology of Teaching/ Learning	4
0514-723	Developmental Psychopathology	4
0514-739	Ecological Psychology	4
0515-701	Cultural Diversity in Education	4
Required Statistics and Research Methodology		*11*
0514-728	Statistics	4
0514-759	Experimental Design	4
0514-890	Master's Thesis OR	
0514-891	Master's Project (1 per quarter for 3 quarters)	3
Required Specialized Courses		*44*
0514-724	Interpersonal Intervention Skills	4
0514-726	Psychoeducational Assessment I	4
0514-730	Seminar—Professional & Legal Issues	4
0514-731	Psychoeducational Assessment II	4
0514-732	Psychoeducational Assessment III	4
0514-733	Applied Behavioral Analysis	4
0514-734	Linking Assessment to Intervention	4
0514-742	Biological Basis of Behavior	4
0514-743	Foundations of Education/ Curriculum	4
0514-744	Advanced Counseling	4
0514-745	Alternative Assessment Techniques	4
0514-749	Advanced Consultation	4
Required Field Experience		*21*
0514-712- 717	Practicum I, II, III, IV, V, & VI	12
0514-777	Internship I, II, & III	9
	Total Credits	96

**Indicates elective*

Graduate students wishing to work with the deaf community find RIT a unique place, with specialized programs that include an advanced graduate certificate in school psychology in deafness.

Proposed plan of study

First year

FALL QUARTER
Psychoeducational Assessment I
Interpersonal Intervention Skills
Applied Behavioral Analysis
Practicum I

WINTER QUARTER
Psychoeducational Assessment II
Advanced Consultation
Advanced Development Psychology
Practicum II

SPRING QUARTER
Psychoeducational Assessment III
Advanced Counseling
Developmental Psychopathology
Practicum III

Second year

FALL QUARTER
Statistics
Alternative Assessment Techniques
Psychology of Teaching/Learning
Practicum IV

WINTER QUARTER
Biological Basis of Behavior
Experimental Design
Ecological Psychology
Practicum V

SPRING QUARTER
Cultural Diversity in Education
Linking Assessment to Intervention
Seminar—Professional & Legal Issues
Practicum VI
Master's Project/Master's Thesis
(1 credit hour continuation)

Third year

FALL QUARTER
Internship I
Master's Project/Master's Thesis
(1 credit hour registration continuation)

WINTER QUARTER
Internship II
Master's Project/Master's Thesis
(1 credit hour registration continuation)

SPRING QUARTER
Internship III

Degree requirements

A minimum of 96 quarter credit hours is required for completion of the program. Before registering for the internship, students must pass a comprehensive examination. A cumulative grade point average of 3.0 or above is required.

Advanced Certificate in School Psychology and Deafness

The College of Liberal Arts, in collaboration with the National Technical Institute for the Deaf (NTID), offers an advanced certificate in school psychology and deafness. In addition to course work offered by the school psychology program, students in this advanced certificate program take two courses offered by NTID's teacher preparation program, the master of science in secondary education of students who are deaf or hard of hearing (MSSE). They also participate in a six-week sign language training program offered by the Department of American Sign Language and Interpreting Education.

This program is designed for school psychologists who will work with deaf and hard-of-hearing children and youth. It is one of only two programs nationwide that merges the school psychology and deafness specialization for practicing school psychologists.

The curriculum is designed to prepare school psychologists to work effectively with deaf and hard-of-hearing students. Courses emphasize the cultural context of the development of these children and youth and the interactions occurring among the child and the family, the school, the hearing and the deaf communities, and the legal system. The course work focuses on an interdisciplinary, ecological perspective of deafness.

Admission requirements

Admission decisions are made at the time of matriculation into the specialist level school psychology program. Preference will be given to students with experience and/or expressed interest in working with deaf and hearing-impaired learners.

Program prerequisites

Course numbers and titles

PREREQUISITE
0514-XXX Pre-AAS Sign Language Training Program
(6 weeks for 6 hrs./day, 5 days/week; Dept. of American Sign Language and Interpreting Education)

FIRST FALL
0514-440 ASLII
(College of Liberal Arts course)

FIRST WINTER
0514-441 ASL III
(College of Liberal Arts course)
ASL criterion—Intermediate Plus by completion of course work (pre-internship), as determined by SCPI. Following ASL III, students are expected to satisfy ASL criterion through independent study using campus resources.

Program curriculum

First Year

FIRST SPRING
(Following the program's Developmental Psychology course)
0514-764 Developmental Issues with Deaf & Hard-of-Hearing Learners* 4

SECOND SUMMER
(Following the program's assessment and counseling courses)
0514-766 Psycho-Ed. Assessment & Educational Planning with Deaf & Hard-of-Hearing Learners* 6
(6 weeks; 3 hrs./day, 5 days/week)
0514-769 Counseling & Consultation Process with Deaf & Hard-of-Hearing Learners* 6
(6 weeks; 3 hrs./day, 5 days/week)
These two courses are concurrent

Second Year

FALL QUARTER
0835-702 Educational Implications of Cultural Anthropology & Deafness 4
(MSSE course)
0514-715 Practicum IV**
(No additional tuition charge)

WINTER QUARTER
0514-716 Practicum V**
(no additional charge)

SPRING QUARTER
0514-788 Application of ASL to Workplace* 2
0835-820 Perspectives on Teaching Deaf & Hard-of-Hearing Students 2
(MSSE course)
Note: Students could elect to drop Linking Assessment to Intervention in the larger school psychology program without penalty if so desired. Offered one week, May, 6 hrs./day, 5 days/week

Assessment and management, counseling techniques, and educational and developmental psychology are among the topics explored in the school psychology program.

Third year

0514-777 One quarter of internship in setting serving deaf and hard-of-hearing learners.

Supervision where possible by program faculty (assessment or counseling/ consultation instructor); on-site supervision by psychologists trained in deafness**

Master's project/thesis on topic related to school psychology and deafness***

Total quarter credit hours 24

** Denotes courses offered in currently state-registered advanced certificate program.*

" Two quarters ofpracticum and one quarter of internship will be in setting serving deaf and hard-of-hearing students (credit to be awarded through master's program in school psychology).

**** Thesis supervisor will be instructor from either psycho-educational assessment or counseling/ consultation course (credit to be awarded through master's program in psychology).*

Advanced certificate requirements

- Successful completion of the specialist degree in school psychology
- Successful completion of 30 quarter units above the specialist degree
- Completion of course work with a cumulative average of B or better and a B or better in both assessment/ educational planning courses
- Demonstrated proficiency in sign language communication at the Intermediate Plus skill level (as assessed by the Sign Communication Proficiency Index, classroom performance and observations in applied setting)

Graduate Faculty College of Liberal Arts

School Psychology

Brian Barry, BA, St. John Fisher College; MSSc, Ph.D., Syracuse University—Associate Professor, Psychology

Kathleen Chen, BA, Rangoon University, Burma; MA, Bryn Mawr College; Ph.D., Pennsylvania State University—Professor, Psychology

Virginia K. Costenbader, BA, Dickinson College; MS, Ph. D., Syracuse University—Associate Professor, Psychology

Nicholas DiFonzo, MA, Rider College; MA, Ph.D., Temple University—Assistant Professor, Psychology

Gerald T. Guild, BA, SUNY College at Geneseo; MS, St. Boneventure University; M.Ed., Ph.D., University of Cincinnati—Assistant Professor, Psychology

Murli M. Sinha, AB, Bihar University, India; MA, Patna University, India; MA, City College of City University of New York; Ph.D., Cornell University—Professor, Sociology

Humanities

Frank Annunziata, AB, Manhattan College; MA, City College of the City University of New York; Ph.D., Ohio State University-Professor, History

Bruce A. Austin, BA, Rider College; MS, Illinois State University; Ph.D., Temple University—Professor, Communications

Douglas R. Coffey, Diploma, Cleveland Institute of Arts; BFA, University of Denver; MA, Case Western Reserve University—Professor, Fine Arts

Charles D. Collins, AB, Rutgers University; MA, Ph.D., University of Iowa—Professor, Fine Arts

Dane R. Gordon, BA, MA, University of Cambridge; BD, University of London; MA, University of Rochester—Professor, Philosophy

Tina Lent, BA, MA, University of California at Los Angeles; Ph.D., University of Rochester—Associate Professor, Fine Arts

David B. Suits, BA, Purdue University; MA, Ph.D., University of Waterloo—Assistant Professor, Philosophy

Charles W. Warren, AB, State University of Iowa; MA, Ph.D., Ohio State University—Professor, Fine Arts

Houghton Wetherald, BA, Brown University; MA, Oberlin College—Professor, Fine Arts

Note: Prerequisites are within parentheses at the end of the course description.

School Psychology

0514-701 Advanced Developmental Psychology
This course will cover the major theoretical approaches to the understanding of human development. Areas of study will include, but not be limited to, cognitive development, language development, development of personality, social development and moral development. (See admission requirements for prerequisites or receive permission of instructor.) **Class 4, Credit 4 (offered annually)**

0514-702 Psychology of Teaching/Learning
This course is designed to 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. Instructional and remedial techniques are reviewed. (See requirements for admission for prerequisites or receive permission of professor.) **Class 4, Credit 4 (offered annually)**

0514-712, 713, 714, 715, 716, 717 Practicum I, II, III, IV, V, VI
The practica serve as a bridge from theory and research to the professional practice of school psychology. They allow the student to become familiar with the organization and operation of schools. A weekly classroom seminar will be provided in addition to a placement in a school setting. The practica experiences are a major part of the preparation for the field placement/internship. (Matriculation in the school psychology program) Class 2, Credit 2/qtr.

0514-723 Developmental Psychopathology
This course focuses on maladaptive behavior of children and youth. Models of deviant behavior are presented, with attention to physiological, learned and environmental bases of behavior. Assessment and treatment approaches are discussed. (See requirements for admission for prerequisites or receive permission of instructor.) **Class 4, Credit 4**

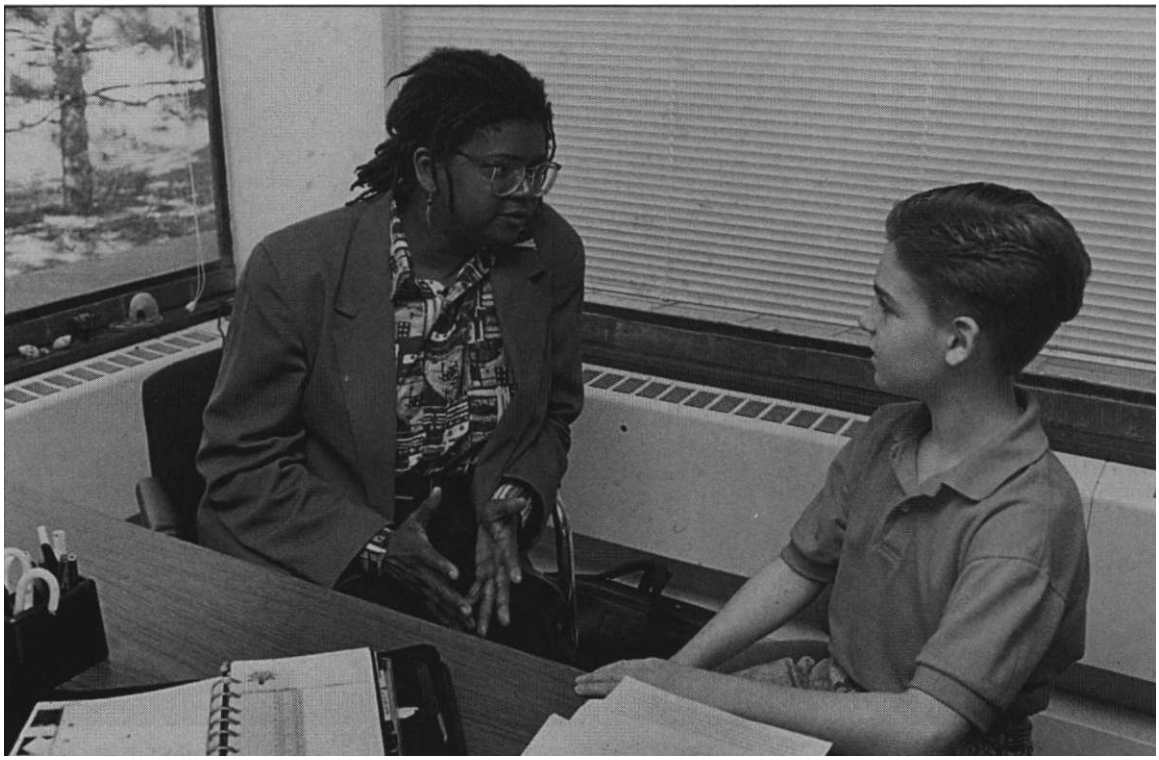
0514-724 Interpersonal Intervention Skills
This course provides opportunities for graduate students to interview individual clients, applying effective, cognitive, and behavioral approaches to the counseling situation. Under supervision, graduate students develop their counseling skills in relation to special populations, client concerns, and problem situations. (See requirements for admission for prerequisites or receive permission of professor.) **Class 4, Credit 4**

0514-726 Psychoeducational Assessment I
This introductory course, in a series of assessment courses, discusses basic assessment and measurement processes, types of tests and their uses, strengths and weaknesses, 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. Assessment from a cross-cultural perspective is emphasized. (Matriculation in the school psychology program or permission of instructor) Class **4,** Credit **4**

0514-728 Statistics: Inferential
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. Statistics will be reviewed and amplified in the course. (See requirements for course admission for prerequisites or receive permission of instructor.) **Class 4, Credit 4**

0514-730 Seminar—Professional & Legal Issues
Historic foundations and current critical professional issues, roles and functions of the school psychologist are emphasized in the course. Legal and ethical issues that bear on the role of the psychologist in the school are considered. (Matriculation in the school psychology program plus 32 quarter credit hours successfully completed in the program or permission of instructor) **Class 4, Credit 4**

0514-731 Psychoeducational Assessment II
This course concentrates on development of intellectual assessment skills. Students learn to select and administer individual intelligence tests, to interpret results and to provide written and oral reports. Assessment of culturally different and handicapped populations is discussed. Laboratory tests including the Stanford-Binet-IV, Wechsler Intelligence Scale for Children **III** (WISC**-III),** Wechsler Adult Intelligence Scale-Revised (WAIS-R), Wechsler Pre-school and Primary Scale of Intelligence-Revised (WPPSI-R), Kaufman Assessment Battery for Children (K-ABC), McCarthy Scales of Children's Abilities. (0514-726 and matriculation in the school psychology program or permission of instructor) **Class 4, Credit 4**



A 1,200-hour supervised internship in an educational setting is the capstone of our school psychology program.

0514-732 **Psychoeducational Assessment** III
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 0514-726 and 0514-731 or permission of instructor) **Class** 4, **Credit** 4

0514-733 Applied Behavior Analysis
This course offers training in the behavioral assessment of students in educational settings. Students apply various techniques for recording and analyzing behavior and programs for behavior management. (Matriculation in the school psychology program or permission of instructor) Class 4, Credit 4

0514-734 Linking Assessment to Intervention
This is the fourth course in the psychoeducational assessment sequence. An applied course in the diagnostic evaluation of exceptional individuals in order to provide psycho-educational 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 theories of exceptionality and current status of diagnosis and treatment of exceptional children and adolescents is provided. (Matriculation in the school psychology program plus 0514-726, 0514-731, 0514-732 or permission of the instructor) Class 4, Credit 4

0514-739 Ecological Psychology
With special emphasis on schools, this course examines the relationship between the behavior of individuals and the social and physical environment in which they act. By examining social psychological research as well as systems and social learning theories it will illuminate the interactive relationship between individuals and the systems within which they move. The course will pay particular attention to the ways in which such variables as school and class size, gender and racial composition, spatial design and organizational structure affect academic and social behavior. (See requirements for admission for prerequisites or receive permission of professor.) Class **4,** Credit **4**

0514-742 Biological Basis of Behavior
This course 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 professor.) Class **4,** Credit **4**

0514-743 Foundations of Education/Curriculum
This course will develop an understanding of the changing nature of the schools and the continuing need for the school psychologist to become involved as a change agent and participant in the educational process. Legal and ethical considerations will be addressed. Issues surrounding curriculum, classroom management, and methods of instruction will be discussed. (See requirements for admission for prerequisites or receive permission of instructor.) **Class 4,** Credit **4**

0514-744 Advanced Counseling
This practicum focuses on group counseling and crisis intervention in the public schools. It provides students with the opportunity to lead groups under supervision and to integrate theory, method, and process with their experience. (0514-724) **Class** 4, **Credit** 4

0514-745 Alternative Assessment Techniques
The prime focus of this course is on the assessment of academic problems in the classroom with special emphasis on the collection of data that allow the planning of interventions. Students will learn alternative direct methods of academic or behavioral assessment for both performance and skill deficits. Alternative assessment techniques include Curriculum Based Assessment, Curriculum Based Measurement, and Analogue Assessment. Emphasis will be on the integration of these assessment techniques, collaborative problem solving, systematic observation, the principles of applied behavior analysis and the psychology of learning for the purposes of intervention development. (Prerequisites for this course include 0514-733, 0514-749, 0514-726, 0514-731, 0514-732. Class 4, Credit 4

0514-749 Advanced Consultation
This course will concentrate on the development of consultation skills for the psychologist in the schools. Students will acquire an understanding of the basic models of consultation and the stages in the consultation process. Extensive laboratory work will involve observations of trained consultants, role play and experiences in client- and consultee-centered case consultation. Readings will focus on pertinent research in school-based consultation. (Matriculation in the school psychology program plus 16 quarter credit hours successfully completed in the program or permission of instructor) Class **4,** Credit **4**

0514-764 Developmental Issues & Deaf Learners
This course examines the development of language, cognitive and psychosocial skills in deaf and hard-of-hearing children. Current research in these areas will be critically reviewed and analyzed. Careful attention will be given to understanding the social-cultural contexts of the child and the implications for psychosocial, language and cognitive development and educational planning. The cultural, deficit, compensation and ecological perspectives on deaf and hard-of-hearing children's development will be compared and contrasted. The role of the school psychologist as a consultant on psychosocial, language, and cognitive developmental issues will be discussed. (Matriculation in the school psychology and deafness program or permission of the instructor) **Class 4, Credit 4**

0514-766 Psychoeducational Assessment & Educational Planning With Deaf & Hard-of-Hearing Learners
This course will examine the assessment of the following areas of functioning for deaf and hard-of-hearing children and adolescents: communication, academic, cognitive, personality, and interpersonal. Assessment and educational planning for a student will be viewed from an ecological perspective including the family, the school, the community, the support services and the legal systems. Attention will be given to preparing and communicating psychological report data and developing individual educational plans. **Class 3 hrs/day, 5 days/wk for 6 weeks, Credit 6**

0514-769 Counseling & Consultation Processes With Deaf & Hard-of-Hearing Learners
This course will concentrate on the development of counseling and consultation skills for the psychologist working with deaf and hard-of-hearing children and youth in the schools. Students will learn and practice basic skills, methods and techniques for providing remedial and preventive counseling with deaf and hard-of-hearing individuals. Counseling and consultation will be experienced within the context of the family, school, community, support services, legal and mental health systems. Special attention will be given to ethical and legal issues surrounding the provision of counseling and consultation services to meet the needs of deaf and hard-of-hearing individuals. **Class 3 hrs/day, 5 days/wk for 6 weeks, Credit 6**

0514-777 Internship School Psychology I
Through direct, supervised 1,200-hour internship experience, the student will practice the various professional roles of a school psychologist in an educational setting. Competency in carrying out these tasks in an ethical and professional manner will be developed as preparation for employment. (Matriculation in the school psychology program plus satisfactory completion of 84 hours in graduate program and qualifying examination) **Class 3, Credit 3/qtr**

0514-778 Applications of American Sign Language In the Workplace
This course includes linguistic features, cultural protocols and relevant vocabulary for students to function in a variety of settings where school psychologists may use American Sign Language such as testing, counseling and/or teaching. (ASL **I,** II, **III) Credit 2**

0514-799 Independent Study
A student may register for a graduate independent study project subject to the approval of the director of the student's graduate program, the faculty sponsor, the school psychology graduate committee and the dean of the College of Liberal Arts. Because of the length of the approval process, students who desire to take independent study should make arrangements several weeks before the quarter begins. An independent study project enables the interested student and his or her faculty sponsor to coordinate their efforts on subjects and topics that range beyond the normal sequence of the graduate course selection. **Credit variable**

0514-890 **Master's Thesis**
Students will register for this course under the thesis option for the MS degree in school psychology. The thesis option will be available to students only with the prior written approval of program faculty. Students must make clear their intent to enroll in the thesis option during the quarter prior to registration. Students will submit a proposal to a faculty member who agrees to serve as the student's committee chair. The proposal will describe the basic research question to be investigated and how the student will gain access to subjects. Proposals will be reviewed by the program faculty who will give permission to register for thesis credit. **(1** Credit **hour each for 3** quarters)

0514-891 **Master's Project**
This course is used to fulfill the master's project requirements under the non-thesis option for the MS degree in school psychology. The project may take the form of an original program designed to meet the needs of a specific school related population or a paper on some important or controversial topic. The candidate must obtain prior approval before registering for this course. A formal written paper and an oral presentation of the project are required. **(1 Credit hour each for 3 quarters)**

0515-701 **Cultural Diversity in Education**
The aim of the course is to understand the historical and structural origins of the present schooling system in the United States. The functions of schools, from an ideological as well as technical viewpoint, will be analyzed. In addition, different forms of school organizations will be compared, as in the public vs. private dimensions. The functionalist theoretical approach will be presented as well as the conflict perspective to frame the discussion and analysis of opposing sociological system of thought. The role of education in promoting or inhibiting socio-economic mobility will also be analyzed. The course attempts to understand how role expectations are actually carried within the school system and how its different actors react to technical as well as value constraints. (See requirements for admission for prerequisites or receive permission of professor.) **Class 4, Credit 4**

Liberal Arts Graduate Elective Courses

0504-702 **Film & Society**
An inquiry concerning the relationship between motion pictures and society that will use historical, humanistic and social science research to achieve an understanding of movies as a social force, industry and art form. **Class 4, Credit 4 (offered occasionally)**

0505-702 **Film History & Criticism**
This course examines the historical development of film as an art and the differing interpretations of its meaning, traced through major films by important directors. Emphasis will be placed on the varying critical methodologies by which films can be analyzed. **Class 4, Credit 4 (offered occasionally)**

0505-703 **American Architecture**
An examination of American architecture from the 17th century to the present designed for the graduate level of study. Emphasis will be placed on American building art in the late 19th and 20th centuries. **Class 4, Credit 4 (offered occasionally)**

0505-705 **Theories of Aesthetics & Art Criticism**
A course for 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 4, Credit 4 (offered occasionally)**

0505-707 **Cubism to the Present**
Cubism as a way of seeing and as an expression of 20th century thinking. Differences and similarities with art forms of earlier eras and other cultures will be discussed. **Class 4, Credit 4 (offered on sufficient demand)**

0505-711 **20th Century American Art**
An investigation of American art from the Civil War to the present. Emphasis will be placed on the visual arts, but many references will be made to music and architecture. **Class 4, Credit 4 (offered occasionally)**

The College of Liberal Arts

0505-712 Arts & Crafts in Tribal Societies
A study of the function of primitive art and the techniques of its production, including the use of clay, stone, fibers, bark, wood, bronze, gold, etc. Hair styling, body painting and scarification also will be discussed. **Class 4, Credit 4 (offered occasionally)**

0505-713 Contemporary Issues in Art
This course offers the graduate art student the opportunity to investigate those aspects of 20th century art that question the very nature of art and the role of the artist in today's and tomorrow's society. **Class 4, Credit 4 (offered occasionally)**

0505-714 Art: Vision & Concept
Though the course will develop chronologically from the Medieval period to the present, emphasis will be placed on a close analysis of (1) selected works of art, including paintings, sculpture and architecture, and (2) the development of the unique oeuvre of selected artists. Topics chosen for study will be limited in number but treated in depth. Topical choices will be based on richness and import of the formal and/or conceptual content embodied therein. Some background in the history of art is helpful but not necessary. **Class 4, Credit 4 (offered occasionally)**

0505-715 Picasso
The impact of Picasso and his circle on 20th century art. Their affinities with modem scientific and philosophical attitudes also will be discussed. **Class 4, Credit 4 (offered occasionally)**

0505-716 Rembrandt
A detailed analysis of the art and times of the Baroque master. Emphasis will be placed on the development of his style and technique, on his and other artists' relationship to their society and to the character of the baroque outlook. **Class 4, Credit 4 (offered occasionally)**

0505-717 Topics in Music History
This course is a study of various aspects of music in different historical environments with emphasis on analogies between music and the other fine arts. **Class 4, Credit 4 (offered occasionally)**

0505-721 Oriental Art: China & Japan
A seminar exploring the philosophical and cultural perspectives underlying traditional Asian art as a prelude to examining selected topics in Chinese and Japanese art. Emphasis will be placed on the application of research techniques and critical methods of an individual selected area of interest that may serve as a foundation for continuing study. **Class 4, Credit 4 (offered occasionally)**

0505-722 Oriental Art: India & Southeast Asia
A seminar exploring the philisophical and cultural perspectives underlying traditional Asian art as a prelude to examining selected topics in Indian and Southeast Asian art. Emphasis will be placed on the application of research techniques and critical methods of an individually selected area of interest that may serve as a foundation for continuing study. **Class 4, Credit 4 (offered occasionally)**

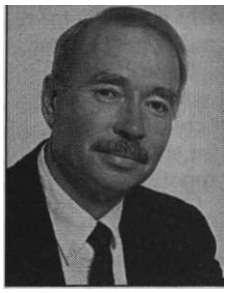
0505-723 Art & Politics
The purpose of the course is to familiarize the student with the relationships that can exist between the art world and society. Fundamental questions concerning the social/political role of the artist (questions that are often overlooked in most curriculums) will be investigated. Questions dealing with public funding of the arts, the ideologic/political nature of art education, the function of art as a catalyst for political change, and other questions will be examined. **Class 4, Credit 4 (offered occasionally)**

0507-701 History of American Educational Thought & Practice
A historical analysis of change and continuity in American educational history from colonial through contemporary America. Special emphasis on the leading historiographical aspects of American educational history and on enabling the student to acquire mastery of the relevant bibliography. Lectures, seminars and readings offer comprehensive coverage of the salient intellectual themes and a chronological structure to mark the significant educational developments in particular periods—e.g., the progressive era, the 1920s and 30s, and post-World War II changes. Course structure: lectures, seminars, readings from multiple paperbacks and class handouts, essay exams and critique. **Class 4,** Credit **4 (offered annually)**

0509-705 Seminar in Aesthetics
The four-hour meetings of this course are not lectures but discussions, and participation is required of all students. Since the examples discussed are mostly from Western art, students should be familiar with the history of Western art, particularly the last 50 years. The questions discussed are philosophical questions about art and aesthetic experience: Can art be defined? Can ugliness be part of aesthetic experience? In appreciating an artwork, do we have to take into account the artist's intentions? What makes an interpretation of an artwork valid or invalid? How is aesthetic value related to ethical values? **Class 4, Credit 4 (offered annually)**

0509-706 Philosophy of Mind
An investigation into concepts concerning mental experience. The basic question is "What is consciousness?" The question hides some presuppositions and raises many further questions. Can we be conscious of consciousness? What does it mean to be conscious? Is there a mind-brain identity? Can we describe mental experiences in non-mentalistic terms? Can computers think? It will be the business of this course to explore these and other related questions and to see what progress has been made in attempting to answer them. **Class 4, Credit 4 (offered occasionally)**

College of Science



Robert A. Clark, Dean

The College of Science offers a unique complement of graduate programs with curricula designed with sufficient flexibility to prepare the graduate for direct entry into a career in the profession or for further study toward a more advanced graduate degree in a chosen discipline. The scheduling of courses allows the student to complete all requirements for each degree program on a full-time or part-time evening basis.

Whether the focus is on the foundations of matter, on applications of mathematics, on the role of the chemist in the health care environment, on the specialized properties of advanced materials or on the science and technology of advanced imaging systems, the College of Science graduate faculty join an outstanding group of students to furnish a valuable and integrated understanding of today's clinical, industrial and research problems.

PROGRAMS

MASTER OF SCIENCE DEGREES IN:

Chemistry
Clinical Chemistry
Color Science
Imaging Science
Industrial and Applied Mathematics
Materials Science and Engineering (offered jointly with the College of Engineering)

DOCTOR OF PHILOSOPHY DEGREE IN:

Imaging Science

A new multimillion dollar addition to the College of Science builds on the excellence that has been the foundation of graduate science programs at RIT.

Master of Science in Chemistry

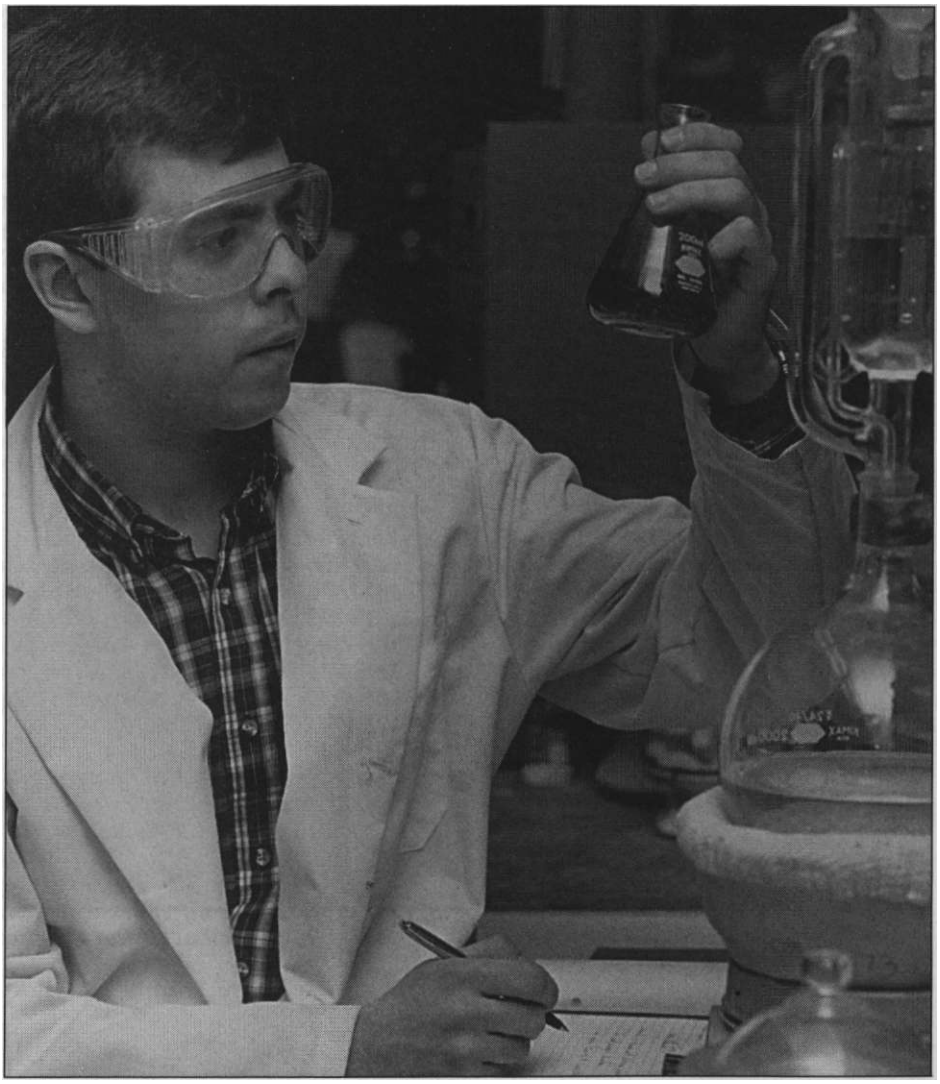
Gerald A. Takacs, *Department Head, Chemistry 716-475-2497*

Terence Morrill, *Chair, Chemistry Graduate Committee 716-475-2047*

The master of science degree in chemistry is offered on either a part-time or full-time basis. The program options are designed to fill the needs of both the practicing chemist in the greater Rochester industrial community and the full-time graduate student.

Objectives

The objectives of the program are, through course work and research experience, to increase both the breadth and depth of the graduate student's background and to provide an opportunity for the student to attack scientific problems on his



Graduate science programs seek to encourage the breadth and depth of students' educations while encouraging creative thinking.

or her own initiative with a minimum of supervision.

Various program options are available to cover the diverse needs of graduate chemists. Program concentrations in such important areas as polymer chemistry, microelectronics, materials science, biochemistry, etc., are possible.

Admission

Admission to the program will be granted to qualified graduates who are holders of a bachelor's degree in chemistry from an accredited college or university. An applicant with a bachelor's degree in another scientific discipline and the equivalent of a full year's course in each of analytical chemistry, organic chemistry, physical chemistry, physics and calculus will be considered for admission.

The admission decision will be based on: 1) college transcripts; 2) GRE scores (chemistry exam is recommended); and 3) letters of reference. It is strongly recommended that students visit RIT as a supplement to the normal application process.

An applicant with a bachelor's degree from an approved undergraduate school and the background necessary for specific courses is permitted to take graduate courses as a nonmatriculated student. Courses taken for credit can usually be applied toward the master's degree if the student is formally admitted to the graduate program at a later date. However, the number of credits that will be transferred to the degree program from courses taken at RIT as a nonmatriculated student will be limited to a maximum of nine credits.

Any applicant who wishes to register for a graduate course as a nonmatriculated student must obtain permission from the chair of the graduate program plus the course instructor.

English language requirement

All students who do not speak English as their primary language are required to submit TOEFL scores. All foreign students must take the Michigan Test, given by the RIT English Language Center. If a student's score is below standard, he or she must follow the recommendations of the center for additional course work. Successful completion of this work is a program requirement for the master of science degree in chemistry. This may mean that the student will need additional time and financial resources to complete the degree program.

Full-time graduate work

A number of teaching assistantships and tuition-remission scholarships are available to qualified students to undertake full-time graduate work that includes research experience. The department of chemistry has 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. The research can result in either a thesis or a project report.

Students enrolled in the program full time are expected to complete 45 credit hours of course work, including up to 16 credit hours of research leading to the submission of an independent research thesis. A full-time student normally takes six to nine graduate credits per quarter, including thesis work. Typically, all requirements are met within two years.

No more than eight credit hours of research are allowed for students working on a project report.

Part-time study

The department of chemistry encourages practicing chemists in the greater Rochester industrial community to pursue a program toward the master of science degree in chemistry without interrupting their employment. Consequently, most of the courses in the graduate program in chemistry are scheduled in the late afternoon or early evening.

Students employed full time normally take one course each quarter. Part-time students in the program are not required to complete a research thesis; the course work can be completed within four to five years.

Five-year combined BS/MS chemistry program

The BS/MS program combines the BS chemistry programs and the MS chemistry program and allows undergraduate chemistry majors to acquire an MS degree with only one extra year of study. Undergraduate chemistry majors are considered for entrance into the BS/MS combined program as early as their third year. Students in the combined program will be advised by the Chemistry Graduate Committee to take graduate-level electives so that they will receive both the BS and MS degrees after five years of full-time study.

External research credit

The department of chemistry recognizes that the in-plant experience of a number of chemists employed in local industry includes independent, creative research. This experience may be applied, to a maximum of 16 hours of research credit, towards the completion of the master of science degree in chemistry on either a full- or part-time basis.

Schedule of Graduate Chemistry Courses

Some of the courses, designated Y1 or Y2, are offered every other year. The 1997-98 academic year is Y1.

See pages 133 to 141 for course descriptions.

FaU	Winter	Spring	Summer
1008-711	1008-711	1009-704	1010-870
1008-720	1008-720	1009-705	1010-879
1009-702	1009-702	1010-870	
1009-703	1009-703	1010-879	
1010-870	1010-870	1012-764	
1010-879	1010-879	1013-739 (Y1)	
1013-737	1012-765	1014-730	
1014-740	1013-730 (Y1)	1014-744 (Y2)	
1029-701	1014-736	1015-720 (Y2)	
1029-703	1014-741 (Y1)	1015-721 (Y2)	
1029-705 (Y2)	1014-742 (Y2)	1029-702 (Y2)	
	1014-743 (Y2)	1029-704 (Y2)	
	1014-747 (Y1)		

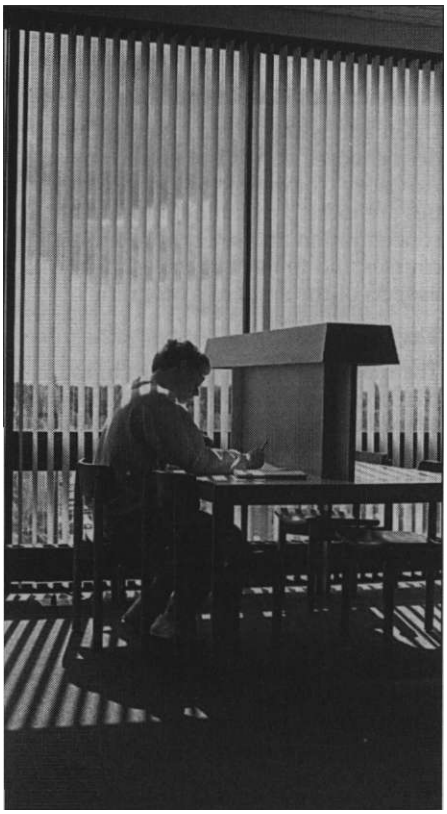
Cooperative education option

The cooperative education option accommodates students at the master's level who have or are able to obtain industrial employment. Quarters of work can be interspersed with quarters of full-time academic work. If industrial employment permits research, up to 16 of the 45 required credits may be obtained through the external research credit option. If industrial employment does not permit research, research credits may be obtained within the department of chemistry.

Program

Each student, together with an adviser, will arrange a program best suited to the student's interests and needs. This program will be subject to the approval of the department head and the chair of the Graduate Committee.

A deliberate effort will be made to strengthen any areas of weakness indicated by the student's undergraduate records and the placement examinations. To qualify for the MS degree, a candidate must satisfy the following requirements:



The expansion of Wallace Library increased study space available to students.

1. A minimum of 45 quarter credits beyond the bachelor's degree. Courses in chemistry will be chosen from 700- and 800-level numbers and should include one or more representing each of the three fields: analytical, organic and physical. In addition a course in inorganic or biochemistry is required. A maximum of nine quarter credits may be taken in undergraduate-level courses.

   Each student must select courses (subject to approval by the student's adviser and the graduate committee) that include the following core: 1008-711 and 1008-720; either 1013-737 or 1013-739; one of 1014-741; 1014-743 or 1014-744. The inorganic core course is 1012-764. For biochemistry it is 1009-702. The core requirement is one course each in organic, physical and analytical chemistry and one course in either biochemistry or inorganic chemistry. As part of the required credits, each student must have one or two quarter credit hours in seminar 1010-870 and three to four quarter credit hours from outside of the department of chemistry.
2. The thesis option requires a minimum of nine quarter credit hours in research and submission of a satisfactory thesis.
3. Pass an oral thesis defense or comprehensive examination.

Additional information

More information may be obtained from the chair of the Graduate Committee, 716-475-2047, or the department of chemistry, 716-475-2497.

Master of Science in Clinical Chemistry

John M. Waud, Director, Clinical Chemistry Program
716-475-2182

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. The design of the program provides technical and managerial proficiencies in either the diagnostic laboratory or a related industry.

Admission

Individuals holding a bachelor's degree in chemistry, biology, medical technology, nuclear medicine technology, or a related field from an accredited college or university are invited to apply.

English language requirement

All students who do not speak English as their primary language are required, upon arrival at RIT, to take the Michigan Test, given by the RIT English Language Center. If a student's score is below standard, he or she must follow the recommendations of the center for additional course work. Successful completion of this work is a program requirement for the master of science degree in clinical chemistry. This may mean that the student will need additional time and financial resources to complete the degree program.

Financial support

A limited number of teaching assistantships, research assistantships, and tuition scholarships are available for graduate students. Detailed information is available from the office of the director.

Program

The master's program includes a core curriculum and electives which are chosen to reflect the student's background and career goals. A minimum of 50 quarter credits beyond the bachelor's degree is required. Required courses include Biochemistry, 1009-702; Biochemistry-Metabolism, 1009-703; Advanced Clinical Chemistry, 1023-820, 821, 822, 823; Organizational Behavior, 0102-740; Statistics and Quality Control, 1023-712; Survey of Physical Chemistry, 1014-742; Clinical Laboratory Computer Applications, 1023-722; Clinical Chemistry Research, 1023-877 or 879; Mechanisms of Disease, 1023-705.

All students are required to carry out and defend original research as part of the program requirements. Research is carried out under the direction of a faculty member and is reviewed and defended before a graduate committee appointed by the program director.

Students in the clinical chemistry program come from diverse educational backgrounds and have a variety of professional goals. The program focuses on the activities of the diagnostic clinical laboratory, developmental research in pathology and diagnostic testing as well as industrial activities related to clinical laboratory products and instruments.

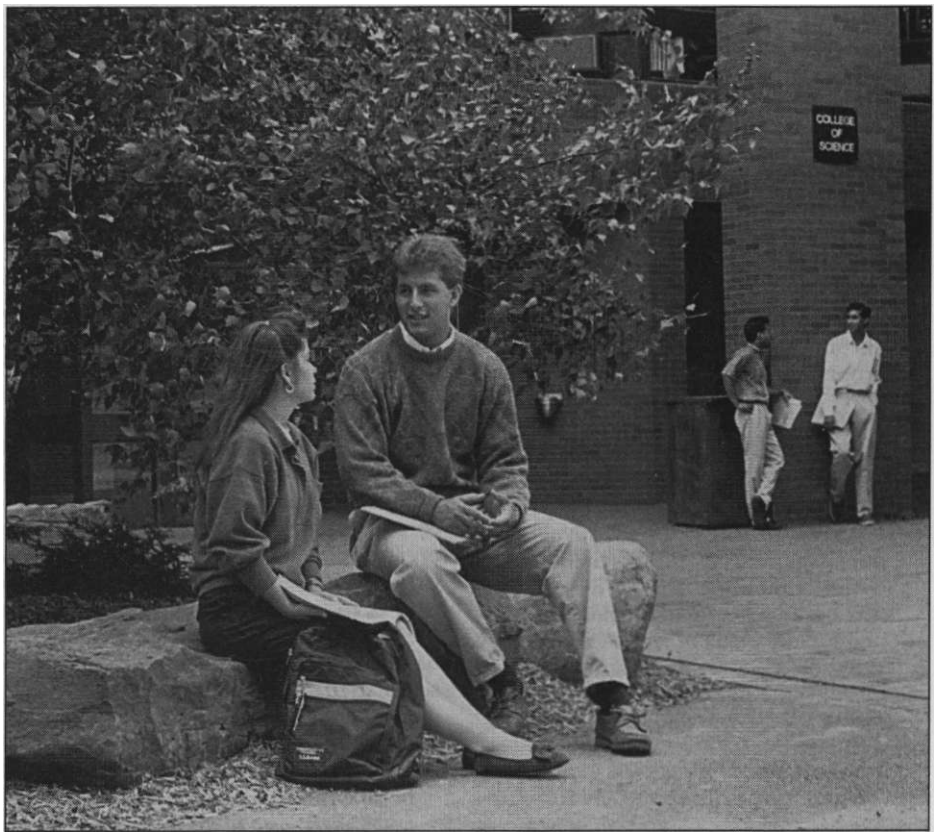
Master of Science in Industrial and Applied Mathematics

Rebecca E. Hill, *Department Head*
716-475-2498

Theodore W. Wilcox, *Graduate Coordinator 716-475-5125*

The ideas of applied mathematics pervade several areas of applications in a variety of businesses and industries and in government. Sophisticated mathematical tools are increasingly used to develop new models, modify existing ones, and analyze system performance. This includes applications of mathematics to problems in management science, biology, portfolio planning, facilities planning, control of dynamic systems, and design of composite materials. The goal is to find computable solutions to real-world problems arising from these types of situations.

The department of mathematics and statistics offers an interdisciplinary master of science degree program in industrial and applied mathematics. The program addresses the need for the education and training of people in the areas of mathematics that can effectively be used to solve problems encountered in business and industry.



Students chat in front of the College of Science building.

Objective

The objective of the program is to provide the student with the capability to apply mathematical models and methods to study various problems that arise in industry and business. With the emphasis on computable, implementable solutions, the student uses mathematics to solve a variety of industrial and business-related problems. Since this is an interdisciplinary program, students have the opportunity to choose from a wide variety of courses across campus.

Admission requirements

The applicant should have a baccalaureate degree with a cumulative grade-point average of 3.0 or above out of 4.0 (or its equivalent) from an accredited institution. The degree could be in mathematics or any related field. The prerequisite courses are: Multivariable Calculus, Differential Equations, Matrix Theory, Probability, and Statistics. Knowledge of a programming language is also required.

A student may also be granted conditional admission and be required to complete "bridge" courses selected from among RIT's existing undergraduate courses, as prescribed by the student's adviser. Until the student completes these requirements, he or she is considered a nonmatriculated student. The graduate coordinator evaluates the student to determine eligibility for conditional and provisional admission.

English language requirement

To indicate proficiency in the language needed to handle university-level work, every applicant for whom English is not the native language is required to take the TOEFL and achieve a minimum score of 550. Those who cannot take the TOEFL will be required to take the Michigan Test of English Proficiency at RIT and obtain a score of 80 or higher. Although GRE scores are not required, submitting them enhances the chances of acceptance into the program.

Part-time study

The program is ideal for practicing professionals who are interested in applying mathematical methods in their work and in enhancing their career options. All courses are scheduled in the late afternoon or early evening hours. The graduate program may normally be completed in two years (six quarters) of part-time study.

Student's advisory committee

Upon admission to the program, the student chooses an adviser and forms an Advisory Committee whose responsibilities are to help the student formulate a concentration and select appropriate courses and to oversee the academic aspects of the student's program.

The program

The master's degree program in industrial and applied mathematics consists of 48 quarter credit hours of study. There are four "core courses" for a total of sixteen quarter credit hours. These courses are usually taken by the student in the first two quarters of the program and provide the student with a focus on some of the ideas of applied mathematics. Core courses are offered every year. The following are the core courses along with the quarters in which they are offered: 1016-725: Stochastic Processes (W); 1016-801: Numerical Linear Algebra (F); 1016-802: Methods of Applied Mathematics I (F); a fourth course, 0304-874: Numerical Analysis, is offered by the mechanical engineering department every winter.

The concentration and the corresponding course of study are formulated by the student in consultation with his or her Advisory Committee. The student completes a total of 24 quarter credit hours by taking a set of six specialized courses offered in the department of mathematics and statistics and other departments. Some of the possible concentrations are: operations research, communications networks, dynamical systems, and applied mathematics.

The program of study culminates in thesis or project work. The thesis option requires that the student present original ideas and solutions to a specific mathematical problem. The project option involves applying or adapting existing methodologies to solve a problem, or an expository paper on the methodology in a particular area. Both a proposal for the thesis or project work and the results must be presented and defended before the Advisory Committee.

Cooperative education option

The optional cooperative education (co-op) program enables the student to alternate periods in school with full-time, paid professional employment. Students may sign up for the co-op program after their first quarter.

Nonmatriculated students

A student with a bachelor's degree from an approved undergraduate school and with the background necessary for specific courses may take graduate courses as a nonmatriculated student with the permission of the graduate coordinator and the instructor. Courses taken for credit may usually be applied toward the master's degree if the student is formally admitted to the graduate program at a later date. However, the number of credits that will be transferred to the degree program from courses taken at RIT as a nonmatriculated student will be limited to a maximum of 12 quarter credits.

Graduate Faculty College of Science

Robert A. Clark—Professor and Dean

Department of Biological Sciences

Richard L. Doolittle, BA, University of Bridgeport; MS, Ph.D., University of Rochester—Professor, Biology

Jean A. Douthwright, BA, Skidmore College; MS, Pennsylvania State University; MS, Ph.D., University of Rochester—Associate Professor, Biology

Irene Evans, AB, University of Rochester; MS, Wesleyan University; Ph.D., University of Rochester—Associate Professor, Biology

Paul A. Haefner, BS, Franklin and Marshall College; MS, Ph.D., University of Delaware—Professor, Biology

David A. Lawlor, BA, University of Texas; MS, Ph.D., University of Texas Health Science Center at San Antonio—Assistant Professor, Biology

Jeffrey S. Lodge, BA, University of Delaware; Ph.D., University of Mississippi—Associate Professor, Biology

Douglas Merrill, BS, Ph.D., SUNY College of Environmental Science and Forestry, Syracuse University—Professor, Biology

Robert H. Rothman, BA, Ph.D., University of California, Berkeley—Professor, Biology

Franz K. Seischab, BS, Cornell University; MS, SUNY College at Geneseo; Ph.D., SUNY College of Environmental Science and Forestry, Syracuse University—Professor, Biology

Martin A. Vaughan, BS, MS, Ohio University; Ph.D., Indiana State University—Associate Professor, Biology

Nancy Wanek, BS, University of Wisconsin; Ph.D., University of California—Associate Professor, Biology

Department of Chemistry

B. Edward Cain, BA, Harpur College, SUNY Binghamton; Ph.D., Syracuse University—Professor, Inorganic Chemistry: chemical education, methodologies and adaptation for the handicapped student

Robert A. Clark, BS, Massachusetts Institute of Technology; Ph.D., University of Maryland—Professor and Director of the Center for Materials Science and Engineering: imaging science, physical organic chemistry, polymers

Paul A. Craig, BS, Oral Roberts University; Ph.D., University of Michigan—Assistant Professor, Analytical Biochemistry

Thomas Gennett, BA, SUNY College at Potsdam; Ph.D., University of Vermont—Associate Professor, Analytical Chemistry: electrochemistry, HPLC, ion implantation of electrode surfaces

Joseph P. **Hornak,** BS, Utica College of Syracuse University; MS, Purdue University; Ph.D., University of Notre Dame—Professor, Joint Appointment with Imaging Science, Physical Chemistry: magnetic resonance spectroscopies and imaging

Marvin L. Illingsworth, BS, Lafayette College; Ph.D., University of Massachusetts—Professor, Inorganic Chemistry: atomic oxygen resistant polymers, synthesis of eight-coordinate complexes and mixed ligand complexes

Andreas Langner, BS, Ph.D., SUNY at Buffalo—Associate Professor, Physical Chemistry: polymer science, electro-optical properties of macromolecules, polymer characterization techniques

Massoud J. Miri, BS, MS, Ph.D., University of Hamburg—Assistant Professor, Polymer Chemistry: polymerization mechanisms, polymer properties, catalysis

Terence C. Morrill, BS, Syracuse University; MS, San Jose State College; Ph.D., University of Colorado—Chair, Graduate Committee, and Professor, Organic Chemistry: stereochemistry and mechanism of organic reactions, lanthanides, NMR spectrometry, organometallics

John P. **Neenan,** BS, Wayne State University; Ph.D., University of California, Santa Barbara—Professor, Biochemistry and Bioorganic Chemistry: design of active site-directed irreversible enzyme inhibitors

Christian G. Reinhardt, BS, Lafayette College; Ph.D., University of Rochester-Professor, Biophysical Chemistry: biological drug receptor recognition, binding and stereochemistry, quantitative structure-activity studies and biomolecular design

Gerald A. Takacs, BS, University of Alberta; Ph.D., University of Wisconsin—Professor and Department Head, Physical Chemistry: chemical kinetics, atmospheric chemistry, plasma chemistry, and photochemistry

Laura Ellen Tubbs, BS, Hood College; Ph.D., University of Rochester—Professor, Physical Chemistry: accelerator-based ultrasensitive mass spectroscopy, natural radioisotope dating, neutron activation analysis

Kay G. Turner, BS, Bucknell University; Ph.D., Ohio State University—Professor, Synthetic Organic Chemistry: synthesis of natural products including fluorescent estradiol analogs; study of estrogen receptor mechanisms

James J. Worman, BS, Moravian College; MS, New Mexico Highlands University; Ph.D., University of Wyoming—Visiting Professor, Physical Organic Chemistry: environmental spectroscopy of small ring systems, naturally occurring biocumulative organics

Department of Allied Health Sciences

James C. Aumer, BS, MS, Michigan Technological University—Program Director, Medical Technology; Professor

John M. Waud, BS, Lehigh University; MS, University of Pennsylvania; Ph.D., Lehigh University— Program Director, Clinical Chemistry; Professor

Adjunct Faculty

Richard M. Bayer, BA, MS, Ph.D., Rutgers University—Rochester General Hospital, Adjunct Clinical Professor

Michael R. Bogovich, MS, Rochester Institute of Technology—Calibration Engineer, Clinical Products Division, Eastman Kodak Company

David R. Brown IV, BS, Rochester Institute of Technology—Lead Systems Analyst/ Programmer, Eastman Kodak Company

Howard Harrison, Ph.D., Cornell University—Rochester General Hospital, Adjunct Clinical Associate Professor

Fred D. Lasky, Ph.D., SUNY at Buffalo-Senior Clinical Chemist, Clinical Products Division, Eastman Kodak Company

Daniel Montondo, BS, MS, Rochester Institute of Technology—Administrative Coordinator, Data Management, Department of Pathology and Laboratory Medicine, Rochester General Hospital

Department of Mathematics and Statistics

Maurino Bautista, BS, Ateneo de Manila University; MS, Ph.D., Purdue University—Associate Professor, Numerical Analysis, Applied Mathematics

Patricia Clark, SB, SM, Massachusetts Institute of Technology; Ph.D., University of Rochester—Professor, Fluid Dynamics

Alejandro Engel, BS, Universidad de Chile; Ph.D., SUNY at Buffalo—Professor, Bio-Mathematics

David Farnsworth, BS, Union College; MA, Ph.D., University of Texas at Austin—Professor, Nonparametric Statistics

George Georgantas, AB, University of Rochester; AM, Washington University; Ph.D., SUNY at Buffalo—Professor, Abstract Algebra

Marvin Gruber, BS, Brooklyn College; MA, Johns Hopkins University; MS, Rochester Institute of Technology; MA, Ph.D., University of Rochester—Professor, Linear Models, Bayes Estimation, Reliability

Laxmi Gupta, BS, MS, Agra University, India; MS, Rochester Institute of Technology; Ph.D., SUNY at Buffalo—Professor, Algebraic Geometry

David Hart, BS, Syracuse University; MA, University of Rochester—Associate Professor, Algebra, Number Theory

Rebecca Hill, BS, Frostburg State College; MA, West Virginia University; MS, Rochester Institute of Technology—Professor, Analysis, Computer Science

Seshavadhani Kumar, BS, MS, University of Madras; Ph.D., University of Delaware—Associate Professor, Operations Research, Simulation

Sophia Maggelakis, BS, MS, Ph.D., Old Dominion University—Associate Professor, Bio-Mathematics

James Marengo, BA, MS, California State University; Ph.D., Colorado State University—Associate Professor, Statistics

Douglas Meadows, BS, Stanford University; MS, New York University; Ph.D., Stanford University—Professor, Topology, Computer Science

Edward Newburg, BS, Stanford University; MS, New York University; Ph.D., University of Illinois—Professor, Mathematical Modeling

Richard Orr, BS, John Carroll University; MS, Case Institute of Technology; MS, SUNY at Buffalo— Professor, Logic, Computability

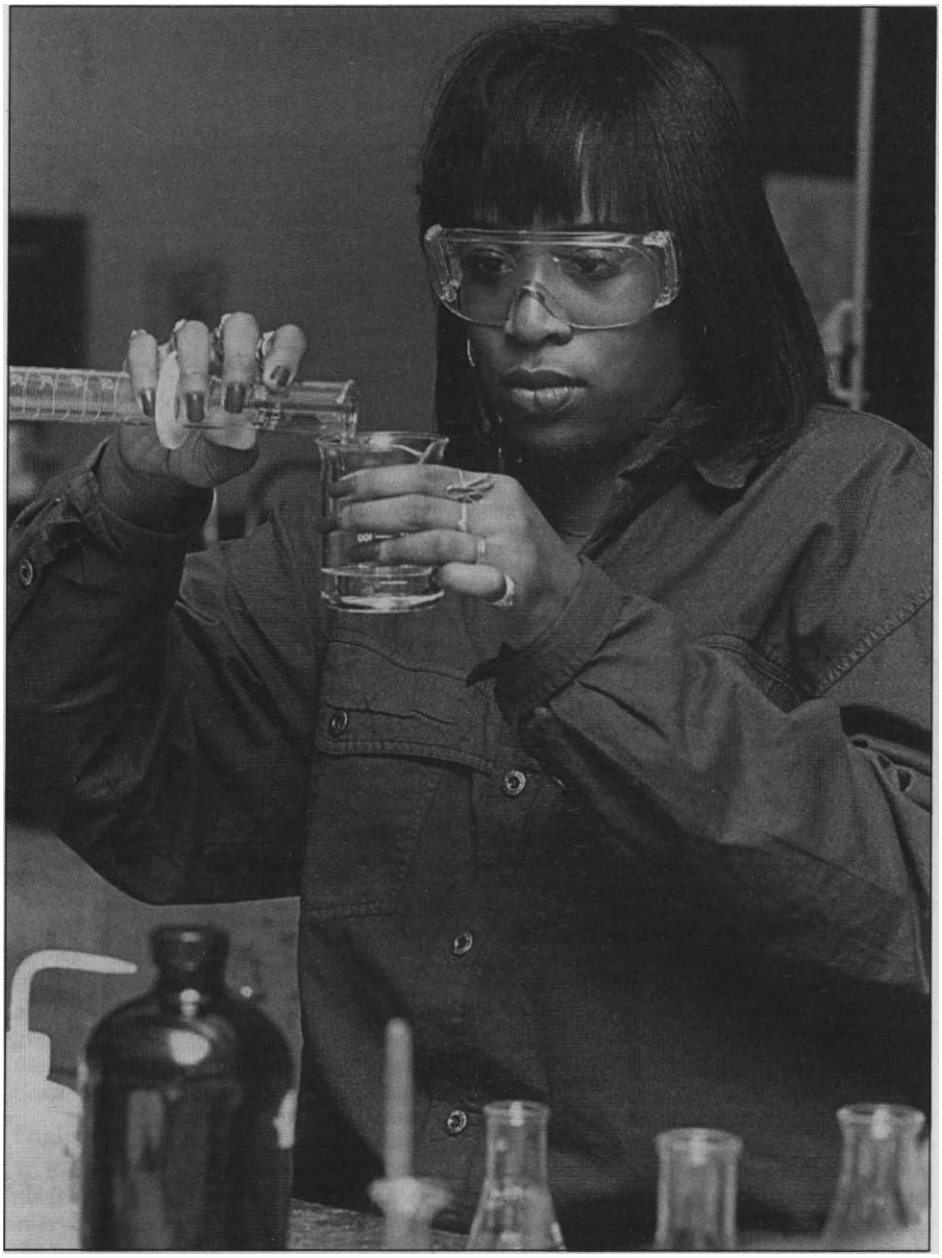
John Paliouras, BS, Alfred University; MA, Ph.D., University of Illinois—Professor, Topological Dynamics

Harry Schey, BS, Northwestern University; AM, Harvard University; Ph.D., University of Illinois—Professor, Statistics

Wanda Szpunar-Lojasiewicz, MS, Ph.D., University of Cracow—Associate Professor, Differential Equations, Function Analysis

Jack Weiss, BS, MS, AM, University of Michigan; Ph.D., North Carolina State University—Assistant Professor, Mathematical Biology, Dynamical Systems

Theodore Wilcox, BS, University of Michigan; MS, Ph.D., University of Washington—Professor, Analysis, Simulation



Materials science and engineering incorporates classical sciences such as chemistry and physics with electrical and mechanical engineering.

Paul Wilson, BA, MA, University of Cincinnati; Ph.D., University of Illinois—Professor, Algebra

Elmer Young, BA, Amherst College; MS, Ph.D., Ohio State University—Associate Professor, Topology

Department of Physics

John D. Andersen, BS, SUNY at Buffalo; MA, Ph.D., University of Rochester—Associate Professor, Physics

Hrishikesh Banerjee, BS, Presidency College; MS, University College of Science; Ph.D., Saha Institute of Nuclear Physics, University of Calcutta—Professor, Physics

Peter A. Cardegna, BS, Loyola College; Ph.D., Clemson University—Professor, Physics

Tracy A. Davis, BA, BS, Wofford College; Ph.D., Clemson University—Associate Professor, Physics

F. **Kingsley Elder Jr.,** Ph.D., Yale University—Professor Emeritus, Physics

Alan B. Entenberg, AB, Washington University; Ph.D., University of Rochester—Professor, Physics

Charles A. Hewett, Ph.D., University of Missouri—Professor Emeritus, Physics

Ronald E. Jodoin, BS, Worcester Polytechnic Institute; Ph.D., University of Rochester—Professor, Physics

James R. Kern, BS, Indiana University of Pennsylvania; Ph.D., Clemson University—Professor, Physics
Michael Kotlarchyk, BS, MS, Ph.D., Massachusetts Institute of Technology—Professor, Physics
Arthur Z. Kovacs, AB, Wabash College; Ph.D., Duke University—Professor, Physics
Vein Lindberg, BS, University of Alberta; MS, Ph.D., Case Western Reserve University—Associate Professor, Physics
Linda S. Meichle, BS, Massachusetts Institute of Technology; MS, Ph.D., University of Illinois—Assistant Professor, Physics
Varadaraja V. Raman, BS, St. Xavier College; MS, Calcutta University; Ph.D., University of Paris—Professor, Physics
Earl H. Sexton, BS, Tufts University; MS, Massachusetts Institute of Technology; MST, Cornell University; Ph.D., SUNY at Albany-Professor, Physics
John S. Shaw, BS, MS, Indiana University; Ph.D., SUNY at Albany—Professor, Physics
Jerome Wagner, BS, Case Institute of Technology; MS, Ph.D., University of Wisconsin—Professor, Physics
Anne G. Young, BA, Bryn Mawr; MS, Ph.D., Cornell University—Professor, Physics

Materials Science and Engineering

Robert A. Clark, *Director of the Center for Materials Science and Engineering*

Peter A. Cardegna, *Program Director, Materials Science and Engineering*
716-475-2944

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 threefold:

- With the advent of whole new classes of materials and instruments in recent times, the traditional practice of empiricism in the search for and selection of materials is rapidly becoming obsolete. The program offers, therefore, a serious interdisciplinary learning experience in materials studies, crossing over the traditional boundaries of such classical disciplines as chemistry, physics, 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, physics, and related disciplines; and consequently, to provide a new intellectual identity to those involved in the study of materials.

Second, there is an emphasis on experimental techniques in the program, with one required experimental course and additional optional experimental courses available. These are organized into appropriate units covering many aspects of analysis of materials. This aspect of the program should enhance student confidence when dealing with materials-related problems.

Finally, a large number of highly qualified scientists and engineers in the Rochester area are engaged in the research and development of materials. This reservoir of talent is utilized to ensure the breadth and quality of the program.

The overall thrust of the program is to establish a positive relationship between academia and industry by building a sound academic base in the field of materials.

Thesis option and the external research option

The inclusion of a research thesis as a formal part of the master of science degree program in materials science and engineering is optional. The research thesis option carries a minimum of eight and a maximum of 16 quarter credit hours, subject to review and approval of the project.

STUDENT PROFILE

Her undergraduate degree is in chemistry, but when Linda Slapelis decided to get her master's, she chose a program with a more focused approach: materials science and engineering.

"This field opens up more opportunities and allows me to focus my education on research and development in polymers," she said. "Polymeric materials are progressively replacing other materials since they are much lighter, economical and can, in some cases, be recycled." As a result, there is a lot of research in the modification and development of polymers to suit specific needs.

Linda also appreciates RIT's close ties to industry and its applications approach. "A lot of industries support RIT, so I thought those ties would help when I enter the job market," she said.

The external research option allows participants to continue their studies in their work environment, thus enhancing job satisfaction. In-plant work experience in materials-related areas may include independent study and creative research. This external research option may be applied, for a minimum of four and a maximum of eight quarter credit hours, toward the completion of the master of science degree.

Admission

The program is open to individuals with a bachelor's degree in chemistry, physics, chemical engineering, electrical engineering, mechanical engineering, or a related field from an accredited college or university. Any student who wishes to study at the graduate level must first be admitted to the program. An applicant may be 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.

English language requirement

All applicants who do not speak English as their primary language are required to take both the TOEFL (Test of English as a Foreign Language) and the TWE (Test of Written English) examinations. Minimum scores of 575 on the TOEFL and 4.0 on the TWE are required. In addition, all such students, upon arrival at RIT, are required to take the Michigan Test of English Language Proficiency, administered by the RIT English Language Center. Individuals scoring below an established minimum will be referred to the center for further evaluation and assistance. These students are required to follow the center's recommendations regarding language course work; this may require additional time and financial resources to complete the degree requirements. Successful completion of this course work is a requirement for the master of science degree in materials science and engineering.

Part-time study

Practicing scientists and engineers are encouraged to pursue the program on a part-time basis; therefore, all of the courses are offered in the late afternoon or early evening hours. (This may not apply to courses offered off campus at selected industrial sites.)

Students employed full time in industry are normally limited to a maximum of two courses, or eight credit hours, each quarter. A student who wishes to register for more than eight credit hours while employed full time must obtain the permission of his or her adviser.

Financial aid

A limited number of teaching assistantships, research assistantships, and tuition scholarships are available for graduate students. Detailed information is available from the office of the program director.

Degree requirements

A minimum of 45 quarter credit hours, which includes five core courses (1028-701 through 1028-705) and the seminar course, 1028-890, are required for the completion of the program.

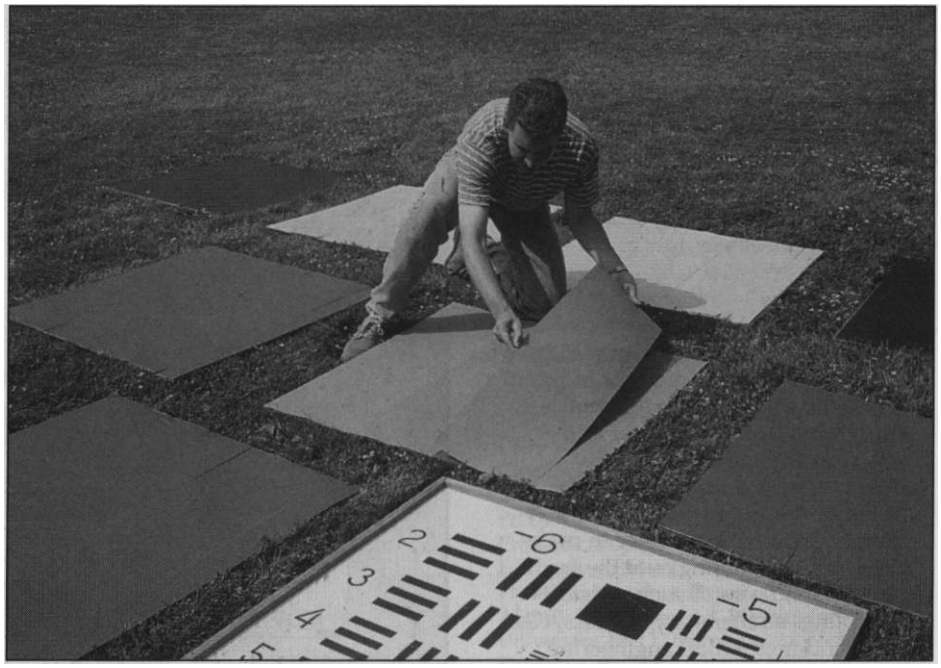
The remaining 24 quarter credit hours are completed either as a combination of the research thesis and elective courses, or as a combination of external research and elective courses, or as elective courses. The elective courses may be selected from advanced courses offered by the Center for Materials Science and Engineering or, upon approval, from courses offered by other RIT graduate programs. Transfer credit may be awarded based on academic background beyond the bachelor's degree or credit by examination based on experience.

Curriculum

The core courses will be offered every year and the elective courses will be scheduled on a periodic basis.

Maximum limit on time

The required credits for the master's degree must be completed within seven years of the start of the oldest credits applied toward the degree.



Imaging science research has included aerial photographs of specially prepared panels to test film's color reproduction qualities.

Graduate Faculty Materials Science and Engineering

College of Engineering and College of Science

John Andersen, BS, SUNY at Buffalo; MA, Ph.D., University of Rochester—Associate Professor, Physics: theoretical solid-state physics, transport phenomena, electron-phonon interactions, nonlinear phenomena, electronic properties of molecular crystals, experimental low-temperature physics, large scale computations, parallel processing

Hrishikesh Banerjee, BS, Presidency College; MS, University College of Science; Ph.D., Saha Institute of Nuclear Physics, University of Calcutta—Professor, Physics: theoretical solid-state physics, band theory, band transitions, dislocations, models for junction and transport phenomena

Peter Cardegna, BS, Loyola College; Ph.D., Clemson University—Professor, Physics: superconductivity, low temperature physics, photographic materials

Robert A. Clark, BS, Massachusetts Institute of Technology; Ph.D., University of Maryland—Professor, Chemistry: plasma modification of organic polymers, polymer science, chemistry of microlithographic imaging systems, kinetics and thermodynamics of thermal and photochemical transformations of small hydrocarbon molecules

Tracy Davis, BA, BS, Wofford College; Ph.D., Clemson University—Associate Professor, Physics: experimental solid-state physics, optics, low temperature physics, computer models of chaotic systems

Alan B. Entenberg, AB, Washington University; Ph.D., University of Rochester—Professor, Physics: stress and adhesion in thin films; surface modification by glow discharge plasma and/or ion bombardment

Thomas Gennett, BA, SUNY College at Potsdam; Ph.D., University of Vermont—Associate Professor, Chemistry: electroanalytical chemistry, HPLC detectors, biosensors, ion-exchange partition coefficient

Surendra K. Gupta, B.Tech., India Institute of Technology; MS, University of Notre Dame; Ph.D., University of Rochester—Professor, Mechanical Engineering: dislocation theory, x-ray diffraction, sintering, numerical modeling, digital image analysis, computer-integrated manufacturing, micromechanics of heteroepitaxial structures, morphological filters in image processing of microstructures

Joseph P. Hornak, BS, Utica College of Syracuse University; MS, Purdue University; Ph.D., University of Notre Dame—Professor, Chemistry: physical chemistry, magnetic resonance spectroscopy and imaging

Marvin L. Illingsworth, BS, Lafayette College; Ph.D., University of Massachusetts—Professor, Chemistry: inorganic polymers, synthesis and characterization of coordination polymers, ferroelectric thin films, specialty materials

Michael A. Jackson, BS, MS, Ph.D., SUNY at Buffalo—Associate Professor, Microelectronic Engineering: microelectronic device design, fabrication, and test; material characterization techniques, surface analytical instrumentation; vacuum processing, including CVD, plasma, and ion beam techniques, micromachining, ferroelectric thin films, amorphous silicon and polysilicon film deposition and characterization

Ronald Jodoin, BS, Worcester Polytechnic Institute; Ph.D., University of Rochester—Professor, Physics: optical properties of photoreceptor materials, experimental physics, electronics, microcomputer interfacing

Michael Kotlarchyk, BS, MS, Ph.D., Massachusetts Institute of Technology—Professor, Physics: characterization of structure and phase transitions in surfactant systems (micelles, microemulsions, and liquid crystals) using scattering techniques; mass and surface fractals in condensed matter systems, theories of liquids; chaos in simple nonlinear physical systems

Santosh Kurinec, BS, MS, Ph.D., University of Delhi—Professor, Microelectronic Engineering: electronic materials, amorphous and semicrystalline materials, solid-state devices

Richard Lane, BS, Ph.D., Alfred University-Professor, Microelectronic Engineering: micromachining of silicon, chemical vapor deposition, crystal growth, plasma etching of thin films, stress measurement in CVD films

Andreas Langner, BS, Ph.D., SUNY at Buffalo—Associate Professor, Chemistry: physical chemistry, polymer chemistry, theoretical chemistry and chemical engineering, transient spectroscopy, charge and energy transfer, diffusion and flow in polymeric gels and blends

Vern Lindberg, BS, University of Alberta; MS, Ph.D., Case Western Reserve University—Associate Professor, Physics: deposition of metals onto polymeric substrates, effects of surface modification of polymer substrates on growth of PVD (physical vapor deposited) films, glow discharge and ion bombardment, stress in sputtered thin films, adhesion of PVD thin films, multilayer optical filters

Chris F. Nilsen, BS, Rochester Institute of Technology; MS, Worcester Polytechnic Institute; P.E., Ph.D., Michigan State University—Professor, Mechanical Engineering: metallurgy, materials science, structure-property relationships in metal alloys

Ali Ogut, B.Ch.E., Hacettepe University, Turkey; MS, Ph.D., University of Maryland—Associate Professor, Mechanical Engineering: polymer processing, heat and mass transfer, rheology, transport phenomena

Sannasi Ramanan, BS, BE, M.Tech., Ph.D., Indian Institute of Technology—Associate Professor, Electrical Engineering: semiconductor materials, IC processing, epitaxial growth of semiconductors, quantum-well heterostructures, simulation and design of solid state devices

Robert Snyder, BS, Rochester Institute of Technology; P.E., Ph.D., Iowa State University—Professor, Mechanical Engineering: consulting work for attorneys—product liabilities, property damage, etc.; metallic alloys and materials, crystal structure, mechanical properties, materials testing

David A. Sumberg, BA, Utica College of Syracuse University; MS, Ph.D., Michigan State University—Associate Professor, Electrical Engineering: fiber optics and applications of fiber optics (polarization properties, microwave transmission on optical fiber, sensors, couplers); integrated optics (couplers, materials for integrated optics)

Gerald A. Takacs, BS, University of Alberta; Ph.D., University of Wisconsin—Professor, Chemistry, and Head of Chemistry Department: physical chemistry, chemical kinetics, photochemistry, atmospheric chemistry, plasma etching and modification of materials

I. R. Turkman, MS, Ph.D., Institut National des Sciences Appliquees—Associate Professor, Electrical and Microelectronic Engineering: susceptibility of microelectronic devices to damage from electrostatic discharges, CVD, sputtering, plasma-assisted etching processes

Jerome Wagner, BS, Case Institute of Technology; MS, Ph.D., University of Wisconsin—Professor, Physics: solid state physics, nuclear physics, medical physics, diagnostic nuclear medicine, defect properties in insulating materials, radiation-induced defects, color centers

Adjunct Faculty

John E. Carson, MS, Massachusetts Institute of Technology—Eastman Kodak Company, Rochester, N.Y.

Dennis H. Feduke, MS, P.E., Syracuse University—IBM, Endicott, N.Y.

George J. S. Gau, Ph.D., University of California, Berkeley—Eastman Kodak Company, Rochester, N.Y.

Mool C. Gupta, Ph.D., Washington State University—Eastman Kodak Company, Rochester, N.Y.

Henry J. Gysling, Ph.D., University of Delaware—Eastman Kodak Company, Rochester, N.Y.

J. Raymond Hensler, Ph.D., Pennsylvania State University—Director of Manufacturing Technology, Bausch and Lomb, Inc., Rochester, N.Y.

Merle N. Hirsh, Ph.D., The Johns Hopkins University—Plasma Resources

Robert Lord, MS, Syracuse University—Manager, IBM-Endicott, Endicott, N.Y.

Gerald F. **Meyers,** BS, University of Pittsburgh—Plant Metallurgist, Delco Products, General Motors Corporation, Rochester, N.Y.

J. William Sexton, BS, University of Rochester—Coordinator of Optics Contracts and New Opportunities Development, Eastman Kodak Company, Rochester, N.Y.

Hen-Kuei **Su,** Ph.D., University of Massachusetts—Supervisor, Mobil Chemical Corporation, Macedon, N.Y.

E. Wayne Turnblom, Ph.D., Columbia University—Manager, Materials Development and Manufacturing, Technical Operations, Graphics Imaging Systems Div., Eastman Kodak Company, Rochester, N.Y.

Edward G. **Williams,** MS, University of Rochester—Manager of Plastics Technology, Xerox Corporation, Rochester, N.Y.

Chester F. Carlson Center for Imaging Science

Harvey E. Rhody, Interim Director

The Chester F. Carlson Center for Imaging Science was established in 1985 for the interdisciplinary study of all aspects of imaging. The center offers BS, MS and Ph.D. degrees in imaging science and an MS degree in color science. It is located in the Chester F. Carlson building, which contains extensive laboratories supporting the center's teaching and research mission.

Master of Science in Color Science

Roy S. Berns, *Coordinator*
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Color science is broadly interdisciplinary, encompassing physics, chemistry, physiology, statistics, computer science and psychology. The curriculum leading to a master of science degree in color science educates students using a broad interdisciplinary approach. This is the only graduate program in the country devoted to this discipline, and it is designed for students whose undergraduate majors are in physics, chemistry, imaging science, computer science, electrical engineering, experimental psychology, physiology or any discipline pertaining to the quantitative description of color.

Graduates are in high demand and have accepted industrial positions in electronic imaging, color instrumentation, colorant formulation and basic and applied research. Companies include Hewlett Packard, Canon, Apple, Eastman Kodak, Xerox, International Paper and the Gemological Institute of America.

The color science major provides graduate-level study in both theory and practical application. The program gives students a broad exposure to the field of color and affords them the unique opportunity of specializing in an area appropriate for their background and interest. This objective will be accomplished through the program's core courses, selection of electives and completion of a thesis or graduate project.

The degree program in color science revolves around the activities of the Munsell Color Science Laboratory within the Center for Imaging Science. The Munsell Laboratory is the preeminent academic laboratory in the country devoted to color science. Research is currently under way in color appearance and discrimination psychophysics, imaging device-independent calibration, color reproduction, high-accuracy spectrophotometry, spectroradiometry and multi-spectral image analysis. Since the inauguration of the program in 1984, three industrial conferences have been held drawing participants from around the world. Industrial seminars devoted to the quantitative specification of color are offered on a continuing basis. Students have received co-op and full-time positions through contacts made with the assistance of the Munsell Laboratory.

The program

All students must earn 45 credits as a graduate student, 36 of which must be taken at RIT, to earn the master of science degree. For full-time students, the program requires four to six quarters of study at the graduate level. Part-time students generally require two to four years of study at the graduate level. The curriculum is a combination of required courses in color science, elective courses appropriate for the candidate's background and either a research thesis or graduate project. Students must enroll in either the research-thesis or graduate project option at least one year before completion of required course work. Candidates who wish to enter the program but lack adequate preparation may have to take as many as 36 credits of foundation courses in mathematics, statistics, computer science and general science before matriculating with graduate status. Foundation courses can be completed in three quarters.

Core courses

All graduate students in the MS program are required to complete the following core courses:

		Credits
1050-701	Vision & Psychophysics	4
1050-702	Applied Colorimetry	4
1050-721	Color Measurement Laboratory I	2
1050-703	Color Appearance	3
1050-722	Color Measurement Laboratory II	2
1050-813	Color Modeling	4
1050-801	Color Science Sem	3

Elective courses

Appropriate electives should be selected to bring course work to 36 credit hours for the research thesis option or 41 credit hours for the graduate project option. Approval by the color science coordinator is required. (Some courses might require special permission for enrollment.)

The following is a partial list:

		Credits
0307-801 802	Design of Experiments I, II	3
0307-830 831	Multivariate Analysis I, II	3
0307-841 842	Regression Analysis I, II	3
0605-761	Fundamentals of Computer Graphics	4
1051-726	Programming for Scientists & Engineers	4
1051-736	Geometrical Optics	4
1051-737	Physical Optics	4
1051-738	Optical Image Formation	4
1051-749	Color Reproduction	4
1051-771 772,773	Silver Halide Science I, II, III	3
1051-782	Introduction to Digital Image Processing	4
1051-816	Color Systems	4

Research thesis option

Students without research experience are encouraged to select the research thesis option (nine credits). The thesis is performed during the second year of study. Topics are chosen that complement the candidate's undergraduate education and career interests. The technical advisory board of the Munsell Color Science Laboratory, as well as the program coordinator, can aid in the selection of a thesis topic. Full-time students receiving full-time assistantships are required to perform a research thesis.

Graduate project option

Students with research experience may select the graduate project option (four credits). The project has the same intellectual level as a research thesis but is less lengthy. It might take the form of an experiment, demonstration, research project or critical review. The graduate project is normally performed during the last quarter of study. Part-time students often select this option.

A Typical Full-Time Schedule of Courses

		Credits
FALL		
1050-701	Vision & Psychophysics	4
1050-702	Applied Colorimetry	4
1050-721	Color Measurement Laboratory I	2
	Graduate Elective	
WINTER		
1050-703	Color Appearance	3
1050-722	Color Measurement Laboratory II	2
	Graduate Electives	
SPRING		
1050-813	Color Modeling	4
	Graduate Electives	
FALL		
1050-801	Color Science Seminar	3
1050-890	Thesis	3
	or	
1050-840	Color Science MS Project	4

Note: 12 credit hours per quarter is considered a full-time load. Remaining credits are given as equivalency credits for teaching and research assistantship activities.

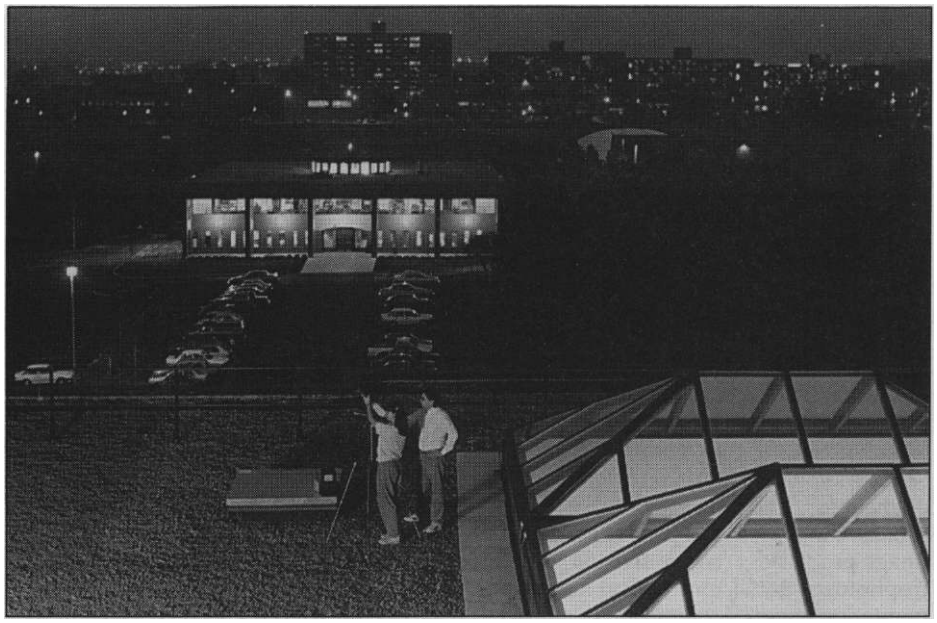
Admission requirements

Prior to being admitted to the master of science degree program, applicants must satisfy the coordinator of the program that their previous education, ability and practical experience indicate a reasonable chance of success. Scientific reasoning, technical writing and oral communication skills are particularly important.

- Graduate application
- Earned baccalaureate degree
- Graduate record examination (GRE)
- Official undergraduate transcript
- Two professional recommendations
- An on-campus interview when possible
- GPA of 3.0 or higher
- Foundation course work of 3.0 or higher (if required)
- TOEFL score of at least 575 (international students)
- TSE-A score of at least 250 (international students)

Assistantships and scholarships

Scholarships and assistantships are available for qualified applicants. These include the Macbeth-Engel Fellowship, Grum Memorial Scholarship, Munsell Color Science Laboratory Assistantship and research assistantships associated with ongoing grants and contracts. Most of these require 20 hours of work per week. Funding can consist of up to full tuition remission and a 12-month stipend.



Graduate imaging science students use an infrared video system to do thermal imaging of the sky.

Students receiving fully funded assistantships tend to have undergraduate cumulative grade point averages of 3.5 and higher, GRE "quantitative" and "analytical" scores above 700 and "verbal" above 600. Applicants whose native language is not English have TOEFL scores above 600 and TSE-A scores above 250. Partial assistantships are also awarded. Applicants seeking financial assistance from the center must have all application documents submitted to the Admissions Office by February 15 for the next academic year.

The foundation program

The color science major is designed for the candidate with an undergraduate degree in a scientific or nonscientific discipline. Candidates with adequate undergraduate work in related sciences will start the program as matriculated graduate students.

Candidates without adequate undergraduate work in related sciences must take foundation courses prior to matriculation into the graduate program. Such students may be required to take as many as 36 credits in these subjects. A written agreement between the candidate and the program coordinator will identify the required foundation courses.

Foundation courses must be completed with an overall B average before a student can matriculate into the graduate program. A maximum of nine graduate level credit hours may be taken prior to matriculation into the graduate program.

The foundation courses listed below" are representative of those often required.

1016-251 252, 253	Calculus I, II, III
1017-211 212, 213	College Physics I, II, III
1017-271, 272, 273	College Physics Lab I, II, III
0601-309	C Programming
1016-309	Elementary Statistics
0514-445	Psychology of Perception

Munsell Advisory Board

The Munsell Color Science Laboratory Advisory Board ensures that the research activities surrounding the degree program are relevant to current industrial needs. The board's members have expertise in color vision, color measuring instrumentation, psychophysics, computer colorant formulation, lighting, art and applied color technology. The Advisory Board is an excellent resource for students in the selection of both a thesis topic and future placement.

Master of Science in Imaging Science

***Harvey** E. **Rhody**, Coordinator*
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The objective of this program is to prepare men and women holding a bachelor's degree in science or engineering for positions in research in the imaging industry or in the application of various imaging modalities to problems in engineering and science. Formal course work includes consideration of the physics and chemistry of radiation-sensitive materials and processes, the applications

of physical and geometrical optics to electro-optical systems, the mathematical evaluation of image forming systems and the statistics of experimental design and quality control. Technical electives at the graduate level may be selected from the courses offered in imaging science, color science, engineering, science and mathematics. Both thesis and project options are available. In general, full-time supported students are required to pursue the thesis option with the project option targeted at part-time students who can demonstrate that they have sufficient practical experience through their professional activities.

Faculty within the Center for Imaging Science supervise thesis research in areas of chemistry and physics of radiation-sensitive materials and processes, digital image processing, remote sensing, electrophotography, electro-optical instrumentation, medical diagnostic imaging, chemical imaging, color imaging systems and astronomy. Interdisciplinary efforts are possible with the colleges of Engineering and Science.

The degree requirements can be completed either on a full- or a part-time basis.

The program

Imaging science studies are available as a full- or part-time master's degree program. All students must earn 45 credits as a graduate student, 37 of which must be taken at RIT to earn the master of science degree.

The curriculum is a combination of required core courses in imaging science and elective courses appropriate for the candidate's background and interests. Six tracks (concentrations) have been established: Digital Imaging Processing, Medical Imaging, Electro-Optical Imaging Systems, Remote Sensing, Color Imaging and Hard Copy Materials and Processes. Additional tracks may be created for interested students. Students must enroll in either the research-thesis or graduate paper/project option at the beginning of their studies.

Candidates who wish to enter the program but lack adequate preparation may have to take bridge courses in mathematics, chemistry or physics before matriculating with graduate status.

All graduate students in the program are required to complete the following core courses:

1051-711, 712	Basic Principles of Imaging Science I, II
1051-716, 717	Linear Image Mathematics I, II

All non-imaging science courses must be approved by the CIS master of science coordinator as acceptable for CIS credit.

Research thesis option

Full-time students who elect this option begin their thesis work during the first year of study. Part-time students may defer the beginning of their thesis work until their second or subsequent years. Full-time students receiving funding assistance are required to choose the research thesis option. Students who elect this option will take 36 credit hours of course work (including the core) and nine credit hours of thesis/research, three of which are associated with the graduate seminar course (1051-706, 707, 708).

The thesis is to be based on experimental evidence obtained by the candidate in an appropriate field as arranged between the candidate and his or her adviser. The minimum number of thesis credits required is nine. The thesis requirement may be fulfilled by experiments in Institute laboratories. In some cases, the requirement may be fulfilled by work done in other laboratories. An example might be the candidate's place of employment, under the following conditions:

1. The results must be fully publishable.
2. The candidate's adviser must be approved by the graduate coordinator.
3. TTie thesis must be based on the candidate's independent, original work, as it would be if the work were done in Institute laboratories.

Graduate paper/project option

Students with demonstrated practical or research experience approved by the graduate coordinator may choose the graduate project option (five credit hours) in addition to 40 hours of core and elective courses. This option takes the form of a systems course (a different course for each track) and an associated project/paper. The graduate paper is normally performed during the final quarter of study. Both part- and full-time students may choose this option subject to the approval of the graduate coordinator.

Admission

Admission will be granted to graduates of accredited degree-granting institutions whose undergraduate studies have included at least the following courses in the major areas of study: mathematics through calculus, including differential equations; a full-year calculus-based physics course; a full-year college-level course, with laboratory, in chemistry. It is assumed that students can write a common computer program.

Applicants must demonstrate to the Graduate Admissions Committee of the Center for Imaging Science that they have the capability to pursue graduate work successfully. Normally this will include an interview, the submission of a statement of purpose, presentation of undergraduate academic record, letters of evaluation from individuals familiar with the applicant's capabilities, and any other pertinent data furnished by the applicant. While previous high academic achievement does not guarantee admission, such achievement or other unusually persuasive evidence of professional promise is expected.

Applicants seeking financial assistance from the center must have all application documents submitted to the Admissions Office by February 15 for the next academic year. Those seeking funding from the center are also required to take the GRE. Students whose native language is not English must demonstrate proficiency in English, as evidenced, for example, by a TOEFL score of 600 or higher. Students whose native language is not English are advised to obtain as high a TOEFL score as possible if they wish to apply for a teaching or research assistantship. These candidates are also required to take the TSE-A test of spoken English, in order to be considered for financial assistantship.

Grades

The average of the grades for all courses taken at the Institute and credited toward a master's degree must be at least a "B" (3.0) grade point average. Research and thesis does not carry a letter grade and is not included in the average.

Doctor of Philosophy in Imaging Science

Harvey E. Rhody, *Coordinator*
716-475-6215
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The doctor of philosophy degree in imaging science signifies high achievement in scholarship and independent investigation in the diverse aspects of imaging science. Candidates for the Ph.D. degree must demonstrate proficiency by:

1. successfully completing course work, including a core curriculum, as defined by the student's plan of study;
2. passing a series of examinations;
3. completing an acceptable dissertation under supervision of the student's research adviser and Dissertation Committee.

The core curriculum includes courses that span and integrate a common body of knowledge essential to an understanding of imaging processes and applications. The core courses are:

		Credits
1051-706, 707, 708	Imaging Science Seminar	1
1051-711, 712	Basic Principles of Imaging Science	4

Imaging science students have conducted research in areas from medical diagnostic imaging to remote sensing.

1051-713	Noise & Random Processes	4
1051-714	Information Theory for Imaging Systems	4
1051-716, 717	Linear Image Mathematics I, II	4
1051-721, 722,723	Imaging Lab I, II, III	1
1051-726	Programming for Scientists and Engineers	4

Admission

Because imaging science encompasses a wide variety of scientific disciplines, students with diverse backgrounds are accepted into the program. Undergraduate preparation leading to a bachelor of science degree in engineering, computer science, applied mathematics or one of the natural sciences is usually required, but exceptional students from other fields may be accepted. All students admitted to the Ph.D. program in imaging science must have completed courses in the following areas:

- Calculus and differential equations
- Probability and statistics
- Chemistry (one year)
- University physics (one year)
- Modern physics
- Computer language

Admissions decisions are made by a committee of the graduate faculty of the Center for Imaging Science. To be admitted, students must have a record of academic achievement from their undergraduate institutions, as indicated by official transcripts, must demonstrate proficiency on the Graduate Record Examination (GRE) and must request letters of recommendation from two people well qualified to judge their abilities for graduate study. Students for whom English is not the native language must also submit the results of the Test of English as a Foreign Language (TOEFL). Industrial and research experience are also considered in the decision to admit. Applicants seeking financial assistance from the center must have all application documents to the Admissions Office by February 15 for the next academic year.

Due to the variety of backgrounds of incoming students, it is recognized that some will not have the requisite preparation in all areas and will have to complete some undergraduate requirements during the course of their graduate study.

Students with a master of science degree in a related field (e.g., physics, chemistry or electrical and computer engineering) may be granted up to 36 quarter credits toward the Ph.D. degree in imaging science based on their earlier studies and after successful completion of the comprehensive examination. The required research credits may not be waived by experience or examination.

Comprehensive examination

All students must pass a written comprehensive examination. The examination is given each year prior to the Fall Quarter and is ordinarily taken after completing the core course of study (30 quarter credits); i.e., after the first year of study. The examination consists of sections that cover the core disciplines of imaging as well as concentration areas and is prepared and administered by the graduate faculty. The student must successfully pass the comprehensive examination to advance to candidacy (two attempts are permitted).

By the time they take the comprehensive examination, all students must select a research adviser from the graduate faculty of the Center for Imaging Science.

Dissertation committee

After the student passes the comprehensive examination and upon recommendation of the director of the Center for Imaging Science, a Dissertation Committee of four members is appointed for the duration of the student's tenure in the program. One is appointed by the Provost's Office from the faculty within the Institute but outside the center and acts as the chair of the final dissertation defense. The committee must also include the student's research adviser and at least one other member of the imaging

science graduate faculty. The fourth member may be affiliated with industry or another institution. Persons who are not members of the graduate faculty must be approved by the coordinator of the doctoral program.

The duties of the Dissertation Committee include:

1. reviewing the study plan and dissertation proposal;
2. preparing and administering the examination for admission to candidacy;
3. assisting in planning and coordinating the research;
4. supervising the writing of the dissertation;
5. conducting the final examination of the dissertation.

Study plan

The student and the research adviser develop a study plan that defines the course work to be completed, including the technical electives most relevant to the student's field of interest. The study plan must be filed with the doctoral coordinator of the Center for Imaging Science and must be approved by three members of the graduate faculty. The plan may be amended if the changes are approved by the student's advising committee.

Research proposal

The student and the research adviser select a research topic for the dissertation. The proposed research must be original and publishable. Although the topic may deal with any aspect of imaging, the research is usually concentrated in an area of current interest within the center. These areas include: silver halide imaging, remote sensing, digital image processing, color and visual perception, digital microlithography, astronomy, medical imaging, electro-optics and machine vision.

The student must make a formal proposal of the dissertation topic to the Dissertation Committee for approval.

Admission to candidacy

As soon as possible after acceptance of the research proposal, but not later than six months prior to defending the dissertation, the student must pass an examination to be admitted to candidacy for the doctoral degree. The examination is prepared and administered by the Dissertation Committee and may have oral and/or written sections at the committee's option. A typical examination may consist of oral responses to previously assigned written questions.

Course requirements

All students must complete a minimum of 72 credit hours of course work. The courses are defined by the student and the Dissertation Committee in the study plan and must include completion of the core sequences plus at least two three-quarter sequences in topical areas. These topical areas include: silver halide science, remote sensing, digital image processing, digital graphics, electrophotography, electro-optical imaging systems, medical imaging and microlithographic imaging technologies.

Students may take a maximum of 16 credits in other departments and must also complete 27 credits of research, with a maximum of nine credits per quarter.

Residency

All students in the program must spend at least three consecutive quarters (Summer Quarter excluded) as resident full-time students to be eligible to receive the Ph.D. A full-time academic load is defined as a minimum of nine academic credits per quarter or an equivalent amount of research as certified by the graduate coordinator.

Time limitations

All candidates for the Ph.D. must maintain continuous enrollment during the research phase of the program. Such enrollment is not limited by the maximum number of research credits that apply to the degree. Normally, full-time students complete the course of study for the doctorate in approximately three to four years. A total of seven years is allowed to complete the requirements after first attempting the comprehensive exam.

Final examination of the dissertation

The Dissertation Committee must submit a letter to the graduate coordinator requesting permission to administer the final examination of the dissertation. The letter must indicate that each member has received the dissertation and concurs with the request. The examination is scheduled by the graduate coordinator but may not be held sooner than two weeks after permission has been granted.

The final examination of the dissertation is open to the public and is primarily a defense of the dissertation research. The examination consists of an oral presentation by the student, followed by questions from the audience. The Dissertation Committee may also elect to privately question the candidate following the presentation. The Dissertation Committee will immediately notify the candidate and the graduate coordinator of the result of the examination.

Graduate Faculty
Center for Imaging Science

Jonathan S. Arney, BS, Wake Forest University; Ph.D., University of North Carolina—Associate Professor

Roy S. Berns, BS, MS, University of California; Ph.D., Rensselaer Polytechnic University—Richard S. Hunter Professor.

Roger L. Easton, BS, Haverford College; MS, University of Maryland; MS, Ph.D., University of Arizona—Associate Professor

Mark D. Fairchild, BS, MS, Rochester Institute of Technology; Ph.D., University of Rochester—Director of the Munsell Color Science Laboratory; Associate Professor

Richard Hailstone, BS, Northern Illinois University; MS, Indiana University—Associate Professor

Joseph P. Hornak, BS, Utica College, MS, Purdue University; Ph.D., University of Notre Dame—Professor

Pantazis Mouroulis, BS, University of Athens; Ph.D., University of Reading—Associate Professor

Zoran Ninkov, BS, University of Western Australia; MS, Monash University; Ph.D., University of British Columbia—Associate Professor

Navalgund Rao, MS, Banaras Hindu University; Ph.D., University of Minnesota—Associate Professor

Harvey E. Rhody, BSEE, University of Wisconsin; MSEE, University of Cincinnati; Ph.D., Syracuse University—Professor

John Schott, BS, Canisius College; MS, Ph.D., Syracuse University—Professor

Extended Graduate Faculty

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

Lynn F. Fuller, BS, MS, Ph.D., SUNY Buffalo (Electrical Engineering)—Professor, Microelectronic Engineering

Guifang Li, BS, Tianjin University; MS, Ph.D., University of Wisconsin (Electrical Engineering)—Assistant Professor, Electrical Engineering

Mysore Raghuveer, BS, Mysore University, India; ME, Indian Institute of Science, Bangalore, India; Ph.D. University of Connecticut (Electrical Engineering)—Associate Professor, Electrical Engineering

Bruce Smith, BS, MS, Ph.D., Rochester Institute of Technology—Assistant Professor, Microelectronic Engineering

Note: Prerequisites are within parentheses at the end of the course description.

Chemistry

1008-711 Instrumental Analysis
Theory, applications and limitations of selected instrumental methods in qualitative, quantitative and structural analysis. Topics include nuclear magnetic resonance, electrochemistry, surface methods and other modem instrumental methods. (1014-340,1013-432,436) Class 3, Credit 3 (F, W-X*)

1008-720 Instrumental Analysis Lab
Problem solving and experimental design are emphasized. Experiments include AA, FT-IR, HPLC, ICP, GC/MS, electrochemistry, polymer characterization and thermal analysis. (1014-441,445) Lab 6, Credit 2 (F-X*, W)

1009-702 Biochemistry: Biomolecular Conformation & Dynamics
The first course in our graduate sequence in biochemistry. Molecular transport and enzymatic catalysis are related to the three-dimensional structures of biomolecules and the laws of thermodynamics. Also provides an introduction to membrane structure as preparation for the next course in the sequence (1009-703; Biochemistry: Metabolism). (Baccalaureate degree or permission of instructor) Class 3, Credit 3 (F-X*, W-X*)

1009-703 Biochemistry: Metabolism
Metabolic processes involved in energy consumption and production as well as the synthesis and degradation of biomolecules are discussed. Metabolic pathways are described in terms of thermodynamic principles, cellular localization and regulation mechanisms. Finally, the metabolic basis of several diseases is presented. (Baccalaureate degree or permission of instructor) Class 3, Credit 3 (F, W-X*)

1009-704 Biochemistry: Nucleic Acids & Molecular Genetics
Nucleic acid structures, including the classical Watson-Crick model for DNA, are introduced. The flow of genetic information by replication (DNA to DNA), transcription (DNA to RNA) and translation (RNA to protein) as well as gene expression and regulation in prokaryotes are discussed. The methodology of new techniques, such as DNA sequencing and recombinant DNA, and their role in medicine and forensics are presented. The genetic aspects of viruses and oncogenes are also reviewed. (Baccalaureate degree or permission of instructor) Class 3, Credit 3 (S-X*)

1009-705 Biochemistry: Experimental Techniques
An introduction to the theory and practice of modem experimental biochemical laboratory techniques and concepts. The weekly one-hour lecture provides a theoretical framework for the various experimental techniques including a discussion of the properties of biomolecules, and how those properties are exploited in the separation and characterization of the molecules. Practical laboratory techniques include the preparation of buffers, centrifugation, gel exclusion chromatography, electrophoretic methods, and UV/visible and fluorescence spectrophotometry as applied to the isolation and characterization of proteins and nucleic acids. The manipulation of genetic material in E. coli will also be examined. (Baccalaureate degree) Class 1, Lab 6, Credit 3 (offered every year) (S)

1010-772 Special Topics
Advanced courses which are of current interest and/or logical continuations of the course already being offered. These courses are structured as ordinary courses and have specified prerequisites, contact hours and examination procedures. Recent courses taught as special topics include Nuclear Chemistry, Polymer Morphology, Advanced Chromatographic Methods, Applications of Computer Interfacing and Environment Chemistry. Class variable, Credit variable

1010-870 Chemistry Seminar
Matriculated students are required to attend the weekly chemistry seminar series and to present a one-hour seminar on a topic in chemistry. Credit 1

1010-877 External Research
Industrial internship research. Credit 1-16

1010-879 Research & Thesis Guidance
Hours and Credits to be arranged. Chemical research in a field chosen by the candidate, subject to approval of the department head and adviser. Credit variable

1010-899 Independent Study: Chemistry
Credit variable

1010-999 Graduate Chemistry Co-op
Cooperative education experience for graduate students. Credit 0 (Offered every quarter)

1012-764 Inorganic Chemistry III: Physical Methods & Applications
Introduces the more sophisticated tools with which an inorganic chemist investigates inorganic materials. These physical methods, with the bond theories from 1012-563, are applied to inorganic reactions that exemplify the similarities and differences for the elements in each family of the periodic table. (1012-563) Class 4, Credit 4 (S-X*)

1012-765 Preparative Inorganic Chemistry
The complexity of many inorganic "building blocks" requires a detailed understanding of inorganic theory, special handling precautions and special methods to investigate inorganic products. Different areas of the periodic table, new synthetic methods and new characterization techniques are examined. (1012-563 or permission of instructor) Lab 8, Credit 2 (W)

1013-730 Chemical Toxicology
Clinical and forensic aspects of abused drugs, including history, structure, classification, drug levels, metabolism and effects. Drug analysis methods: history, theory and practical applications of GLC, HPLC, GC/MS, UV spectrometry, TLC, IR, EIA, FPIA and stat tests. You are the drug chemist and the toxicologist in this multimedia experience. (College biology and chemistry, some biochemistry helpful or permission of instructor) Class 4, Credit 4 (offered alternate years; offered 1997-98) (W-X*)

1013-736 Spectrometric Identification of Organic Compounds
Theory and application of proton carbon and 2-D nuclear magnetic resonance, infrared, mass spectrometry and ultraviolet spectra as applied to organic structure determination. (1013-433) Class 4, Credit 4 (W)

1013-737 Advanced Organic Chemistry
Several of the following advanced topics in organic chemistry are covered: polyfunctional compounds, modern synthetic methods, anion chemistry, stereospecific syntheses, protecting group chemistry, total synthesis, with strong emphasis on recent chemical literature. (1013-433) Class 4, Credit 4 (F)

1013-739 Advanced Organic Chemistry
Selected topics in physical organic chemistry including: techniques for elucidation of mechanism (kinetic, linear free, energy relationships, isotope effects), molecular orbital theory, electrocyclic reactions. (1013-433, 1014-443) Class 4, Credit 4 (offered alternate years; offered 1997-98) (S)

1013-832 Stereochemistry
Advanced treatment of steric relationships, conformational analysis an stereoisomerism in organic compounds. (1013-433,1014-433) Class 4, Credit 4 (offered upon sufficient request)

1013-833 Heterocyclic Chemistry
A general treatment of heterocyclic chemistry. Syntheses and relative reactivities of heterocyclic compounds as demonstrated by their chemical reactions. (1013-433) Class 4, Credit 4 (offered upon sufficient request) (F)

1014-730 Magnetic Resonance Imaging
Introduction to the principles of magnetic resonance imaging (MRI) at level understandable by both the scientist and nonscientist. The course begins with the basics of nuclear magnetic resonance, the foundation of MRI. Magnetic resonance imaging techniques and instrumentation are explained. Emphasis is on understanding the imaging process. A discussion of information available for water proton content images of body parts and tissue types is presented. Future directions of MRI are presented. (1017-311,312,313 or 1017-211,212,213) Class 4, Credit 4 (S-X*)

1014-740 Basics of Pulsed NMR
An introduction to the principles of pulsed nuclear magnetic resonance (NMR) spectroscopy. Lectures on instrumentation, pulse sequences, Fourier transforms and artifacts are presented. (1008-311) Class 1, Credit 1 (F)

1014-741 Advanced Chemical Thermodynamics
A study of the basic fundamentals of thermodynamics, including an introduction to statistical mechanics and their use in deriving the interrelationships of thermodynamic functions. Thermodynamic properties of gases are calculated based on spectroscopic data. Theory of solutions and phase equilibria are discussed. (1014-443,1016-306) Class 4, Credit 4 (offered alternate years; offered 1997-98) (W-X*)

X*: *course is offered at extended day hours (after 5 p.m.)*

1014-742 Survey of Physical Chemistry
A study of the fundamental principles of physical chemistry for clinical chemistry and biotechnology students. Kinetic-molecular theory, quantum mechanics, spectroscopy, thermodynamics and kinetics are presented in application to the life sciences. Not acceptable for BS in chemistry. Class 3, Credit 3 (offered alternate years; offered 1998-99) (W-X*)

1014-743 Advanced Chemical Kinetics
Methods of investigating the kinetics of chemical reactions and the theories used to interpret their results. Focus on homogeneous reactions in gas and liquid phases. Discussions of references from recent chemical literature. (1014-443) Class 4, Credit 4 (offered alternate years; offered 1998-99) (W-X*)

1014-744 Advanced Quantum Mechanics
Review of basic quantum theory and models. Variation and perturbation methods, atomic and molecular orbital theory, emphasis on relationship of spectroscopy and quantum chemistry. (1014-442) Class 4, Credit 4 (offered alternate years; offered 1998-99) (S-X*)

1014-747 Principles of Magnetic Resonance
A series of lectures designed to introduce the principles of magnetic resonance spectroscopies with emphasis on pulsed nuclear magnetic resonance (NMR) spectroscopy. Topics covered include classical and quantum mechanical theory, Fourier transform techniques, pulse sequences, instrumentation, instrumental techniques and modem applications such as 2-D NMR and solid-state NMR. (1014-443; 1014-648) Class 4, Credit 4 (offered alternate years; offered 1997-98) (W-X*)

1015-720 Environmental Chemistry
Environmental sources, reactions, transport, effects and fate of chemical species in air, soil, water and living systems are studied. (Physical Chemistry or permission of instructor) Class 3, Credit 3 (offered alternate years; offered 1998-99) (S-X*)

1015-721 Atmospheric Chemistry
The chemical composition of the Earth's atmosphere with emphasis on the role of the biosphere and the changes induced by human activity will be studied. Special emphasis will be placed on urban pollution, acid rain, stratospheric ozone depletion and climate change. (1014-443) Class 3, Credit 3 (offered alternate years; offered 1998-99) (S-X*)

1029-701 Organic Chemistry of Polymers
Polymerization reactions that are used to prepare high molecular weight polymers and industrially important polymer chains, copolymerization, graft polymer preparation and polymer degradation reactions are also considered. (1013-433) Class 4, Credit 4 (F-X*)

1029-702 Polymer Chemistry: Chains & Solutions
Although most polymeric materials find utility as solids, polymer fabrication and characterization techniques are generally liquid-phase processes. This course is concerned with the fundamental physical chemistry of polymers in liquid solutions. Topics to be addressed include: polymerization kinetics and chain structure, molecular weight distributions and determination, polymer solution thermodynamics and transport phenomena, and solution phase transitions. The study of polymeric solids is the focus of 1029-703. (Baccalaureate degree in science or engineering, or permission of instructor) Class 4, Credit 4 (S-X*)

1029-703 Polymer Chemistry: Properties of Bulk Materials
This course is designed to give the student with a chemistry or materials science background a thorough grounding in the main concepts that describe bulk polymer structure, behavior and properties and to give the student practical tools to predict them. Basic to the understanding of polymer behavior is the fact that it is time-dependent. To emphasize this idea, the course is designed to build up to a study of thermo-mechanical behavior of viscoelastic materials. (Baccalaureate degree in science or engineering, or permission of instructor) Class 4, Credit 4 (F-X*)

1029-704 Polymer Characterization Lab
Many students in the Chemistry and Materials Science and Engineering graduate programs are involved in polymer research. This course gives these students an opportunity to acquire proficiency in using the tools of polymer characterization. Techniques for studying 1) molecular weight distributions, 2) spectroscopic analysis of chemical structure, 3) thermal stability, 4) morphology and phase transitions, and 5) mechanical properties will be introduced and mastered. Students have the option to cover all the techniques taught to the undergraduates in 1029-504 or they can concentrate on the techniques useful to their particular research topic. (Baccalaureate degree in a science or engineering discipline, or permission of instructor) Lab 6, Credit 2 (offered alternate years; offered 1998-99) (S)

1029-705 Preparative Polymer Chemistry
Students will carry out eight experiments. They will conduct in about half of those experiments step-growth polymerizations, and in the other half chain-addition polymerizations. Among the polymers produced will be polyvinyl alcohol gel, Nylon 6-10, Nylon 11, polystyrene, high-density polyethylene, linear low-density polyethylene, copolymer of styrene and methyl methacrylate and polyurethane. The more specific types of polymerizations and reactions introduced will be: crosslinking of polymer, interfacial and bulk step-growth polymerizations, cyclopolymerization, radical, ionic, and coordinative chain polymerizations. Instructors may add and/or delete polymer-related experiments of their choice. The students in this course will also be primarily responsible to analyze the produced polymers and use literature data to identify them. (1013-437 or permission of instructor) Lab 6, Credit 2 (offered alternate years; offered 1998-99) (F)

Industrial and Applied Mathematics

1016-725 Stochastic Processes
An introduction to stochastic processes. Important random processes that appear in various applications are studied. It covers basic properties and applications of Poisson processes and Markov processes as well as applications in renewal theory, queueing models, and optimal stopping. (Advanced Calculus, Probability, Matrix Algebra) Class 4, Credit 4

1016-801 Numerical Linear Algebra
An introduction to the theoretical concepts and computational issues in linear algebra. Topics include: vector spaces; linear transformations; linear functionals; polynomials; canonical forms; eigenvalues; diagonalization; decompositions; rational and Jordan forms; iterative techniques; factorization algorithms; special matrices. Computing projects, involving user-written programs and/or software packages, will be part of the course work. (Advanced Calculus, Matrix Algebra, knowledge of a programming language) Class 4, Credit 4

1016-802 Methods of Applied Mathematics I
An introduction to some classical topics in mathematical analysis. Models arising in physics and engineering are introduced. Topics include: dimensional analysis and scaling; partial differential equations, classical techniques; Fourier series; integral transforms; orthogonal functions; wave phenomena in continuous systems. (Advanced Calculus, Differential Equations) Class 4, Credit 4

1016-803 Methods of Applied Mathematics II
This is a continuation of 1016-802 and deals with further applications of differential equations. Topics include: classification of partial differential equations; Laplace's equation; diffusion equations and their applications in physics and engineering. (1016-802) Class 4, Credit 4

1016-804 Numerical Methods for Stochastic Models
This course covers the algorithmic and numerical aspects of analyzing stochastic processes. Emphasis here is on computing the solutions to the systems represented by stochastic processes and identifying their probabilistic interpretations. Topics include: queueing models; examples from communications networks and manufacturing systems; reliability models; simulation; approximation methods. (1016-725,1016-801) Class 4, Credit 4

1016-859 Topics in Applied Mathematics
This course covers some topics that are not covered in the regular courses and are not offered in other departments. This course may be used to study other areas of applications in the student's concentration. A wide variety of topics may be offered. Some examples are: reliability models; biological models; calculus of variations; computational probability; and dynamical systems. (Consent of the adviser and the instructor) Class 4, Credit 4

1016-879 **Thesis or Project Work**
This is the capstone of the program in which the student works on a problem in applied mathematics under the guidance of the Advisory Committee. A formal written proposal of the problem to be studied must be presented before embarking on the project. A written report and an oral defense of the project/ thesis are required at the completion of the work. This course may be repeated for a maximum of 12 quarter credit hours. (Consent of the adviser)

1016-899 **Independent Study**
A topic of special interest to the student and related to the student's area of concentration may be taken for independent study with the approval of the adviser and the instructor who will offer the course. The student submits a proposal for independent study to the Advisory Committee for consideration and approval. (Consent of the adviser and the instructor) **Credit variable (maximum of 4 credits/quarter)**

Clinical Chemistry

1023-705 **Mechanisms of Disease**
Mechanisms of cellular injury, the healing process, atherosclerotic heart disease, hypertension, infectious disease, and many other disease states are presented. **Class 4, Credit 4 (offered alternate years) (W)**

1023-712 **Statistics & Quality Control**
The principles of statistics as applied to biomedical research, manufacturing of reagents for the clinical laboratory, and as applied to the clinical laboratory analysis are studied. Using a problem-oriented approach to probability; normal values; analysis of variance; and quality control as well as the relationship of these procedures to patient care are studied. **Class 3, Credit 3 (offered alternate years) (S)**

1023-722 **Clinical Laboratory Computer Applications**
Computerized office management and administrative techniques are discussed with emphasis on PCs. The basic concepts of data processing and spread sheets; design, evaluation, and the utilization of computer systems in both hospital and clinical laboratories; and the legal aspects of biomedical data processing are studied. **Class 3, Credit 3 (offered alternate years)**

1023-820 **Advanced Clinical Chemistry I**
Electrolytes, acid-base physiology, renal function, trace metals, lipids, carbohydrate metabolism, enzymes, and various standard methods are covered, (permission of instructor) **Class 4, Credit 4 (offered alternate years)**

1023-821 **Advanced Clinical Chemistry II**
A study of the concepts and applications of therapeutic drug monitoring, pharmacokinetics, toxicology, inherited disorders of metabolism, liver function tests, protein measurement, hepatitis, porphyrias, vitamins, pediatric clinical chemistry, geriatric clinical chemistry and gene probes. (Permission of instructor) **Class 4, Credit 4 (offered alternate years)**

1023-822 **Advanced Clinical Chemistry III**
A survey of endocrinology and of the immunoassay methods used in performing endocrine assays. The endocrine systems covered include the thyroid, the adrenals, calcium metabolism, growth hormone, the human reproductive system and the fetal-placental unit. **Class 4, Credit 4 (offered alternate years)**

1023-823 **Advanced Clinical Chemistry IV**
Introduces the student to the types of instrumentation and analytical methods commonly found in the clinical laboratory. Instrumentation and methods covered include UV-visible spectroscopy, immunoassay, GC-MS, HPLC, TLC, ion selective electrodes, atomic absorption spectroscopy, electrophoresis, osmometry, nephelometry and multi-analyzers. The laboratory component serves to provide hands-on experience in these types of procedures and measurements. **Class 3, Lab 3, Credit 4 (offered alternate years)**

1023-870 **Clinical Chemistry Seminar**
Credit 1 (W)

1023-872 **Special Topics in Clinical Chemistry**
In response to student and/or faculty interest, special courses that are of current interest and/or logical continuations of regular courses are presented. These courses are structured as ordinary courses with specified prerequisites, contact hours and examinations. **Class variable, Credit variable (offered upon sufficient request)**

Graduate students may serve as assistants in the laboratories.

1023-877 External Clinical Chemistry Research
Research carried out in a laboratory outside of the College of Science. Prior to the initiation of external research, a proposal from the student as well as a commitment of support and direction from the laboratory are evaluated. Credit variable

1023-879 Clinical Chemistry Research
Research carried out in the College of Science laboratories under the direction of RIT faculty members. The amount of credit awarded for such projects is determined after evaluation of a research proposal. Credit variable 1-16

1023-899 Clinical Chemistry Independent Study
Individual projects or studies carried out under the direction of a faculty member. Study objectives and design are developed through faculty-student interaction with evaluation and credit to be awarded determined after review of a study proposal. Credit variable

Materials Science and Engineering

1028-701 Introduction to Materials Science
The course provides an understanding of the relationship between structure and properties for development of new materials. Topics include atomic and crystal structure, crystalline defects, diffusion theories, strengthening mechanisms, ferrous alloys, cast irons. Structure of ceramic and polymeric materials and corrosion principles. (Graduate standing or permission of instructor) Class 4, Credit 4 (F)

1028-702 Introduction to Polymer Science
A study of the chemical nature of plastics detailing the relationships between polymerization conditions, structure and properties in both the solid and fluid states. (1028-701 or equivalent) Class 4, Credit 4 (W)

1028-703 Solid State Science
Survey of topics in the physics of solids. Included are crystal symmetry, structure and binding; mechanical, thermal and electrical properties of insulators, semiconductors and conductors, including band theory. (1028-704 or equivalent) Class 4, Credit 4 (W)

1028-704 Introductory Theoretical Methods
Treatment of waves and fields; selected topics of interest in electrodynamics and fluid mechanics; statistical mechanics; Maxwell-Boltzmann, Bose Einstein and Fermi-Dirac distributions and their applications. (Graduate standing and permission of instructor) Class 4, Credit 4 (F)

1028-705 Introductory Experimental Techniques
Introduction to laboratory equipment for hardness testing, impact testing, tensile testing, x-ray diffraction and thermal treatment of metallic materials. Experiments illustrating the characterization of high molecular weight organic polymers are conducted. (1028-701 and 702 or equivalents) Class variable, Lab variable, Credit 4 (S)

1028-706 Experimental Techniques: Thin Films
Production of thin films of metals and dielectrics by physical vapor deposition. Lectures cover vacuum systems, evaporation, sputtering, nucleation and growth of thin films, analysis and characterization of thin films, and application of thin films. Laboratories cover use of vacuum systems in evaporation and sputtering and some methods of characterizing the thin films thus produced. (Permission of instructor) Class variable, Lab variable, Credit 4

1028-707 Experimental Techniques: Electron Microscopy & Spectroscopy
An in-depth look at various techniques used to characterize thin film materials. Lectures will cover resistivity measurements, ellipsometry, reflectance techniques, optical microscopy, electron microscopy, and scanning probe microscopy. The lab provides hands-on training in these techniques and is conducted in the cleanroom housed in the Center for Microelectronic Engineering. Students will be required to perform an in-depth study on a material of their choice using these techniques or to research an associated technique not covered in lecture. (Permission of instructor) Class variable, Lab variable, Credit 4

1028-708 Experimental Techniques
Provides an in-depth integrated approach to the analysis, investigation and development of materials, concentrating on specific types or classes. (1028-701 or equivalent) Class variable, Lab variable, Credit 4

1028-710 Material Properties & Selection
Study of the principles of material behavior as applied to design. Application of materials according to these principles is stressed. Ferrous, nonferrous and nonmetallic materials are considered. (1028-701 or equivalent) Class 4, Credit 4

1028-714 Glass Science
Topics include the structure and properties of glass, applied areas such as glass melting and processing, and various technological applications of glass. (1028-701 or equivalent; 1028-704) Class 4, Credit 4

1028-717 Materials Degradation: Corrosion
This course introduces the basic electrochemical nature of corrosion and considers the various factors that influence the rate of corrosion in a variety of environments. Various means of controlling corrosion are considered. (1028-701 or equivalent) Class 4, Credit 4

1028-720 Organic Polymers
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. (1028-702 or equivalent) Class 4, Credit 4

1028-721 Physical Chemistry of Polymers
A study of the theoretical and experimental methods available for designing plastics products and selecting appropriate materials, with special emphasis on the interrelationships between materials, product design, tooling construction and manufacturing producibility. (1028-702 or equivalent) Class 4, Credit 4

1028-722 Polymer Processing
A study of the basic principles and methods involved in the technology of processing polymeric materials, including treatments of heat transfer, mass transfer, mixing and shaping or molding of these materials. (1028-702 or equivalent) Class 4, Credit 4

1028-730 Optical Properties of Materials
Fundamentals of geometrical and physical optics, interaction of radiation with matter, dielectrics and thin films, introduction to electro-optic and acousto-optic effects. (1028-704 or equivalent) Class 4, Credit 4

1028-733 Magnetic Properties of Materials
Magnetostatics, creation and measurement of magnetic fields, galvanomagnetic and magneto-optic effects, magnetic materials, applications. (1028-701 and 704 or equivalent) Class 4, Credit 4

1028-734 Advanced Optics
Lasers: theory, types and construction; optics of metals; multilayer dielectrics; electro- and acousto-optic modulators and deflectors; optical detectors. (1028-730 or equivalent) Class 4, Credit 4

1028-736 Amorphous & Semicrystalline Materials
Electrical, thermal and optical properties of amorphous materials; model of conduction. (1028-701,703,704 or equivalents) Class 4, Credit 4

1028-740 Nuclear Science & Engineering
Systemics of the atomic nuclei, radioactivity, nuclear reactions, fission, nuclear reactor principles, designs, materials and safety. (1028-701 and 704 or permission of instructor) Class 4, Credit 4

1028-760 Plasma Science
An introduction to plasma science; a study of the basic phenomena and application of plasma to etching, deposition, polymerization, plasma production of materials, analytical emission spectroscopy and atmospheric science. (1028-701 or equivalent) Class 4, Credit 4

1028-770 Physics & Chemistry of IC Processing
Study of the various processing steps used in integrated circuit fabrication technology with special emphasis on diffusion, thermal oxidation, ion implantation and plasma-assisted deposition and etching processes. Process modelling using SUPREM. (1028-703 or permission of instructor) Class 4, Credit 4

1028-800 Special Topics
In addition to in-depth study of any of the courses listed under Elective Courses, special topics may be selected from such areas as elastomers, organometallics, radiation damage, processing of materials, superconductivity, etc. (Permission of instructor) Class variable, Credit 4

1028-877 External Research
Research using equipment and facilities at a site other than RIT. Prior to enrollment in the course, a proposal from the student that includes a letter of support from the host facility is evaluated for determination of credit to be awarded upon successful completion of the project. A total of eight quarter credit hours, with a maximum of four quarter credit hours per quarter, can be applied toward the MS degree. For matriculated MSE students employed full time by local companies. (Permission of program director) Credit variable

1028-879 Research & Thesis Guidance
A project involving research on a topic in materials science and engineering. An oral examination and written thesis are required. Credit variable

1028-879-99 Continuation of Thesis
Course section available to satisfy Institute's Continuation of Thesis policy. Credit 0

1028-890 Seminar
Required for completion of the program and involves a one-hour presentation on some topic in materials science in engineering. Class variable, Credit 1 (F, S)

1028-899 Independent Study
This course number should be used by students wishing to study a topic on an independent study basis. (Permission of instructor) Credit variable

Color Science

1050-701 Vision & Psychophysics
This course provides an overview of the human visual system and psychophysical techniques used to investigate it. The optical, sensory, and neural aspects of vision and image quality are treated. Topics include color vision, adaptation, sensor response functions, neural networks, and an introduction to electro-optical and computational analogs. (Graduate status) Class 3, Lab 3, Credit 4

1050-702 Applied Colorimetry
An introduction to the measurement and specification of color. The CIE system of colorimetry is presented with an emphasis on its practical application to common problems in quality control, reproduction and imaging. Topics include color perception, photometry, trichromatic theory, color matching mathematics, obtaining colorimetric data through measurement, color quality spaces, deriving industrial tolerances, and an introduction to device independent color. Class 4, Credit 4

1050-703 Color Appearance
This course is for students who have an understanding of the applications of colorimetry. It presents the transition from the measurement of color patches and differences to the description and measurement of color appearance. This seminar course is based mainly on review and discussion of primary references. Topics include, appearance terminology, appearance phenomena, viewing conditions, chromatic adaption and color appearance modeling. (1050-702) Class 3, Credit 3

1050-721 Color Measurement Lab I
An in-depth treatment of the instrumentation and standardization required for accurate, precise measurements of optical radiation. The optical properties of objects and radiation sources will be covered. Optical and electronic design of spectroradiometric and spectrophotometric instrumentation is discussed in detail. The use of standard reference materials for calibration and evaluation of instrumentation is explored. The laboratory is heavily stressed, with students fully analyzing the design and performance of various instruments. (1050-701 corequisite) Class 1, Lab 3, Credit 2

1050-722 Color Measurement Lab II
Course stresses technical writing and scientific reasoning applied in a laboratory environment. Laboratories include precision and accuracy analysis of color measuring instrumentation, measuring observer metamerism, color tolerance psychophysics and building a colorimeter. (1050-701,711). Class 1, Lab 3, Credit 2

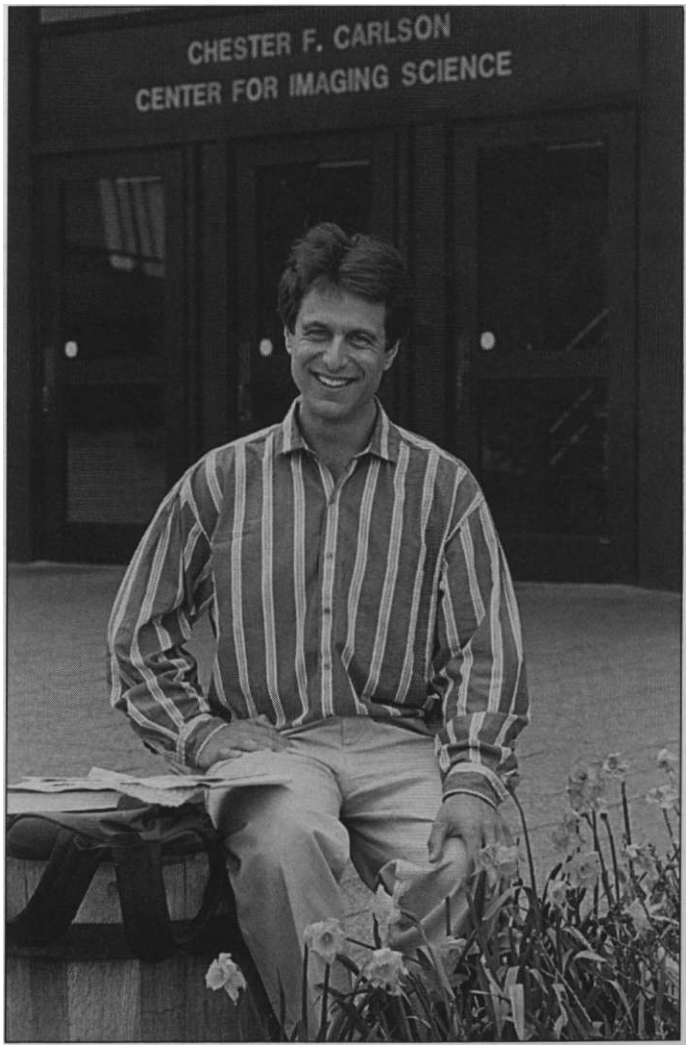
1050-751 Special Topics
Advanced topics of current interest, varying from quarter to quarter, selected from the field of color science. Specific topics announced in advance. (Not offered every quarter. Consult the color science graduate program coordinator.) Credit variable

1050-752 Special Topics
Advanced topics of current interest, varying from quarter to quarter, selected from the field of color science. Specific topics announced in advance. (Not offered every quarter. Consult the color science graduate program coordinator.) Credit variable

1050-753 Special Topics
Advanced topics of current interest, varying from quarter to quarter, selected from the field of color science. Specific topics announced in advance. (Not offered every quarter. Consult the color science graduate program coordinator.) Credit variable

1050-799 Independent Study
An independent project in an area of color science not covered in the available courses. This project can be experimental research, literature review, or other appropriate work. This course requires a formal proposal and a faculty sponsor. Credit variable

1050-801 Color Science Seminar
A seminar course in which students will study the literature in particular areas of color science and present that material to the class. Topics will be based on student interest and current issues in the field. Available to color science MS students or by permission of the instructor. May be taken more than once for credit with permission of coordinator. (1050-703,813) Class 3, Credit 3



Robert Loce, an imaging scientist at Xerox Corporation, has the distinction of earning the nation's first Ph.D. in imaging science. The program attracts scholars from across the globe.

1050-813 **Color Modeling**
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 Grassmann'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. (1050-702) Class 3, Lab 3, Credit 4

1050-840 **Color Science MS Project**
An independent project in an area of color science that serves as the major culminating experience for students in the Graduate Project Option of the color science MS program. This project can be an experiment, critical literature review, demonstration or other appropriate work. This course requires a formal proposal and faculty sponsor; a written technical report and oral presentation of the results. (1050-801 and faculty sponsor) Credit 4

1050-890 **Research & Thesis**
Thesis based on experimental evidence obtained by the candidate in an appropriate topic as arranged between the candidate and the coordinator of the program. Credit **9 (minimum for MS)**

Imaging Science

1051-706 **Introduction to Imaging Science**
The course introduces the student to the historical context from which the field of Imaging Science has evolved. It proceeds to define the fundamental scientific principles on which the science is based and to expose the student to the technologies and directions that encompass the field. This course is intended to set the framework for graduate study in Imaging Science and to provide the non-image scientist with a non-quantitative survey of the field. **Credit 1 (F)**

1051-707 **Introduction to Imaging Science**
The course introduces the student to the historical context from which the field of Imaging Science has evolved. It proceeds to define the fundamental scientific principles on which the science is based and to expose the student to the technologies and directions that encompass the field. This course is intended to set the framework for graduate study in Imaging Science and to provide the non-image scientist with a non-quantitative survey of the field. Credit 1 (W)

1051-708 **Imaging Science Seminar**
The course introduces the student to the historical context from which the field of Imaging Science has evolved. It proceeds to define the fundamental scientific principles on which the science is based and to expose the student to the technologies and directions that encompass the field. This course is intended to set the framework for graduate study in Imaging Science and to provide the non-image scientist with a non-quantitative survey of the field. Credit 1 (S)

1051-711 **Basic Principles of Imaging Science I**
This course provides the student with a basic understanding of the scientific principles associated with electromagnetic radiation propagation, image capture and formation, and image processing used to reproduce or display images. An end-to-end treatment of an imaging system shall be employed to illustrate the interrelationships among the concepts introduced throughout the course. System analyses include the use of modeling concepts and image quality metrics to demonstrate how the concepts developed in Linear Image Mathematics can be used in concert with concepts in this course to describe and assess a simple imaging system. (Calculus, Differential Equations, University Physics, concurrent registration in 1051-716) **Class** 4, **Credit** 4 (F)

1051-712 **Basic Principles of Imaging Science II**
This course continues the development of basic understanding of scientific principles associated with image capture, formation, and image processing used to reproduce or display images. An end-to-end treatment of an imaging system shall be employed to illustrate the interrelationships among the concepts introduced throughout the course. System analyses include the use of modeling concepts and image quality metrics to demonstrate how the concepts developed in Linear Image Mathematics can be used in concert with concepts in this course to describe and assess a simple imaging system. (1015-711, 716 and concurrent registration in 1051-717) **Class** 4, **Credit** 4 (W)

1051-713 **Noise & Random Processes**
The purpose of this course is to develop an understanding and ability in modeling noise and random processes within the context of imaging systems. The focus will be on stationary random processes in both one dimension (time) and two dimensions (spatial). Power spectrum estimation will be developed and applied to signal characterization in the frequency domain. The effect of linear filtering will be modeled and applied to signal detection and maximization of SNR. The matched filter and the Wiener filter will be developed. Signal detection and amplification will be modeled, using noise figure and SNR as measures of system quality. At completion of the course, the student should have the ability to model signals and noise within an imaging system. (1051-711,712,716, 717; Probability or consent of instructor) **Class 4, Credit 4 (offered alternate years; offered 1997-98) (S)**

1051-714 **Information Theory for Imaging Systems**
This course develops a basic understanding of the efficient representation of information for storage and transmission. Classical concepts of information theory are developed and applied to image compression, storage and transmission. The intent is to develop a foundation for the efficient handling of image-based information in imaging systems. (1051-711, 712, 716, 717; Probability or consent of instructor) **Class 4, Credit 4 (offered alternate years; offered 1998-99)** (S)

1051-716 **Linear Image Mathematics I**
This course develops the mathematical methods required to describe continuous and discrete linear systems, with special emphasis on tasks required in the analysis or synthesis of imaging systems. The classification of systems as linear/nonlinear and shift variant/ invariant is discussed first, followed by development and use of the convolution integral. This is followed by a discussion of Fourier methods as applied to the analysis of linear systems, including the Fourier series and Fourier transform. Emphasis is placed on the physical meaning and interpretation of these transform methods. Image sampling and quantization is introduced and discrete convolution and Fourier transform is considered. Within the context of image analysis, imaging systems as a linear filter, image enhancement and information extraction and several basic image processing techniques are also introduced. (Calculus, Differential Equations, Linear Algebra and Complex Variables or permission of instructor) **Class 4,** Credit **4 (F)**

1051-717 **Linear Image Mathematics II**
This course continues the development of mathematical methods required to describe continuous and discrete linear systems that was begun in 1051-716, with emphasis placed on the use of discrete models of imaging systems. The various types and effects of quantization are considered first, followed by discussions of common means to process sampled and quantized images. The use of linear models of imaging systems is considered, including he discussion of the valid limiting cases of optical imaging in coherent and incoherent light. The course concludes with discussions of various applications of the mathematical models. (1051-716) Class **4,** Credit **4 (W)**

1051-721 **Imaging Laboratory I**
This three quarter laboratory is designed to parallel the Basic Principles of Imaging Science I, II, and Noise and Random Processes core requirements. It provides hands-on experience with imaging materials and devices, digital imaging techniques, electro-optical devices, and other imaging modalities. It is intended to reinforce course work and provide the student exposure to, and facility with, a broad variety of instrumentation and analytical methods. In addition, statistical methods of data analysis will be introduced and utilized. (SIMD Graduate status, 1051-711 corequisite) **Lab 3,** Credit 1 **(F)**

1051-722 **Imaging Laboratory II**
This three quarter laboratory sequence is designed to parallel the Basic Principles of Imaging Science I, II, and Noise and Random Processes core requirements. It provides hands-on experience with imaging materials and devices, digital imaging techniques, electro-optical devices, and other imaging modalities. It is intended to reinforce course work and provide the student exposure to, and facility with, a broad variety of instrumentation and analytical methods. In addition, statistical methods of data analysis will be introduced and utilized. (SIMD Graduate status, 1051-712 corequisite) **Lab 3,** Credit 1 **(W)**

1051-723 **Imaging Laboratory III**
This three quarter laboratory sequence is designed to parallel the Basic Principles of Imaging Science I, II, and Noise and Random Processes core requirements. It provides hands-on experience with imaging materials and devices, digital imaging techniques, electro-optical devices, and other imaging modalities. It is intended to reinforce course work and provide the student exposure to, and facility with, a broad variety of instrumentation and analytical methods. In addition, statistical methods of data analysis will be introduced and utilized. (SIMD Graduate status, 1051-713 corequisite) **Lab** 3, Credit 1 (S)

1051-726 **Programming for Scientists & Engineers**
A course to prepare graduate students in science and engineering to use computers as required by their disciplines. Covers: the organization and programming of computers at various levels of abstraction (e.g. assembly, macros, high-level languages, libraries), advanced programming techniques, the design, implementation, and validation of large computer programs, modern programming practices, introduction to a programming environment and to a variety of programming languages. Programming projects will be required. (0602-700 or equivalent) **Class 4, Credit 4 (W)**

1051-728 **Design & Fabrication of Solid State Cameras**
The purpose of this course is to provide the student with hands-on experience in building a CCD camera. The course provides the basics of CCD operation including an overview, CCD clocking, analog output circuitry, cooling, and evaluation criteria. (Graduate status) **Class 1.5, Lab 7.5, Credit 4 (offered 1998-99) (W)**

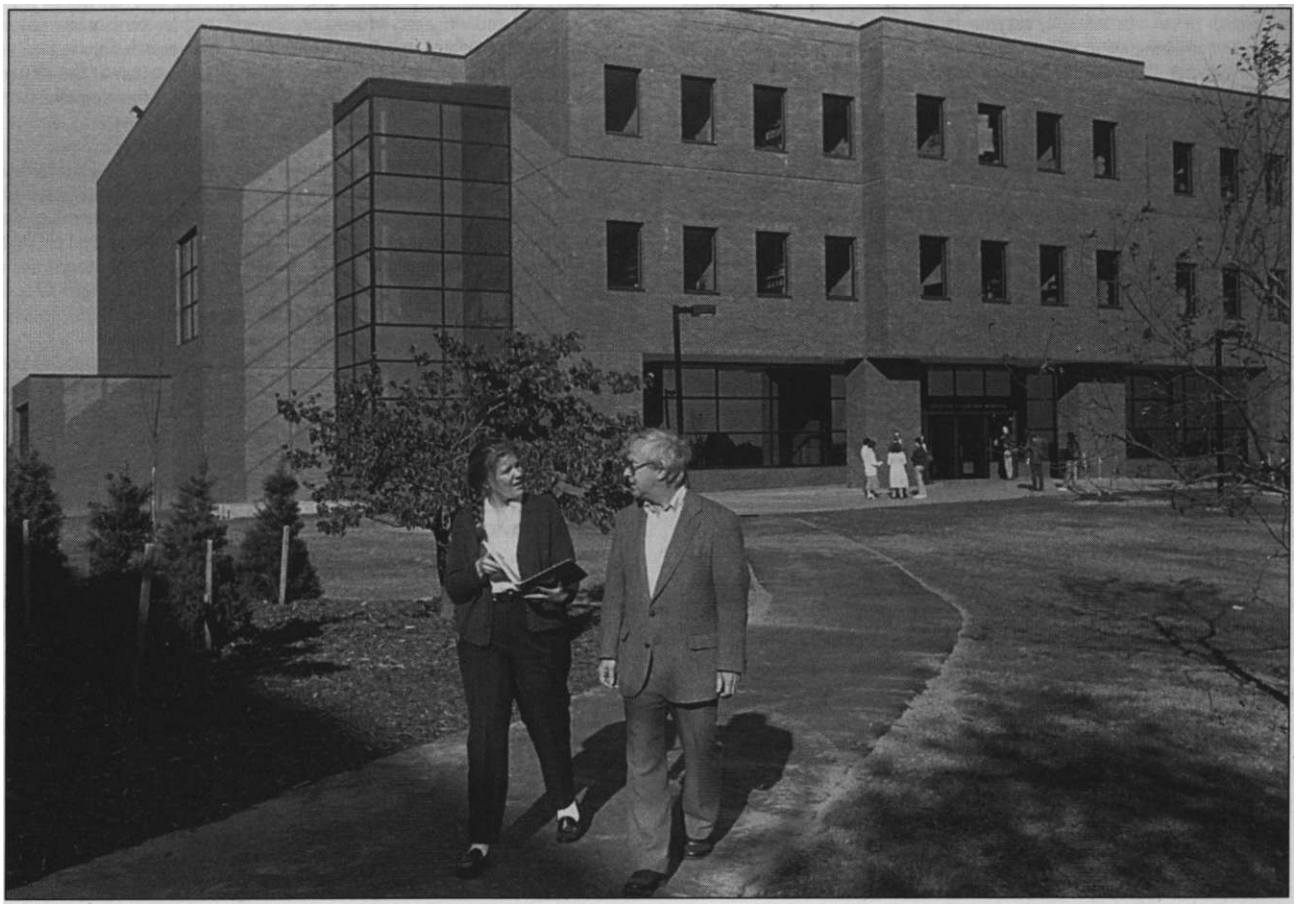
1051-731 **Principles of Chemical Imaging I**
This course provides the student with a basic understanding of the principles of chemical imaging. The physical and chemical principles required for studying chemical imaging are reviewed. The phenomenon and mechanism of reciprocity law failure are illustrated. Emphasis is on relating the underlying principles of physics and chemistry to the metrics of system performance. Technologies to be covered include ink jet and thermal printing. (College Chemistry, Calculus, **1051-711** corequisite) **Class 4,** Credit **4 (F)**

1051-732 **Principles of Chemical Imaging II**
A continuation of 1051-731 providing the student with a basic understanding of the principles of chemical imaging. Emphasis is on relating the underlying principles of physics and chemistry to the metrics of system performance. Chemical imaging technologies to be covered include electrophotographic, silver halide, and polymer. Spatial properties of chemical images are related to their underlying physics and chemistry. (1051-731) **Class 4,** Credit **4 (W)**

1051-736 **Geometrical Optics & First Order Design**
This course leads to a thorough understanding of the geometrical properties of optical imaging systems. A method is developed of performing a first-order design of an optical system, applicable to uniform and gaussian beams. The following topics are included: paraxial optics of axisymmetric systems, gaussian optics (cardinal points, pupils and stops, optical invariant), propagation of energy through lens systems, basic optical instruments and components, gradient index optics, finite raytracing, introduction to aberrations, geometrical optics of gaussian beams. (Graduate status) **Class 3, Lab 3, Credit 4 (F)**

1051-737 **Physical Optics**
The wave properties of light and their application to imaging systems and metrology. Polarization, birefringence, interference and interferometers, spatial and temporal coherence, scalar diffraction theory are covered. (1051-717) **Class 4, Credit 4 (W)**

1051-738 **Optical Image Formation**
This course presents a unified view of the formation of images and image quality of an optical system from an applications viewpoint, but with a strict mathematical development. Topics covered are: geometrical and diffraction theory of aberrations, image quality criteria and MTF, MTF tolerance theory, image formation with coherent light. Throughout the course, the problem of image formation is treated also in its inverse form of designing an optical imaging system that satisfies a given set of specifications. (1051-711, 712, 716, 717,736,737) **Class** 3, **Lab** 3, **Credit 4 (S)**



The Carlson Center for Imaging Science, one of the newest buildings on campus

1051-739 Principles of Solid State Imaging Arrays
This course covers the basics of solid state physics, electrical engineering, linear systems and imaging needed to understand modern focal plane array design and use. The course emphasizes knowledge of the working of infrared arrays. (Graduate status, Optics, Linear Systems) **Class 4, Credit 4 (offered 1998-99) (F)**

1051-746 Probability & Statistics for Imaging Science I
This course concentrates on probability theory, with emphasis on probability measures, univariate and multivariate distributions, and modeling using important distributions such as Poisson, normal and gamma distributions. Estimation theory is also introduced. (Graduate status) **Class 4, Credit 4**

1051-749 Color Reproduction
This course presents the concepts required for an understanding of the relationships between mean-level input and output in various color imaging systems. Analog, digital, and hybrid color imaging systems will be covered. Special emphasis will be given to mean-level reproduction in photography, printing, and television. **(1051-711, 712, 716, 717** or permission of instructor) **Class 4, Credit 4 (W)**

1051-750 Hyperspectral Imaging & Synthetic Image Generation
This course is divided into two parts. The first half focuses on hyperspectral imaging, starting with the physical and chemical phenomena that cause spectral signatures and tracing spectral imaging through sensing by image spectrometers and analysis with specialized algorithms for handling spectrally rich data. The other half of the course is similar to a seminar and focuses on synthetic image generation (SIG). Several SIG models will be reviewed by the class and compared to the DIRSIG model, which will be treated in detail as a point of reference for the other models. There is particular emphasis on the potential for using SIG to model the hyperspectral phenomena. (Permission of instructor) **Class 4, Credit 4**

1051-751 Special Topics in Imaging Science
Advanced topics of current interest, varying from quarter to quarter, selected from the field of imaging science. Specific topics announced in advance. (Not offered every quarter. Consult the imaging science graduate program coordinator.) **Credit variable**

1051-752 Special Topics in Imaging Science
Advanced topics of current interest, varying from quarter to quarter, selected from the field of imaging science. Specific topics announced in advance. (Not offered every quarter. Consult the imaging science graduate program coordinator.) **Credit variable**

1051-753 Special Topics in Imaging Science
Advanced topics of current interest, varying from quarter to quarter, selected from the field of imaging science. Specific topics announced in advance. (Not offered every quarter. Consult the imaging science graduate program coordinator.) **Credit variable**

1051-756 Introduction to Electrophotography Materials & Processses
An introduction to materials and processes in electrophotography. Topics include an historical development of electrostatic and electrophotographic imaging, surface deformation imaging, and current topics in electrophotographic and related processes. **(1051-711,712,716,717) Class 4, Credit 4 (offered alternate years; offered 1998-99) (F)**

1051-757 Fundamentals of Electrophotography
This course describes the physical basis for field variation electrophotography, and the fundamentals of xerographic system design and analysis. Topics covered include calculation of development fields, the mathematical and physical basis for viscosity-controlled and adhesion-controlled development, the physical basis for charging and discharging photoconductors, and system optimization of the xerographic process. **(1051-756) Class 4, Credit 4 (offered alternate years; offered 1998-99) (W)**

1051-758 Electrophotographic Systems
Basic principles and techniques in engineering design and analysis of electrophotographic copiers, input scanners, raster output scanners, and other solid state electronic printing devices. Emphasis will be given to such topics as reliability, systems optimization, quality control, and print and copy quality. **(1051-756,757) Class 4, Credit 4 (offered alternate years; offered 1998-99) (S)**

1051-761 Principles of Remote Sensing & Image Analysis I
An introduction to radiometric concepts as they relate to remote sensing. The emphasis is on aerial and satellite imaging systems operating from 0.4-20 um. After a brief review of the field, the basic radiometry concepts needed for remote sensing are introduced and a governing equation for radiance reaching the sensor is carefully derived. (Graduate Status or permission of instructor) **Class 4, Credit 4(F)**

1051-762 Remote Sensing & Image Analysis II
The problem of inverting recorded image data to surface reflectance on temperature values is treated using a variety of techniques, including the use of ground truth, "in scene" methods, and radiation propagation models. Multispectral digital image processing methods are introduced and their utility in various remote sensing applications considered. The potential for including multiple sources of data in image analysis is treated through consideration of multispectral image data fusion and the use of geographic information systems. **(1051-761) Class 3, Lab 3, Credit 4 (W)**

1051-763 Remote Sensing & Image Analysis III
Analysis of digital remotely sensed images is treated with emphasis on multispectral analysis techniques. This includes consideration of multivariate discriminate analysis and principal components for material identification and analysis. Special topics such as radar, Fraunhofer line discriminator, hierarchial classifiers will also be treated. (Graduate Status or permission of instructor) **Class 3, Lab 3, Credit 4 (S)**

1051-765 Remote Sensing Systems
This course is designed to draw on the student's knowledge of linear system theory, digital image processing, and noise concepts and apply it to an end-to-end system in an area associated with remote sensing. Generalized concepts from these fields will be focused to show how they can be applied to solve remote sensing image analysis and systems design and evaluation problems. An overriding objective is on the application of theory to practice. **(1051-711, 712, 716, 717, 761, 762,1051-713** corequisite or permission of instructor) **Class 4, Credit 4 (S)**

1051-771 Silver Halide Science I
A comprehensive study of the science of imaging with silver halide materials. Includes materials preparation and their physical and chemical properties, mechanisms and efficiency of image recording, and reciprocity law failure measurement and mechanisms. The course will focus on correlations between events at the atomic and molecular level and their manifestation at the macroscopic level. (College Chemistry and Physics) **Class 4, Credit 4 (offered alternate years; offered 1997-98) (F)**

1051-772 Silver Halide Science II
A continuation of the comprehensive study of the science of imaging with silver halide materials. Includes mechanisms and procedures of chemical sensitization, dopants, and spectral sensitization, and image detection and enhancement. This course will focus on correlations between events at the atomic and molecular level and their manifestation at the macroscopic level. **(1051-771) Class 4, Credit 4 (offered alternate years; offered 1997-98) (W)**

1051-773 Silver Halide Science III
A comprehensive study of the application of silver halides in imaging systems. The emphasis is on how the material properties of silver halides influence the properties of the imaging system such as sensitivity, reciprocity failure, curve shape, color and tone reproduction, granularity, sharpness, resolution, and processability. **(1051-711, 712, 772) Class 4, Credit 4 (offered alternate years; offered 1997-98) (S)**

1051-774 Vision & Psychophysics
This course provides an overview of the human visual system and psychophysical techniques used to investigate it. The optical, sensory, and neural aspects of vision and image quality are treated. Topics include color vision, adaptation, sensor response functions, neural networks, and an introduction to electro-optical and computational analogs. (Graduate status) **Class 3, Lab 3, Credit 4 (F)**

1051-775 Applied Colorimetry
An introduction to the measurement and specification of color. The CIE system of colorimetry is presented with an emphasis on its practical application to common problems in quality control, reproduction, and imaging. Topics: color perception, photometry, trichromatic theory, color matching mathematics, obtaining colorimetric data through measurement, color quality spaces, deriving industrial tolerances, and an introduction to device independent color. **Class 4, Credit 4 (F)**

1051-776 Color Modeling
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 transluscent systems and on Grassmann'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. (1051-775) Class 3, Lab 3, Credit 4 (S)

1051-779 Astronomical Instrumentation & Techniques
This course provides an in-depth look at various pieces of instrumentation used in many low light imaging applications with emphasis on astronomical requirements. Aspects of hardware, systems analysis, and performance calculation will be covered. (Graduate status, Optics, Linear Systems) **Class** 4, **Credit** 4

1051-782 Introduction to Digital Image Processing
After a brief review of 2-dimensional signal processing, the course discusses the processing of images on a computer. It includes methods of contrast manipulation, image smoothing, and image sharpening using a variety of linear and non-linear methods. Also discussed are methods of edge and line enhancement and detection, followed by techniques of image segmentation. The course concludes with a discussion of image degradation models and image restoration. (1051-716,717 or permission of instructor) Class 4, Credit 4 (W)

1051-784 Digital Image Processing: Spatial Pattern Recognition
This course develops a fundamental understanding of adaptive pattern recognition and a basic working knowledge of techniques that can be used in a broad range of applications. Inherent in adaptive pattern recognition is the ability of the system to leam by supervised or unsupervised training, or by competition within a changing environment. The effectiveness of the system depends upon its structure, adaptive properties and specifics of the application. Particular structures that are developed and analyzed include statistical PR, clustering systems, fuzzy clustering systems, multi-layered perceptrons (with a variety of weight training algorithms), and associative memory systems. The goal is to gain both a fundamental and working knowledge of each kind of system and the ability to make a good system selection when faced with a real application design. **Class 4, Credit 4 (W)**

1051-797 Principles of Computerized Tomographic Imaging
Image reconstruction from projections is introduced as a mathematical problem. Technique for reconstruction via Fourier domain is explained using Fourier slice theorem. Simple and filtered backprojection and iterative methods are analyzed. Algorithms for various techniques are developed and artifacts and noise in discrete case are considered. Applications to several medical imaging modalities are outlined, with brief consideration of the physics of imaging involved in each case. (1051-716,717 or 1051-782 or permission of instructor) **Class** 4, **Credit** 4

1051-799 Independent Study
An independent project in an area of imaging science not covered in the available courses. This project can be experimental research, literature review, or other appropriate work. This course requires a formal proposal and a faculty sponsor. **Credit variable**

1051-801 Advanced Optics Seminar I
This course covers several advanced aspects of optics and imaging that are not included in other regular course offerings. Topics vary every year. The course may be taken more than once. Student participation includes presentations to the class on agreed upon topics. (1051-736, 737 or permission of instructor) **Class 1, Credit 1 (F)**

1051-802 Advanced Optics Seminar II
This course covers several advanced aspects of optics and imaging that are not included in other regular course offerings. Topics vary every year. This course may be taken more than once. Student participation includes presentations to the class on agreed upon topics. (1051-736, 737 or permission of instructor) **Class 1, Credit 1 (W)**

1051-803 Advanced Optics Seminar III
This course covers several advanced aspects of optics and imaging that are not included in regular course offerings. Topics vary every year. The course may be taken more than once. Student participation includes presentations to the class on agreed upon topics. (1051-736, 737 or permission of instructor) **Class** 1, **Credit 1 (S)**

1051-807 Hard Copy Systems
The focus is on concepts of "Imaging Systems" and system's image quality. Metrics of image qualify (IQ) will be explored. These will include IQ metrics of concern in systems which are not discussed elsewhere in the curriculum. These will include concepts such as costs, reliability, and permanence. Two particular types of imaging systems will be covered in detail. The first, designated the "Internal Imaging System", focuses on strategies for the design and quality optimization of components internal to individual technologies. The second type of imaging system, designated the "External Imaging System", focuses on strategies for the design and quality optimization of components of an imaging chain. (1051-711, 712, 716, 717) **Class** 4, **Credit** 4 **(offered alternate years; offered 1998-99)**(S)

1051-812 Medical Imaging Systems
This is an advanced graduate level course that describes existing medical imaging systems in terms familiar to imaging scientists and electrical engineers. These include impulse response, the transfer functions, and the signal to noise ratio. The course considers in detail, three different imaging modalities: Conventional projection X-ray, X-ray radiography and X-ray CT, ultrasonic imaging, and magnetic resonance imaging. A complete system is examined piece by piece in terms of subsystems. (1051-711, 712, 716, 717 and 1051-797 or 1010-730) **Class** 4, **Credit** 4 **(offered alternate years; offered 1997-98) (S)**

1051-816 Color Systems
This course builds on the theory and concepts presented in the Color Reproduction and Color Modeling courses to cover the key techniques utilized in device-independent color imaging systems. Topics covered include: device calibration and characterization (input, output, display), device profiles, multi-dimensional look-up table construction, inversion, and interpolation, gamut mapping, appearance matching, and color-management systems. (1051-711, 712, 716, 717, 749, 1051-776 corequisite) **Class** 4, **Credit** 4 **(offered alternate years; offered 1997-98) (S)**

1051-840 MS Project Paper
The analysis and solution of Imaging Science Systems problems for students enrolled in Systems Capstone option. (Coregistration in approved systems course) **Credit 1**

1051-890 Research & Thesis
Thesis (MS) or dissertation (Ph.D) based on experimental data obtained by the candidate for an appropriate topic as arranged between the candidate and the research advisor. **Credit 1-9 (MS); Credit 1-24 (Ph.D.)**

National Technical Institute for the Deaf

James J. DeCaro, Dean

The National Technical Institute for the Deaf is the world's largest technological college for deaf students. Among RIT's more than 12,000 full- and part-time students are more than 1,000 deaf students from the United States and other countries. Within the college of NTID, students can choose from more than 30 fields of study to earn certificates, diplomas and associate degrees. Hearing students may pursue an associate degree in educational interpreting from NTID. Or students may choose from more than 200 technical and professional courses of study to pursue bachelor's or master's degrees through RIT's other seven colleges.

Master of Science Degree in Secondary Education of Students Who Are Deaf or Hard of Hearing

Gerald C. Bateman, *Director,*
716-475-6480 (voice/TTY)

The National Technical Institute for the Deaf offers a graduate program leading to the master of science degree in secondary education of students who are deaf or hard of hearing. The unique program prepares professionals to meet the national need for excellent teachers of secondary students who are deaf or hard of hearing. The program's purpose includes not only the preparation of teachers as effective practitioners but also as leaders in the profession.

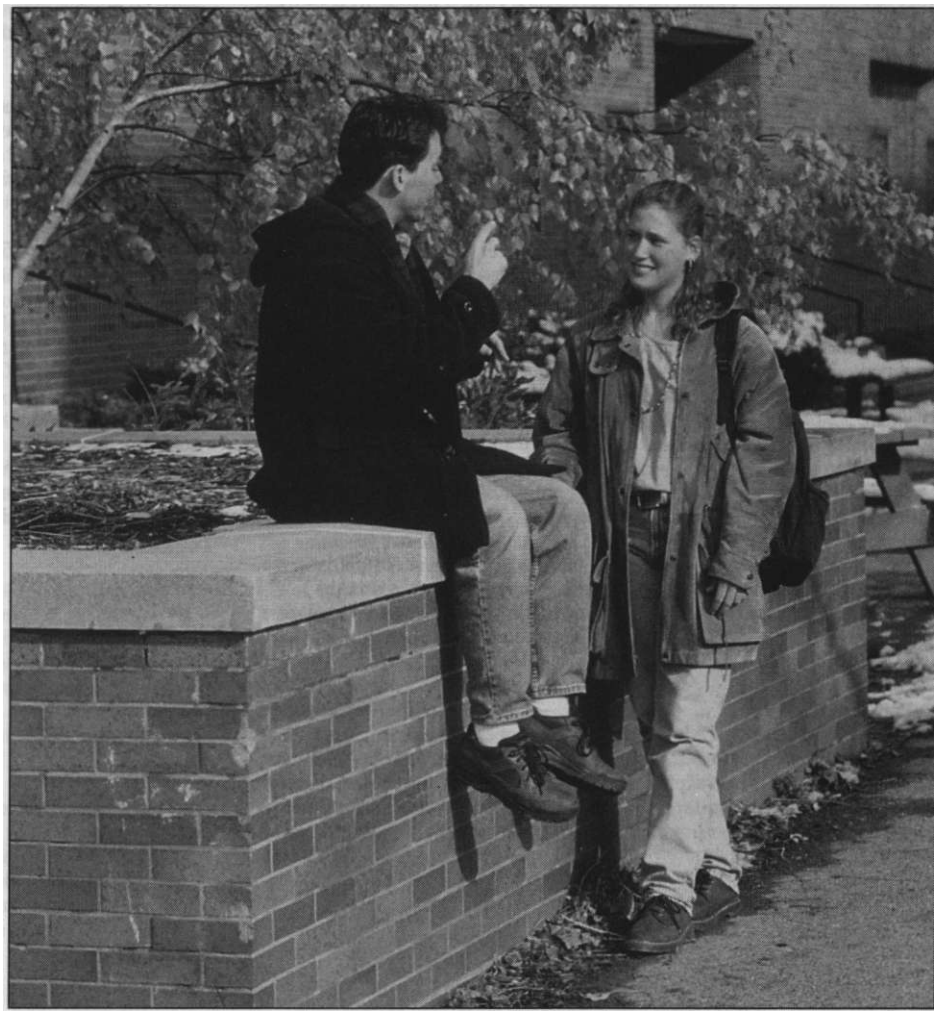
NTID is a logical home for this innovative program. Faculty members are international leaders in research and the art of teaching in the education of deaf people. A carefully designed system of faculty advisement is a prominent feature of this program. On-campus facilities, state-of-the-art technology and a well-established system of educational access services combine to make this a vital program for both deaf and hearing students who desire careers as professional educators of deaf students.

NTID is dedicated to the achievement of deaf and hard-of-hearing students not only through their education at NTID but also by preparing their teachers through the MS program in secondary education of students who are deaf or hard of hearing.

Admission guidelines

Admission to the program is based on the following criteria:

- Successful completion of the baccalaureate degree at an accredited college or university
- Cumulative grade point average of 3.0 or above
- Either a score of 550 of better on the Test of English as a Foreign Language (TOEFL) or a score of 80 or better on the Michigan Test of English Proficiency (if English is not the applicant's first language)
- Prerequisite course work: a 36-semester-hour concentration of college-level credit in a secondary academic subject recognized for certification by New York State. Secondary academic subjects include English, mathematics, social studies or science.



More than 1,000 deaf and hard-of-hearing students are enrolled at NTID.

The Lyndon B. Johnson Building houses many NTID classrooms, faculty offices and administrative services.

0835-711	Contemporary Issues in Education	4
0835-712	Curriculum Content & Methods of Instruction	4
0507-701	History of American Educational Thought & Practice	4
0835-790	Foundations of Educational Research	4
0515-701	Cultural Diversity in Education	4
0870-110	American Sign Language I	3
0870-120	American Sign Language II	3
0835-721	Structure of American Sign Language	4
0835-724	English Language Development	4
0835-701	Psychology & Sociology of Adolescence	4
0835-722	Audiology & Speech in Secondary Education	4
0835-723	Psycholinguistics & Sociolinguistics of Deafness	4
0835-820	Perspectives on Teaching Deaf & Hard-of-Hearing Students	4
0835-702	Educational Implications of Cultural Anthropology & Deafness	4
0835-705	Political/Legal Environment	4
0835-713	Assessment	4
0835-860	Student Teaching I	10
0835-861	Student Teaching II	10
0835-880	Master's Thesis/Project Seminar	2
0835-890	Master's Thesis/Master's Project	8
0835-898	Special Topics Electives Variable	
	Professional Development Seminars	0

Proposed plan of study

First Year

FALL QUARTER
Contemporary Issues in Education
American Sign Language I
Structure of American Sign Language
Psychology & Sociology of Adolescence
Professional Development Seminars

WINTER QUARTER
Curriculum Content & Methods of Instruction
American Sign Language II
Audiology & Speech in Secondary Education
History of American Educational Thought & Practice
Psycholinguistics & Sociolinguistics of Deafness
Professional Development Seminars

SPRING QUARTER
Student Teaching I
Perspectives on Teaching Deaf & Hard-of-Hearing Students

Second Year

FALL QUARTER
Assessment
Foundations of Educational Research
English Language Development
Educational Implications of Cultural Anthropology & Deafness
Professional Development Seminars

WINTER QUARTER
Master's Thesis/Project Seminar
Student Teaching II

SPRING QUARTER
Master's Thesis/Master's Project
Political/Legal Environment
Cultural Diversity in Education
Special Topics Electives
Professional Development Seminars

Degree requirements

Course work will require a minimum of seven quarters. Students must take a minimum of 84 quarter credits in areas related to deaf studies and education, including 20 credit hours of student teaching. A cumulative GPA of at least 3.0 must be maintained. Before graduation, students must demonstrate proficiency in sign language at the Intermediate Plus level rating of the Sign Communication Proficiency Interview (SCPI).

Graduate Faculty National Technical Institute for the Deaf

John A. Albertini, BA, Drew University; MS, Ph.D., Georgetown University—Professor
Victoria Armour, BA, M.Ed., Western Maryland College—Assistant Professor
Gerald C. **Bateman,** BA, MS, SUNY College at Geneseo; Ed.D., University of Rochester—Associate Professor; Director MSSE
Gerald P. Berent, BS, University of Virginia; Ph.D., University of North Carolina at Chapel Hill—Associate Professor
Joseph Bochner, BA, CUNY Queens College; MA, Ph.D., University of Wisconsin—Associate Professor
Paula Brown, BA, University of Missouri, Columbia; MA, Kent State University; MS, Ph.D., University of Rochester—Associate Professor
Karen Christie, BS, M.Ed., Lewis and Clark College; Ph.D., University of Pittsburgh—Assistant Professor
Kathleen E. Crandall, BA, MA, California State University at Fresno; Ph.D., Northwestern University—Associate Professor
Vincent A. Daniele, BS, MS, SUNY College at Cortland; Ph.D., Syracuse University—Associate Professor
Patricia A. DeCaro, BA, Earlham College; MS Ed., SUNY College at Brockport
Judy C. Egelston-Dodd, BS, MS, SUNY Albany; Ed.D., SUNY Buffalo—Professor
Susan Fischer, AB, Radcliffe College; Ph.D., Massachusetts Institute of Technology—Professor
Susan Foster, BA, Northwestern University; BS, University of Maine; M.Ed., Bridgewater State College; Ph.D., Syracuse University—Associate Professor
T. Alan Hurwitz, BS, Washington University; MS, St. Louis University; Ed.D., University of Rochester—Professor
Ronald Kelly, BS, M.Ed., Ph.D., University of Nebraska at Lincoln—Associate Professor
Patricia Lago-Avery, BS, Central Michigan University; MS, University of Arizona; NCC certification—Assistant Professor
Peter A. Lalley, BS, Sienna College; MS, Catholic University of America; Ph.D., SUNY Buffalo—Professor; Director, Center for Baccalaureate and Graduate Studies
Harry G. Lang, BS, Bethany College; MS, Rochester Institute of Technology; Ed.D., University of Rochester—Professor
Robert S. **Menchel,** AAS, Hudson Valley Community College; BS, Clarkson College; MBA, Rochester Institute of Technology; Ed.D., Harvard University—Assistant Professor
Christine Monikowski, MS, Shippensburg State College; MS, Gallaudet University; MA, Ph.D., University of New Mexico—Assistant Professor
Jeffrey E. Porter, B.Ed., M.Ed., University of Virginia; Ph.D., Washington University—Associate Professor
Larry K. Quinsland, BA, University of Wisconsin at Madison; MA, MS, University of Wisconsin at Milwaukee; Ph.D., Waldon University—Associate Professor
Marilu Raman, BS, University of Puerto Rico; MS, Rochester Institute of Technology; Ed.D., University of Rochester—Associate Professor
Marvin C. Sachs, BS, MA, Ed.D., University of Rochester—Associate Professor
Donald G. Sims, BA, University of Colorado; MS, Ph.D., University of Pittsburgh—Associate Professor
Michael S. Stinson, BA, University of California at Berkeley; MA, Ph.D., University of Michigan—Professor
Tovah M. Wax, BA, SUNY Albany; MA, University of Delaware; MSW, University of Maryland at Baltimore; Ph.D., University of Delaware—Associate Professor

NTID's master of science degree in education of students who are deaf or hard of hearing prepares graduates to teach in both schools for the deaf and public high schools.

Robert R. Davila (center), the first deaf vice president in the history of NTID, offers a new perspective to the RIT administration.

Note: Prerequisites are within parentheses at the end of the course description.

Secondary Education of Students Who Are Deaf or Hard of Hearing

0835-701 Psychology & Sociology of Adolescence
The purpose of this course is to examine the psychological and social development of adolescents. The ways that family, school and community affect the adolescent's development, including effects on cognitive processes, identity formation and peer relationships, are considered. Psychological and sociological perspectives on the adolescent experience in general are used to provide a framework for understanding the development of deaf adolescents. Educational implications of the theories and research presented are discussed. Credit 4

0835-702 Educational Implications of Cultural Anthropology & Deafness
This course introduces the concepts underlying cultural anthropology and uses a cross-cultural approach to examine issues that include transmission and preservation of culture, cultural change and transformation, concepts of marginality, and majority and minority cultures. Deaf culture is examined and compared with other cultures, using comparative studies and cultural constructs such as norms, values and beliefs. The relationship between education and culture is discussed, and the nature of this relationship with respect to Deaf culture is studied. Credit 4

0835-705 Political/Legal Environment
The relationship of the goals and processes of deaf education to those of special education and education in general is explored. The course provides a detailed examination of historical and current demographic, economic, political, legal and social trends that affect the education of deaf and hard-of-hearing students. Current federal and state legislation affecting students with disabilities is analyzed and critiqued. Credit 4

0835-711 Contemporary Issues in Education
The purpose of this course is to introduce and discuss the issues and problems related to education in general. The approach is survey in nature as certain topics are covered in more depth in subsequent courses. The topics may include (but are not limited to) the following: the impact of society on education, current trends and issues in education (such as bilingual/bicultural education), inclusion, the purposes of education, empowerment of students, learning theories, governance and curriculum, and history of the education of deaf students. Classroom observations in schools serving deaf and hard-of-hearing students are required. Credit 4

0835-712 Curriculum Content & Methods of Instruction
Note: There are actually four discipline-specific courses here, designated by section: 01 (English), 02 (Mathematics), 03 (Science) and 04 (Social Studies). Students will take only the section focusing on the content area in which they will be certified. Descriptions of all four sections follow.

Section 01 English
This course examines issues and methods related to teaching English at the secondary level to students who are deaf or hard of hearing. Students investigate and analyze current approaches to curriculum, instruction and materials in the area of English instruction through readings, observations and seminars. Students design content area projects to demonstrate a variety of methodological philosophies. (Contemporary Issues in Education) Credit 4

Section 02 Mathematics
This course examines issues and methods related to teaching mathematics at the secondary level to students who are deaf or hard of hearing. Current instructional methods, curriculum and professional resources in mathematics are studied through seminars, readings, special projects, observations and work with content-area specialists and teachers in secondary-level mathematics courses. (Contemporary Issues in Education) Credit 4

Section 03 Science
This course examines issues and methods in teaching secondary level science to deaf and hard-of-hearing students, including the selection, modification, and use of curriculum materials in science. Discussions will be concerned with instructional strategies, classroom management, cognitive development, testing and evaluation, lab report writing and theories of science teaching. Students will be required to observe teachers in secondary level science courses. (Contemporary Issues in Education) Credit 4

Section 04 Social Studies
This course examines issues and methods related to teaching social studies at the secondary level to students who are deaf or hard of hearing. Through seminars, readings, special projects, and work with content area specialists/teachers, current instructional methods, curriculum and professional resources in social studies are examined. Students will be required to observe teachers of secondary level social studies courses at public schools, residential schools for deaf students or in mainstream programs. (Contemporary Issues in Education) Credit 4

0835-713 Assessment
This course addresses assessment as a process involving the choice and interpretation of assessment measures to diagnose the need for and aid in planning for services, referrals and placement of secondary students who are deaf and hard of hearing, including students with other secondary disabilities. The respective roles of the classroom teacher, school psychologist, parents and support service providers are addressed. Assessment and educational planning for a student are viewed from an ecological perspective, including the family, the school, the community, the support services and the legal systems. This course also addresses the development and interpretation of assessment measures of learning through teacher-made, criterion-referenced, curriculum-based and norm-referenced methods. Credit 4

0835-721 Structure of American Sign Language
This course concentrates on the linguistic structures of American Sign Language (ASL). Students examine all levels of structure from phonology (sublexical) through morphology and syntax to semantics and discourse. ASL structures will be elucidated through comparison and contrast with English and other spoken languages or dialects, as well as with other sign languages. ASL literacy, language variation and code switching in the deaf population are also examined. Credit 4

0835-722 Audiology & Speech in Secondary Education
This course focuses on the ways individuals comprehend and produce spoken English. It provides a functional understanding of auditory physiology, speech perception and deafness, hearing aids and other assistive listening devices. Procedures for audiological and speech/language assessment are examined with their implications for auditory training, speechreading and speech/language instruction. Models of collaboration among teachers, speech/language pathologists and audiologists to enhance students' communication using spoken English are discussed and observed. (Prerequisite or taken concurrently: Psycholinguistics and Sociolinguistics of Deafness) Credit 4

0835-723 Psycholinguistics & Sociolinguistics of Deafness
This course is designed to familiarize students with the processes involved in learning English with a focus on reading and writing. The course concentrates on those aspects of English language development that pertain to teaching deaf and hard-of-hearing students in grades 7 to 12. Students investigate deaf learners' attainments in reading and writing, patterns of English language performance observed in deaf learners, relationships between spoken and written English performance, bilingual/bicultural issues related to English learning and use, second language teaching strategies, and reading and literacy questions. (0835-721, Structure of ASL) Credit 4

0835-724 English Language Development
This course is designed to familiarize students with the processes involved in learning English with a focus on reading and writing. The course concentrates on those aspects of English language development that pertain to teaching deaf and hard-of-hearing students in grades 7 to 12. Students investigate deaf learners' attainments in reading and writing, patterns of English language performance observed in deaf learners, relationships between spoken and written English performance, bilingual/bicultural issues related to English learning and use, second language teaching strategies, and reading and literacy questions. (Psycholinguistics and Sociolinguistics of Deafness) Credit 4

0835-790 Foundations of Educational Research
This course is an introduction to research and inquiry in education. Perspectives on and issues related to research in the education of people who are deaf and hard of hearing are examined. Students are introduced to the research process, including design, theoretical perspectives, methods of data collection, validity/reliability, data analysis and interpretation. Students leave this course with a preliminary proposal for the master's thesis or project. Credit 4

0835-820 **Perspectives on Teaching Deaf & Hard-of-Hearing Students**
This course reviews fundamental principles of teaching and learning in light of the recently completed student teaching assignment. Students analyze examples of theoretical applications in teaching this class and from viewing videotapes of their actual lessons used during the student teaching experience. Students propose a plan for change and skill development. (Student Teaching I) Credit 2

0835-860 **Student Teaching I**
This first practicum consists of 10 weeks (250 hours) of teaching and observation. Student teachers are placed with cooperating teachers in residential schools for the deaf. Students develop lesson and unit plans and teach in the content area in which they plan to receive New York State certification. (Contemporary Issues in Education, Curriculum Content and Methods of Instruction, Psychology and Sociology of Adolescence, Structure of ASL, Psycholinguistics and Sociolinguistics of Deafness, and Audiology and Speech in Secondary Education) **Credit 10**

0835-861 **Student Teaching II**
This is an eight-week practicum done in conjunction with an itinerant or resource room cooperating teacher at the middle or secondary level in a mainstream setting with students who are deaf or hard of hearing. Students develop and deliver support for instruction, participate in student assessment, and, where appropriate, prepare lesson plans and teach to specific IEP objectives. (Student Teaching I, Assessment, Perspectives on Teaching Deaf and Hard of Hearing Students) **Credit 10**

0835-880 **Master's Thesis/Project Seminar (December)**
Students finalize their thesis/project proposal and begin research and development. Students also finalize the selection of their thesis/project adviser. Format for the seminar is full group meetings in the early part of December followed by individual or small group consultation with thesis/project advisers. (Foundations of Educational Research) **Credit 2**

0835-890 **Master's Project**
This is the capstone experience of the master's degree program. Students must submit an acceptable project proposal in order to enroll. Project development, presentation, and/or reporting or research and the preparation of the written thesis are completed in this course. **Credit 8**

0835-898 **Special Topics Electives**
Special topics courses will be developed based on student interest and demand as well as faculty interest and availability. They may include electives in speech, audiology and comparative linguistics, among others. **Credit variable**

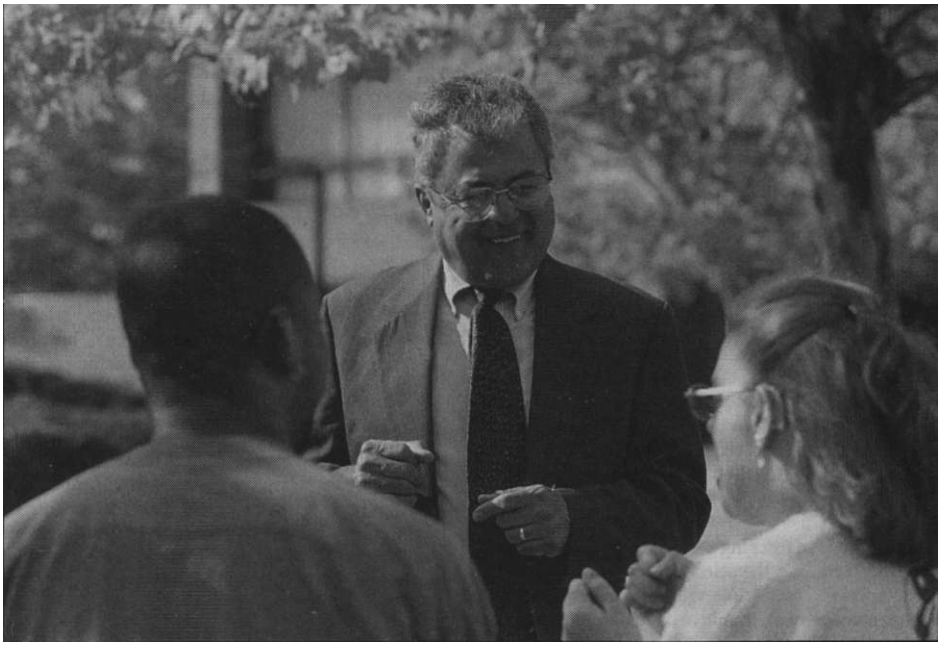
0870-110 **American Sign Language I**
This course focuses on the development of conversational fluency in ASL. Students learn to recognize and produce accurate ASL with appropriate nonmanual behaviors and grammatical features. (Pre-AAS sign language program) **Credit 3**

0870-120 **American Sign Language II**
This course focuses on continued development of conversational fluency in ASL. Students learn to accurately recognize and produce ASL with appropriate nonmanual behaviors and grammatical features. (American Sign Language I) Credit 3

0507-701 **History of American Educational Thought & Practice**
A historical analysis of change and continuity in American educational history from colonial through contemporary America. Special emphasis on the leading historiographical aspects of American educational history and on enabling the student to acquire mastery of the relevant bibliography. Lectures, seminars and readings offer comprehensive coverage of the salient intellectual themes and a chronological structure to mark the significant educational developments in particular periods—e.g., the Progressive Era, the 1920s and '30s and post-World War II changes. Course structure: lectures, seminars, readings from multiple paperbacks and class handouts, essay exams and critique. Credit **4**

0515-701 **Cultural Diversity in Education**
This course is designed to lay the foundation for the introduction of a broad multicultural perspective in education. Such perspective will include the examination of cultural differences of various ethnic groups and the role schools play in addressing the questions of interpretation, ability groupings, home environments, equality of opportunity and equality of outcome. Also analyzed are ways in which the school may act as a cultural transmitter and the teacher as cultural mediator. Different forms of school organizations will be compared, as in the public vs. private dimension. The functionalist theoretical approach will be presented, as well as the conflict perspective, to frame the discussion and analysis of opposing sociological systems of thought. The course attempts to understand how role expectations are actually carried within the school system and how its different actors react to technical as well as value constraints. Credit **4**

Professional Development Seminars
Variety of topics: second-year students present research topics and ideas to all program faculty and students; child abuse and substance abuse; the code of ethics for interpreters; using educational support personnel effectively; identifying and using community resources. **No** credit



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RIT Terminology

Academic probation—**A** formal warning from your college dean that you are in danger of being suspended or dismissed from RIT because your grade point average (GPA) has fallen below 3.00 (B average). (See page 312 for a more complete description.)

Accredited—An academic program, school or university that has been reviewed by an appropriate educational association and meets its standards of quality in academics and services is accredited. RIT is accredited by the Middle States Association of Colleges and Schools, and several of its academic departments and programs have achieved additional accreditation by national associations within their discipline.

Audit—Attending a course without receiving an evaluation grade (such as A, B, etc.) or receiving credit. To audit a course, you must formally register for it and have the permission of the department. Audited courses may not be used to fulfill degree requirements, although the course and an audit grade of Z will appear on your official transcript.

Cooperative education (co-op)—The opportunity to work in a full-time, paid position related to your field of study. Co-op is a formal component of many RIT programs. Co-op experiences are divided into "blocks" of one quarter each and do not carry credit. They should be carefully coordinated with the help of your adviser, the Office of Cooperative Education and Career Services and your employer. Registration is required.

Credit by exam or experience—Academic credit awarded based on evaluation of a comprehensive examination, interview or record review.

Credit hour—The numerical value assigned to courses, internships and other educational experiences. RIT follows a quarterly academic calendar, so its base measure is the quarter credit hour, which generally equals two-thirds of a semester hour.

Curriculum—The set of courses that, when finished successfully, can qualify a student for an academic degree. The curricula for all of RIT's degree programs have been registered with the New York State Education Department.

Discipline—A distinct academic area of study. At RIT, most programs are interdisciplinary, or include course work from a variety of areas of study.

Distance learning—A means of earning a certificate or degree off campus through methods such as cable TV broadcasts and videotapes of lectures; teleconferences; computer conferences; and on-line computer services such as electronic blackboards, picture phones and electronic mail. These technologies enable RIT's distance-learning students to follow the same quarter system of study as on-campus students.

Drop/add—Formally changing the set of courses in which you are enrolled in any quarter by adding or removing yourself from an official class list for a course. You may add or drop a course until the end of the sixth class day of a quarter, as specified on the academic calendar. If you do not officially submit a drop/add form for a course, you may receive a failing grade for a course you have stopped attending or not receive credit for a course you have begun attending.

Dual degree program—A program combining the course curricula from a bachelor's degree program and a master's degree program. This produces a streamlined curriculum that allows selected students to earn both a bachelor's and master's degree at the same time.

Full-time student—A student registered for at least 12 quarter credit hours of course work per quarter (excluding audits and credits by exam or experience) or registered for a cooperative education work block during the quarter.

Good standing—A student eligible to enroll in courses (not suspended) as verified by the Office of the Registrar. Certain financial aid programs have specific "standards of progress" by which students are determined to be in "good standing" and therefore eligible for aid.

Graduate-level course—a course designed for postbaccalaureate students and in support of one of RIT's many master's or doctorate degree programs (700-level and higher).

Half-time student—A student registered for six to 11 credit hours during a quarter.

Internships/field instruction—An experiential learning program in which students are placed into a public or private agency to work with professionals in their field of study. The student is eligible for academic credit for the work and is supervised and supported by a mentor while in the position.

Lower-division course—An undergraduate course typically taken during the first or second years of study (100- to 300-level).

Matriculated—A student who has been formally accepted into an academic program and begun a course of study. You must be matriculated in order to receive degrees or other formal awards from RIT.

New York State Immunization Certification—New York State Public Law 2165 (June 1989) requires RIT to either verify that students have been immunized according to state health law (see page 332 for specifics) or deny them access to RIT facilities. For more information, contact the RIT Student Health Center.

Part-time student—A student registered for at least one course during a quarter, excluding audits and credits by exam/experience.

Residency—Term for the minimum number of credit hours a student must earn at RIT to be eligible for academic certification and completion of degree requirements. The residency requirement ensures that RIT faculty have sufficient opportunity to evaluate your academic abilities.

Suspension—Dismissal from RIT for either academic or disciplinary reasons, which bars a student from enrolling in any RIT courses while the suspension is in effect. If you are suspended for academic reasons, you must usually wait for at least a year before applying for readmission (see page 312). If you are suspended as a result of action by the judicial and appeals processes, you may not be readmitted until the dismissal is formally waived by the assistant to the vice president for Student Affairs/Judicial Affairs.

Upper-division course—An undergraduate course usually taken during the last two to three years of study (400- to 600-level courses).

Withdrawal from a course—Removal of a student from the official enrollment list of a class for a given quarter after the six-day drop/add deadline. You may withdraw from a course at any time through the eighth week of the quarter (time frames are adjusted for sessions of fewer than 10 weeks). After the end of the eighth week, you may withdraw only with written approval of the course instructor and chairperson of your department of study. In either case, the course remains on your record with a grade of "W," and you are still financially responsible for the course tuition.

Index

Course Number Index

RTT course numbering: Throughout this bulletin and in registration materials that are published quarterly, courses are generally referred to by their seven-digit registration number. The first two digits refer to the college offering the course. The third and fourth digits identify the discipline within the college. The final three digits are unique to each course and identify whether the course is noncredit (less than 099); lower division (100-399); upper division (400-699); or graduate-level (700 and above).

College of Business

*0101 Accounting
*0102 Management
•0104 Finance
•0105 Marketing
*0106 Decision Sciences/Info. Systems

College of Engineering

"0301 Electrical Engineering
0302 General Engineering
*0303 Industrial Engineering
*0304 Mechanical Engineering
*0305 Microelectronic Engineering
*0306 Computer Engineering
3010 Software Engineering

College of Liberal Arts

0501 Criminal Justice
0502 Language
0503 Foreign Languages
0504 Literature
*0505 Fine Arts
0507 History
* 0508 Science, Technology & Society
0509 Philosophy
0510 Anthropology
0511 Economics
0513 Political Science
*0514 Psychology
0515 Sociology t
0516 Social Work
0518 Lang./Lit. Basic Communications
0520 Interdisciplinary—Liberal Arts
0535 Professional & Technical Communication

College of Applied Science and Technology

0601 Computer Programming
*0602 Information Technology—Software
*0603 Computer Science
*0604 Information Technology—IT/IMD
*0605 Graduate Computer Science
0606 Engineering Technology
*0607 Packaging Science
0608 Civil Engineering Technology
0609 Electrical Engineering Technology
0610 Mechanical Engineering Technology
0614 Telecommunications Engineering Technology
*0617 Manufacturing Engineering Technology
0618 Computer Engineering Technology
0620 Nutrition Management
0621 Food Management
0622 Hotel & Resort Management
0623 Travel Management
*0624 Hospitality/Tourism
*0625 Service Quality Management
*0626 Career & Human Resource Development
*0627 Instructional Technology
0630 Environmental Management
*0635 Health Systems Administration
0640 Reserve Officer Training—Army
0680 Business & Management
0681 Business & Management
0682 Business & Management
0684 Quality Management
0686 Humanities & Social Science
0688 Communications
0690 Deaf Studies
0692 Math & Science
0694 Emergency Management
0699 Multidisciplinary Professional Studies

National Technical Institute for the Deaf

0801 Applied Accounting
0802 Applied Computer Technology
0804 Business Occupations
0808 Architectural Technology
0809 Civil Technology
0810 Industrial Drafting
0811 Electromechanical Technology
0813 Manufacturing Processes
0817 Technical Math
0818 Technical Physics
0822 Elec. Publishing Technology
0827 Optical Finishing Technology
*0835 Graduate Secondary Education
0847 General Education
0848 General Education/Theater
0849 Applied Art
0860 Speech
0861 Audiology
0862 English
0863 Sign Communication
0870 Educational Interpreting
0872 Photo/Media Technology

College of Science

1001 Biology
1004 General Biology
1005 Field Biology
* 1008 Analytical Chemistry
•1009 Biochemistry
*1010 Chemistry
1011 General Chemistry
1012 Inorganic Chemistry
*1013 Organic Chemistry
* 1014 Physical Chemistry
*1016 Mathematics
1017 Physics
1018 General Science
1019 Technology Mathematics
* 1023 Clinical Chemistry
1024 Medical Technology
1025 Nuclear Medicine Technology
1026 Clinical Science—General
1027 Biomedical Computing
*1028 Materials Science & Engineering
1030 Diagnostic Medical Sonography
1032 Physician Assistant
* 1050 Color Science
* 1051 Imaging Science

English Language Center

1701 English Language Center

Learning Development Center

1710 Learning Dev. Ctr.—Technical

College of Imaging Arts and Sciences

2001 Interdisciplinary Imaging Arts
•2010 Graphic Design
•2011 Art Education
2013 Foundation Courses
*2014 Computer Graphic Design
* 2015 Interior Design
*2019 Illustration
*2020 Medical Illustration
* 2021 Painting
*2022 Printmaking
*2035 Industrial Design
*2037 Graduate Studies
2039 Art History
*2040 Ceramics & Ceramic Sculpture
•2041 Glass
*2042 Metalcrafts & Jewelry
•2043 Textiles
* 2044 Woodworking & Furniture Design
2060 Fine Art Photo
2061 Biomedical Photo
•2065 Film/Video Photo
*2066 Graduate Photography
2067 Applied Photo
2068 Imaging Systems Management
2076 Imaging & Photo Technology
2080 Printing Management
2081 Printing Technology

Interdisciplinary

3010 Software Engineering

(Program offered jointly by computer science and computer engineering departments.)

* *Graduate-level courses offered*