

National Technological University Bulletin 2001-2003 Academic Programs

The National Technological University administrative offices are located at 700 Centre Avenue in Fort Collins, Colorado.

The NTU administrative offices in Fort Collins are open daily from 8:00 a.m. to 5:00 p.m., Mountain Time, Monday through Friday, but not Saturdays, Sundays or holidays.

NTU Telephone

(970) 495-6400 or (800) 582-9976

NTU Fax

(970) 484-0668

Electronic Access

Web Site: www.ntu.edu

E-mail: Academic/Preadvising information: academic@ntu.edu

Registration information: registration@ntu.edu

Admissions information: admissions@ntu.edu

Mailing Address

National Technological University
700 Centre Avenue
Fort Collins, CO 80526-1842

Academic Calendar

All National Technological University courses originate from the participating universities and are delivered via satellite and/or Internet. Many courses are also available via videotape or CD-ROM. The schedule for each course depends on the academic calendar of the university offering the course. Please refer to the NTU web site or to the *Class Schedule* published each term for each university's academic calendar.

NTU Master's Degree Programs:

- ! Business Administration (MBA)
- ! M.S. in Chemical Engineering
- ! M.S. in Computer Engineering
- ! M.S. in Computer Science
- ! M.S. in Electrical Engineering
- ! M.S. in Engineering Management
- ! M.S. in Environmental Systems Management
- ! M.S. in Management of Technology
- ! M.S. in Manufacturing Systems Engineering
- ! M.S. in Materials Science and Engineering
- ! M.S. in Mechanical Engineering
- ! M.S. in Microelectronics and Semiconductor Engineering
- ! M.S. in Software Engineering
- ! M.S. in Systems Engineering
- ! M.S. (Special Majors)

Table of Contents

National Technological University	4	Videotape Guidelines, Copyright Issues, Security	14
The Vision of National Technological University	4	Evaluations	15
The Mission of National Technological University	4	Student Responsibilities	15
The Purpose of National Technological University	4	Academic Integrity	15
The Goals of National Technological University	4	Academic Information	16
The Objectives of National Technological University	5	Credit Information	16
Nondiscrimination Policy	5	Grades	16
Board of Trustees	5	Academic Standing	17
Academic Organization	5	Equivalency Examinations	17
Accreditation	6	Repeating a Course	17
Delivery System and Facilities	6	Same Course Numbers	17
Participating Universities in NTU Programs	7	Program of Study Plan (PSP)	17
Organizational Chart	8	Change of Graduate Major	17
Admission	9	Student Records	17
Admission Policies and Procedures	9	Transcripts	17
General Information	9	Appeals	17
Recommended Application Time	9	MS Thesis Guidelines	18
Courses for Degree	9	Graduation Information	19
Double Major	9	Bulletin Under Which Students May Graduate	19
Application Deadline	9	Application for Graduation	19
Application Materials Required	9	Graduation Requirements	19
Misrepresentation	10	Graduate Ceremony	19
Admission Classifications	10	Seven-Year Rule	19
Automatic Admission Requirements	10	NTU Alumni Association	19
Non-Automatic Admission Requirements	11	Certificate Programs	20
Petitioning a Decision for Denial of Admission	11	NTU Certificate of Completion Program	20
Advancement to Regular Graduate Standing From Provisional		Fast Track Certificate Program in Computer Science	21
Admission Status	11	Transfer Credit	22
Reapplication	11	Definition of Transfer Credit	22
Student Advising	11	Guidelines	22
Course Registration Information	12	Maximum Number of Credits Which Can Be Transferred	22
Registration Requirements	12	Special Transfer Fee	22
Course Cancellations	12	Procedure	22
Changes of Registration Status	13	Tuition and Fees	23
Administration of Courses	14	Introduction	23
Student Support	14	Tuition and Fees	23
Optimizing Videobased Instruction	14	Special Fees	23
Class Schedule	14	Textbooks and Supporting Materials	23
Course Viewing Guide	14	Payments	24
Instructors	14	Refunds	24
Course Requirements	14	Tax Deduction	24
Textbook Ordering Procedure	14		
Examinations	14		

Electronic Access/World Wide Web Services	25
General Information	25
Applying for User Name and Password	25
Registering on the Web	25
Password Protected Services	25
Instructional Programs in Specific Majors	26
Master of Business Administration	26
Chemical Engineering	29
Computer Engineering	31
Computer Science	33
Electrical Engineering	36
Engineering Management	39
Environmental Systems Management	41
Management of Technology	44
Manufacturing Systems Engineering	46
Materials Science and Engineering	48
Mechanical Engineering	50
Microelectronics and Semiconductor Engineering	53
Software Engineering	55
Systems Engineering	57
Special Majors Program	59
Undergraduate Bridging Courses	61
Courses of Instruction	63
Terms of Instruction	63
Prerequisites	63
Course Fees	63
Special Topics Courses	63
Course Delivery Methods	63
Course Numbering System	64
Institution Identification	64
Course Area and Subarea Designations	64
Course Listing	69
Algorithms and Data Structures (AD)	69
Aerospace Engineering (AE)	69
Bridging: Computer Engr, Computer Science & Software Engr (BC) ...	70
Bridging: Electrical Engineering (BE)	71
Bridging: Undergraduate Certificate (BN)	71
Bridging (BR)	71
Computer Architecture (CA)	71
Communications (CC)	72
Chemical Engineering (CH)	73
Computational Methods and Theory (CM)	74
Circuit Theory (CR)	75
Computer Software (CS)	75
Control Theory (CT)	76
Digital Systems (DS)	77
Emerging Areas (EA)	77
Economics and Finance (EF)	77

Electromagnetics (EM)	78
Electrical Properties (EP)	79
Engineering Science (ES)	79
Environmental Systems Management (EV)	79
Foreign Languages (FL)	81
Fast Track (FT)	81
Integrated Circuits (IC)	81
Intelligent Systems (IS)	82
Mathematics (MA)	83
Management and Behavioral Science (MB)	84
Materials Characterization (MC)	85
Mechanical Engineering (ME)	86
Business and Administration (MG)	87
Mechanical Properties (MP)	88
Materials Science (MS)	88
Management of Technology (MT)	89
Product and Process Design (PD)	89
Polymeric Materials (PM)	90
Power Systems (PS)	90
Quantitative Methods (QM)	91
Software Engineering (SE)	92
Manufacturing Systems Planning and Control (SP)	93
Software Techniques (ST)	94
Systems Engineering (SY)	95
Telecommunications (TC)	96
Technical Operations (TO)	96
Trustees, Faculty and Staff	98
Board of Trustees	98
Staff	98
Faculty	98
Academic Executive Committee	98
Business Administration (MBA)	99
Chemical Engineering	99
Computer Engineering	99
Computer Science	99
Electrical Engineering	99
Engineering Management	100
Environmental Systems Management	100
Management of Technology	100
Manufacturing Systems Engineering	100
Materials Science and Engineering	101
Mechanical Engineering	101
Microelectronics and Semiconductor Engineering	101
Software Engineering	101
Systems Engineering	101
Special Majors	101
Administrative Contact Personnel	102
Index	104

National Technological University

National Technological University was established in Colorado as a nonprofit corporation in 1984. NTU is recognized by the Federal government as an exempt organization under section 501(c)(3) and 509(a)(1) of the Internal Revenue Code. The Board of Trustees governs NTU.

The Vision of National Technological University

Enabling working professionals to share premier educational resources globally via technology.

The Mission of National Technological University

As an institution of higher education, National Technological University (NTU) maintains the unique mission to serve the advanced educational needs of graduate engineers, technical professionals and managers using advanced educational and telecommunications technology and to award degrees at the master's level to qualified candidates.

The NTU academic programs draw upon approved courses from the universities who participate in the NTU Satellite Network and/or online delivery. Participating university instructors teach courses and submit grades to NTU. Many universities require additional registration information and have a separate transcript for their NTU students. Selected undergraduate classes from participating universities are offered to assure appropriate foundation for master's level course work.

Students may attend NTU classes at their work place, a public or community site or even at home. The courses are rigorous, but provide a convenient and flexible alternative to campus study. NTU draws upon the expertise of outstanding faculty members to ensure instructional programs of the highest quality. Moreover, NTU conducts research in the areas of educational technology as related to teaching and learning so as to ensure continued responsiveness to the needs of the students. In addition to credit courses, each day NTU delivers one or more short courses, tutorials or research teleconferences; these Professional Development programs draw instruction from university faculties as well as from consultants and industry experts. Finally, the University performs service to the community and the profession as appropriate to a special purpose institution of higher education.

In summary, the National Technological University mission is to:

- ! Serve the advanced educational needs of graduate engineers, technical professionals and managers.
- ! Award degrees at the master's level and certificates.
- ! Explore, develop and use advanced educational and telecommunications technologies to deliver instructional programs to students at their employment locations or any place at which they elect to pursue their education.

- ! Provide an infrastructure linking technical professionals and managers nationally and internationally in research seminars, technology transfer activities and related technical exchanges. NTU's multiple distance learning delivery methods are ideally suited to perform this function.

The Purpose of National Technological University

National Technological University shares with all universities the responsibility to enhance and extend knowledge, to transmit the intellectual content of the culture and to educate people for critical thought. As an institution dedicated to academic excellence and increased access to advanced education within an information society, NTU has the central purpose to enhance national well being by assuring an appropriate supply of human resources to meet the technological and economic challenges of the future.

National Technological University's educational programs, therefore, focus upon engineering disciplines, information technology, management and other fields deemed to be important to the development and maintenance of appropriate technology and management. The range and variety of academic offerings and experiences reflect the rapidly changing needs of a technological society, the aspirations of the students, the expertise of the participating faculty, the curricular requirements of the selected programs of study, and the results of research and development. Of equal importance, education at NTU emphasizes studying the impact of technology and technological development upon society and the importance of values so as to prepare the learner for the critical choices involved in the application of technology in response to national and international challenges.

Responsibility for achieving these fundamental purposes rests with the community of scholars constituting NTU. The University, in conjunction with the participating institutions and organizations, provides the services, environment, materials and facilities necessary to enable the faculty and students to discover, examine critically, preserve, disseminate and apply the knowledge and wisdom essential to the enhancement of the quality of life for present and future generations. To these ends, NTU has identified and articulated four goals which provide a frame of reference for the University community.

The Goals of National Technological University

1. Discovery of Knowledge

The University depends upon faculty drawn from participating institutions to engage in and prepare students for scholarly endeavors, creative activities, and basic and applied research. Because of its unique mission in an information, knowledge-intensive, technological society, the University encourages and fosters research and development of educational and telecommunications technology for teaching and learning.

2. Dissemination of Knowledge

The University relies upon the most advanced pedagogical and technological methods to provide quality learning experiences for students and selected audiences at their work locations or wherever students elect to take their courses. Students are expected to synthesize the delivered knowledge, to think critically, communicate effectively and use knowledge and technology intelligently and responsibly to benefit society, and to participate creatively in society.

3. Application of Knowledge

The University accepts and acts upon the responsibility to serve the needs of an increasingly technological world. It is developing and applying new and tested knowledge and technology to identified challenges. It is providing the leadership required for implementing educational innovation.

4. Preservation of Knowledge

The University recognizes and acts upon the responsibility to preserve and transmit the heritage of intellectual culture and knowledge to its students. It strives to develop the technology appropriate to those ends.

The Objectives of National Technological University

As guides to action in pursuit of purposes and goals, objectives facilitate the planning and implementation processes of the University. Thus, the stated objectives render concrete and manifest the intentions and aspirations of the University. They suggest the standards for the evaluation of its programs and activities.

1. Instructional Objectives

To encourage and foster the development of innovative pedagogical and technological methods to enhance learning achievement.

2. Creativity Objectives

To encourage and foster developing creativity between the faculty and students as the most dynamic response to a rapidly changing technological society. To design research seminars which give people the capacity to glimpse the future as it unfolds and act to shape it.

3. Student Relations Objectives

To stress the responsibility of the faculty to the professional and instructional needs of the students and the responsibility of the students for their own individual growth and development.

4. Human Resources Objectives

To select as participating faculty individuals with reputations for outstanding performance as teachers and scholars and offer selected programs to assist these faculty members in their own professional development.

5. Support Objectives

To provide the facilities and services essential to the fulfillment of the institutional mission and to strive for the development and refinement of technological means to enhance the quality of the facilities and services.

6. Organization and Administration Objectives

To maintain a supportive organization and administrative structure that rest firmly upon participatory management of academic programs.

7. Evaluation Objectives

To continually evaluate programs and services to ensure progress toward achieving institutional goals.

Nondiscrimination Policy

The University supports the provisions and the intent of the applicable state and national statutes and regulations. Equal opportunity for employment and admission is extended to all qualified persons, and the University promotes equal opportunity through a positive program of affirmative action.

National Technological University does not discriminate in admissions, program participation, or employment on the basis of race, age, color, religion, national origin, gender, sexual orientation, disability or veteran status. A student or University employee who encounters any such discriminatory acts should report them to the President, National Technological University.

Board of Trustees

The National Technological University Trustees include industry representatives, alumni, the public at large and members from the participating universities. Individuals serving as Trustees are listed in the *Trustees, Faculty and Staff* section of this *Bulletin*. The Board delegates authority to NTU administrators and faculty committees to recommend academic policies and manage the University within the framework of approved policies and procedures.

To communicate with the Board of Trustees, contact NTU headquarters.

Academic Organization

To conduct the academic functions, National Technological University uses the expertise of outstanding faculty consultants suggested by the participating institutions. The faculty consultants are organized by discipline to form Graduate Faculties. The NTU Chief Academic Officer appoints the Chair of each Graduate Faculty. This group meets annually with additional meetings scheduled as necessary. Extensive use is made of electronic mail, computer conferences and teleconferences to carry out committee activities between annual meetings. The Graduate Faculty of each discipline establishes the committees required to ensure program quality and operational efficiency. The NTU Academic Coordinator supports the functions of the Graduate Faculties.

Each curriculum is under continuous evaluation as are course additions and revisions. Submissions by participating universities are carefully reviewed by appropriate faculty committees before being recommended for inclusion in the NTU offerings.

Each matriculated student in a NTU degree program is assigned an academic advisor who is a faculty consultant drawn from a participating university. Advisors have access to student records through the interactive, computer-based record system maintained at NTU. Nonmatriculated students may seek advice from the Curriculum Chairs or the Chief Academic Officer. Academic policies governing admissions, continuation and graduation are set by the Graduate Faculties and implemented by the NTU Director of Admissions and Records.

The Chairs of every Graduate Faculty and the NTU Chief Academic Officer make up the Academic Executive Committee (AEC). This committee considers and makes recommendations on academic affairs to the President and the NTU Board of Trustees. Although the University does not grant tenure to its faculty consultants, the academic organization clearly follows the traditional model by providing both the freedom and responsibility to the faculty to develop and maintain outstanding programs of study in advanced subjects of importance to technical professionals and managers.

Accreditation

National Technological University is accredited by The Higher Learning Commission and a member of the North Central Association.

Each participating university offering instruction in engineering subjects has undergraduate programs accredited by the Accreditation Board for Engineering and Technology (ABET) or its national equivalent. The specific programs for each participating school may be found in the current ABET Annual Report.

Delivery System and Facilities

National Technological University's administrative offices are located in Fort Collins, Colorado. However, faculty consultants are located on campuses of participating universities and students are located at their work sites or at home. Students receive instructional programs via telecommunications and computer technologies from faculty located at the participating universities.

The mission of the NTU delivery strategy is to increase accessibility by utilizing multiple distance learning technologies to enrich the learning experience and respond to its students' varying needs. Over the years, NTU has relied on satellite delivery as the best delivery medium for point to multi-point television delivery. Although the satellite-to-set-top-receivers remains a core delivery model, the adoption of MPEG2 transmission standards allows NTU to deliver its programs over a wide range of delivery systems including online, CD-ROM, etc.

Briefly, the satellite based portion of the NTU distribution system uses a series of satellite uplink stations, located at participating universities, and a network of television receive-only terminals at corporate and government

sites where some of the students are located. The technical operations of the network are controlled at the NTU Network Control Center, where schedules are prepared and satellite channels are monitored for technical quality.

Many courses are offered directly from participating universities online. These courses may employ streaming video, audio over slide presentations, or other technologies as part of the course delivery. Another course distribution option available to students is course delivery via CD-ROM. A number of universities provide lectures on CD-ROM. Videotapes are also available for most courses; courses are identified by format in the academic *Class Schedule*.

Most students communicate with other students and instructors using electronic means such as e-mail, threaded discussions, chat rooms, etc. Traditional methods of communication include telephone, fax, mail and/express mail. All students can participate and interact with students at other sites. Many NTU students make use of instructional services provided by sponsoring organizations. These include classrooms, computer access, selected equipment, laboratories, telecommunications equipment, and educational personnel to assist in the instructional process. Finally, institutional and organizational libraries, combined with public and academic libraries in areas where students are located, provide learning materials needed for their studies.

Participating Universities in NTU Programs

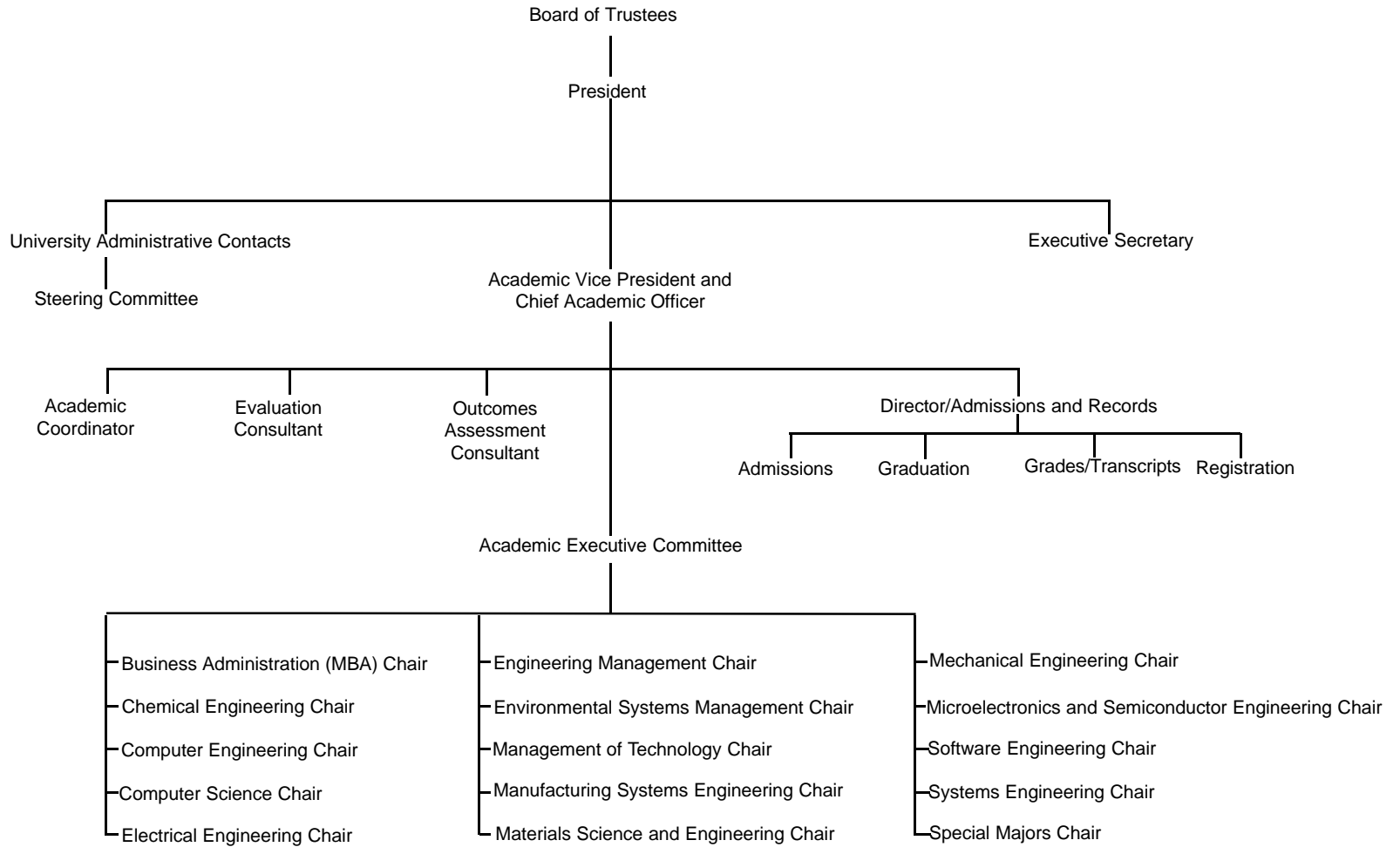
Over 50 universities participate in the academic graduate programs offered by National Technological University. Some institutions participate in many disciplines, while others provide courses only in selected subject matter areas. Many universities also produce noncredit courses, tutorials and research teleconferences offered by NTU.

Arizona State University	The University of Alabama at Tuscaloosa
Auburn University	
Boston University	University of Alaska Fairbanks
Carnegie Mellon University (ECE)	The University of Arizona
Clemson University	University of Arkansas
Colorado State University	University of California, Berkeley
Columbia University	University of California, Davis
Florida Gulf Coast University	University of Colorado at Boulder
The George Washington University	University of Delaware
Georgia Institute of Technology	University of Florida
Illinois Institute of Technology	University of Idaho
Iowa State University	University of Illinois at Urbana-Champaign
Kansas State University	
Kettering University	University of Kentucky
Lehigh University	University of Maryland, College Park
Massachusetts Inst. of Technology	University of Massachusetts Amherst
Michigan State University	The University of Michigan
Michigan Technological University	University of Minnesota
New Jersey Institute of Technology	University of Missouri-Rolla
New Mexico State University	University of Nebraska-Lincoln
North Carolina State University	The University of New Mexico
Northeastern University	University of Notre Dame
Oklahoma State University	University of South Carolina
Old Dominion University	University of Southern California
Purdue University	The University of Tennessee
Rensselaer Polytechnic Institute	University of Washington
Southern Methodist University	University of Wisconsin-Madison
The University of Alabama in Huntsville	Vanderbilt University

NTU contracts with these and other institutions and faculty to develop additional curricula and courses as demand warrants.

The *Class Schedule* for each term which is also on the NTU website (www.ntu.edu) contains additions or corrections to this *Bulletin* as new courses are approved.

Organizational Chart National Technological University



Admission

Admission Policies and Procedures

The latest information on admission policies and procedures, after the current *Bulletin* has been published, will appear on the NTU web site. Updates will also appear in subsequent *Class Schedules* for each specific academic term. Students are encouraged to access the web for the most up-to-date information.

The Board of Trustees of National Technological University reserves the right to change admission requirements, policies and procedures at any time but with appropriate prior notice.

General Information

National Technological University's admission decision reflects a judgement that an applicant has the background and potential to attain a Master's Degree from National Technological University and thus has taken into account the applicant's prior academic preparation and performance, relevant aptitude information, professional experience and professional responsibilities. Because of NTU's unique mission to serve the needs of graduate engineers and technical professionals around the world, NTU does not set geographical or other kinds of quotas and/or goals. All qualified applicants are admitted to approved programs of study. National Technological University is an equal access/equal opportunity institution.

Recommended Application Time

Since only admitted students are assigned an advisor, NTU recommends that students who plan to seek admission to a NTU Master's Degree program apply as early as possible, but definitely before they have finished *six* NTU semester credit hours. Students who continue to take courses without being admitted and assigned an advisor do so with the risk that one or more of the courses they have taken may not be accepted in their Program of Study Plan.

Courses for Degree

Courses used for one degree program cannot be applied or transferred to another degree program. Only one course with the same course number can be counted for a degree program. For example, AD 520-B, AD 520-CL, AD 720-F and AD 720-KS are considered the same course and only one can be counted in a degree program. Courses for a degree program cannot be taken for a pass/fail grade.

Double Major

Students are prohibited from being admitted to more than one master's degree program at a time.

Application Deadline

Applications for admission are accepted any time throughout the year. However, a 60-day lead time is recommended for students who wish to be admitted before the start of a specific term. The admission application, all transcripts and optional items should be submitted to the NTU Admissions office at least 60 days prior to the start of a term to ensure processing before the term begins. If the admission process is not completed before the term begins, a qualified student may still register for courses during that term. Students will be notified in writing when the admission decision is made.

Incomplete applications will be closed six months after the initial application. Students are required to reapply and pay the application fee to have the file reactivated.

Application Materials Required

Course Registration and Admission Application Form

The Course Registration and Admission Application forms are available on the NTU web site. They are also included in each *Class Schedule* and additional copies are available from the NTU Admissions and Records office and Site Coordinators. To register and apply for admission on the web, see the "*On-line Registration and Admission Application*" section below or call 800-582-9976.

On-line Registration and Admission Application

Continuing NTU students (students who have taken courses with NTU previously or have already created a profile) can login into the NTU Community web site by going to www.ntu.edu and clicking on "Community Login." Admission Applications and Registration Forms can be accessed by clicking on "Academic Programs." Students can register or apply by following the procedures indicated on the web.

New NTU students (students who have never taken a course with NTU) will need to create a profile by clicking on "Community Login" and then Create a Profile. Once that is set up, the student can follow the steps set forth above for continuing students. For questions concerning registration or admission on the web, please call (800) 582-9976.

Admission Application Fee

Applicants to a Master's Degree program must submit a \$50 nonrefundable Admission Application Fee once the student has submitted an application. Payment may be made by check, money order, or credit card. Credit card payments can be made by calling (800) 582-9976 or on the web at www.ntu.edu. NTU will not bill an employer for the fee. Receipts are available upon request for reimbursement purposes.

Transcripts

Official transcripts; i.e., transcripts sent directly from the Registrar at the institution attended to the NTU Admissions and Records office, are required for all applicants from *each* undergraduate and graduate institution attended. The application for admission will not be processed until NTU receives all

transcripts. A Transcript Request Form is available on the NTU web site and is provided in each *Class Schedule* for use in requesting transcripts from universities previously attended. NTU only keeps transcripts for six months after your application has been processed.

Non-English *Foreign* transcripts must be translated by a certified agent prior to submission to NTU.

Optional Items

Letters of recommendation, statements of purpose, resumes and copies of publications are not required for admission unless listed in program requirements. However, applicants are encouraged to submit any such information to strengthen their admission file and provide a clearer understanding of their academic and experiential background and objectives.

Misrepresentation

Applicants who fail to indicate all prior academic work and/or misrepresent grade point averages or other details of their academic records on the NTU application form are subject to dismissal from the University. Students not in good standing with any institution previously attended, either academically or financially, will be required to clear their records before they will be admitted to a NTU Master's Degree program.

Admission Classifications

Students admitted to a NTU Master's Degree program will be accorded either Regular or Provisional Admission status.

a) **Regular Admission Status**

Students are admitted without any restrictions.

b) **Provisional Admission Status**

Students admitted provisionally are required to meet certain stipulations before advancement to Regular Graduate Status. Conditions vary in each case but generally require completion of specified bridging courses, or completion of the first three graduate level degree courses with grades of "B" or better in each. A minimum 3.0 cumulative NTU GPA must be maintained. *Students who do not meet the specified conditions within two years will automatically be placed in Nondegree status.*

Automatic Admission Requirements

Applicants who meet the following specific criteria will automatically be admitted to Regular Graduate Standing. Please see "Instructional Programs in Specific Majors" section for additional information on degree programs.

Master's in Business Administration (MBA)

- ! Four-year undergraduate Bachelor of Science degree; and
- ! Minimum cumulative undergraduate GPA of 2.9 on a 4.0 scale; and
- ! A minimum of two years of managerial work experience; and
- ! Evidence of knowledge related to basic business skills and disciplines, generally requiring evidence of completion of academic coursework in accounting, economics, and mathematics; and

- ! A letter of support from a supervisor in the student's organization indicating the organization's support of the student's pursuit of the degree and addressing the likelihood of the student's academic and career success.

M.S. in Chemical Engineering

- ! B.S. Degree in Chemical Engineering from an ABET accredited engineering program at an institution in the United States, or a CEAB accredited program in Canada; and
- ! Cumulative undergraduate GPA of at least 2.9 on a 4.0 scale.

M.S. in Computer Engineering

- ! B.S. Degree in Computer Engineering from an ABET accredited engineering program in the United States, or a CEAB accredited program in Canada, or equivalent from a foreign institution; and
- ! Cumulative undergraduate GPA of at least 2.9 on a 4.0 scale.

M. S. in Computer Science

- ! B.S. Degree in Computer Science; and
- ! Cumulative undergraduate GPA of at least 2.9 on a 4.0 scale.

M. S. in Electrical Engineering

- ! B.S. Degree in Electrical Engineering from an ABET accredited engineering program in the United States, or a CEAB accredited program in Canada, or equivalent from a foreign institution; and
- ! Cumulative undergraduate GPA of at least 2.9 on a 4.0 scale.

M. S. in Engineering Management

- ! B.S. Degree in Engineering from an ABET accredited engineering program in the United States, or a CEAB accredited program in Canada, or equivalent from a foreign institution; and
- ! Cumulative undergraduate GPA of at least 2.9 on a 4.0 scale; and
- ! Evidence of two years engineering work experience.

M. S. in Environmental Systems Management

- ! B.S. Degree in engineering or hard sciences, (i.e. biology, chemistry, physics, geology) from an accredited program; and
- ! College mathematics courses through ordinary differential equations; and
- ! Cumulative undergraduate GPA of at least 2.9 on a 4.0 scale.

M. S. in Management of Technology

- ! B.S. Degree from an engineering program accredited by ABET in the United States, or CEAB in Canada, or equivalent from a foreign institution, or a B. S. degree in the sciences or a B.S. degree in Computer Science; and
- ! Cumulative undergraduate GPA of at least 2.9 on a 4.0 scale; and
- ! At least two years of work experience in a technical environment (industry or government); and
- ! Undergraduate courses in calculus, economics and statistics; and
- ! Management sponsorship.

M. S. in Manufacturing Systems Engineering

- ! B.S. Degree in Engineering from an ABET accredited program in the United States, or a CEAB accredited program in Canada, or equivalent from a foreign institution; and
- ! Cumulative undergraduate GPA of at least 2.9 on a 4.0 scale.

M. S. in Materials Science and Engineering

- ! B.S. Degree in Materials Science, the Physical Sciences, or in Engineering from an ABET accredited engineering program in the United States or a CEAB accredited program in Canada; and
- ! Cumulative undergraduate GPA of at least 2.9 on a 4.0 scale.

M. S. in Mechanical Engineering

- ! B.S. Degree in Mechanical Engineering from an ABET accredited engineering program in the United States or a CEAB accredited program in Canada, or equivalent from a foreign institution; and
- ! Cumulative undergraduate GPA of at least 2.9 on a 4.0 scale.

M.S. in Microelectronics and Semiconductor Engineering

- ! B.S. Degree in Electrical Engineering, Chemical Engineering or Materials Science and Engineering from an ABET accredited engineering program in the United States, or a CEAB accredited program in Canada, or equivalent from a foreign institution; and
- ! Cumulative undergraduate GPA of at least 2.9 on a 4.0 scale.

M. S. in Software Engineering

- ! B.S. Degree in Computer Science, Computer Engineering or in an ABET accredited engineering program with a minor in computing systems; and
- ! Cumulative undergraduate GPA of at least 2.9 on a 4.0 scale; and
- ! Can demonstrate knowledge of the key topic materials.

M. S. in Systems Engineering

- ! B.S. Degree in an engineering discipline from an ABET accredited engineering program in the United States or a CEAB accredited program in Canada, or equivalent from a foreign institution; and
- ! Cumulative undergraduate GPA of at least 2.9 on a 4.0 scale.

M.S. (Special Majors)

- ! B.S. Degree in an appropriate science or engineering area; and
- ! Cumulative undergraduate GPA of at least 3.0 on a 4.0 scale; and
- ! Proposed Program of Study Plan; and
- ! Statement of purpose, goals and objectives.

Non-Automatic Admission Requirements

Applicants who do not meet specific criteria for automatic admission or anyone with an undergraduate GPA below a 2.9 may still be eligible for Regular or Provisional admission. These applications will be reviewed by the appropriate Academic Committee for an admission determination. Applicants are encouraged to submit a detailed outline of their relevant work experience, letters of recommendation, resumes, and other items that will strengthen their application and provide a clearer understanding of their academic and experiential background and objectives. Applicants with a B.S. in engineering from an accredited institution in the U.S. (or equivalent from a foreign institution) and a cumulative GPA of at least a 2.5 on a 4.0 scale are encouraged to apply. Applicants with degrees in other appropriate fields (Physics, Chemistry, Math, etc) and a cumulative GPA of at least a 2.9 on a 4.0 scale are also encouraged to apply. Applicants may be requested to provide GRE scores, evidence of having passed the Fundamentals of

Engineering (FE) exam, or evidence of registration as a Professional Engineer (PE) in certain cases.

Petitioning a Decision for Denial of Admission

Applicants denied admission may appeal the decision. All appeals must be set forth in writing and will be reviewed solely on the basis of the written appeal, with no right of a formal hearing at any level. The determination of the NTU Chief Academic Officer is final.

Advancement to Regular Graduate Standing From Provisional Admission Status

When Provisional terms have been satisfied, the students should notify NTU Admissions. Students will then be sent notice of advancement to Regular Graduate Status. Provisional terms must be met within two years from the time of admission and a minimum 3.0 cumulative NTU GPA maintained. Students who do not meet these terms within the two-year limit will be placed in Nondegree status.

Reapplication

Applicants who are denied admission, or students who are placed in Nondegree status for failure to complete the admission process, failure to meet the terms of Provisional admission, failure to work out of academic probation within the prescribed period of time, failure to take courses within a two-year period, or students who have withdrawn from a program may reapply to a NTU Master's Degree program. Reapplicants must pay a \$50 nonrefundable Application Fee and may have to request transcripts again.

Student Advising

Each student admitted to a NTU Master's Degree program is assigned an academic advisor. These advisors seek to maintain continuous communication with their advisees, help them plan their studies and resolve problems related to students' academic programs. Students who wish to change advisors should submit their requests in writing to the NTU Admissions Officer. Nonadmitted students may seek advice from the NTU Admissions Officer or the Chief Academic Officer.

When applicable, students are encouraged to discuss with their Site Coordinators the services that are provided. The coordinators have important obligations to assure maintenance of an environment conducive to studying and learning.

Potential students who have questions related to differences in degree programs or degree program clarification may have these addressed by contacting NTU's Academic Vice-President at 800-582-9976. Preadvising questions such as these may also be addressed to the individual master's degree chairpersons.

QUESTIONS REGARDING ADMISSION SHOULD BE ADDRESSED TO THE NTU ADMISSIONS OFFICE at 800-582-9976.

Course Registration Information

Registration Requirements

Individuals who plan on taking courses as a non-degree seeking student do not need to apply for admission into an NTU degree program or pay the \$50 admission fee.

Credit Registration

An appropriate bachelor's degree from an accredited institution in the U.S. or the equivalent from a foreign institution is required. The degree must have been awarded *prior* to registration for NTU course(s).

An "appropriate degree" is a degree which could reasonably be expected to provide the student with adequate quantitative and subject background to satisfactorily complete the NTU course(s) concerned. Students who have a bachelor's or advanced degree, but one which is not clearly related to engineering, a physical science (math, chemistry or physics) or computer science, may be eligible if they have documentable background or preparation for the NTU course.

A minimum GPA* of 2.5 (undergraduate) on a 4.0 scale is required for registration both for degree and non-degree seeking students.

Students are responsible for meeting the stated course prerequisites for which they register.

In some special circumstances, member universities might require additional information such as TOEFL scores or degree certifications.

Audit Registration

It is expected that auditors will have an adequate background to benefit from any course taken. Persons who register as auditors work under their own schedules and direction. They do not interact with the instructor, have assignments evaluated, take examinations, have a course grade recorded or receive credit for a course.

Individuals are prohibited from "sitting in" on a course unless they are officially registered for credit or audit. Courses taken as audit may not be retroactively converted to credit.

Materials Required for Course Registration

a) Course Registration

Registration can be accomplished by registering on the NTU web site at www.ntu.edu or by filling out the registration form which is in the *Class Schedule*. Additional copies of the registration form are available from Site Coordinators and the NTU Admissions and Records office.

b) Employer Requirements

Students are responsible for contacting their employer concerning any specific requirements stipulated by their company.

Applying for User Name and Password on the Web

To access the secured services and information, users first need to create a profile. Go to www.ntu.edu, choose "Community Login," and follow the instructions given on the page. New NTU students must create a profile before they can access the online registration and admission system. Existing students already have a user name and password. Contact profileproblems@ntu.edu if you do not know your username or password.

Registering On the Web

Upon logging into the Community Section of the NTU website, click the option that reads "Academic Programs." This will bring up a menu of options from which you should select "Registration." Select a term and click next. Select a course for either Credit or Audit and if it is requested, enter your proctor information, then click next. If the course is a variable credit course, select the credit you would like to receive. If the course has multiple delivery methods available, select your preferred method, read the authorization agreement and click "I Accept Above Agreement." You may be prompted for additional information such as home, shipping and billing addresses and proctor information. If this is the case, please fill it out completely.

NTU Deadlines for Course Registration

The course registration is due at NTU according to the registration deadlines posted on the NTU web site and published in the *Class Schedule*. It is important to be aware that deadline dates vary among participating universities. NTU must have registrations in hand by the published deadline dates. Students who register late run the risk of missing lectures for satellite telecast courses and would be responsible for paying for tapes of sessions that were already broadcast. Also, if registrations are not received in a timely manner, participating universities might cancel courses due to low enrollment.

Course Cancellations

Participating institutions may cancel a course due to minimum enrollment requirements or other unforeseen circumstances. Therefore, NTU reserves the right to cancel a scheduled course. A full refund will be given to registered students.

* Applicants who fail to indicate all prior academic work and/or misrepresent grade point averages or other details of their academic records are subject to dismissal from the University.

Changes of Registration Status

Dropping a Course

A student may **drop** a course *prior to the end of the ninth week of class* on the semester schedule or 9-14 week summer session **or prior to the end of the sixth week** of class on the quarter schedule or 5-8 week summer session.

When a student drops a course, no entry will appear on the NTU academic transcript. In order for a student to be dropped from a course, the Admissions and Records office must receive an *official* request from the student on a Change of Registration Status form which is also available at www.ntu.edu (Community Login–Academic Programs–forms and requests links). Students are advised to check their record on the web site to ensure that NTU received the Change of Registration Status form. See *Tuition and Fees* for refund schedule. No refunds are made after the fourth week of classes. No changes of registration status can be made after the end of a term.

Withdrawing from a Course

A student who formally requests withdrawal after the ninth week of class for semester courses or 9-14 week summer session courses (after the sixth week for quarter courses or 5-8 week summer session courses) or before the final week of class, may receive a grade of “WP” (withdraw passing) or “WF” (withdraw failing) depending on instructor evaluation. Grades of “WP” and “WF” *are not* calculated in the student’s cumulative GPA. A Request for Withdrawal requires approval by the instructor who must indicate the date of withdrawal and a grade of “WP” or “WF.” The form must be submitted to the Admissions and Records office, or online at www.ntu.edu accompanied by supporting recommendations from the student’s sponsoring organization.

Discontinuing a Course

If a student quits attending a course, but fails to officially drop or withdraw by following the procedures set forth above, a grade of “F” will be recorded on the official NTU transcript.

Changes from Credit to Audit/Audit to Credit

A student may change his/her registration from **credit to audit** *until the end of the fourth week of class* for semester courses or 9-14 week summer session courses **or until the end of the third week of class** for quarter courses or 5-8 week summer session courses, and will be billed the audit fee.

Registration may be changed from **audit to credit** *until the end of the third week of class* for semester courses or 9-14 week summer session courses **or until the end of the second week of class** for quarter courses or 5-8 week summer session courses, and will be billed the credit fee.

A change of Registration Status form, also available at www.ntu.edu (Community Login–Academic Programs–forms and requests links), must be submitted to the Admissions and Records office for each of these changes.

QUESTIONS REGARDING REGISTRATION SHOULD BE ADDRESSED TO NTU AT 800-582-9976 OR THE SITE COORDINATOR WHEN APPLICABLE.

Administration of Courses

Student Support

Many NTU students are affiliated with corporations that provide and maintain facilities equipped for receiving instruction delivered by the NTU network. Such corporations may also appoint a Site Coordinator responsible for the interface between the student, the corporation and NTU. In some cases, corporations may provide tutors and other assistance. The Site Coordinator is responsible for the delivery of instruction at the site and helps resolve all technical and communication problems; he/she is also responsible for proctoring exams. It is recommended that students who are at such sites become fully acquainted with their Site Coordinator's role and responsibilities.

A student who does not have a Site Coordinator at his/her facility should apply and register directly through NTU and will be considered an "independent" student. Most independent students do not have access to the satellite network and receive their courses via the Internet, videotape or CD-ROM. In most cases additional media and/or shipping charges are associated with videotape or CD-ROM delivered courses. For the administration of exams, independent students are responsible for identifying a proctor that meets both NTU and member university requirements.

Optimizing Videobased Instruction

Class viewing occurs in several forms. Some sites have classrooms where students meet on a regular viewing schedule while others have individual viewing carrels where students view lectures at their convenience. Still others give student videotape copies of the lectures to take home. Whatever the viewing mode, it is important that Site Coordinators assure that students have their lectures and accompanying notes and handouts on a regular and timely schedule. Delays put students behind in classes and may jeopardize their grades.

Class Schedule

The *Class Schedule* is available on NTU's web site at www.ntu.edu and contains the most up-to-date information on course content, prerequisites, textbooks, instructor information and other course related materials. The *Class Schedule* is also published every term and available to students before the term begins.

Course Viewing Guide

Courses transmitted via satellite uses one of 16 compressed digital video channels, 24 hours a day, seven days a week. Each site receives an overall viewing guide prior to the beginning of a term. Just before classes start, each site receives a site-specific version of the viewing guide based on registrations at that site. Channel assignments are updated weekly and sent to

each site. Site specific viewing guides and channel assignments are also available to Site Coordinators and students on NTU's web site.

Instructors

Instructors for NTU courses are located on campuses of participating universities. Questions pertaining to course content should be directed to instructors whose names, addresses, telephone, fax numbers and e-mail addresses appear on the web site and in the *Class Schedule*. Students are encouraged to contact instructors to maximize the benefit they gain from each course as individual schools and instructors have different ways of administering their courses. It is important to know how each class is conducted.

Course Requirements

Each instructor informs enrolled students of course requirements at the beginning of the term. Each enrolled student is responsible for the fulfillment of these requirements in a timely manner. Late assignments will be accepted only with advance approval of the instructor. Examinations/quizzes required by instructors must be completed as scheduled. If stipulated by the instructor, exams will need to be administered by a designated site coordinator or proctor in the case of independent students.

Textbook Ordering Procedure

To facilitate an effective text ordering procedure that minimizes logistical problems, NTU has arranged for **Total Information, Inc.**, of Rochester, NY to be the text distribution agent for all NTU academic courses.

Total Information, 844 Dewey Avenue, Rochester, NY 14613, USA

Online: www.totalinformation.com

E-mail: orders@totalinformation.com

Phone (800) 876-4636 FAX (716) 254-0153

Examinations

Examinations, when appropriate, are given during the term. Instructors may assign take-home examinations and/or term projects or papers in lieu of proctored examinations. The following procedures apply to proctored examinations:

- ! The Site Coordinator or proctor schedules the time, duration and place of the examination based on the instructor's directions.
- ! The Site Coordinator or proctor is responsible for assuring the integrity of examination procedures.

Videotape Guidelines, Copyright Issues, Security

NTU sites are authorized to videotape and duplicate programs for that site's registered students. The contents of these tapes remain the property of NTU and its providers. Videotapes of academic courses may be retained up to two weeks after the last class lecture of the academic term. All tapes must be erased at that time. After the contents are erased, the blank tape may be

retained by the site. These policies must also be adhered to by independent students or by students who do not have designated Site Coordinators at their location.

Sites and independent students must adhere to the U.S. Copyright Laws in conjunction with participation in the NTU academic program.

NTU reserves the right to offer special programs with restricted or modified videotaping guidelines as long as a notice is published prior to the broadcast.

Evaluations

At the end of each semester, NTU sends out an evaluation form via email to all enrolled students, Site Coordinators and faculty. The results are tabulated and reported to NTU by an independent consultant. NTU uses the results to determine which courses will be offered in the upcoming terms and to acknowledge Outstanding Instructors. A list of the Outstanding Instructors can be found on NTU's web site.

Student Responsibilities

Students are responsible for working with their Site Coordinators when registering for credit courses, viewing courses, handing in assignments and taking examinations in a timely manner. In cases where organizations do not have designated Site Coordinators or for independent students, students will be responsible for these course-related activities. Students may request an extension of course deadlines if travel, illness or work demands cause delays *in excess of two weeks*. Requests for extensions must be made to the instructor *prior* to the deadline.

Students are responsible for familiarizing themselves with NTU academic policies, guidelines and various deadlines; reading course descriptions,

applicability of a course to a particular degree; determining whether they meet the stated prerequisites for courses in which they register; and paying tuition in a timely manner.

Academic Integrity

NTU's reputation depends on maintaining the highest standards of intellectual honesty. Commitment to those standards is a responsibility of every student, Site Coordinator or proctor and instructor involved with NTU.

NTU instructors and Site Coordinators or proctors are expected to use reasonable means of preventing and detecting breaches of academic integrity. Students are expected to exhibit honesty and competence in their academic work.

Instructors who are convinced that academic integrity or a student's learning environment is unacceptable, may deal with the suspected violation by discussing it with the student, the Site Coordinator or proctor and/or the NTU Chief Academic Officer. The instructor may also refer the matter to the appropriate person(s) at that university. If it is determined that a violation has occurred, the instructor will determine how this violation affects the student's grade for the course. The academic regulations at that university apply.

A student who is dissatisfied with the instruction received or the interaction with the instructor of a course should first discuss the complaint with the Site Coordinator, proctor and the instructor. If the issue is not resolved at that level, the student may contact the NTU Chief Academic Officer to request action. The Chief Academic Officer will make the final decision after consultation with the Site Coordinator or proctor, the instructor and/or the appropriate person(s) at the originating university.

Academic Information

Credit Information

Credit System Used

National Technological University awards credit on the basis of semester credit hours (SCH). Generally, a three-semester credit-hour course is 14-15 weeks long and consists of 42-45 contact hours of instruction with additional time scheduled for final examinations. Quarter credit hours are converted to semester credit hours as follows:

<u>Quarter Hours</u>	<u>Equivalent in Semester Hours</u>
2	1.3
3	2
4	2.7
5	3.3
6	4

Maximum Credit Load

Under normal circumstances, students may enroll for a maximum of 10 semester credit hours, or the equivalent in quarter hours in any single academic term, quarter or semester. Under certain circumstances, such as when the employer permits students to study on a full-time basis, an exception to this policy may be made.

Grades

General

National Technological University assigns the following quality points based on the instructor's allocation.

<u>Grade</u>	<u>Quality Points</u>	<u>Grades</u>	<u>Quality Points</u>
A	4.00	C	2.00
A-	3.75	C-	1.75
B+	3.50	D+	1.50
B	3.00	D	1.00
B-	2.75	D-	.75
C+	2.50	F	.00

All grades of record are included in the cumulative GPA calculation.

Grade Notification

Grade rosters are available to the instructors on the web prior to the end of the course. Instructors are required to submit student grades to NTU within 30 days from the course end date. Grade reports are then generated and mailed to students and may also be viewed on the NTU web site in the student's academic profile.

Grades A/B and B/C

Grades of A/B and B/C assigned by instructors of some universities are recorded on the student's NTU transcript as follows:

Grade Awarded by	NTU Transcript	
<u>Instructor</u>	<u>Notation</u>	<u>Quality Points</u>
A/B	B+	3.5
B/C	C+	2.5

Grades of Incomplete "I"

Instructors may, at their option, assign a grade of "I." However, a grade of "I" is *not automatic* just because a course is not completed in time. Students who find that they are unable to complete a course within the allotted time must contact the instructor **before the end of the term** to request a grade of "I" and work out the details for completion. If a student fails to meet the terms stipulated within one year, the "I" grade is automatically changed to "F" on the official NTU transcript.

Grades of "WP" and "WF"

A student who formally requests (in writing) withdrawal after the ninth week of class and before the final week of class, will receive a grade of "WP" (withdraw passing) or "WF" (withdraw failing) depending on the instructor's evaluation.

A grade of "WP" or "WF" *is not included* in the calculation of student's cumulative GPA.

Grades of "W": Retroactive Withdrawal

A student may petition *one term one time only* -- no Exceptions -- for retroactive withdrawal from a course(s) taken in a particular term. The petition must be in writing and will be reviewed solely on the basis of the written appeal, with no right of a formal hearing at any level. If the petition is approved by the NTU Director of Admissions and Records, grades from one or more courses will be replaced with entries of "W" on the official NTU transcript. If the petition is denied, the existing grades will remain on the NTU transcript. A grade of "W" is not included in the computation in a student's GPA nor are the corresponding units counted as units attempted. Petitions should be sent to the Admissions and Records office. No refunds are given after the fourth week of classes.

Please note that a retroactive withdrawal at NTU does not change the grade at the offering university. A grade change at the offering university must be petitioned directly to that university by the student.

Grade Point Averages (GPA)

The *current* Grade Point Average and *cumulative* Grade Point Average are calculated by multiplying the quality points for each grade by the number of credits for that course, summing the results, and dividing the total sum by the total number of credits attempted during the term, or cumulatively, as appropriate.

All credit courses taken by a student will appear on the NTU transcript and will be figured into the overall GPA with the exception of transfer courses. When a student has retaken a course and to ensure that the new grade received the second time overrides the original grade, the student must contact NTU Admissions and Records Office.

Academic Standing

Good Academic Standing

A student admitted to National Technological University remains in good academic standing if the cumulative Grade Point Average (GPA) is equal to or greater than 3.0 on a 4.0 scale at the end of each term. A student failing to maintain good academic standing will be placed on probation and may be subject to dismissal from the University. To reestablish good academic standing, a student must bring the cumulative GPA to 3.0.

Probation

Students are placed on probation if their cumulative GPA falls below 3.0. Students placed on probation have two years to raise the GPA to 3.0 or higher. At the end of two years, if a 3.0 GPA or higher is not attained, the student will automatically be placed in Nondegree status. A student placed in Nondegree status may reapply when the cumulative GPA is 3.0 or above. A \$50 nonrefundable application fee must be paid again.

Satisfactory Progress

Each student admitted to a NTU Master's Degree Program is expected to maintain satisfactory academic progress which will allow the student to graduate within the seven-year limit. (See *Seven-Year Rule* subsection.)

Admitted students who do not take courses for two consecutive years will automatically be placed in Nondegree status. A student who wishes to resume studies towards the master's degree will then have to reapply and pay the \$50 application fee.

Equivalency Examinations

There are no provisions for equivalency examinations or credit for "life experiences" at NTU.

Repeating a Course

A student may repeat a NTU course one time only. When a course is repeated, the student must notify the Admissions and Records office of the intent to replace the first grade with the second grade. A repeated course must have the same course number as the first course, but it does not need to be from the same school or be the same level; e.g., EM 540-CL may be replaced with EM 740-E or EM 740-F. Only the grade and hours earned for the second registration will count in the calculation of the student's cumulative GPA. Attempted hours and the grade for the first registration will show on the transcript but will not be calculated in the cumulative GPA.

Same Course Numbers

A degree program can only include one course with the same course number. For example, students can only include one of the following in their

Program of Study Plan: CS 740-A, CS 740-CA, or CS 540-B. It is important to note that same course numbers are based on the last two digits of the course number.

Program of Study Plan (PSP)

Admitted students should submit a Program of Study Plan (PSP) to NTU upon completion of six semester credit hours. Failure to submit a Program of Study Plan increases the possibility of completing courses not applicable to a degree program or in many cases leads to duplication of courses. Although NTU cannot guarantee preferred course availability in any given term, Program of Study Plans provide substantial information as a guide for course selection from partner universities. It may be necessary to revise approved program of study plans when course availability does not comply with student needs. The PSP form should be submitted to a student's advisor via the NTU web site. The form is located within the "Community" portion of the NTU web site, under "Academic Programs."

Change of Graduate Major

If an admitted student wishes to change to a different major, an Application for Change of Graduate Major and \$25 fee must be submitted to the Admissions and Records office. Students are admitted to only one NTU Master's Degree Program at a time. Transcripts may also be requested again.

Applications will be reviewed under the guidelines for Automatic and Non-Automatic admission (see *Admission* section). Applicants will be informed of the admission decision in a timely manner to facilitate course registration.

Student Records

The Admissions and Records office maintains all official student records, including academic transcripts and other pertinent information. Address changes and other modifications must be submitted in writing to the Admissions and Records office or submitted online. NTU protects the privacy of student records in accordance with state and national statutes and regulations, which include the provisions of the Family Education Rights and Privacy Act (Buckley Amendment) regarding access to and disclosure of student information and records.

Transcripts

A student may obtain a NTU Transcript by submitting a Transcript Request Form to the Admissions and Records office or requesting it on the web. There is no charge for this service. NTU reserves the right to withhold issuance of a transcript under certain conditions including, but not limited to, situations where a student is on financial hold because money is owed to the university.

Appeals

Except as specifically set forth in various sections of this *Bulletin* or on occasional updates on the NTU web site, decisions affecting students' status and academic standing are not appealable.

MS Thesis Guidelines

MS Thesis Guidelines

When desirable and appropriate, as determined by a student in consultation with the NTU advisor, a thesis option is available. NTU students who elect a thesis option should follow these guidelines:

- ! Obtain the agreement of an NTU advisor to use the thesis option; choose and obtain agreement of a faculty member at an NTU institution to act as the thesis advisor. A non-NTU thesis advisor may be arranged in special cases with the approval of the Curriculum Chair and the student's NTU advisor.
- ! Thesis requirements will be determined by the thesis advisor and the student's NTU advisor in accordance with normal acceptable university practices.
- ! Thesis defense will be conducted before an appropriate thesis review committee which will be arranged between the thesis advisor, the NTU Curriculum Chair and appropriate individuals, including industry experts.
- ! Appropriate library facilities must be available to the student.
- ! Student will enroll with NTU for six SCH (course number assigned by NTU), and will receive NTU credit after completion of an acceptable thesis.
- ! Tuition for thesis registration will be charged at the current NTU tuition rate plus a special \$100/SCH fee. Students who do not complete the thesis within one year must register and pay tuition and fees again.

Graduation Information

Bulletin Under Which Students May Graduate

Candidates for Master's Degrees may elect to fulfill degree requirements from any *Bulletin* in effect during their inclusive dates of registration including before admission, with the following exception: Students who do not register for courses at NTU for more than one calendar year must meet degree requirements in the *Bulletin* in effect at the date of reenrollment or any subsequent *Bulletin*.

Application for Graduation

Each candidate must submit an application for graduation with the final Program of Study Plan (PSP) to the Graduation Coordinator the term prior to completing degree requirements. Both forms are available at the NTU web site at www.ntu.edu. Approval of the final PSP and application for graduation takes 4-6 weeks.

Graduation Requirements

In order to graduate, students must meet the following requirements:

- ! have a cumulative GPA of at least 3.00 on *all graduate level* (does not include undergraduate level Bridging courses) *work completed at NTU*, (grades below "C," 2.0 quality points, may not be used in final PSP);
- ! final grades in all courses on the Final Program of Study Plan have been recorded and reviewed to make certain that each degree candidate has fulfilled all degree requirements;
- ! appropriate Academic Advisor, Curriculum Committee Chairperson, the NTU Director of Admissions and Records and the Chief Academic Officer have certified that each candidate has fulfilled all degree requirements; and
- ! the Academic Executive Committee, the Chief Academic Officer, and the Board of Trustees of National Technological University officially approve the conferral of the degree(s).
- ! all outstanding invoices must be paid; and
- ! degree candidates who transfer credits are responsible for ascertaining that the credit they wish to transfer satisfy the conditions outlined in the *Transfer Credit* section.

Graduation Ceremony

NTU has two graduation dates annually. Diplomas are issued in February and August. The graduation ceremony is held once a year in August and students from both of the graduation dates are encouraged to

participate in the ceremony. Additionally, NTU has one graduation date per year for Management of Technology (MOT) students. The MOT graduation ceremony is held each January.

Seven-Year Rule

NTU courses taken to satisfy National Technological University graduation requirements must be successfully completed within seven years. This same time frame applies to transfer credits. For specific information concerning transfer credit, see the section titled *Transfer of Credit*.

Appeals concerning the Seven-Year Rule must be set forth in writing and will be reviewed solely on the basis of the written appeal, with no right to a formal hearing at any level. The determination of the NTU Chief Academic Officer is final.

NTU Alumni Association

National Technological University Alumni Association was founded with the establishment of the University. The purpose of the Association is to promote the interests of NTU by creating relationships with graduates of the University. An informed, interested and active alumni population is one of the University's most valuable assets. The Association seeks close and continuing relationships between NTU and its alumni. A representative of the NTU Alumni Association serves on the Board of Trustees. This representative serves a three-year term.

To serve the needs of the alumni of NTU, the Association will initiate responsive programs appropriate to a society moving toward a knowledge-intensive age.

"I would like to thank IBM and NTU for making my graduate study all possible. The distance learning program from NTU is truly a wonderful program for professionals to enhance their skill and earn a degree."

- Daniel Waicheong Fok, IBM

Certificate Programs

NTU Certificate of Completion Program

Introduction

The NTU Certificate of Completion program is designed to recognize the achievements of students whose courses meet specific needs of their individual careers. This program is especially beneficial to those who already have a Master's or Ph.D. degree and do not wish to pursue another advanced degree. It provides recognition of academic accomplishment while upgrading technical competence or reorienting professional careers.

Students who satisfy the requirements receive a Certificate of Completion and a permanent record on their NTU transcript.

Students may take advantage of this opportunity to earn one or more Certificates of Completion. A course may be used only once for certificate purposes; however, the same course may also be applied also toward a Master's degree.

Bridging courses are not accepted for a certificate.

Application Procedure

Students interested in Certificate Programs do not apply for admission but simply register for their four-course sequence. Upon meeting the requirements for a certificate, a student should submit an electronic request for a certificate, indicating courses taken and grades received. NTU will verify the information and issue certificates quarterly (Feb., May, Aug., Nov.). An entry will be made on the student's transcript and the Certificate will be sent to the student's home address.

Requirements for Certificate of Completion

- ! Complete at least four NTU graduate courses for a minimum of ten semester credits.
 - Three courses in one specific area of specialization (e.g., AD, CA, ME, etc., or a subarea of these).
 - One additional course in the same area or in a supportive area of specialization.
- ! Receive a "B" or better in each course. Note: "B-" is not acceptable.

Specialty Areas

The following is a list of the course area designations that are available through NTU. A complete list of area designations is listed in the *Courses of Instruction* section of this *Bulletin*.

AD Algorithms and Data Structures	CC Communications
AE Aerospace Engineering	CH Chemical Engineering
CA Computer Architecture	CM Computational Methods and Theory

CR Circuit Theory	ME Mechanical Engineering
CS Computer Software	MG Business and Administration
CT Control Theory	MP Mechanical Properties
DS Digital Systems	MS Materials Science
EA Emerging Areas	PD Product and Process Design
EF Economics and Finance	PM Polymeric Materials
EM Electromagnetics	PS Power Systems
EP Electrical Properties	QM Quantitative Methods
ES Engineering Science	SE Software Engineering
EV Environmental Systems Mgmt	SP Manufacturing Systems Planning and Control
FL Foreign Languages	ST Software Techniques
IC Integrated Circuits	SY Systems Engineering
IS Intelligent Systems	TC Telecommunications
MA Mathematics	TO Technical Operations
MB Management and Behavioral Science	
MC Materials Characterization	

Sample Certificate Programs:

Software Engineering:

SE 742-N	Software Generation and Maintenance
SE 750-W	Software Verification, Validation and Testing
SE 770-S	Software Specification
SE 783-S	Software Process Management

Telecommunications Management:

TC 502-N	Introduction to Telecommunications
TC 702-O	Telecommunications Systems
TC 704-CU	Network Management
TC 772-CU	Strategic Planning and Management for Telecommunications

Quality Control and Reliability:

TO 570-O	Industrial Quality Control
TO 771-E	Reliability Engineering
TO 772-E	Maintainability Engineering
TO 775-A	Advanced Management of Quality

Technical Japanese:

FL 501-X	Basic Technical Japanese I
FL 502-X	Basic Technical Japanese II
FL 503-X	Intermediate Technical Japanese I
FL 504-X	Intermediate Technical Japanese II

Semiconductor Engineering:

IC 701-E	Electronic Packaging Principles
IC 506-NM	Microelectronic Reliability
IC 714-W	Semiconductor Material and Device Characterization
IC 730-P	IC Technology and Fabrication

Management and Behavioral Science:

MB 510-T	Management for Engineers
MB 720-NJ	Behavioral Science in Engineering Organizations
MB 550-A	Engineering Law and Ethics
EF 720-T	Advanced Financial Management

Materials Science:

MS 710-P	Modern Concepts in Material Science
MS 715-R	Materials Microstructure
MS 716-R	Science of Biomaterials I
MP 724-P	Mechanical Behavior of Engineering Materials

Computer Architecture:

CA 720-B	Digital Computer Design
CA 726-P	VLSI Architecture
CA 760-U	Embedded Computer Systems
CT 712-A	Linear Systems Theory

Mechanical Engineering - Mechanics, Dynamics, and Vibrations:

ME 510-M	Advanced Dynamics
ME 715-M	Engineering Acoustics
ME 717-O	Advanced Mechanical Vibrations
ME 541-N	Intermediate Fluid Mechanics

Mechanical Engineering - Computing and Design:

ME 520-U	Introduction to the Finite Element Method
ME 521-P	Introduction to Computer-Aided Design (CAD)
ME 523-E	Computer-Aided Analysis and Design of Mechanical Systems
ME 528-M	Multidisciplinary Design Optimization

Fast Track Certificate Program in Computer Science

NTU offers an accelerated academic program of six undergraduate computer science courses designed to help students stay on track in their careers. The Fast Track program offers focused, in-depth courses to learn core computer science knowledge to help in the transition from hardware to software engineering.

Instructors have condensed course material to specifically meet the needs of students working in high-tech fields. Each course is 1.6 credits and is offered for Audit or Pass/Fail only. Course notes are provided as well as optional homework assignments and exams. A teaching assistant is available via e-mail and phone to answer questions and help with assignments.

The Fast Track courses are:

- FT 001-NT - Computer Organization
- FT 002-NT - Algorithms and Data Structures
- FT 003-NT - Computer Programming Languages
- FT 004-NT - Foundations of Computer Science: Formal Languages and Automata
- FT 005-NT - Software Engineering
- FT 006-NT - Operating Systems

NTU does not grant academic credit for these courses, but successful completion will enable a student with an unrelated bachelor's degree to better prepare for graduate-level coursework in NTU's Computer Science or Software Engineering master's programs. Students are not required to take all six courses, but completion of the six course series will earn a student a Certificate of Completion in "Principles of Computer Science."

Transfer Credit

Definition of Transfer Credit

Transfer credit is academic graduate credit completed outside the NTU network and approved for inclusion into a student's Program of Study Plan. All credits taken directly via the NTU network must be petitioned and approved to be included in the student's Program of Study Plan.

Guidelines

Students admitted to **Regular Graduate Status** may petition to transfer credit. All courses, including transfer credit, used for an NTU degree must be completed within seven years of the NTU graduation date.

Credit will not be allowed for transfer under any circumstances if:

- ! the course(s) was previously used to meet any degree requirement;
- ! the student's grade for the course was less than a "B";
- ! the course(s) was taken on a pass/no pass (P/NP) or on a satisfactory/unsatisfactory (S/U) basis;
- ! the course is not a graduate level course.

Maximum Number of Credits Which Can Be Transferred

FROM NTU PARTICIPATING UNIVERSITIES -- There is no limit on the number of credits a student may transfer to NTU provided a minimum of 18 semester credit hours (or equivalent in quarter hours) are taken directly through NTU. However, courses being transferred from NTU member schools must be from the same location as the NTU member school. For example, the University of Nebraska, Lincoln, is the NTU member school and a course from the University of Nebraska, Omaha, would not be considered in transfer as a course from a NTU member school.

FROM NON-NTU UNIVERSITIES -- NTU may accept up to six (6) credits in transfer from an accredited university.

Special Transfer Fee

Transfer courses taken after admission to an NTU degree program are subject to a special transfer fee of \$50 per course. The student will be billed the \$50 per course transfer fee at the time the transfer credit is approved.

Procedure

Students who want to transfer credit to NTU must submit to the NTU Admissions and Records Office:

- ! A Petition for Transfer of Credit;
- ! An official transcript showing the course(s) to be transferred;
- ! A photocopy of the catalog description of the course;
- ! A current Program of Study Plan.

Students should contact their NTU advisor before submitting the Petition for Transfer Credit to NTU. Acceptance of transfer courses as part of an NTU Master's Degree Program will be approved by the student's advisor, NTU Director of Admissions and Records, the appropriate Curriculum Committee, and the Chief Academic Officer. Transferred courses will appear on the NTU transcript but will not be figured into the NTU GPA or NTU earned hours computation.

Tuition and Fees

Introduction

The National Technological University Board of Trustees has the authority to set tuition and fees. The rates that apply during any succeeding academic year may not be known until March or April of the current year. The Board of Trustees reserves the right to change the rates at any time deemed necessary.

Up-to-date tuition rates are indicated on the NTU web site at www.ntu.edu. They are also available in the NTU *Class Schedule* which is published every term.

Tuition and Fees

For the 2000-2001 academic year, the following represented the NTU Tuition and Fees per Semester Credit Hour (SCH):

	<u>Credit</u>	<u>Audit</u>
Arizona State University (W)	\$625	\$525
Auburn University (AU)	\$625	\$525
Clemson University (CN)	\$625	\$525
Colorado State University (H)	\$722	\$722
Columbia University (CL)	\$1104	\$1004
Florida Gulf Coast University (FG)	\$625	\$525
The George Washington University (GW)	\$743	\$743
Georgia Institute of Technology (J)	\$892	\$892
Iowa State University (U)	\$662	\$562
Kansas State University (KS)	\$625	\$525
Kettering University (GM)	\$625	\$525
Lehigh University (LE)	\$625	\$525
Michigan State University (MS)	\$625	\$525
Michigan Technological University (I)	\$757	\$657
National Technological University (NT) (Except FT and MOT courses)	\$625	\$525
New Jersey Institute of Technology (NJ)	\$735	\$735
New Mexico State University (NS)	\$625	\$525
North Carolina State University (P)	\$652	\$652
Northeastern University (F)	\$752	\$595
Oklahoma State University (O)	\$625	\$525
Old Dominion University (OD)	\$625	\$525
Purdue University (M)	\$748	\$748
Rensselaer Polytechnic Institute (Z)	\$1062	\$1062
Southern Methodist University (N)	\$762	\$525
The University of Alabama in Huntsville (AH)	\$625	\$525
The University of Alabama at Tuscaloosa (AT)	\$625	\$525
University of Alaska Fairbanks (G)	\$625	\$525

The University of Arizona (E)	\$625	\$525
University of Arkansas (AR)	\$625	\$525
University of California at Berkeley (CA)	\$1162	\$1062
University of California, Davis (DA)	\$812	\$712
University of Colorado at Boulder (CU)	\$735	\$735
University of Delaware (DE)	\$625	\$525
University of Florida (R)	\$705	\$592
University of Idaho (S)	\$739	\$739
University of Illinois at Urbana-Champaign (Q)	\$815	\$815
University of Kentucky (L)	\$802	\$802
University of Maryland, College Park (B)	\$625	\$525
University of Massachusetts at Amherst (A)	\$687	\$573
The University of Michigan (UM)	\$722	\$722
University of Minnesota (C)	\$625	\$525
University of Missouri-Rolla (T)	\$625	\$525
University of Nebraska-Lincoln (NB)	\$625	\$525
The University of New Mexico (NM)	\$625	\$525
University of South Carolina (D)	\$625	\$525
University of Southern California (SC)	\$874	\$577
The University of Tennessee (TN)	\$907	\$907
University of Washington (Y)	\$942	\$942
University of Wisconsin-Madison (X)	\$862	\$862
Vanderbilt University (VU)	\$1365	\$1365

These tuition and fees are likely to increase for subsequent years.

The tuition and fees for the Management of Technology M.S. degree program can be found on the NTU web site.

NOTE: The tuition and fee rates do not include the nonrefundable \$50 admission processing fee that must accompany an application for admission to an NTU Master's degree program or any associated charges for textbooks, other instructional materials or computer support services.

Special Fees (additional tuition and fees)

Change of Major Fee	\$25
Nonrefundable Application Fee or Reapplication Fee	\$50
M.S. Thesis	\$100/credit
Project Courses (e.g.; Individual Study and Capstone Courses)	\$100/credit
Special Topics Courses	\$100/credit
Laboratory Courses	\$100/credit
Transfer Course Fee	\$50/course

Textbooks and Supporting Materials

In addition to the charges listed, each student must purchase textbooks and supporting materials. These additional materials are identified by course on the web and in the *Class Schedule*.

Payments

All persons taking NTU courses must register for credit or audit. A registered student, or in some cases a sponsoring organization, become liable for the payment of tuition, fees and all other charges. Each sponsoring organization sets its policy concerning the responsibility and method of payment for its sites. Full payment is required within 30 days of receipt of the invoice unless prior arrangements have been approved by the NTU Accounting Department. Payments are to be submitted to the NTU Accounting Department. If payment is not made, the student will not receive grade(s) or transcripts and the bill will be sent to an NTU collection agency. Students with outstanding bills will not be allowed to register or graduate.

Refunds

Students who drop a course or change from credit to audit may be eligible for partial tuition refund. **NTU Registrar's office must be informed in writing** of a request to drop a course or change registration status (Change of Registration Status forms are available from the NTU web site or from Site Coordinators).

A student may change registration status from credit to audit within the allotted time (see *Course Registration Information*) and will be billed the audit fee. A student may also change from audit to credit within the allotted time and will be billed the credit fee.

Tuition/fee refunds are made according to the following schedule:

Course Start Date	Semester Schools or 9-14 Wk Summer Sessions	Quarter Schools or 5-8 Wk Summer Sessions
90%	through 2 nd week	through 1 st week
70%	through 3 rd week	through 2 nd week
50%	through 4 th week	through 3 rd week
No refund	after 4 th week	after 3 rd week

Refunds are calculated on a 7-day schedule (i.e. Monday-Sunday).

Tuition and fee refunds are not given after the close of the fourth week of instruction (semester schools or 9-14 week summer sessions) or third week of instruction (quarter schools or 5-8 week summer sessions).

If MOT students need to withdraw from the MOT program, they will be financially responsible for any portion of the program already begun or completed.

Charges for textbooks and supporting materials *are not refundable at any time* after registration. Such materials cannot be returned to NTU.

Tax Deduction

Tax regulations permit an income tax deduction for educational expenses undertaken to maintain or improve skills required for employment, or to meet the expressed requirements of an employer or law imposed as a condition for retention of employment, job status or rate of compensation. Individuals are advised to consult with their tax advisors and sponsoring organizations to ascertain the applicability of these regulations to their particular circumstances.

Electronic Access/World Wide Web Services

The NTU web server is located at www.ntu.edu. There are two major sections to the NTU web pages: general public information and secured services and information. These sections are both available through www.ntu.edu. Users gain access to secured services by clicking on "Community Login" from the home page and entering their unique user name and password.

General Information

General information about NTU and its program offerings can be accessed through NTU's public web pages. Information available includes course descriptions for Academic and Non-Credit courses, information about master's degree programs, the current *Class Schedule* and *Academic Bulletin*, outstanding instructor lists, current tuition and fees, and NTU contact information. A comprehensive search tool allows the user to search the NTU web site for topical areas of interest.

Applying for User Name and Password

To access the secured services and information, new users first need to create a profile. Go to www.ntu.edu, choose "Community Login," and follow the instructions given on the page. First time users must create a profile before they can access the online registration and admission system. Existing students already have a user name and password. Contact profileproblems@ntu.edu if you do not know your username or password. Immediate access will be given to some services requested; however, NTU will verify your roles before giving full access to sensitive services. You may be contacted by NTU if there are questions or discrepancies.

Registering On the Web

Upon logging into the Community Section of the NTU web site, click the option that reads "Academic Programs." This will bring up a menu of options from which you should select "Registration." Select a term and click next. Select a course and a method (Credit or Audit) and if it is requested, enter your proctor information, then click next. If the course is a variable credit course, select the credit you would like to receive. If the course has multiple delivery methods available, select your preferred method, read the authorization agreement and click "I Accept Above Agreement." You are then registered for your course and NTU will send you a confirmation. You may be prompted for additional information such as shipping address. If this is the case, please fill it out completely. Additionally, you can register by clicking the "Register Now" link that appears in the full descriptions of courses that are available for registration.

Password Protected Services

Approved users will have access to a variety of additional information. Users are assigned one or more roles (student, site coordinator, faculty, etc.) which allow access to information and news items of specific interest to each user. Users can update and change their profile information as necessary. Changes will automatically be made in the appropriate NTU databases.

Students can view their NTU academic record online as well as access a variety of online forms and requests including: registration, application for admission, change of registration status, graduation request, application for certificate of completion, change of major request, and an NTU transcript request form. Program of Study Plan forms and Transfer Credit petitions are also available to download.

When applicable, site coordinators will log on to process and approve pending registrations and applications submitted by students via the online system. Additionally, site coordinators, university administrators and faculty will have access to the most current registration and class list information that relates to them.

Instructional Programs in Specific Majors

National Technological University offers Master's Degrees in 14 selected disciplines and a Special Majors Program. Each degree program is governed by a faculty committee. NTU senior staff in the central administrative office assist in coordinating all functions. The NTU Admissions and Records Office responds to all requests for information about the various degree programs and assures prompt communication with the appropriate faculty committees. The Academic Executive Committee of NTU is the highest faculty governing agency that recommends academic policy to the President and Board of Trustees. For specific admission requirements for each degree program, see *Admissions* section of this *Bulletin*.

SPECIAL NOTE: National Technological University and the participating universities reserve the right to alter the curriculum or the courses and any of the policies stated in this Bulletin. The faculty members teaching the courses determine the course content, as reviewed and approved under the established procedures of their institutions. However, the Curriculum Committee of the various Graduate Faculties of NTU determine the appropriateness of the courses for fulfilling the degree requirements established by National Technological University.

Master of Business Administration

Program Description

The Master of Business Administration Degree (MBA) is designed to provide managers an academic learning experience that qualifies them to be leaders, to better accomplish their managerial responsibilities and in many cases to advance in their management responsibilities. The curriculum is challenging and prepares students for leadership positions in all types of businesses, service and public organizations.

The MBA is a professional degree that provides knowledge relating to business management skills in diverse areas ranging from accounting to managerial behavior. It provides the student the opportunity to learn the analytical, technical and behavioral tools that can be used to solve organizational problems. Many classes in the program provide the student an in-depth understanding of the business environment including the impact of global competitiveness and the legal issues that managers encounter.

Any person who has managerial experience can benefit from the formal study of business skills and knowledge that the MBA provides. Typical students come from diverse backgrounds including managers with undergraduate education in engineering, business and other disciplines. The MBA program is intended to meet the needs of this broad but unique population of working adult managers and supervisors who can benefit from a graduate business education. It is designed on the model of executive MBA programs, where the student's busy schedule and work experience is acknowledged as qualifying them for a "fast track" program, allowing completion in approximately three years of part-time study.

The MBA program consists of a minimum of 36 semester credits included in the core curriculum, electives and capstones. Up to 6 hours of the foundation courses may be substituted with permission of the Curriculum and Academic Administration Committee, based on a student's prior academic experience and course work. Students may work with their advisor concerning appropriate substitutions, or prerequisites. All students are expected to have completed appropriate undergraduate courses before their admission to the program including undergraduate course work in accounting, economics and math/statistics.

Elective courses may be taken from many of the diverse course offerings available through NTU. In many cases, students may choose to enhance their technical competency by taking course work in the many outstanding engineering programs offered through NTU. In other cases, the students may choose more breadth or depth in the business disciplines. Students should work with their advisor to select course work most appropriate for their plan of study.

With careful planning, a student may qualify for the International Master of Business Administration Degree. The IMBA degree requires that students select appropriate elective courses that enhance their understanding and knowledge about the global market place. Specific MG courses, foreign language courses and those that focus on global business issues may all be appropriate for this major. Students should work closely with their advisors if they select this option.

The eligibility requirements for admission to the Master of Business Administration Program are specified in the section of this *Bulletin* titled *Admission*.

Curricular Requirements

A total of 36 credit hours are required for graduation. Students may transfer a maximum of six hours of Core courses into the program subject to approval of the MBA academic admissions committee. Three Elective hours may be used to customize the student's program to facilitate his/her understanding in areas related to his/her career interest.

Curriculum

Foundation Courses - 18 Credit Hours - 3 Credit Hours Each

MG 710 - Managerial Accounting - Interpretation of accounting data. How management uses an accounting information system in order to be more effective in planning, controlling, decision making, setting and communicating goals, measuring performance, and allocating the resources of an organization.

MG 720 - Global Marketing Management- Major elements of marketing from the point of view of the marketing executive. Emphasis on problem solving and decision making. Development of an integrated, comprehensive marketing strategy.

MG 730 - Managerial Economics - A study of the application of the economic theory of profits, competition, demand, and costs to analysis of problems arising in the firm and in decision-making. Price policies, forecasting, and investment decisions are among the topics considered. Includes an analysis of the organization and operation of the world's major economic systems.

MG 740 - Financial Management - Theory and fundamentals of analysis and decision-making in financial management. Advanced study of problems involved in the financial management of economic organizations.

MG 750 - Management of Technology - Focuses on applications of information technologies to manage competitively in a global economy. The emphasis is on strategic as well as operational applications of technologies. The course includes case studies of several national and international companies. Opportunities and challenges presented by multinational telecommunications are also studied.

MG 760 - Organizational Behavior and Cultural Environments - Development of an understanding of behavioral concepts and cultural environments necessary for effective management of global organizations. Current literature demonstrates applicability of concepts.

Capstone - Integrative - Business Environment Courses
6 Credit Hours - 3 Credit hours each

MG 770 - Legal Environment of Business - The forces which influence and constrain decision and actions within organizations. Global legal and political issues as they influence business organizations. Attention to organizational response to these forces through management policies and strategies.

MG 780 - Global Strategic Management - Overall strategic management of the globally oriented firm, with strong emphasis on industry analysis and strategy formulation in a global environment.

Electives - 12 Credit Hours

Year 1

Fall

MG 710 Managerial Accounting
MG 730 Managerial Economics

Spring

MG 720 Global Marketing Management
Electives - 3 Credits

Summer

MG 760 Organizational Behavior and Cultural Environments

Year 2

Fall

MG 740 Financial Management
MG 770 Legal Environment of Business

Spring

MG 750 Management of Technology
Electives - 3 credits

Summer

Electives - 3 Credits

Year 3

Fall

MG 780 Global Strategic Management
Electives - 3 Credits

MBA - Specialization

Students have the opportunity to specialize by selecting elective coursework in areas of their interest. This opportunity makes the MBA particularly beneficial to managers who need to develop the foundation business skills needed for advancement and has an area of specialization in their career and industry. Examples of possible areas of interest include those in Finance; International Business and E-Commerce. In all cases students should work closely with their advisor to select courses appropriate to their interest and career goals. In some cases, courses given for examples may not be available during certain terms. Check the *Class Schedule* for the current term offerings.

Financial Management and Accounting

Elective course work - 12 Credit Hours

Sample Specialization Track could include:

EF 510-T	Cost Accounting
EF 720-T	Advanced Financial Management
EF 735-N	Economic Decision Analysis
MG 740-F	International Finance Management

International Business - IMBA

Elective Course Work - 12 Credit Hours

Sample Specialization Track could include:

FL 501-X	Basic Technical Japanese I
FL 502-X	Basic Technical Japanese II
MB 795-GM	International Business
MG 783-NB	Directed Reading or Research Toward a Single Market

E-Commerce

Elective Course Work - 12 Credit hours

Sample Specialization Track could include:

MG 724-O	Electronic Commerce and Interactive Marketing
MG 772-F	An Introduction to Valuing E-Commerce Companies
MG 775-NB	Electronic Business
TO 711-F	Introduction to Software Engineering and Computer Technology

Telecommunications

Elective Course Work - 12 Credit Hours

Sample Specialization Track could include:

TC 702-O	Telecommunications Systems
TC 774-NJ	Management of Telecommunications
TC 775-N	Wireless Management and Convergence
TC 580-CU	Economics, Policy and Management

Marketing

Elective Course Work - 12 Credit Hours

Sample Specialization Track could include:

MB 540-GW	Organization, Management and Leadership
TO 512-P	E-Commerce Technology
TO 735-VU	Marketing of Advanced Technologies
TO 736-NJ	Internet Marketing Strategy

Program of Study Plan (PSP)

Admitted students should submit a Program of Study Plan (PSP) to NTU upon completion of six semester credit hours. Failure to submit a Program of Study Plan increases the possibility of completing courses not applicable to a degree program or in many cases leads to duplication of courses. Although NTU cannot guarantee preferred course availability in any given term, Program of Study Plans provide substantial information as a guide for course selection from partner universities. It may be necessary to revise approved program of study plans when course availability does not comply with student needs. The PSP form should be submitted to a student's advisor via the NTU web site. The form is located within the "Community" portion of the NTU web site, under "Academic Programs."

M. S. in Chemical Engineering

Program Description

The Master of Science Degree program in Chemical Engineering prepares graduates to succeed in a wide spectrum of careers. Chemical engineers are equipped to contribute in all technical areas that involve the conversion of raw materials, through chemical or physical changes, to produce products of greater benefit to society.

Examples of important technical challenges where Chemical Engineering graduates will apply expertise include the areas of: energy, global food supply, environment, medicine and advanced materials. To meet each of these challenges requires intelligent application of the combined principles of chemistry and engineering - and that is exactly what chemical engineers are equipped to do.

The program consists of a minimum of 33 semester credits (or the equivalent quarter credits) as approved by the student's academic advisor. These courses are distributed between two broad categories: Core and Electives. The Core course requirements ensure a sound foundation in important chemical engineering fundamentals, while the Elective courses provide an excellent opportunity to design a curriculum to meet each student's individual interests.

Most NTU students maintain a full-time job and, by completing at least two three-credit courses each academic year, can plan to fulfill the requirements in no more than six years. Applicants who do not possess B.S. degrees in Chemical Engineering will have to complete Bridging courses; the exact courses will be determined by the student's academic advisor.

The eligibility requirements for admission to the Chemical Engineering program are specified in the section of this *Bulletin* titled *Admission*.

Curricular Requirements

A total of 33 semester credit hours are required for graduation, distributed between Core and Elective areas as follows:

Core Requirement

Five Core courses (15 hours) which include one course from each of the following Core areas:

CH 10-19	Thermodynamics
CH 20-29	Transport Phenomena
CH 30-39	Chemical Kinetics, Catalysis and Reactor Design
CH 40-49	Systems Analysis and Design
CH 50-59	Chemical Engineering Mathematics

It should be noted that not all courses in the CH area are accepted as Core courses. The student is advised to refer to the listing of the individual courses via electronic access and/or current class schedules to ensure that the letter

“C” is included in the brackets following the designation of CH; e.g. CH [C] implies the course is acceptable to meet this requirement.

Elective Requirement

A minimum of six Elective courses (18 Credits). Two of these (six credits) must be in Chemical Engineering, selected from the Core areas listed above or from other Chemical Engineering offerings. The remainder of the Electives may be chosen from courses identified in the bracket line by CH [E], subject to approval by the student's advisor.

Thesis

Most students are expected to pursue a non-thesis Master of Science Degree program. However, when desirable and appropriate, as determined by the student in consultation with an academic advisor, a thesis option is available. The thesis can be used to replace six credits of Electives (but not the two required Chemical Engineering courses).

Example Programs of Study

Shown below are two example curricula with common Core courses but with separate emphasis areas, tailored to suit particular interests as determined through choices of Elective courses. In one curriculum, the emphasis is in the Environmental Area and, in the other, in the Materials Area.

Course Number

Title

Core

CH 711-NJ	Thermodynamics
CH 725-B	Transport Phenomena
CH 731-NJ	Kinetics of Reactions and Reactor Design
CH 741-K	Advanced Process Control
CH 751-O	Chemical Engineering Process Modeling

Elective Courses (Example 1) - Environmental Emphasis

CH 568-P	Life Cycle Concepts for the Environment
CH 775-X	Biological Separations Processes
EV 744-S	Air Pollution Control
EV 577-N	Sources and Nature of Hazardous Waste
EV 581-NS	Chemical Theories of Environmental Engineering
EV 585-NS	Environmental Toxicology

Elective Courses (Example 2) - Materials Emphasis

CH 762-O	Polymer Processing
CH 565-P	Chemical Processing of Electronic Materials
EP 726-R	Deposition and Properties of Thin and Thick Films
MC 720-P	Scanning Electron Microscopy
MS 714-U	Powder Processing of Materials
MS 716-R	Science of Biomaterials I

Bridging Courses

NTU bridging courses offer to professionals from other science and engineering disciplines an overview of chemical engineering principles, and provide sufficient background that such students can successfully enter and complete graduate chemical engineering degrees. Commonly, the bridging program for students without a B.S. Degree in Chemical Engineering involves two courses that introduce the most important concepts from the broad undergraduate chemical engineering curriculum, CH 591-MS and CH 592-MS. Information on these two courses can be found on the following web site - www.egr.msu.edu/che/cont.ed/ (CHE 804 and CHE 805). Additional bridging courses may be required depending on the student's background. Specific bridging requirements are developed on an individual basis with an advisor.

Bridging courses are not available for graduate credit.

Program of Study Plan (PSP)

Admitted students should submit a Program of Study Plan (PSP) to NTU upon completion of six semester credit hours. Failure to submit a Program of Study Plan increases the possibility of completing courses not applicable to a degree program or in many cases leads to duplication of courses. Although NTU cannot guarantee preferred course availability in any given term, Program of Study Plans provide substantial information as a guide for course selection from partner universities. It may be necessary to revise approved program of study plans when course availability does not comply with student needs. The PSP form should be submitted to a student's advisor via the NTU web site. The form is located within the "Community" portion of the NTU web site, under "Academic Programs."

M. S. in Computer Engineering

Program Description

The Computer Engineering program prepares students to work in the dynamic and rapidly expanding field of digital technology. Computer engineers design computers and computer systems, apply computers as components of larger systems, and apply digital techniques to solving a broad range of engineering problems.

The Master of Science Degree program in Computer Engineering consists of 30 semester credits distributed through four broad categories: Core, Depth, Breadth and Elective courses. The curriculum features substantial choices in all four categories, thereby enabling students to tailor their programs of study to meet their specific needs and fulfill their particular aspirations. The Breadth courses expose students to a spectrum of topics outside of Computer Engineering. In this way, the University ensures that students become aware of important and emerging areas that might otherwise be overlooked. The NTU curriculum in Computer Engineering remains open-ended with regard to advanced courses, in order to encourage students to take advantage of new courses concentrating on the latest developments in the field.

Completion of the curriculum requires approximately one and one-half years of full-time graduate study. Students enrolled through National Technological University, whose work schedules preclude full-time study, should expect to fulfill the requirements in no more than five years by registering for at least two three-credit courses each academic year.

The specific eligibility requirements for admission into the Computer Engineering program are identified in the section of this *Bulletin* titled *Admission*.

Curricular Requirements

Each student should expect to enroll in ten or more courses with a minimum of three Core courses, four Depth courses, two Breadth courses and one Elective course. A minimum of 30 credits is necessary for graduation. Excess hours accumulated in the Core, Depth and Breadth areas may be used to help satisfy the Elective requirement.

Core Requirement

At least eight credits of required Core courses, with at least one course in each of the three identified areas. It should be noted that not all courses in the following areas are accepted as Core courses. The student is advised to refer to the listing of the individual courses via electronic access and/or current class schedules to ensure that the letter “C” is included in the brackets following the designation of CE; e.g., CE [C] implies the course is acceptable to meet this requirement.

- AD Algorithms and Data Structures
- CA Computer Architecture
- CS Computer Software or SE Software Engineering

Depth Requirement

At least 10.5 credits of required Depth courses consisting of at least two courses from each of two areas from the following list. Depth courses provide instruction on the most advanced and current topics in eight distinct areas (four of which form the three Core areas). In order to meet this requirement, the student must ensure that the letter “D” appears in the brackets following the designation of CE [] for each course.

- AD Algorithms and Data Structures
- CA Computer Architecture
- CM Computational Methods and Theory
- CS Computer Software
- DS Digital Systems
- IS Intelligent Systems
- SE Software Engineering
- ST Software Techniques

With the advice of an academic advisor, the student should plan a program of study that assures appropriate depth in the two areas selected.

Breadth Requirement

At least five credits of Breadth courses consisting of at least two courses. Breadth courses focus on fields that relate to or support the study of Computer Engineering. Breadth courses require the approval of the student’s advisor *before* they are taken. Breadth areas include all NTU areas not designed as a Computer Engineering Depth area. To meet this requirement, each course must have the designation “AA” in the CE brackets following the course title and institution, e.g., CE [AA] implies the course requires the approval of the student’s academic advisor.

With the assistance of an academic advisor, the student should plan an integrated program of study that assures breadth complementing the depth achieved in Computer Engineering.

Elective Requirement

Additional courses required to meet the 30 credit requirement may be taken from any area offered by NTU provided the letter “AA” appears in the brackets following the designation of CE [] for the courses. Elective courses must also be approved by the student’s academic advisor.

Thesis

National Technological University offers a non-thesis Master of Science Degree program in Computer Engineering. However, when desirable and appropriate, as determined by the student in consultation with his/her academic advisor, a thesis with a maximum of six credits may be substituted for the Elective course and one of the Depth courses (see *MS Thesis Guidelines* section of this *Bulletin*).

Example Programs of Study

The following examples illustrate the flexibility available to students wishing to specialize in specific areas of Computer Engineering:

Software Engineering Emphasis

Course Number	Title	Credits
Core		
AD 720-M	Computational Models and Methods	3.0
CA 514-P	Digital Computer Technology and Design	3.0
SE 710-R	Software Engineering	3.0
Depth		
CS 740-A	Operating System II	3.0
CS 750-R	Database Management Systems	3.0
SE 760-S	Software Quality Assurance	3.0
SE 580-P	Software Process and Risk Management	3.0
Breadth		
MA 520-N	Probability and Statistics for Engineers	3.0
MB 710-N	Management for Engineers	3.0
Elective		
IS 710-R	Artificial Intelligence Concepts	<u>3.0</u>
		30.0

Computer Architecture Emphasis

Course Number	Title	Credits
Core		
AD 711-R	Advanced Data Structures	3.0
CA 514-P	Digital Computer Technology and Design	3.0
CS 720-SC	Issues in Programming Language Design	3.0
Depth		
CA 720-M	Advanced Computer Systems	3.0
CA 562-M	CISC Microprocessor System Design	3.0
DS 770-A	Testing and Diagnosis of VLSI Systems	3.0
DS 780-R	Fault-Tolerant Computing	3.0
Breadth		
CC 760-F	Digital Signal Processing	3.0
IC 742-A	VLSI Design Principles	3.0
Elective		
ST 750-N	Data Communications	<u>3.0</u>
		30.0

Bridging Courses

Bridging courses are available for those students whose background is deficient in any way. The undergraduate bridging areas available for students entering graduate study in Computer Engineering are:

BC 10-19	Fundamentals of Computer Engineering
BC 20-29	Digital Logic Design
BC 30-39	Data Structures
BC 40-49	Microprocessors and Assembly Level Programming
BC 50-59	Operating System Principles
BC 60-69	Digital System Design - Computer Architecture
BC 70-79	Interfacing and Computer Networks
BC 80-89	Discrete Structures

Bridging courses are not available for graduate credit.

Program of Study Plan (PSP)

Admitted students should submit a Program of Study Plan (PSP) to NTU upon completion of six semester credit hours. Failure to submit a Program of Study Plan increases the possibility of completing courses not applicable to a degree program or in many cases leads to duplication of courses. Although NTU cannot guarantee preferred course availability in any given term, Program of Study Plans provide substantial information as a guide for course selection from partner universities. It may be necessary to revise approved program of study plans when course availability does not comply with student needs. The PSP form should be submitted to a student's advisor via the NTU web site. The form is located within the "Community" portion of the NTU web site, under "Academic Programs."

"There have been many hurdles to overcome in completing this degree, but it has all been worth it. I would like to thank Lexis-Nexis and NTU for providing me a unique opportunity to obtain my Master's Degree while continuing to work."

- Christine M. Wummel, Lexis-Nexis

M. S. in Computer Science

Program Description

Computer science is the body of knowledge dealing with the design, analysis, implementation, efficiency and application of algorithmic processes that transform information. It is a non-engineering approach to computing with the primary emphasis on software, operating systems and programming languages.

The Master of Science Degree program in Computer Science consists of 30 semester credits distributed through three broad categories: Core, Depth and Breadth courses. The curriculum features substantial choices in all three categories, thereby enabling students to tailor their programs of study to meet their specific needs and fulfill their particular aspirations. The Breadth courses expose students to a spectrum of topics outside of Computer Science. In this way, the University ensures that students become aware of important and emerging areas that might otherwise be overlooked. The NTU curriculum in Computer Science remains open-ended with regard to advanced courses in order to encourage students to take advantage of new courses concentrating on the latest developments in the field.

Completion of the curriculum requires approximately one and one-half years of full-time graduate study. Students enrolled through National Technological University, whose work schedules prevent full-time study, should expect to fulfill the requirements in no more than five years by registering for at least two three-credit courses each academic year.

The specific eligibility requirements for admission into the Computer Science program are identified in the section of this *Bulletin* titled *Admission*.

Curricular Requirements

A total of 30 credits are required for graduation. These courses should satisfy the following distribution requirement:

Core Requirement

At least one course from each of the five Core areas listed below:

- AD Algorithms and Data Structures
- CA Computer Architecture
- CM Computational Methods and Theory
- CS Computer Software or SE Software Engineering
- IS Intelligent Systems

The student is advised to refer to the listing of the individual courses via electronic access and/or current class schedules to ensure that the letter “C” is included in the brackets following the designation of CS; e.g., CS [C] implies the course is acceptable to meet this requirement.

Depth Requirement

At least three additional courses from one of the areas listed below. Depth courses provide instruction on the most advanced and current topics in seven distinct areas. In order to meet this requirement, the student must ensure that

the letter “D” appears in the brackets following the designation of CS [] for each course, e.g., CS [D].

- AD Algorithms and Data Structures
- CA Computer Architecture
- CM Computational Methods and Theory
- CS Computer Software
- IS Intelligent Systems
- SE Software Engineering
- ST Software Techniques

With the advice of an academic advisor, the student should plan a program of study that assures appropriate depth in at least one area.

Breadth Requirement

At least one course in a Breadth field. This course requires the approval of an academic advisor and should be selected to support the depth achieved in Computer Science. Breadth areas include all NTU areas not designated as a Computer Science Depth area. To meet this requirement, each course must have the designation “AA” in the CS brackets following the course title and institution, e.g., CS [AA] implies the course requires the approval of the student’s academic advisor.

Elective Requirement

Additional courses required to meet the 30 credit requirement may be taken from any area offered by NTU provided the letter “AA” appears in the brackets following the designation of CS [] for the courses. Elective courses must be approved by the student’s academic advisor.

Thesis

National Technological University offers a non-thesis Master of Science Degree program in Computer Science. However, when desirable and appropriate, as determined by the student in consultation with his/her academic advisor, a thesis with a maximum of six credits may be substituted for the Elective course and one of the Depth courses (see *MS Thesis Guidelines* section of this *Bulletin*).

Example Programs of Study

The following examples illustrate the flexibility available to students wishing to specialize in a specific area of Computer Science:

Computer Software Emphasis

Course Number	Title	Credits
Core		
AD 711-R	Advanced Data Structures	3.0
CA 714-CA	Graduate Computer Architecture	4.0
CM 730-A	Theory of Computation	3.0
IS 710-R	Artificial Intelligence Concepts	3.0
SE 710-F	Software Engineering I	3.0

Depth		
CS 720-SC	Issues in Programming Language Design	3.0
CS 743-N	Advanced Operating Systems	3.0
CS 750-SC	Database Systems	3.0
Breadth		
TO 712-N	E-Commerce, Architectures and Technologies	3.0
Elective		
CS 540-P	Operating Systems Principles	<u>3.0</u>
		31.0

Computer Architecture Emphasis

Course Number	Title	Credits
Core		
AD 711-R	Advanced Data Structures	3.0
CA 714-CA	Graduate Computer Architecture	4.0
CM 710-W	Theory of Formal Languages	3.0
CS 530-P	Compiler Construction	3.0
IS 710-M	Artificial Intelligence	3.0
Depth		
CA 720-E	Parallel Processing: Architectures, Algorithms and Technologies	3.0
CA 760-U	Embedded Computer Systems	3.0
CA 562-M	CISC Microprocessor System Design	3.0
Breadth		
IC 742-A	VLSI Design Principles	3.0
Elective		
CA 775-R	Hardware-Software Interactions: Time Sharing Systems	<u>3.0</u>
		31.0

Robotics Emphasis

Course Number	Title	Credits
Core		
AD 711-R	Advanced Data Structures	3.0
CA 514-M	Computer Architecture	3.0
CM 710-W	Theory of Formal Languages	3.0
IS 760-P	Computer Vision	3.0
SE 510-C	Software Engineering I	3.0
Depth		
IS 710-B	Problem Solving Methods in AI	3.0
IS 755-C	Artificial Agents	3.0
IS 770-D	Machine Learning	3.0

Breadth		
CT 780-A	Robotics	3.0
Electives		
CT 572-X	Computer Control of Machines and Processes	<u>3.0</u>
		30.0

Artificial Intelligence Emphasis

Course Number	Title	Credits
Core		
AD 720-R	Analysis of Algorithms	3.0
CA 720-H	Architecture of Advanced Systems	4.0
CM 710-R	Formal Languages and Computation Theory	3.0
IS 710-R	Artificial Intelligence Concepts	3.0
SE 710-F	Software Engineering I	3.0
Depth		
IS 710-B	Problem Solving Methods in AI	3.0
IS 720-R	Expert Systems	3.0
IS 730-N	Logic Programming	3.0
Breadth		
MA 520-B	Applied Probability and Statistics	3.0
Elective		
IS 770-D	Machine Learning	<u>3.0</u>
		31.0

Bridging Courses

Bridging courses are available for students whose background is deficient in any way. The undergraduate bridging areas available for students entering graduate study in Computer Science are:

BC 10-19	Fundamentals of Computer Engineering
BC 30-39	Data Structures
BC 80-89	Discrete Structures

Bridging courses are not available for graduate credit.

Fast Track Certificate Program

NTU offers an accelerated academic program of six undergraduate computer science courses designed to help students stay on track in their careers. The Fast Track program offers focused, in-depth courses to learn core computer science knowledge to help in the transition into computer science or software engineering.

Instructors have condensed course material to specifically meet the needs of students working in high-tech fields. Each course is 1.6 credits and is offered for Audit or Pass/Fail only. Course notes are provided as well as optional homework assignments and exams. A teaching assistant is available via e-mail and phone to answer questions and help with assignments.

The Fast Track courses are:

FT 001-NT - Computer Organization

FT 002-NT - Algorithms and Data Structures

FT 003-NT - Computer Programming Languages

FT 004-NT - Foundations of Computer Sciences: Formal Languages and Automata

FT 005-NT - Software Engineering

FT 006-NT - Operating Systems

NTU does not grant academic credit for these courses, but successful completion will enable a student with an unrelated bachelor's degree to better prepare for graduate-level coursework in NTU's Computer Science or Software Engineering master's programs. Students are not required to take all six courses, but completion of the six course series will earn a student a Certificate of Completion in "Principles of Computer Science."

Program of Study Plan (PSP)

Admitted students should submit a Program of Study Plan (PSP) to NTU upon completion of six semester credit hours. Failure to submit a Program of Study Plan increases the possibility of completing courses not applicable to a degree program or in many cases leads to duplication of courses. Although NTU cannot guarantee preferred course availability in any given term, Program of Study Plans provide substantial information as a guide for course selection from partner universities. It may be necessary to revise approved program of study plans when course availability does not comply with student needs. The PSP form should be submitted to a student's advisor via the NTU web site. The form is located within the "Community" portion of the NTU web site, under "Academic Programs."

M. S. in Electrical Engineering

Program Description

The NTU program in Electrical Engineering is designed to provide students with the technical background for analysis, design, development, operation or research on electrical or electronic systems. Subject areas include communications, control, electric power, electromagnetics, electronics, signal processing, integrated circuits and many other important subareas of electrical engineering. Because of the wide range of subject matter, there are no specific required courses. Each student designs a course program that fulfills his/her needs and long term goals within the context of a broad set of curriculum requirements and with the approval of an advisor.

The Master of Science Degree program in Electrical Engineering consists of 33 graduate semester credits as approved by the student's academic advisor. The courses in the program are grouped into seven course areas:

Circuit Theory (CR)	Electromagnetics (EM)
Communications (CC)	Microelectronics (IC)
Control Theory (CT)	Power Systems (PS)
Electrical Properties (EP)	

The courses are also categorized in terms of their role in individual student programs as Depth, Breadth and Elective courses. The curriculum features substantial student choices in each of these three categories, thereby enabling students to tailor their programs of study to meet their specific needs and fulfill their particular aspirations. Completion of the curriculum requires approximately one and one-half years of full-time graduate study. Students enrolled through the National Technological University whose work schedules prevent full-time study may fulfill the requirements in five years or less by registering for two or three courses each year.

Fully qualified applicants should have completed a one-year, junior-level sequence of courses in circuits (e.g., BE 311, 312) and junior-level semester courses in Electronics (e.g., BE 322), Systems (e.g., BE 341), Electromagnetics (e.g., BE 330) and Digital Design (e.g., BC 320). Applicants without Electrical Engineering undergraduate degrees will be required to complete Bridging courses. See the section titled *Admission* for specific requirements for admission.

Program Manual

Additional information and help in planning your EE program is contained in the EE Academic Program Manual. Contact admissions@ntu.edu for a copy.

Curricular Requirements

A total of 33 semester credits, including a Depth minimum of 18 credits and a Breadth minimum of nine credits, are required for graduation.

Depth Requirement

The Depth requirement represents the focus area of the student's program and will normally be met by 18 credits of courses selected from one of the course areas (CR, CC, CT, EP, EM, IC or PS) within Electrical Engineering.

Although the Depth requirement will usually be satisfied by courses from a single course area, exceptions are permitted with advisor approval. It should be noted that not all courses in the course areas are accepted as Depth. The student is advised to refer to the listing of the individual courses via electronic access and/or current class schedules to ensure that the letter "D" is included in the brackets following the designation of EE; e.g., EE [D] implies the course is acceptable to meet this requirement.

The Breadth requirement is satisfied by at least nine credits outside of the Depth course area. These may be from the other course areas in Electrical Engineering or from the following course areas outside of Electrical Engineering; a minimum of two course areas must be represented. In order to meet this requirement, the student must ensure that the letter "B" appears in the brackets following the designation of EE, e.g., EE [B] for these courses.

AD	Algorithms and Data Structures	ME	Mechanical Engineering
CA	Computer Architecture	MP	Mechanical Properties
CH	Chemical Engineering	MS	Materials Science
CM	Computational Methods and Theory	PD	Product & Process Design
CS	Computer Software	QM	Quantitative Methods
DS	Digital Systems	SE	Software Engineering
IS	Intelligent Systems	SP	Manufacturing Systems
MA	Mathematics	ST	Software Techniques
MC	Materials Characterization	SY	Systems Engineering

Most students will complete their Breadth program by taking courses in the areas identified above. Students wishing to take Breadth courses from any other NTU course area should consult their advisor.

Elective Requirement

The remaining portion of the program (six credits) are Elective credits. To meet this requirement, only courses with an "E" in the EE [] bracket line are acceptable as Elective courses. Students wishing to take Elective courses which do not have an "E" in the EE bracket line should consult their advisor.

Thesis

National Technological University offers a non-thesis Master of Science Degree program in Electrical Engineering. However, when desirable and appropriate, as determined by the student in consultation with his/her NTU advisor, a thesis option is available (see *MS Thesis Guidelines* section of this *Bulletin*).

Scheduled Course Sequences

NTU's Scheduled Course Sequences (SCS) in Electrical Engineering are groups of two or more courses in a specific area from a single participating university or from a cooperating group of participating universities which are offered on a prearranged regular schedule and represent a focus area of the individual university or university group. In many cases, the basic prerequisite course(s) required to take courses in a sequence is offered regularly through NTU by a number of schools and is not part of the scheduled sequence.

The sequences undergo a rigorous review process which includes evaluation of the courses, course faculty and special facilities available at the participating university. Many of the sequences originate within a strong research and educational program component involving a large group of faculty members working together to form the course sequence.

The Scheduled Course Sequence program provides NTU students with a regularly scheduled group of high quality courses which will enhance their ability to plan their academic programs with the assurance that courses will be available as scheduled. In the event a participating SCS university is unable to offer a SCS course on schedule, NTU will make every effort to schedule an equivalent course so students can continue their planned programs.

Scheduled Course Sequence Listing

Digital Signal Processing Georgia Institute of Technology

Prerequisite Course: CC 560 or CC 760

Sequence Courses

CC 750-J	Digital Processing of Speech Signals	Every Spring Semester
CC 763-J	Advanced Digital Signal Processing	Every Fall Semester
CC 764-J	Statistical Digital Signal Processing And Modeling	Every Spring Semester
CC 766-J	Adaptive Filtering	Every Fall Semester
CC 770-J	Digital Image Processing	Every Fall Semester

Electronic Packaging The University of Arizona

Sequence Courses

IC 701-E	Electronic Packaging Principles	Every Spring
IC 702-E	Electronic Packaging Design	Fall, even numbered yrs
IC 503-E	Microelectronic Packaging Materials	Spring

Microwave Engineering University of Massachusetts at Amherst

Sequence Courses

EM 530-A	Microwave Engineering I	Every Fall
EM 531-A	Microwave Engineering II	Every Spring
EM 736-A	Active Microwave Circuits	Every Spring

Power Electronics and Electric Drives University of Wisconsin - Madison University of Colorado at Boulder

Prerequisite Course: PS 541

Sequence Courses

PS 530-X	Introduction to Electric Drive Systems	Every Fall
PS 734-X	Dynamics and Control of AC Drives	Every Spring
PS 745-CU	Power Electronics I	Every Fall

Example Programs of Study

The following examples illustrate the flexibility available to students wishing to specialize in specific areas of Electrical Engineering. Some of the examples list more than the required minimum in the Depth and Breadth areas to illustrate the use of 2, 2.7 and 4 credit courses in the program. If more than the required minimum is selected in the Depth or Breadth areas, the credits in the Elective area are correspondingly reduced.

Control Theory Emphasis

Course Number*	Example Title	Credits
Depth		
CC 714-	Stochastic Processes	3.0
CC 730-	Detection and Estimation Theory	3.0
CT 712-	Linear Systems Theory	3.0
CT 520-	Feedback Control Systems	3.0
CT 741-	Nonlinear Systems and Control	3.0
CT 770-	Digital Control Systems	2.7
NT 700-799**	Special Topics	<u>0.3</u>
		18.0

Breadth

CA 512-	Computer Architecture	3.0
IS 790-	Neural Network Design	3.0
ME 510- or 710-	Advanced Dynamics	<u>3.0</u>
		9.0

Elective 6.0 credits to produce a minimum program total of 33.0

Electromagnetics Emphasis

Course Number*	Example Title	Credits
Depth		
EM 711-	Introduction to Fourier Optics	3.0
EM 713-	Fiber Optics	3.0
EM 714-	Introduction to Optical Design	3.0
EM 530-	Microwave Engineering	3.0
EM 732-	Active Microwave Circuits	3.0
EM 740-	Electromagnetic Theory	<u>3.0</u>
		18.0
Breadth		
CC 714-	Stochastic Processes	3.0
CC 560- or 760-	Digital Signal Processing	3.0
CT 712-	Linear Systems Theory	<u>3.0</u>
		9.0

Elective 6.0 credits to produce a minimum program total of 33.0

Signal Processing Emphasis

Course Number*	Example Title	Credits
Depth		
CC 714-	Stochastic Processes	3.0
CC 730-	Detection and Estimation Theory	3.0
CC 750-	Digital Processing of Speech Signals	3.0
CC 760-	Digital Signal Processing	3.0
CC 770-	Digital Image Processing	3.0
EM 736-	Microwave Electronics	<u>3.0</u>
		18.0

Breadth

CS 740-	Operating Systems	3.0
DS 770-	Digital Systems Testing	3.0
IC 540-	Digital Integrated Circuits and Systems	<u>3.0</u>
		9.0

Elective 6.0 credits to produce a minimum program total of 33.0

Wireless Communication Emphasis

Course Number*	Example Title	Credits
Depth		
CC 718-	Wireless Communication Networks	3.0
EM 535-	Radio Frequency Design for Wireless	3.0
EM 750-	Antenna Theory and Design	3.0
EM 740-	Electromagnetic Theory	3.0
EM 751-	Phased Arrays	3.0
CC 730-	Detection and Estimation Theory	<u>3.0</u>
		18.0

Breadth

CA 712-	Digital Systems Design	3.0
CC 714-	Random Variables and Signals	3.0
IC 742-	VLSI Design Principles	<u>3.0</u>
		9.0

Elective 6.0 credits to produce a minimum program total of 33.0

Integrated Circuits Emphasis

Course Number*	Example Title	Credits
Depth		
IC 701-	Electronic Packaging Principles	3.0
IC 721-	Semiconductor Device Theory I	3.0

IC 722-	Semiconductor Device Theory II	3.0
IC 730-	IC Technology and Fabrication	3.0
IC 742-	VLSI Design I	3.0
IC 743-	VLSI Design II	<u>3.0</u>
		18.0

Breadth

CA 712-	Digital Systems Design	3.0
EP 525-	Materials Science and Processing of Semiconductor Devices	3.0
CC 560-	Digital Signal Processing	<u>3.0</u>
		9.0

Elective 6.0 credits to produce a minimum program total of 33.0

*The suffix designating the source institution need not appear in a *Program of Study Plan*.

**Professional Development courses may be used to obtain partial credit toward a degree up to 0.5 credits (see Special Topics Courses in the *Courses of Instruction* section of this *Bulletin*).

Bridging Courses

Bridging courses are available for students whose background is deficient in any way. The undergraduate bridging areas available for students entering graduate study in Electrical Engineering are:

BE 10-19	Circuits
BE 20-29	Electronics
BE 30-39	Electromagnetics
BE 40-59	Systems
BC 20-29	Digital Logic Design

Bridging courses are not available for graduate credit.

Program of Study Plan (PSP)

Admitted students should submit a Program of Study Plan (PSP) to NTU upon completion of six semester credit hours. Failure to submit a Program of Study Plan increases the possibility of completing courses not applicable to a degree program or in many cases leads to duplication of courses. Although NTU cannot guarantee preferred course availability in any given term, Program of Study Plans provide substantial information as a guide for course selection from partner universities. It may be necessary to revise approved program of study plans when course availability does not comply with student needs. The PSP form should be submitted to a student's advisor via the NTU web site. The form is located within the "Community" portion of the NTU web site, under "Academic Programs."

M. S. in Engineering Management

Program Description

The Master of Science Degree program in Engineering Management has been designed with significant industry input to provide a broad technical management educational experience for engineers and other scientific professionals. It requires some full-time work experience to fully profit from many of the courses. The program is especially suited for engineers just moving into their first management position or, with proper advising and course selection, can help those who already have some management experience.

Several course options are available but all require some technical tools - probability and statistics, operations research, accounting and/or finance, project management and others. A final three-hour capstone project requires students to integrate and synthesize their experiences. Students can also take their electives in a management or technical area to best fit their personal goals and objectives.

The program consists of a minimum of 33 semester credits distributed among two broad categories of courses: Core (including a Capstone Project course) and Elective. In order to meet the Core requirement, the student must ensure that the letter "C" is included in the brackets following the designation of EM; e.g., EM [C] implies the course is acceptable to meet this requirement and approved by his/her advisor. In order to meet the Elective requirement, the student must ensure that the letter "E" appears in the brackets following the designation EM and approved by his/her advisor. This allows further in-depth study in any Core or technical area. Students enrolled through National Technological University could fulfill the degree requirements in two and one-half years by registering for at least four courses per year and completing the Capstone Project as an additional course in the final year. Students should complete the degree within five years by taking two to three courses per year.

Applicants are expected to have a minimum of two years work experience in an engineering environment. The specific eligibility requirements for admission into the Engineering Management program are identified in the section of this *Bulletin* titled *Admission*.

Curricular Requirements

Because applicants are admitted from any engineering or scientific undergraduate major course of study, their programs will have to be individually planned. A high degree of flexibility is possible.

Core Requirements

MA 20-39	Probability and Statistics
MB 10-19	Management for Engineers
QM 10-19	Operations Research

Courses Required

1
1
1

One course from the following:	1
MB 20-29	Organizational Behavior/Personnel
MB 30-39	Human Relations
MB 40-49	Industrial Psychology
One course from the following:	1
EF 10-19	Managerial or Cost Accounting
EF 30-39	Engineering Economics
One course from the following:	1
EF 20-29	Financial Management
TO 30-39	Marketing Management/Industrial Marketing
One course from the following:	1
TO 60-69	Project Management
TO 80-89	Production Management
One Capstone Course:	1
MB 80-89	Capstone Projects

Courses not taken to meet Core requirements may be chosen as Electives.

Typical Elective Course Categories 3

EF 40-49	Managerial Economics
MB 50-59	Law
MB 60-69	Emerging Issues in Technical Management
MB 90-99	Special Topics
MG 10-89	Business Administration
QM 20-59	Systems Management and Quantitative Management Engineering
SP 10-19	Modeling and Analysis
SP 20-29	Production Control and Scheduling
SP 30-39	Materials Management and Logistics
ST 30-39	Simulation
SY 10-89	Systems Engineering
TO 10-19	Information Systems
TO 20-29	Forecasting
TO 40-49	Human Factors
TO 50-59	Industrial Engineering
TO 70-79	Quality Control and Reliability

Courses from other program areas as approved by advisor.

Total Courses 11

Comments on Electives and Capstone Project

In addition to the eight Core courses, students, with the guidance of their advisors, must select sufficient additional Core or Elective courses to total 33 credits. The Elective segment of the curriculum permits students to customize their program through a coherent but individualized sequence of courses which may build upon the Core areas, their prior college major, and/or the special interests of the students or their employers.

In the last semester of the program, or after all other Core courses and Electives have been met, students are to enroll in the Capstone Course (MB 780) which involves conducting a project and writing a report which is relevant to the practice of engineering management for which three NTU credits will be given. This assignment is to be negotiated with, and carried out under the direction of a qualified faculty person. This study might involve the role of government, entrepreneurship, and/or professional ethics. Sponsors of enrollees may be able to suggest projects of importance. See both the NTU web site or the *Class Schedule* each semester for more details.

Example Program of Study

The following example illustrates the flexibility available to students wishing to specialize in specific areas of engineering management.

Course Number	Title	Credits
Core		
MA 520-A	Probability and Statistics for Engineers	3.0
MB 710-N	Management for Engineers	3.0
QM 710-NJ	Management Science	3.0
MB 721-OD	Sociotechnical Systems Design	3.0
EF 710-N	Engineering Accounting	3.0
EF 720-T	Advanced Financial Management	3.0
TO 760-AH	Engineering Project Management	3.0

Capstone

MB 780-W	Engineering Management Capstone Project	3.0
----------	---	-----

Electives

CA 512-B	Computer Systems Architecture	3.0
TO 570-O	Industrial Quality Control	3.0
SE 710-R	Software Engineering	<u>3.0</u>
		33.0

Program of Study Plan (PSP)

Admitted students should submit a Program of Study Plan (PSP) to NTU upon completion of six semester credit hours. Failure to submit a Program of Study Plan increases the possibility of completing courses not applicable to a degree program or in many cases leads to duplication of courses. Although NTU cannot guarantee preferred course availability in any given term, Program of Study Plans provide substantial information as a guide for course selection from partner universities. It may be necessary to revise approved program of study plans when course availability does not comply with student needs. The PSP form should be submitted to a student's advisor via the NTU web site. The form is located within the "Community" portion of the NTU web site, under "Academic Programs."

M. S. in Environmental Systems Management

Program Description

Many sites in this country contain a myriad of environmental or hazardous wastes, ranging from industrial plants and municipal landfills to government nuclear facilities. All of these sites pose some level of threat to human health and ecological impact. These health and eco-system hazards include water contamination, air pollution, food supply poisoning, and species extinction.

Good management of such a critical, technical and complicated task is essential to successful outcomes of cleanup efforts and appropriate pollution prevention technologies. Managers, well versed in the technical aspects, are needed from among those who have the scientific and engineering skills to do the job, but have not developed appropriate management skills, or appropriate up-to-date knowledge in the subject matter.

Toward that end, the M.S. Program in Environmental Systems Management allows students to further develop their knowledge in the subjects of environmental systems, waste systems, prevention technologies, and management skills.

The Master of Science Degree program in Environmental Systems Management consists of 30 semester credit hours chosen from the Core, Depth, and Elective areas. Completion of the curriculum should require one and one-half to two years of full-time graduate study. Students enrolled through National Technological University should expect to fulfill requirements in two to four years of part-time study, depending on the course load taken during that time.

The program is designed for professionals with degrees in engineering or the "hard sciences" (e.g. biology, chemistry, physics, geology). Although not a requirement for admission to the program, the student is expected to have completed college mathematics courses through ordinary differential equations. Within a year after acceptance into the program, students lacking this background will be required to have completed courses to eliminate this deficiency.

The specific eligibility requirements for admission into the Environmental Systems Management program are identified in the section of this *Bulletin* titled *Admission*.

Curricular Requirements

A total of 30 semester credit hours are required for the Environmental Systems Management Degree.

- ! Core area requires four courses (12 semester credits) including one course (3 credits) on basic principles of Environmental Systems Management, one course (3 credits) on Systems Engineering, and two courses (6 credits) selected from the following three areas: Laws and Regulations, Risk Assessment, Fate and Transport of Wastes (no more than one course from any area is permitted).
- ! Depth areas covering the management and technical subjects are required for a total of 12 semester credit hours. The 12 credits must come from the following:

The Technology area (9 credits) with at least three credits from each of the Treatment sub-areas and the Source Reduction/Minimization sub-area.

The Management area with MB designation (3 credits)

Advisors may authorize substitutions.

- ! Elective courses may be chosen from a variety of support areas.

Students are encouraged to contact their advisor to discuss their program of study. Also, new courses may be added from time to time.

Core Requirement (total of 12 credits)

One course from the following area:

Environmental Systems Management (EV 05-09)

EV 706-NJ Pollution Prevention

EV 506-TN Industrial Pollution Prevention

EV 507-N Integrated Waste Management

One course from the following area:

Systems Engineering (QM or SY designation)

QM 750-B Systems Engineering Principles and Practices

SY 710-E The Systems Engineering Process

SY 710-SC Systems Engineering Methodology

SY 711-E The Systems Engineering Process II

SY 720-U Systems Engineering and Analysis

SY 521-E Simulation Modeling and Analysis

SY 562-N Systems Integration and Test

Two courses selected from the following three areas (no more than one course from any area is permitted):

Laws and Regulations (EV 10-14)

EV 711-NJ Legal Aspects in Environmental Engineering

EV 512-N Environmental and Hazardous Waste Laws

Risk Assessment (EV 20-24)

EV 521-N Risk Assessment and Health Effects

EV 721-P Environmental Exposure and Risk Analysis

EV 721-S Engineering Risk Assessment for Hazardous Waste Evaluations

Fate and Transport (EV 25-29)

EV 726-N Fate and Transport of Contaminants

EV 727-NS Fate and Transport of Environmental Contaminants

The student is advised to refer to the listing of individual courses via electronic access and/or current class schedules to ensure that the letter "C" is included in the brackets following the designation of ESM; e.g., ESM [C] implies the course is acceptable to meet this requirement.

Depth Requirement (12 credits from the following two areas)

Technology (choose nine credits with at least three credits from each of the two sub-areas under Technology)

Treatment Sub-area: (EV 40-45)

EV 741-N Physical and Chemical Treatment Methods

EV 741-NJ Indus. Waste Control: Physical and Chem.

- EV 541-TN Physiochemical Unit Processes
- EV 742-N Biological Waste Treatment and Incineration
- EV 742-NJ Industrial Waste Control: Biology Treatment
- EV 542-P Design of Water and Wastewater Facilities
- EV 744-B Control of Combustion Generated Air Pollution
- EV 744-CU Air Pollution Control Engineering
- EV 744-NJ Industrial Gas Cleaning
- EV 544-NS Air Pollution Control System Design
- EV 544-P Air Pollution Control
- EV 744-S Air Pollution Control
- EV 544-TN Air Quality Management/Pollution Control

Source Reduction/Minimization Sub-area: (PD designation)

- PD 580-E Microelectronics Manufacturing and the Environment
- PD 781-W Design for Environment
- PD 782-NJ Multi-Lifecycle Engineering or CH 568-P Life Style Concepts for the Environment

Management (choose three credits with the MB 10-19 designation)

- MB 712-AH Implementation of Technology
- MB 512-I Management of Technology
- MB 713-B Technology and Technology Assessment
- MB 713-J Analysis of Emerging Technologies
- MB 714-B Engineering and Technology Planning
- MB 716-B Technology Planning

In order to meet this requirement, the student must ensure that the letter “D” appears in the brackets following the designation of ESM [] for these courses.

Elective Requirement (six credits)

To meet the Elective requirement, the courses must have the designation [E] in the ESM brackets following the course title and institution. Selection of Elective courses should be made in consultation with the faculty advisor.

Suggested Electives:

Chemical Engineering (CH)

- CH 731-NJ Kinetics of Reactions and Reactor Design
- CH 731-P Chemical Reaction Engineering
- CH 732-X Kinetics and Catalysis
- CH 740-K Statistical Quality and Process Control
- CH 741-K Advanced Process Control
- CH 741-O Advanced Chemical Process Control
- CH 541-W Principles of Process Dynamics and Control
- CH 742-O Stagewise Operations
- CH 565-P Chemical Processing of Electronic Materials

Mechanical Engineering (ME)

- ME 528-M Multidisciplinary Design Optimization
- ME 550-DE Combustion

Systems Engineering (QM or SY designation)

- QM 533-NS Large Scale Systems Engineering
- SY 710-SC Systems Engineering Methodology
- SY 521-E Simulation Modeling and Analysis
- SY 521-N Systems Analysis Methods
- SY 721-U Applied Systems Engineering
- SY 540-N Systems Optimization and Analysis

Water Applications (EV 50-59)

- EV 752-N Groundwater Hydrology and Contamination
- EV 552-NM Ground Water Engineering
- EV 554-NS Natural Water Pollution Control

Air Applications (EV 60-64)

- EV 762-N Air Pollution Mgmt, Regulations and Public Policy
- EV 763-N Air Quality Modeling
- EV 563-P Air Quality

Land Applications (EV 65-69)

- EV 565-P Engineering Principles of Solid Waste Management

Hazardous Waste (EV 75-79)

- EV 776-CU Hazardous and Industrial Waste Management
- EV 577-N Sources and Nature of Hazardous Waste

Science/Engineering (EV 80-89)

- EV 581-N Environmental Chemistry and Biology
- EV 581-NS Chemical Theories of Environmental Engineering
- EV 583-P Physical Principles in Environmental Engineering
- EV 584-NS Soil Microbiology
- EV 785-N Introduction to Environmental Toxicology
- EV 585-NS Environmental Toxicology

Special Topics (EV 90-94)

- EV 791-R Environmental Policy
- EV 792-NJ Environmental Systems Issues
- EV 794-NT Environmental Systems Management Special Topics

Example Programs of Study

The following examples illustrate the flexibility available to students wishing to specialize in specific areas of Environmental Systems Management.

Example I

Course No.	Title	Credits
Core		
EV 506-TN	Industrial Pollution Prevention	3.0
SY 720-U	Systems Engineering and Analysis	3.0
EV 521-N	Risk Assessment and Health Effects	3.0
EV 726-N	Fate and Transport of Contaminants	3.0
Depth (Management Area)		
MB 712-AH	Implementation of Technology	3.0
Depth (Treatment Sub-area)		
EV 741-N	Physical and Chemical Waste Treatment	3.0
EV 742-NJ	Industrial Waste Control: Biological Treatment	3.0

Depth (Source Reduction/Minimization Sub-area)		
PD 580-E	Microelectronics Manufacturing and the Environment	3.0
Elective		
EV 585-NS	Environmental Toxicology	3.0
EV 577-N	Sources and Nature of Hazardous Waste	<u>3.0</u>
		30.0

Example II

Course No.	Title	Credits
Core		
EV 706-NJ	Pollution Prevention	3.0
SY 710-E	The System Engineering Process	3.0
EV 512-N	Environmental and Hazardous Waste Laws	3.0
EV 727-NS	Fate and Transport of Environmental Contaminants	3.0
Depth (Management Area)		
MB 714-B	Engineering and Technology Planning	3.0
Depth (Treatment Sub-area)		
EV 541-TN	Physiochemical Unit Processes	3.0
Depth (Source Reduction/Minimization Sub-area)		
PD 781-W	Design for Environment	3.0
PD 782-NJ	Multi-Lifecycle Engineering	3.0
Elective		
QM 533-NS	Large Scale Systems Engineering	3.0
EV 792-NJ	Environmental Systems Issues	<u>3.0</u>
		30.0

Program of Study Plan (PSP)

Admitted students should submit a Program of Study Plan (PSP) to NTU upon completion of six semester credit hours. Failure to submit a Program of Study Plan increases the possibility of completing courses not applicable to a degree program or in many cases leads to duplication of courses. Although NTU cannot guarantee preferred course availability in any given term, Program of Study Plans provide substantial information as a guide for course selection from partner universities. It may be necessary to revise approved program of study plans when course availability does not comply with student needs. The PSP form should be submitted to a student's advisor via the NTU web site. The form is located within the "Community" portion of the NTU web site, under "Academic Programs."

M. S. in Management of Technology

Program Description

The Management of Technology (MOT) program prepares technical professionals for strategic management responsibilities in globally competitive firms and industries. It is an interdisciplinary program that draws upon knowledge from engineering, science, business, economics and management to address the issues of creating and sustaining competitive advantage through technological innovation. MOT deals with the creation of technological opportunities through scientific research and development, the commercial development and deployment of innovative products, processes and services, and the strategic positioning of innovative firms to generate and capture wealth, all in the context of increasing global competition, and rapidly expanding access to scientific and technical knowledge. This part-time, two-year interdisciplinary program of instruction enables technical professionals and managers with appropriate undergraduate preparation to complete the requirements without having to undertake an extended leave of absence from the workplace.

The NTU MOT Curriculum Committee designed this program to address the competitive issues as defined in the 1987 National Research Council Report, *Management of Technology: The Hidden Competitive Advantage*. This report was developed in response to the major problems facing technology-based firms which are subject to increasing pressure from domestic and international competitors. This MOT MS degree program helps both individual employees and organizations expand their understanding of these issues. NTU calls upon the nation's leading academic instructors and business experts and government to participate in this instructional program.

The eligibility requirements for admission to the Management of Technology program are specified in the section of this *Bulletin* titled *Admission*.

Curricular Requirements

The Management of Technology program consists of 36 credits distributed over a wide range of subjects and disciplines, including economics, accounting, manufacturing, finance, marketing and R&D management, public policy, and international management.

Students Progress as a Group - Students take the prescribed curriculum together in a lock step manner and are able to complete their degree requirements in two years. New class begins each August.

Delivery of Courses - 27 credits - Some courses are delivered via satellite television while others are delivered via the Internet. Students have access to an interactive telephone bridge.

Residencies - 6 credits - The six residencies are an integral part of the academic program and all students are required to attend. The purpose is to supplement and reinforce materials presented during the previous semester's courses; to provide transitions to new material being presented in the

subsequent semester; to provide opportunities for the students to develop their field research projects; and to present special materials and prominent guest speakers around the residency themes. Additionally, a three-credit academic course, MT 738, is presented live during the residencies.

Five of the residencies are up to one week in length (early January, mid-May and mid-August), held at various locations. All students are required to attend the following residency courses:

- MT 910 Program Foundation and Introduction
- MT 920 Field Project Research Methods
- MT 930-960 Topics include:
 - International Study Mission
 - Federal Laboratory System
 - International Competitiveness and Trade Issues
 - Product Development Cycles

International Study Mission -All students participate in an International Study mission of approximately two weeks (alternate May residency period). The International Study Mission residency includes visits to international companies in the Pacific Rim, Europe or Latin America. During the visits, meetings are held with senior technical managers in host companies to discuss management issues and practices of mutual interest. Meetings are also held with policy makers from various government agencies.

Field Research Project - 3 credits - All students work on an individual research project during the program. This project may focus on a specific work-related problem relevant to the student's current or planned job responsibilities. In doing this project, students learn about research methodology in the management/social/ behavioral sciences as well as in the subject matter which is the focus in their research. The field research project begins early in the program, with stages clearly identified, and progress reports during residencies. The research project requires a final report and oral presentation.

Optional Items

Resumes and letters of support from supervisors may be submitted in support of the formal application and to provide a clearer understanding of the applicant's academic and experiential backgrounds and objectives.

Program of Study

<u>Course Number</u>	<u>Title</u>
MT 710	Technology and Economic Analysis
MT 720	Competitive Advantage and Operations Strategy
MT 731	Management of Research and Development
MT 732	Activity-Based Accounting and Financial Decision Making
MT 738	Managing and Leading Technical People (during residencies)
MT 750	Strategic Management of Technological Innovation

MT 760 Scientific and Technical Institutions in a Global
Context
MT 761 Analysis of Emerging Technologies
MT 712 Field Research Project - Independent Study
MT 910-60 Six Residencies

Electives

Choose one from the following:

MT 741 Managing New Product Development
TO 735-VU Marketing of Advanced Technologies

and choose one from the following:

MT 751 Total Quality Management
TO 512-P E-Commerce Technology
MG 723-A Supply Chain Management
TO 560-GW Introduction to Project Management

Tuition and Fees

- ! \$38,400 for the 6-term program for students starting Fall 2001
- ! All travel, hotel and meal expenses associated with residencies, International Study Mission and Field Research Project oral presentation are additional.
- ! \$50 non-refundable application fee

NOTE: Please contact the Secretary to the NTU Chief Academic Officer for details on the program - 800-582-9976.

“The Management of Technology (MOT) curriculum provided me with a broad perspective and taught me how to think more strategically. The MOT program was an experience of a lifetime. On behalf of my teammates, we would like to thank NTU for offering this rewarding program. Thanks to our outstanding professors for their well developed curriculum, their inspired teaching and their dedication to us as MOT students. And thanks to our individual companies (Hewlett Packard, IBM, the US Air Force, and Xerox) for this wonderful opportunity.”

- MOT graduate

M. S. in Manufacturing Systems Engineering

Program Description

The competitiveness of a modern manufacturing firm requires an interdisciplinary viewpoint of its employees, one that can be gained through completion of a MS degree in NTU's Manufacturing Systems Engineering (MSE) program. The MSE degree program has been designed to educate the engineer who will be most capable of contributing to the solution of the many broad problems in information intensive programs. The program's objective is to provide a graduate level degree for engineers who will work in the design, implementation, operation, and management of information based manufacturing systems. The students in this program learn technical skills that are typically not taught in undergraduate courses, and management skills essential to keep industry moving in the right direction. The MSE graduates will receive an interdisciplinary education that presents their employers an alternative to the hiring of engineers with specialized degrees for manufacturing related positions. Students desiring to have a manufacturing focus in their degree program narrower than that of the MSE program should consult the Special Majors section of this *Bulletin*.

Completion of the curriculum requires approximately one and one-half years of full time graduate study. Students enrolled through National Technological University should expect to fulfill the requirements in three to five years of part time study, depending on the course load they choose.

The specific eligibility requirements for admission into the Manufacturing Systems Engineering program are identified in the section of this *Bulletin* titled *Admission*.

Curricular Requirements

Each student must complete a minimum of 33 equivalent semester credits including at least 17 credits in the Core, at least 5 credits each in Breadth and Depth areas, and additional Elective credits to complete the minimum of 33.

Core Requirement

Each student must select at least one Core course in each of the six areas listed below. It should be noted that not all courses in the following areas are accepted as Core courses. The student is advised to refer to the listing of the individual courses via electronic access and/or current class schedules to ensure that the letter "C" is included in the brackets following the designation of MSE; e.g., MSE [C] implies the course is acceptable to meet this requirement.

Students with significant prior academic or work experience in one or more of the six MSE core course areas may be able to substitute an Elective course for the Core course in that area. The MSE Curriculum Chair must approve this substitution prior to the student's enrolling in the substitute Elective course.

Design - One course from any of the following Core course categories:

- PD 10-19 Design for Assembly
- PD 20-29 Design for Manufacturability

- PD 30-39 Facility Design and Material Handling
- PD 60-69 Flexible Automation
- PD 70-79 Integration of CAD/CAM/CAE

Modeling - One course from either of the following Core course categories:

- SP 10-19 Modeling and Analysis
- ST 30-39 Simulation

Control - One course from any of the following Core course categories:

- CT 10-19 Linear Systems
- CT 20-29 Feedback Control
- CT 30-39 Stochastic Control
- CT 40-49 Nonlinear Systems
- CT 60-69 Optimal Control
- CT 70-79 Digital Control
- CT 80-89 Robotic Systems
- SP 20-29 Production Control and Scheduling
- SP 50-59 Measurement and Sensing

Management - One course from any of the following Core course categories:

- SP 20-29 Production Control and Scheduling
- SP 30-39 Materials Management and Logistics
- SP 40-49 Strategic Planning
- SP 60-69 Manufacturing Management and Integration
- TO 70-79 Quality Control and Reliability

Information Technology - One course from the following Core course categories:

- AD 10-19 Data Structures
- AD 20-29 Design and Analysis of Algorithms
- CA 60-69 Microcomputers and Embedded Computer Systems
- CS 50-59 Database Systems
- SE 10-19 Software Engineering Methodology
- ST 30-39 Simulation
- ST 50-59 Computer Networks

Manufacturing Processes - One course from any of the following Core course categories:

- IC 30-39 Fabrication and Process Modeling
- PD 40-49 Manufacturing Processes
- PD 50-59 Materials Processing
- PD 80-89 Environmentally Conscious Manufacturing
- PM 30-39 Processing of Polymers

Depth Requirement

At least five credits consisting of at least two additional courses from the same or related areas among those listed below. In order to meet this requirement, the student must ensure that the letter "D" appears in the brackets following the designation of MSE [] for both courses. Individual course descriptions and bracket information are available via electronic access and/or current class schedules.

- AD Algorithms and Data Structures
- CA Computer Architecture
- CS Computer Software
- CT Control Theory
- IS Intelligent Systems
- MP Mechanical Properties
- PD Product and Process Design
- QM Quantitative Methods
- SE Software Engineering
- SP Manufacturing Systems Planning and Control
- ST Software Techniques
- SY Systems Engineering
- TO Technical Operations

Breadth Requirement

At least five credits consisting of one course in each of two of the areas listed below:

- | | |
|-----------------------------------|--------------------------------|
| AD Algorithms and Data Structures | MA Mathematics |
| CA Computer Architecture | ME Mechanical Engineering |
| CC Communications | MG Business and Administration |
| CM Comp. Methods and Theory | MP Mechanical Properties |
| CS Computer Software | MS Materials Science |
| EA Emerging Areas | PM Polymeric Materials |
| EF Economics and Finance | SE Software Engineering |
| EP Electrical Properties | ST Software Techniques |
| IC Integrated Circuits | TO Technical Operations |
| IS Intelligent Systems | |

To meet this requirement, both courses must have the designation "B" in the MSE brackets following the course title and institution.

Elective Requirement

Additional courses having the designation "E" in the MSE brackets must be chosen to bring the total credits to a minimum of 33. Individual course descriptions are available via electronic access and/or current class schedules.

Example Programs of Study

The following examples illustrate the flexibility available to students wishing to specialize in specific areas of Manufacturing Systems Engineering.

Area of Emphasis - Advanced Automation

<u>Course No</u>	<u>Title</u>	<u>Credits</u>
Core		
CA 765-A	Real-Time Systems	3.0
CT 572-X	Computer Control of Machines and Processes	3.0
PD 540-H	Manufacturing Engineering	3.0
PD 570-T	Expert Systems in Manufacturing	3.0
SP 542-N	Manufacturing in a Global Era	3.0
ST 731-F	Simulation Methodology and Applications	3.0

Depth

CT 722-P	Linear Control & Design for Multivariable Systems	3.0
CT 780-X	Advanced Automation and Robotics	3.0

Breadth

AD 510-B	Data Structures	3.0
EF 530-CU	Engineering Economics	3.0

Elective

PD 760-E	Manufacturing Automation	<u>3.0</u>
		33.0

Area of Emphasis - Information Technology

<u>Course Number</u>	<u>Title</u>	<u>Credits</u>
----------------------	--------------	----------------

Core

CS 550-CL	Database Systems	3.0
CT 572-X	Computer Control of Machines and Processes	3.0
PD 540-H	Manufacturing Engineering	3.0
PD 760-E	Manufacturing Automation	3.0
SP 542-N	Manufacturing in a Global Era	3.0
ST 732-E	Object Oriented Simulation/Discrete Event Models	3.0

Depth

CA 760-U	Embedded Computer Systems	3.0
SE 710-B	Software Design and Implementation	3.0

Breadth

EF 530-K	Principles of Engineering Economics	3.0
TO 540-S	Human Factors in Engineering Design	3.0

Elective

QM 750-B	Systems Engineering Principles and Practices	<u>3.0</u>
		33.0

Program of Study Plan (PSP)

Admitted students should submit a Program of Study Plan (PSP) to NTU upon completion of six semester credit hours. Failure to submit a Program of Study Plan increases the possibility of completing courses not applicable to a degree program or in many cases leads to duplication of courses. Although NTU cannot guarantee preferred course availability in any given term, Program of Study Plans provide substantial information as a guide for course selection from partner universities. It may be necessary to revise approved program of study plans when course availability does not comply with student needs. The PSP form should be submitted to a student's advisor via the NTU web site. The form is located within the "Community" portion of the NTU web site, under "Academic Programs."

M. S. in Materials Science and Engineering

Program Description

Materials Science and Engineering is the study of the structure, properties, processing and performance of materials. The field covers the behavior of numerous classes of materials: metals, ceramics, glasses, polymers, electronic materials and composites. The curriculum developed by NTU is intended to accommodate individuals whose background comes from the spectrum identified with Materials Science, Engineering and the Physical Sciences. There are no Core courses required for this program. The large number of elective courses reflects the interdisciplinary nature of the field.

Specific eligibility requirements for admission into the Materials Science and Engineering program are identified in the section of this *Bulletin* titled *Admission*.

Curricular Requirements

Each student must complete a minimum of 33 credits at the graduate level toward earning MS degree in Materials Science and Engineering. Since Materials Science is an interdisciplinary field by nature and attracts students from diverse array of fields, there are no core course requirements toward earning a masters degree. Candidates are required to complete 15 credit hours of Depth courses, designated as MAT [D], 12 credit hours of Breadth courses, designated as MAT [B] and 6 credit hours of Electives, MAT [E]. In general, the courses with numbers CH 61-62, EP 10-49, IC 10-30, MC 10-59, MP 20-59, and MS 11-29 are designated as MAT [B, D, E] and can be applied to any category. The students are expected to demonstrate proficiency in each of the four components of the materials science field, namely: structure, properties, processing and performance. In order to accomplish the proficiency in four components, students are encouraged to choose at least one course from each of the following categories:

Processing:	MS 10-19	General Materials Science
	MS 20-29	Thermodynamics and Kinetics
	MP 50-59	Deformation Processing
Structure:	MS 50-59	Electronic, Atomic and Molecular Arrangements
	MC 10-59	Materials Characterization
	PM 20-49	Polymeric Materials
Properties:	EP 10-49	Electrical Properties
	MP 10-49	Mechanical Properties
Performance:	MC 60-69	Non-Destructive Testing
	MS 30-39	Materials Degradation

Students are encouraged to discuss their interests and career goals with their advisor before preparing their Program of Study Plan (PSP).

Materials Science and Engineering curriculum offers courses in a number of concentrated areas such as:

- Mechanical Aspects of Materials
- Electrical and Physical Aspects of Materials
- Chemical Aspects and Polymeric Materials
- Microanalysis and Characterization of Materials
- Processing of Materials

The student may elect – with the help of his/her advisor – to tailor his program with emphasis on any of these areas. To provide an additional flexibility, the student may choose a three-credit project course. This course will provide an opportunity for the student to study a special topic that is not available through regular course offerings. The project is proposed by the student in consultation with a designated NTU faculty who also grades the project.

Thesis

National Technological University offers a non-thesis Master of Science Degree program in Materials Science and Engineering. However, when desirable and appropriate, as determined by the student in consultation with his/her academic advisor, a thesis, constituting a maximum of six credits, may be substituted for the Elective course requirements (see *MS Thesis Guidelines* section of this *Bulletin*).

Bridging Courses

Bridging courses are available to satisfy background deficiencies. The undergraduate bridging areas offered for students entering graduate study in Materials Science and Engineering are:

- BR 10-19 Physics
- BR 20-29 Chemistry
- BR 40-49 Materials Science and Engineering

The bridging courses are not available for graduate credit.

Examples of Programs of Study

I. Area of Emphasis: Mechanical Properties (also suitable for students with Mechanical or Industrial Engineering background)

Course Number	Title	Credits
Depth		
MP 724-P	Mechanical Behavior of Engineering Materials	3.0
MP 530-B	Deformation of Engineering Materials	3.0
MP 721-Y	Finite Element Analysis I	2.0
MP 730-Y	Introduction to Fracture Mechanics	2.0
MP 731-Y	Advanced Theory of Fracture Mechanics	2.0
MP 741-P	Mechanics of Composite Materials	3.0

Breadth

MC 720-P	Scanning Electron Microscopy	3.0
MC 751-P	Elements of Crystallography and Diffusion	3.0
MC 560-U	Principles of Non-Destructive Testing	3.0
MS 790-U	Advanced Materials Experiments	3.0

Electives

MA 720-P	Experimental Statistics for Engineers	3.0
MB 710-N	Management for Engineers	<u>3.0</u>
		33.0

II. Area of Emphasis: Electronic Materials (also suitable for students with Electrical and Computer Engineering as well as Physics background)

Course

Number	Title	Credits
---------------	--------------	----------------

Depth

EP 722-U	Magnetism and Magnetic Materials	3.0
EP 748-U	Electronic Properties of Materials	3.0
IC 503-E	Microelectronic Packaging Materials	3.0
IC 714-W	Semiconductor Material and Device Characterization	3.0
IC 530-DE	Electronic Materials Processing	3.0

Breadth

MC 720-P	Scanning Electron Microscopy	3.0
MC 560-U	Principles of Nondestructive Testing	3.0
MS 714-U	Powder Processing of Materials	3.0
MS 790-U	Advanced Materials Experiments	3.0

Electives

MA 520-A	Probability and Statistics for Engineers	3.0
MB 550-A	Engineering Law and Ethics	<u>3.0</u>
		33.0

Program of Study Plan (PSP)

Admitted students should submit a Program of Study Plan (PSP) to NTU upon completion of six semester credit hours. Failure to submit a Program of Study Plan increases the possibility of completing courses not applicable to a degree program or in many cases leads to duplication of courses. Although NTU cannot guarantee preferred course availability in any given term, Program of Study Plans provide substantial information as a guide for course selection from partner universities. It may be necessary to revise approved program of study plans when course availability does not comply with student needs. The PSP form should be submitted to a student's advisor via the NTU web site. The form is located within the "Community" portion of the NTU web site, under "Academic Programs."

M. S. in Mechanical Engineering

Program Description

Mechanical Engineering is concerned with the principles of motion, force and energy and how they are transformed, usually through machinery, in a safe, efficient and reliable manner. Subfields include mechanics, combustion, fluid mechanics, heat transfer, materials, control and thermodynamics.

The Master of Science Degree program in Mechanical Engineering consists of 32 credits distributed through four categories: Core, Depth, Breadth, and Elective courses. The non-thesis curriculum option features substantial choices in all four categories enabling a student to develop a program of study to meet specific needs to achieve particular aspirations. The program offers a thesis option and an engineering management option. The thesis option allows a student to gain research experience. The engineering management option allows a student to pursue further technical depth in mechanical engineering coupled with knowledge of technical management.

The Core courses provide technical literacy applicable to all areas of mechanical engineering. The three Core areas are control theory, material science, and engineering mathematics/applied computer usage in mechanical engineering. Technical expertise is gained via the Depth and Breadth categories. The Depth courses allow for advanced studies in a particular area of mechanical engineering. The Breadth courses extend the study into complementary areas of mechanical engineering. Elective courses allow for enrichment of the students by having the opportunity to learn some of the latest developments applicable to their field.

Completion of the curriculum will take approximately one and one-half years of full-time graduate study. Students enrolled through NTU, whose work schedules preclude full-time study, can expect to fulfill the requirements in five years or less by registering for at least two three-credit courses each academic year.

The specific eligibility requirements for admission into the Mechanical Engineering program are identified in the section of this Bulletin titled Admission.

Curricular Requirements

Each student must complete a minimum of 32 equivalent semester credits including at least 8 credits in the Core, at least 11 credits in the Depth area, at least 8 credits in the Breadth area, and additional Elective credits to complete the minimum requirement.

Core Requirement

The Core requirement of at least eight credits allows the student to develop knowledge in three areas that have general application across the discipline of mechanical engineering. Each student must select one course from each of the following three areas.

Controls	CT, ST 20-29
Engineering Math and Applied Computation	CM 40-49, MA, ME 20-29, QM 20-29, SP 10-19, ST 30-39
Materials	IC 00-19, MS, PM

The student is advised to refer to the listing of the individual courses via electronic access and/or current class schedules to ensure that the letter “C” is included in the brackets following the designation of ME; e.g. ME [C] implies the course is acceptable to meet this requirement.

Depth Requirement

Each student will select no more than two Depth areas below and take four courses in the selected Depth areas totaling at least 11 credits. The Depth areas are as follows:

Applied Mechanics	AE, ME 10-19, ME 80-89, MP 10-59
Combustion and Power Systems	ME 50-59, PS
Design and Manufacturing Systems	IS, ME 20-29, ME 80-99, MP 60-69, PD, QM, SP, ST, SY, TO 40-89
Fluid Mechanics and Heat Transfer	ME 30-39, ME 40-49
Materials	IC 00-19, MC, MS 10-19, MS 30-59, PM
Dynamics and Control Systems	CT, IS, ME 10-19, ST 20-29
Thermodynamics	ME 60-79, MS 20-29

In order to meet this requirement, the student must ensure that the letter “D” appears in the brackets following the designation of ME [] for the courses; e.g. ME [D] implies the course is acceptable to meet this requirement.

Breadth Requirement

Each student will select at least eight credits from the following Breadth course areas (AE, CM, CS, CT, EF, IC, IS, MA, MB 10-19, MC, MG, ME, MP, MS, PD, PM, PS, QM, SP, ST, SY, TO). To meet this requirement, the courses must have the designation “B” in the ME brackets following the course title and institution. A student, in consultation with his/her NTU advisor, can pursue a thesis option. Six credits can be used in partial fulfillment of the Breadth requirement (equivalent to two courses).

Elective Requirement

Each student will complete his or her program with Elective course(s). To meet this requirement, the courses must have the designation “E” in the ME brackets.

Thesis Option

When desirable and appropriate, a thesis option is available for a student wanting to pursue an in-depth project or research experience. Six credits toward a thesis count towards partial fulfillment of the Breadth requirement. See the *MS Thesis Guidelines* section in this *Bulletin*.

Engineering Management Option

A student who wants to be exposed to current management practices coupled with the depth of technical knowledge gained from engineering courses may choose the engineering management option. In such a case that student, in consultation with his/her NTU advisor, will take at least 11 credits in the following areas (MB 10-19, MG, QM 10-19, EF, TO 50-89). These credits fulfill the requirements for the Breadth and Elective areas. If a student desires both thesis and engineering management options, the six credits for the thesis will be in addition to the credits in engineering management.

Example Programs of Study

The following examples illustrate the flexibility available to students in the Mechanical Engineering program:

Applied Mechanics
Design and Manufacturing Systems.
Dynamics and Control Systems with Thesis Option
Power Systems with Engineering Management Option

Area of Emphasis - Applied Mechanics

Course Number	Title	Credits
Core		
CT 520-X	Automatic Controls	3.0
ME 728-M	Multidisciplinary Design Optimization	3.0
MS 715-R	Materials Microstructure	3.0
Depth		
ME 716-M	Advanced Engineering Acoustics	3.0
ME 517-M	Mechanical Vibrations	3.0
ME 780-GM	Continuum Mechanics	2.0
MP 740-Y	Mechanics of Composite Materials	3.0
Breadth		
CT 712-A	Linear Systems Theory	3.0
ST 731-U	Simulation Modeling and Analysis	3.0
QM 520-H	Linear Programming and Network Flows	3.0
Elective		
MG 750-D	Management of Technology and Innovation	<u>3.0</u>
		32.0

Area of Emphasis - Design and Manufacturing Systems

Course Number	Title	Credits
Core		
CT 572-X	Computer Control of Machines and Processes	3.0
CM 540-B	Computational Methods	3.0
MS 516-M	Steel: Classification and Properties for Application in Automobiles	3.0
Depth		
PD 570-T	Expert Systems in Manufacturing	3.0
PD 540-H	Manufacturing Engineering	3.0
PD 575-CL	Flexible Manufacturing Systems	3.0
TO 751-AH	Productivity and Quality Engineering	3.0
Breadth		
ME 720-A	Finite Element Analysis	3.0
ME 523-E	Computer-Aided Analysis and Design of Mechanical Systems	3.0
ME 722-L	Advanced CAE Applications	3.0
Elective		
PD 530-AH	Manufacturing Systems and Facilities Design	<u>3.0</u>
		33.0
Area of Emphasis - Dynamics and Control Systems with Thesis Option		
Course Number	Title	Credits
Core		
CT 720-F	Classical Control Theory	3.0
MA 584-S	Ordinary Differential Equations	3.0
MS 710-P	Modern Concepts in Materials Science	3.0
Depth		
ME 710-Y	Principles of Dynamics	2.0
ME 511-M	Kinematics	3.0
ME 513-M	Machine Design	3.0
CT 510-X	Signals and Systems	3.0
Breadth		
PD 522-N	Design for Manufacturability and Concurrent Engineering	3.0
NT 730-NT	Thesis	3.0
NT 731-NT	Thesis	3.0
Elective		
CT 780-A	Robotics	<u>3.0</u>
		32.0

Area of Emphasis - Power Systems with Engineering Management Option

Course Number	Title	Credits
Core		
CT 510-X	Signals and Systems	3.0
MA 780-A	Mathematical Methods for Science and Engr I	3.0
MS 710-P	Modern Concepts in Materials Science	3.0
Depth		
PS 757-S	Understanding Power Quality	3.0
ME 551-M	Thermodynamics	3.0
PS 511-S	Introduction to Power Systems	3.0
PS 760-U	Power System Operation in a Less Regulated Environment	3.0
Breadth		
MB 715-B	Principles of Engr and Technology Mgmt	3.0
QM 710-N	Operations Research Models	3.0
EF 741-B	Systems Life Cycle Cost Estimating	3.0
Elective		
TO 571-N	Engineering Reliability	<u>3.0</u>
		33.0

Program of Study Plan (PSP)

Admitted students should submit a Program of Study Plan (PSP) to NTU upon completion of six semester credit hours. Failure to submit a Program of Study Plan increases the possibility of completing courses not applicable to a degree program or in many cases leads to duplication of courses. Although NTU cannot guarantee preferred course availability in any given term, Program of Study Plans provide substantial information as a guide for course selection from partner universities. It may be necessary to revise approved program of study plans when course availability does not comply with student needs. The PSP form should be submitted to a student's advisor via the NTU web site. The form is located within the "Community" portion of the NTU web site, under "Academic Programs."

M. S. in Microelectronics and Semiconductor Engineering

Program Description

The microelectronics and semiconductor engineering program prepares students to work in the dynamic and continuously evolving field of semiconductor technology. Semiconductor engineers are at the very heart of the process that has affected all aspects of modern technology for the last half century. They develop the materials used to manufacture the devices, design the circuits that are ever more complex, and are responsible for device manufacturing as well as testing.

The Master of Science Degree program in Microelectronics and Semiconductor Engineering requires 33 semester credits distributed through four broad categories: Core, Depth, Breadth and Elective courses. The curriculum features substantial choices in all four categories, thereby enabling students to tailor their programs of study to meet their specific needs and fulfill their particular aspirations. The Core courses provide the basic framework for the program. The Depth courses allow for advanced studies in specific Core areas. The Breadth courses expose students to a spectrum of topics outside of these areas. In this way, the University ensures that students broaden their knowledge into areas related but not necessarily in the mainstream of their interests which might otherwise be overlooked. The NTU curriculum in Microelectronics and Semiconductor Engineering remains open-ended with regard to advanced courses in order to encourage students to take advantage of new courses concentrating on the latest developments in the field.

Completion of the curriculum requires approximately one and one-half years of full-time graduate study. Students enrolled through National Technological University, whose work schedules preclude full-time study, should expect to fulfill the requirements in three years by registering for four three-credit courses each academic year.

The specific eligibility requirements for admission into the Microelectronics and Semiconductor Engineering program are identified in the section of this *Bulletin* titled *Admission*.

Curricular Requirements

Each student should expect to enroll in 11 three-hour courses with a minimum of four Core courses, three Depth courses, three Breadth courses and one Elective course. A minimum of 33 credits is necessary for graduation. Excess hours accumulated in the Core, Depth and Breadth areas may be used to help satisfy the Elective requirement.

Core Requirement

At least one course in each of the following four areas:

IC 20-29	Devices and Modeling
IC 30-39	Fabrication and Process Modeling
IC 40-49	Circuit and System Design (Including General VLSI)
IC 70-79	Analog Circuits (Including Specialized VLSI)

It should be noted that not all courses in these areas are accepted as Core courses. The student is advised to refer to the listing of the individual course descriptions via electronic access and/or current class schedules to ensure that the letter “C” is included in the brackets following the designation of MES; e.g., MES [C] implies the course is acceptable to meet this requirement.

Depth Requirement

The Depth requirement includes three courses distributed between two of the four areas noted. Depth courses build upon the material covered in the Core to provide the student with an opportunity to become more knowledgeable in some of the most advanced and current topics of the field. In order to meet this requirement, the student must ensure that the letter “D” appears in the brackets following the designation of MES for each course.

The student should seek the advice of his/her academic advisor to ascertain that the courses selected provide appropriate Depth.

Breadth Requirement

The Breadth requirement includes at least three courses in areas that relate to, or support the study of Microelectronics and Semiconductor Engineering. Recommended Breadth courses include:

- IC areas not listed as Core and Depth: IC 00-09, IC 10-19, IC 50-59, IC 90-99
- EP courses (Electrical Properties)
- EM courses (Electromagnetics)
- DS courses (Digital Systems)

Courses from other areas might also qualify as Breadth courses and they are identified with a “B” in the bracket following the course title and institution. It is recommended that the student obtain the approval of his or her advisor *before* registering for such courses. It is always in the student’s interest to plan an integrated program of study with an advisor that assures breadth complementing the topics covered in Core and Depth.

Elective Requirement

Additional courses required to meet the 33 credit requirement may be taken from any area offered by NTU provided the course is graduate level. Elective courses must also be approved by the student’s academic advisor.

Thesis

National Technological University offers a non-thesis Master of Science Degree program in Microelectronics and Semiconductor Engineering. However, when desirable and appropriate, as determined by the student in consultation with his/her academic advisor, a thesis with a maximum of six credits may be substituted for the Elective course and one of the Depth or Breadth courses (see *MS Thesis Guidelines* section of this *Bulletin*).

Example Programs of Study

The following example Programs of Study illustrate the flexibility available to students wishing to specialize in Microelectronics and Semiconductor Engineering.

Area of Concentration - Devices, Fabrication and Testing

Course Number	Title	Credits
Core		
IC 721-W	Semiconductor Device Theory I	3.0
IC 530-DE	Electronic Materials Processing	3.0
IC 742-B	VLSI Design	3.0
IC 570-CA	Linear Integrated Circuits	3.0
Depth		
IC 722-W	Semiconductor Device Theory II	3.0
IC 531-NM	Microelectronics Test Engineering	3.0
IC 535-NM	Microelectronics Failure Analysis	3.0
Breadth		
IC 701-E	Electronic Packaging Principles	3.0
EP 741-P	Defects, Diffusion and Ion Implantation in Semiconductors	3.0
EP 725-P	Material Science and Processing of Semiconductor Devices	3.0
Elective		
IC 792-F	Integrated Circuit Fabrication Processes: Plasma Processing	3.0
		<u>33.0</u>

Area of Concentration - Analog Circuits and VLSI Design

Course Number	Title	Credits
Core		
IC 722-C	Semiconductor Device Physics: BJTs and FETs	3.0
IC 530-E	Advanced Microelectronic Processing	3.0
IC 742-C	VLSI Design I	3.0
IC 771-DA	MOS Analog Circuit Design	2.0
Depth		
IC 743-C	VLSI Design II	3.0
IC 774-DA	Analog MOS IC Design for Signal Processing	2.0
IC 776-DA	Data Conversion Techniques and Circuits	2.0
Breadth		

DS 510-P	Digital ASIC Design	3.0
DS 770-A	Testing and Diagnosis of VLSI Systems	3.0
IC 715-E	Solid State Optics	3.0

Electives		
IC 790-P	Computer-Aided Circuit Analysis	3.0
IC 553-E	Computer-Aided Logic Design	3.0
		<u>33.0</u>

Area of Concentration - Circuit and System Design

Course Number	Title	Credits
Core		
IC 724-CA	Solid-State Devices	4.0
IC 730-P	IC Technology and Fabrication	3.0
IC 740-W	Digital Integrated Circuits and Systems	3.0
IC 574-CA	Integrated Circuits for Communications	4.0
Depth		
IC 742-A	VLSI Design Principles	3.0
IC 775-CA	Advanced Integrated Circuits for Communications	3.0
IC 776-CA	Analysis and Design of VLSI-Analog-Digital Interface Integrated Circuits	3.0
Breadth		
DS 763-CA	Logic Synthesis for Hardware Systems	4.0
DS 765-F	Digital System Design with Hardware Description Languages	3.0
DS 770-F	Digital System Testing and Design for Testability	3.0
		<u>33.0</u>

Program of Study Plan (PSP)

Admitted students should submit a Program of Study Plan (PSP) to NTU upon completion of six semester credit hours. Failure to submit a Program of Study Plan increases the possibility of completing courses not applicable to a degree program or in many cases leads to duplication of courses. Although NTU cannot guarantee preferred course availability in any given term, Program of Study Plans provide substantial information as a guide for course selection from partner universities. It may be necessary to revise approved program of study plans when course availability does not comply with student needs. The PSP form should be submitted to a student's advisor via the NTU web site. The form is located within the "Community" portion of the NTU web site, under "Academic Programs."

M. S. in Software Engineering Program Description

Software engineering is the application of engineering design principles to development of software. It includes design, testing, implementation and maintenance of software. The Master of Science Degree program in Software Engineering consists of 33 semester credits distributed through four broad categories: Core, Depth Breadth and Elective courses. The curriculum features substantial choices in all four categories, thereby enabling students to tailor their programs of study to meet their specific needs and fulfill their particular aspirations. The Core courses provide the basic framework for the program. The Depth courses allow for advanced study in selected areas of software engineering. The Breadth courses expose the students to a spectrum of topics outside of Software Engineering. The NTU curriculum in Software Engineering remains open-ended with regard to advanced courses in order to encourage students to take advantage of new courses concentrating on the latest developments in the field.

Completion of the curriculum requires approximately one and one-half years of full-time graduate study. Students enrolled through National Technological University, whose work schedules preclude full-time study, should expect to fulfill the requirements in five years by registering for at least two three-credit courses each academic year.

The specific eligibility requirements for admission into the Software Engineering program are identified in the section of this *Bulletin* titled *Admission*.

Curricular Requirements

Each student should expect to enroll in 11 or more courses. A minimum of 33 NTU credits are required for graduation.

Core Requirement

Six courses selected from the eight current Software Engineering subareas, SE 20-90. The course selection must cover at least five of the eight currently designated core subareas.

SE 20-29	Life Cycle Models and Software Metrics
SE 30-39	Analysis and Design Techniques
SE 40-49	Programming Environments and Implementation Issues
SE 50-59	Testing and Reliability
SE 60-69	Productivity Measures and Quality Assurance
SE 70-79	Specification Languages and Other Language Issues
SE 80-89	Software Management, Psychology and Control Methods
SE 90-99	Advanced Topics

The student is advised to refer to the listing of the individual courses via electronic access and/or current class schedules to ensure that the letter “C” is included in the brackets following the designation of SE; e.g. SE [C] implies the course is acceptable to meet this requirement.

Depth Requirement

Two courses which build upon the material covered in the Core program. These courses must be from any of the following NTU areas:

CS	Computer Software
SE	Software Engineering
ST	Software Techniques

In order to meet this requirement, the student must ensure that the letter “D” appears in the brackets following the designation of SE [] for each course.

Breadth Requirement

One course selected from the following NTU areas:

AD	Algorithms and Data Structures
CA	Computer Architecture
CM	Computational Methods and Theory
DS	Digital Systems
MA	Mathematics
MB	Management and Behavioral Science

To meet this requirement, each course must have the designation “B” in the SE brackets following the course title and institution; e.g. SE [B] implies the course is acceptable to meet this requirement.

Elective Requirement

At least two additional courses selected from the Depth and Breadth areas to bring the total NTU credits to 33. Subject to the approval of the student’s advisor, one of these courses can come from an NTU area not currently designated as a Depth or Breadth area. To meet this requirement, each course must have the designation “E” in the SE brackets following the course title and institution.

Example Program of Study

Course Number	Title	Credits
Core		
SE 720-KS	Software Measurement	3.0
SE 530-P	Object-Oriented Languages and Systems	3.0
SE 533-N	Software Requirements and Design Engineering	3.0
SE 750-P	Software Testing and Reliability	3.0
SE 760-S	Software Quality Assurance	3.0
SE 783-S	Software Process Management	3.0
Depth		
CS 750-SC	Database Systems	3.0
ST 760-U	Information System Security	3.0
Breadth		
MA 520-N	Probability and Statistics for Engineers	3.0

Elective

MB 710-AH	Engineering Management Theory	3.0
SE 535-P	Human Computer Interaction	<u>3.0</u>
		33.0

Bridging Courses

Bridging courses are available for those students whose background is deficient in any way. The undergraduate bridging areas available for students entering graduate study in Software Engineering are:

BC 10-19	Fundamentals of Computer Engineering
BC 20-29	Digital Logic Design
BC 30-39	Data Structures
BC 40-49	Microprocessors and Assembly Level Programming
BC 50-59	Operating System Principles
BC 60-69	Digital System Design - Computer Architecture
BC 70-79	Interfacing and Computer Networks
BC 80-89	Discrete Structures

Bridging courses are not available for graduate credit.

Fast Track Certificate Program

NTU offers an accelerated academic program of six undergraduate computer science courses designed to help students stay on track in their careers. The Fast Track program offers focused, in-depth courses to learn core computer science knowledge to help in the transition into computer science or software engineering.

Instructors have condensed course material to specifically meet the needs of students working in high-tech fields. Each course is 1.6 credits and is offered for Audit or Pass/Fail only. Course notes are provided as well as optional homework assignments and exams. A teaching assistant is available via e-mail and phone to answer questions and help with assignments.

The Fast Track courses are:

- FT 001-NT - Computer Organization
- FT 002-NT - Algorithms and Data Structures
- FT 003-NT - Computer Programming Languages
- FT 004-NT - Foundations of Computer Sciences: Formal Languages and Automata
- FT 005-NT - Software Engineering
- FT 006-NT - Operating Systems

NTU does not grant academic credit for these courses, but successful completion will enable a student with an unrelated bachelor's degree to better prepare for graduate-level coursework in NTU's Computer Science or Software Engineering master's programs. Students are not required to take all six courses, but completion of the six course series will earn a student a Certificate of Completion in "Principles of Computer Science."

Program of Study Plan (PSP)

Admitted students should submit a Program of Study Plan (PSP) to NTU upon completion of six semester credit hours. Failure to submit a Program of Study Plan increases the possibility of completing courses not applicable to a degree program or in many cases leads to duplication of courses. Although NTU cannot guarantee preferred course availability in any given term, Program of Study Plans provide substantial information as a guide for course selection from partner universities. It may be necessary to revise approved program of study plans when course availability does not comply with student needs. The PSP form should be submitted to a student's advisor via the NTU web site. The form is located within the "Community" portion of the NTU web site, under "Academic Programs."

M. S. in Systems Engineering

Program Description

Systems Engineering differs from other branches of engineering in that it deals with methods for analysis, synthesis and design of complex multidisciplinary problems as opposed to solving specific more narrow problems. Thus it encompasses a set of mathematical tools that may be applied to real-world complex problems such as those encountered in the aerospace field. Failures in aerospace projects are often very expensive and highly publicized and it is therefore very important that failures be eliminated. Systems Engineering provides the tools to help prevent failures.

The Core courses provide the fundamental tools used by systems engineers, while the Depth courses provide more advanced material. The Breadth and Elective courses enable the student to focus on more specific areas of systems engineering, such as aerospace, aeronautics, electronics, information or telecommunications systems.

Completion of the curriculum will take approximately one and one-half years of full-time graduate study. Students enrolled through NTU, whose work schedules preclude full-time study, can expect to fulfill the requirements in at most five years by registering for at least two three-credit courses each academic year.

The specific eligibility requirements for admission into the Systems Engineering program are identified in the section of this *Bulletin* titled *Admission*.

Curricular Requirements

Each student must complete a minimum of 33 semester credits distributed as follows: 15 credits of Core courses and 6 credits in each of Depth, Breadth, and Elective courses. Each candidate for the M.S. degree should expect to complete at least 11 courses in order to achieve the required minimum of 33 semester credits.

Core Requirement

Five courses, with one course selected from five of the six following core subareas:

SY 10-19	Systems Engineering Principles and Processes
SY 20-29	Systems Modeling and Analysis
SY 30-39	Systems Concepts of Strategic Cost Analysis or EF 720-T (Advanced Financial Management)
SY 40-49	Systems Optimization
SY 50-59	Systems Reliability
SY 60-69	Systems Management

The student is advised to refer to the listing of the individual courses via electronic access and/or current class schedules to ensure that the letter “C” is included in the brackets following the designation of SY; e.g. SY [C] implies the course is acceptable to meet this requirement.

Depth Requirement

Two courses selected from the following four subareas:

SE 10-19	Software Engineering Methodology
SE 80-89	Software Management, Psychology and Control Methods
SY 70-79	Logistics and Acquisitions Systems Engineering
SY 80-89	Systems Engineering Design

In order to meet this requirement, the student must ensure that the letter “D” appears in the brackets following the designation of SY [] for the courses; e.g. SY [D] implies the course is acceptable to meet this requirement.

Breadth Requirement

Two courses selected from one of the following areas:

Aeronautics/Aerospace - AE
Electronics - CR, CT, DS and IC
Information Systems - TO 10-19
Telecommunications - TC 00-99

In order to meet this requirement, the student must ensure that the letter “B” appears in the brackets following the designation of SY [] for the courses.

Elective Requirement

Two courses selected from any area with advisor approval. To meet this requirement, the courses must have the designation of “E” in the SY brackets.

Example Program of Study

The following example illustrates the flexibility available to students in the Systems Engineering program:

Course Number	Title	Credits
Core		
SY 710-E	The Systems Engineering Process	3.0
SY 720-U	Systems Engineering and Analysis	3.0
EF 720-T	Advanced Financial Management	3.0
SY 540-N	Systems Optimization and Analysis	3.0
SY 562-N	Systems Integration and Test	3.0
Depth		
SY 570-N	Logistics Systems Engineering	3.0
SY 580-N	Systems Engineering Design	3.0
Breadth		
AE 730-SC	Spacecraft Systems Design	3.0
AE 535-SC	Spacecraft Propulsion	3.0

Elective

QM 710-SC	Introduction to Operations Research	3.0
QM 740-A	Multi-Criteria Decision-Making and Decision Analysis	<u>3.0</u>
		33.0

Program of Study Plan (PSP)

Admitted students should submit a Program of Study Plan (PSP) to NTU upon completion of six semester credit hours. Failure to submit a Program of

Study Plan increases the possibility of completing courses not applicable to a degree program or in many cases leads to duplication of courses. Although NTU cannot guarantee preferred course availability in any given term, Program of Study Plans provide substantial information as a guide for course selection from partner universities. It may be necessary to revise approved program of study plans when course availability does not comply with student needs. The PSP form should be submitted to a student's advisor via the NTU web site. The form is located within the "Community" portion of the NTU web site, under "Academic Programs."

M. S. (Special Majors)

Program Description

The NTU Special Majors program is designed to fill the needs of students with a wide variety of fields of interest which go beyond the existing degree programs. The program features substantial choices enabling students to tailor a program of study that meets their specific needs and fulfills their career aspirations--all within a coherent framework assuring academic excellence and state-of-the-art preparation.

The Master of Science Special Majors program consists of 36 semester credits chosen from Depth, Breadth and Elective areas. The Depth area credits form a coherent and acceptable collection of courses which provide the student with a firm understanding of the area of concentration. The Breadth courses are chosen to comprise a second coherent focus for the program of study. The Elective courses expose students to a spectrum of topics which may not be interrelated.

Completion of the curriculum requires approximately one and one-half years of full-time graduate study. Students enrolled through National Technological University should expect to fulfill the requirements in two to five years of part time study, depending on the course load.

Curricular Requirements

A total of 36 semester credit hours are required for the Special Majors program. Eighteen credits are to be chosen from a Depth area. All of the Depth area credits do not have to be from the same course area designation. Nine credits are to be chosen in a Breadth area to create a minor area of study which should be distinct from the Depth area. Breadth courses should come from a different technical area. Nine of the 36 credits are Elective.

Example Programs of Study

Examples of Depth area studies in engineering include Industrial Engineering, Technical Management and Semiconductor Engineering. Two illustrations related to technical management include Human Resource Development and Software Development.

These sample programs illustrate how students may pursue their specific goals. Clearly, there are many options available to the students.

Emphasis: Industrial Engineering Concentration: Reliability Engineering and Product Assurance

Course Number	Title	Credits
Depth		
QM 710-SC	Introduction to Operations Research	3.0
TO 751-AH	Productivity and Quality Engineering	3.0
TO 770-A	Quality Control and Reliability I	3.0
TO 771-E	Reliability Engineering	3.0
TO 772-E	Maintainability Engineering	3.0
TO 775-A	Advanced Management of Quality	3.0
Breadth		
MA 730-A	Probability and Random Processes	3.0
TO 750-AH	Quality Systems Management	3.0
TO 574-TN	Design of Experiments for Engineering Managers	3.0
Electives		
QM 520-H	Linear Programming and Network Flows	3.0
SE 750-P	Software Testing and Reliability	3.0
TO 773-E	Reliability Testing	3.0
		<u>36.0</u>

Emphasis: Technical Management Concentration: Software Development

Course Number	Title	Credit
Depth		
SE 720-KS	Software Measurement	3.0
SE 760-S	Software Quality Assurance	3.0
SE 580-P	Software Process and Risk Management	3.0
SE 783-KS	Software Management	3.0
SE 735-NJ	Design of Interactive Systems	3.0
TO 510-N	Management of Information Technologies	3.0
Breadth		
MB 530-T	Human Relations in Technical Management	3.0
MB 710-AH	Engineering Management Theory	3.0
MB 740-AH	Engineering Management Structures and Systems	3.0
Electives		
MB 713-J	Analysis of Emerging Technologies	3.0
SE 750-W	Software Verification, Validation and Testing	3.0
MB 750-CU	Engineering Contracts	3.0
		<u>36.0</u>

Emphasis: Technical Management
Concentration: Human Resource Development

Course Number	Title	Credit
Depth		
EF 720-N	Engineering Finance	3.0
EF 530-CU	Engineering Economics	3.0
MB 710-AH	Engineering Management Theory	3.0
MB 712-AH	Implementation of Technology	3.0
MB 740-AH	Engineering Management Structures and Systems	3.0
MB 732-NJ	Human Resource Management	3.0
Breadth		
TO 510-N	Management of Information Technologies	3.0
TO 710-D	Information Systems	3.0
TO 780-D	Production Management	3.0
Electives		
MB 550-A	Engineering Law and Ethics	3.0
SP 743-D	Operations Strategy and Productive Systems Design	3.0
TO 574-TN	Design of Experiments for Engineering Managers	3.0
		36.0

Emphasis: Semiconductor Engineering
Concentration: Semiconductor Design with Minor in Semiconductor Testing and Fabrication

Course Number	Title	Credit
Depth		
IC 20-29, two courses in Devices and Modeling, for example		
IC 520-W	Fundamentals of Solid State Devices	3.0
IC 724-CA	Solid State Devices	4.0
IC 40-49, one course in Circuit and System Design, for example		
IC 742-A	VLSI Design Principles	3.0 or
IC 742-CA	Advanced Digital Integrated Circuits	3.0
IC 50-59, two courses in VLSI Design Automation, for example		
IC 750-CA	Computer-Aided Design for Integrated Circuits	3.0
IC 751-E	Computer-Aided Design Algorithms and Techniques for VLSI	3.0
IC 70-79, one course in Analog Circuits, for example		
IC 771-CA	Advanced Analog Integrated Circuits	3.0 or
IC 774-E	Advanced Analog Circuits	3.0 or
IC 775-CA	Advanced Integrated Circuits for Communications	3.0

Breadth

IC 730-P	IC Technology and Fabrication	3.0
IC 531-NM	Microelectronics Test Engineering	3.0
IC 535-NM	Microelectronic Failure Analysis	3.0

Electives

DS 770-A	Testing and Diagnosis of VLSI Systems	3.0
EP 725-P	Material Sciences and Processing of Semiconductor Devices	3.0
IC 506-NM	Microelectronic Reliability	3.0
		37.0

Program of Study Plan (PSP)

Admitted students should submit a Program of Study Plan (PSP) to NTU upon completion of six semester credit hours. Failure to submit a Program of Study Plan increases the possibility of completing courses not applicable to a degree program or in many cases leads to duplication of courses. Although NTU cannot guarantee preferred course availability in any given term, Program of Study Plans provide substantial information as a guide for course selection from partner universities. It may be necessary to revise approved program of study plans when course availability does not comply with student needs. The PSP form should be submitted to a student's advisor via the NTU website. The form is located within the "Community" portion of the NTU website, under "Academic Programs."

"I would like to thank Hewlett-Packard and NTU for giving me the opportunity to pursue an advanced technical degree via distance learning. It was both an exciting and challenging journey to learn from some of the best professors and universities across the country."

- Patrick Nanto, Hewlett-Packard

Undergraduate Bridging Courses

Some NTU students have undergraduate degrees which are not appropriate preparation for the NTU degree they seek, so access is needed to undergraduate courses to help them reorient their technical careers. Other students need to update their undergraduate technical competence. Therefore, NTU offers undergraduate bridging courses from NTU institutions. Advice regarding these matters is available from NTU.

The course numbering system for the Bridging courses is shown below:

Bridging (BR)

BR 00-09	Mathematics
BR 10-19	Physics
BR 20-29	Chemistry
BR 30-39	Engineering Science
BR 40-49	Materials Science and Engineering
BR 50-59	Mechanical Engineering
BR 60-69	Chemical Engineering
BR 90-99	Special Topics

Electrical Engineering (BE)

BE 10-19	Circuits
BE 20-29	Electronics
BE 30-39	Electromagnetics
BE 40-59	Systems

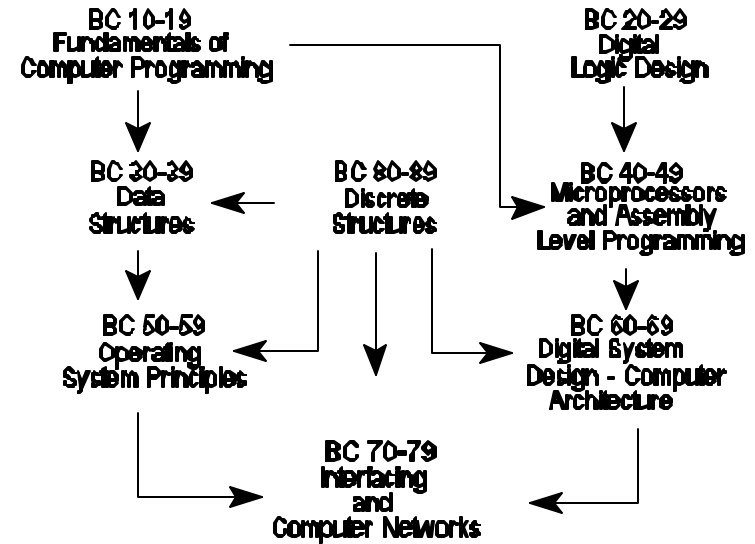
Computer Engineering, Computer Science & Software Engineering (BC)

BC 10-19	Fundamentals of Computer Engineering
BC 20-29	Digital Logic Design
BC 30-39	Data Structures
BC 40-49	Microprocessors and Assembly Level Programming
BC 50-59	Operating System Principles
BC 60-69	Digital System Design - Computer Architecture
BC 70-79	Interfacing and Computer Networks
BC 80-89	Discrete Structures

Computer Engineering, Computer Science and Software Engineering

Applications of computers are pervasive today, affecting the work of most engineers and technical professionals. It is natural, therefore, for people with very diverse technical backgrounds to seek additional education in computing. For that reason, NTU faculty have precisely identified the undergraduate prerequisites which are the necessary background for entering graduate study in computer engineering, computer science and software engineering. This information is intended to serve as a guide to potential registrants in graduate-level courses. They can verify that they have the fundamental knowledge which most instructors of advanced courses expect students to have. NTU does not offer all of these types of courses; therefore, see the detailed course descriptions provided on our website which can provide you help in choosing appropriate courses at your local institution. Check the current *Class Schedule* for course availability via NTU.

Flow Chart of Undergraduate Courses for Computer Science, Computer Engineering and Software Engineering Programs



Fast Track Certificate Program in Computer Science

NTU offers an accelerated academic program of six undergraduate computer science courses designed to help students stay on track in their careers. The Fast Track program offers focused, in-depth courses to learn core computer science knowledge to help in the transition into computer science or software engineering.

Instructors have condensed course material to specifically meet the needs of students working in high-tech fields. Each course is 1.6 credits and is offered for Audit or Pass/Fail only. Course notes are provided as well as optional homework assignments and exams. A teaching assistant is available via e-mail and phone to answer questions and help with assignments.

The Fast Track courses are:

- FT 001-NT - Computer Organization
- FT 002-NT - Algorithms and Data Structures
- FT 003-NT - Computer Programming Languages
- FT 004-NT - Foundations of Computer Science: Formal Languages and Automata
- FT 005-NT - Software Engineering
- FT 006-NT - Operating Systems

NTU does not grant academic credit for these courses, but successful completion will enable a student with an unrelated bachelor's degree to better prepare for graduate-level coursework in NTU's Computer Science or Software Engineering master's programs. Students are not required to take all six courses, but completion of the six course series will earn a student a Certificate of Completion in "Principles of Computer Science."

Chemical Engineering

Applicants to the Chemical Engineering graduate program who do not have a B.S. in Chemical Engineering need to develop an individualized bridging program with an advisor. Commonly, the bridging program for students without a B.S. Degree in Chemical Engineering involves two summer courses, CH 591-MS and CH 592-MS (www.egr.msu.edu/che/cont.ed/) (CHE 804 and CHE 805) that introduce the most important concepts from the broad undergraduate chemical engineering curriculum. Additional bridging courses may be required depending on the student's background. Development of a bridging program using courses from other institutions is also possible.

Electrical Engineering

The basic admission requirement for the M.S.E.E. program is the equivalent of the junior year of technical courses in an accredited Electrical Engineering program: two one semester courses in circuits, one in electronics, one in systems, one in electromagnetics and one in digital design, plus some proficiency in computer programming.

Applicants seeking the M.S.E.E. degree who do not have a B.S.E.E. degree can prepare themselves by taking EE Bridging courses, by taking equivalent courses at a local institution or by establishing equivalencies of courses taken in another degree program. Check the current *Class Schedule* for course availability.

Materials Science and Engineering

An acceptable academic background for this program would be a Bachelor's Degree in Materials Science and Engineering or its equivalent from an ABET accredited program; or a bachelor's degree in a related field, such as in other branches of engineering, physics, geology or chemistry.

In any case, Bridging courses will be available so applicants can prepare themselves for the graduate program. Applicants should analyze their background and take courses which will strengthen their preparation.

Courses of Instruction

National Technological University reserves the right to change this listing of courses without notice.

The courses listed in the *Course Listing* section of this *Bulletin* are those submitted by the participating institutions and accepted by NTU for possible offering via the satellite, CD-ROM and/or the Internet at the time of publication. New courses and programs are added periodically. The frequency of individual course offerings depends upon the programmatic priorities of the institution where the course is taught, student demand and program needs. However, because of its access to courses from more than 50 universities, NTU is likely to offer equivalent courses on a regular basis. Students should consult the NTU web site or the applicable *Class Schedule* published for each term of instruction for a listing of the courses offered during any given term.

SPECIAL NOTE: The most up-to-date information on each course is available on NTU's web site. The Class Schedule is available on the NTU web site and is also published every term and available to students before the beginning of each term.

Terms of Instruction

NTU offers courses in accordance with the calendars of the participating universities. Most institutions use the semester calendar and a few use the quarter calendar. Moreover, some courses may be offered on special schedules, always announced well in advance. Students must consult the NTU web site or the *Class Schedule* for a given term to determine whether a course will actually be offered.

Prerequisites

Permission of the instructor to enroll in the course is implied when the student meets the specified prerequisites. Prerequisites are considered to be met if the student is convinced that he/she is properly prepared. If there is any concern, the student should discuss prerequisites with the instructor. Academic prerequisites notwithstanding, enrollments are sometimes limited to a specified number of students, students within a specified degree program, and/or students at particular class levels (i.e., entry or advanced).

Course Fees

The *Tuition and Fees* section of this *Bulletin* provides the tuition and fee schedule at the time of publication. This does not include the cost of textbooks and other required learning materials. However, the charges *may vary from those listed in this Bulletin*, and students must check the charges posted on the NTU web site or indicated in the current *Class Schedule* to determine the actual charges for any given term.

Special Topics Courses

NTU Special Topics courses are independent study courses which may include extra credit for regular credit courses, special laboratories and Professional Development Program (PDP) courses. Special topics courses must be arranged with the agreement of the student's NTU academic advisor and Curriculum Chair in advance of registration. Special topic course requirements will be determined by the student's NTU advisor in accordance with normal acceptable university practices.

PDP courses may be taken for .1 - .5 semester credit hours (SCH); special labs, etc. may be taken for 1-3 SCH. Tuition for special topic registration is based on the percent of SCH of the current NTU rate, plus a \$100/SCH special fee (minimum 1 SCH). Students need to work with their advisor in completing a project to fulfill the special topics requirement.

When a PDP course is taken for credit, the student enrolls in the PDP course in the usual way and also enrolls for the desired number of credits (maximum .5 SCH) in the NTU credit program. He/she needs to contact NTU Admissions and Records office to obtain the appropriate course number for credit registration.

Special topic courses must be completed within one year. Students need to work with their advisor in completing a project to fulfill the special topics requirement.

Course Delivery Methods

NTU offers courses via a variety of non-traditional delivery methods. The course descriptions will clearly identify each delivery method or methods if more than one format is available for a course. Students will need to indicate when registering, which delivery method they choose. Courses will be identified by one or more of the following categories:

Satellite/Videotape Delivery (Section 1)

Satellite/videotape delivery denotes courses that are aired (live or taped) on the NTU satellite network, or are available to students who do not have downlink equipment. Primary delivery of lectures would be over the satellite transmission or from a videotape.

CD-ROM Delivery (Section 30)

CD-ROM delivery involves any class with course lectures, syllabus and other class materials delivered primarily via CD-ROM. This could be an all inclusive CD-ROM course with everything on one disc, or could include some links to external web sites for information.

Web/Internet (Section 50)

Web/Internet delivery is fairly broad and includes all of the following types of courses; webcasts, audio streaming, internet-delivered and any variation of these that relies on the web or Internet as the primary mode of classroom delivery.

Course Numbering System

NTU course numbers are codes which indicate course area designation, the course level, the subarea and the offering institution. For example:

AD 510-B

AD	3, 5 or 7	10	B
Course Area	300 - Undergraduate Course	Subarea	Offering Institution
"Algorithms and Data Structures"	500 - Introductory Graduate Course 700 - Advanced Graduate Course		

Information in brackets [] shown with course descriptions indicates acceptability of that course in each curriculum.

For example:

AD 711-R Advanced Data Structures

CE [CD] CH [NA] CS [CD] EE [BE] EM [E] ESM [NA] MAT [NA]
MBA [NA] MES [E] ME [E] MSE [CDE] SE [B] SY [AA]

CE = Computer Engineering; CH = Chemical Engineering; CS = Computer Science; EE = Electrical Engineering; EM = Engineering Management; ESM = Environmental Systems Management; MAT = Materials Science and Engineering; MBA = Master of Business Administration; MES = Microelectronics and Semiconductor Engineering; ME = Mechanical Engineering; MSE = Manufacturing Systems Engineering; SE = Software Engineering; SY = Systems Engineering.

[C] = Core; [D] = Depth; [B] = Breadth; [E] = Elective;
[NA] = Not Applicable; [AA] = Advisor Approval; [Br] = Bridging;
[Cap] = Required Capstone.

Thus, AD 711-R is applicable to the Computer Engineering and Computer Science Degree Programs as a Core or Depth; Electrical Engineering as a Breadth or Elective; Manufacturing Systems Engineering as a Core, Depth, or Elective, etc.

Institution Identification

The suffixes following course numbers identify the institution offering the individual course:

A	University of Mass Amherst	M	Purdue University
AH	University of Alabama in Huntsville	MI	Massachusetts Institute of Tech
AR	University of Arkansas	MS	Michigan State University
AT	University of Alabama at Tuscaloosa	N	Southern Methodist University
AU	Auburn University	NB	University of Nebraska-Lincoln
B	University of Maryland, College Park	NJ	New Jersey Institute of Technology
C	University of Minnesota	NM	The University of New Mexico
CA	University of California, Berkeley	NS	New Mexico State University
CL	Columbia University	NT	National Technological University
CM	Carnegie Mellon University	O	Oklahoma State University
CN	Clemson University	OD	Old Dominion University
CU	University of Colorado at Boulder	P	North Carolina State University
D	University of South Carolina	Q	University of Illinois at Urbana-Champaign
DA	University of California, Davis	R	University of Florida
DE	University of Delaware	S	University of Idaho
E	The University of Arizona	SC	University of Southern Calif
F	Northeastern University	T	University of Missouri-Rolla
FG	Florida Gulf Coast University	TN	The University of Tennessee
G	University of Alaska Fairbanks	U	Iowa State University
GM	Kettering University	UM	The University of Michigan
GW	The George Washington University	V	Boston University
H	Colorado State University	VU	Vanderbilt University
I	Michigan Technological Univ	W	Arizona State University
J	Georgia Institute of Technology	X	Univ of Wisconsin-Madison
K	Illinois Institute of Technology	Y	University of Washington
KS	Kansas State University	Z	Rensselaer Polytechnic Institute
L	University of Kentucky		
LE	Lehigh University		

Course Area and Subarea Designations

The following is a list of all course area and subarea designations and numbers within the National Technological University course numbering system; all course numbers start with a "3", "5" or "7" indicating the level of the course.

ALGORITHMS AND DATA STRUCTURES (AD)

AD 10-19	Data Structures
AD 20-29	Design and Analysis of Algorithms
AD 30-39	Multiprocessor Algorithms (see also CA 50's, CM 50's and CS 60's)

AEROSPACE ENGINEERING (AE)

AE 10-19	Analysis (see also MP 20's, ME 20's and MS 60's)
AE 20-29	Mechanics of Compressible Fluids (see also ME 40's)
AE 30-39	Air Frame Design
AE 90-99	Special Topics

BRIDGING: COMPUTER ENGINEERING, COMPUTER SCIENCE AND SOFTWARE ENGINEERING (BC)

BC 10-19	Fundamentals of Computer Engineering
BC 20-29	Digital Logic Design
BC 30-39	Data Structures

BC 40-49 Microprocessors and Assembly Level Programming
BC 50-59 Operating System Principles
BC 60-69 Digital System Design - Computer Architecture
BC 70-79 Interfacing and Computer Networks
BC 80-89 Discrete Structures

BRIDGING: ELECTRICAL ENGINEERING (BE)

BE 10-19 Circuits
BE 20-29 Electronics
BE 30-39 Electromagnetics
BE 40-59 Systems

BRIDGING: UNDERGRADUATE CERTIFICATE (BN)

BN 00-29 Undergraduate Certificate

BRIDGING (BR)

BR 00-09 Mathematics
BR 10-19 Physics
BR 20-29 Chemistry
BR 30-39 Engineering Science
BR 40-49 Materials Science and Engineering
BR 50-59 Mechanical Engineering
BR 60-69 Chemical Engineering
BR 90-99 Special Topics

COMPUTER ARCHITECTURE (CA)

CA 10-19 Computer Architecture
CA 20-29 Parallel Systems and Interconnection Networks (see also CC 80's and ST 50's)
CA 30-39 Microprogramming
CA 40-49 Computer Descriptive Languages/High-Level Language Architecture
CA 50-59 Multiprocessor and Concurrent Computer Systems (see also CM 50's, CS 60's and AD 30's)
CA 60-69 Microcomputers and Embedded Computer Systems
CA 70-79 Interfacing and Memory Systems
CA 80-89 Interactive Computer Systems
CA 90-99 Advanced Topics

COMMUNICATIONS (CC)

CC 10-19 Communications/Statistical Communications and Signal Theory (see TC 10-29, TC 50-59 and CT 10's)
CC 20-29 Pattern Recognition and Remote Sensing
CC 30-39 Estimation and Detection Theory
CC 40-49 Information Theory and Coding
CC 50-59 Speech Processing
CC 60-69 Analog, Optical and Digital Signal Processing (see also CR 50's)
CC 70-79 Image Processing and Radar Systems (see also IS 60's, EM 30's and EM 60's)

CC 80-89 Telecommunications, LANS and Communication Networks (see also TC 40-49, ST 50's and CA 20's)
CC 90-99 Advanced Topics

CHEMICAL ENGINEERING (CH)

CH 10-19 Thermodynamics
CH 20-29 Transport Phenomena
CH 30-39 Chemical Kinetics, Catalysis and Reactor Design
CH 40-49 Systems Analysis and Design
CH 50-59 Chemical Engineering Mathematics
CH 60-79 Chemical Engineering Electives
CH 90-99 Chemical Engineering Bridging

COMPUTATIONAL METHODS AND THEORY (CM)

CM 10-19 Mathematical Logic and Automata Theory
CM 20-29 Formal Languages
CM 30-39 Computability and Computational Complexity
CM 40-49 Numerical Techniques (see also CT 60's)
CM 50-59 Methods for Parallel Computation (see also CA 50's, CS 60's and AD 30's)
CM 60-69 Advanced Topics

CIRCUIT THEORY (CR)

CR 10-19 General Circuit Theory
CR 20-29 Electronic Circuits (see also PS 40's)
CR 30-39 Non-Linear Circuits (see also CT 40's and PS 40's)
CR 40-49 Large Scale Systems - Analysis and Simulation (see also ST 30's, PS 50's and PS 30's)
CR 50-59 Analog/Digital/Adaptive Filter Design (see also CC 60's)
CR 60-69 Switched Capacitor Filter Design
CR 70-79 Computational Methods and Graph Theory
CR 80-89 Optimization Techniques for Large Scale Systems (see also PS 50's and PS 80's)
CR 90-99 Advanced Topics

COMPUTER SOFTWARE (CS)

CS 10-19 Methodology
CS 20-29 Programming Languages
CS 30-39 Translator Design Techniques
CS 40-49 Operating Systems
CS 50-59 Database Systems
CS 60-69 Distributed Computer Systems (see also CA 50's, CM 50's and AD 30's)
CS 70-79 Multiprocessor Software Methods
CS 80-89 Modeling and Performance Evaluation
CS 90-99 Advanced Topics

CONTROL THEORY (CT)

- CT 10-19 Linear Systems (see also CC 10's)
- CT 20-29 Feedback Control
- CT 30-39 Stochastic Control
- CT 40-49 Nonlinear Systems (see also PS 40's and PS 70's)
- CT 60-69 Optimal Control (see also CM 40's)
- CT 70-79 Digital Control (see also PS 40's and PS 70's)
- CT 80-89 Robotic Systems (see also IS 50's and PD 60's)
- CT 90-99 Applications of Control Theory

DIGITAL SYSTEMS (DS)

- DS 10-19 VLSI Design Applications (see also IC 40's and 50's)
- DS 20-29 Reliable Computation
- DS 30-39 Computer Arithmetic
- DS 40-49 High Speed Computation
- DS 50-59 Parallel Processing Hardware Systems
- DS 60-69 Digital Hardware Design (see also IC 80's)
- DS 70-79 Testing of Digital Hardware Systems
- DS 80-89 Fault Tolerant Systems
- DS 90-99 Advanced Topics

EMERGING AREAS (EA)

- EA 20-29 Multimedia

ECONOMICS AND FINANCE (EF)

- EF 10-19 Managerial or Cost Accounting
- EF 20-29 Financial Management (see also SP 40's)
- EF 30-39 Engineering Economics
- EF 40-49 Managerial Economics
- EF 50-59 Special Topics

ELECTROMAGNETICS (EM)

- EM 10-19 Lightwaves and Optics
- EM 20-29 Lasers and Quantum Electronics
- EM 30-39 Active and Passive Microwave Systems (see also CC 70's and IC 70's)
- EM 40-49 Field Theory
- EM 50-59 Antennas
- EM 60-69 Applications (see also CC 70's)
- EM 70-79 Scattering and Diffraction of Waves (see also MC 50's)
- EM 80-89 Computational Methods
- EM 90-99 Advanced Topics

ELECTRICAL PROPERTIES (EP)

- EP 10-19 General
- EP 20-29 Electronic Materials Processing (see also IC 30's and ES 10's)
- EP 30-39 Device Fabrication and Packaging (see also IC 00's, IC 20's and IC 30's)
- EP 40-49 Physical Properties

ENGINEERING SCIENCE (ES)

- ES 10-19 Physics (see also IC 60's)
- ES 20-29 Chemistry (see also PM 10-49 and CH 10's)
- ES 30-39 Biology
- ES 40-49 Geology
- ES 50-59 Health Sciences
- ES 60-69 Nuclear Engineering/Science (see also EV 70's)
- ES 70-79 Civil Engineering/Science
- ES 80-89 Environmental Engineering (see also EV 40's and 80's)
- ES 90-99 Advanced Topics

ENVIRONMENTAL SYSTEMS MANAGEMENT (EV)

- EV 05-09 Environmental Systems Management
- EV 10-14 Laws and Regulations
- EV 20-24 Risk Assessment
- EV 25-29 Fate and Transport
- EV 40-45 Technology: Treatment
- EV 50-59 Water Applications
- EV 60-64 Air Applications
- EV 65-69 Land Applications
- EV 75-79 Hazardous Waste
- EV 80-89 Science/Engineering
- EV 90-94 Special Topics

FOREIGN LANGUAGES (FL)

- FL 00-19 Technical and Business Japanese
- FL 20-29 Japanese Culture
- FL 30-39 Technical and Business Chinese
- FL 40-49 Technical and Business English
- FL 50-59 Technical and Business European Languages

FAST TRACK (FT)

- FT 00-09 Fast Track - Computer Science

INTEGRATED CIRCUITS (IC)

- IC 00-09 Electronic Packaging (see also EP 20's)
- IC 10-19 Electronic Materials (see also EP)
- IC 20-29 Devices and Modeling (see also EP 30's)
- IC 30-39 Fabrication and Process Modeling (see also EP 20's, EP 30's and MS 40's)
- IC 40-49 Circuit and System Design (Including General VLSI) (see also DS 10's)
- IC 50-59 VLSI Design Automation (see also DS 10's)
- IC 60-69 Physical Electronics (see also ES 10's)
- IC 70-79 Analog Circuits (Including Specialized VLSI) (see also EM 30's)
- IC 80-89 Digital Circuits (Including Specialized VLSI) (see also DS 60's)
- IC 90-99 Advanced Topics

INTELLIGENT SYSTEMS (IS)

- IS 10-19 General Methods for AI
- IS 20-29 Expert/Knowledge-Based Systems
- IS 30-39 Programming Languages for AI
- IS 40-49 Natural Language Processing
- IS 50-59 Intelligent Robotic Systems (see also CT 80's and PD 60's)
- IS 60-69 Computer Vision (see also CC 70's and PD 60's)
- IS 70-79 Machine Learning
- IS 80-89 Logic Programming and Deduction
- IS 90-99 Neural Networks

MATHEMATICS (MA)

- MA 10-19 Discrete Mathematics and Combinatorics
- MA 20-39 Probability and Statistics
- MA 40-49 Calculus/Complex Variables/Vector and Matrix Analysis
- MA 50-59 Queueing Theory and Statistical Analysis (see also TO 70's)
- MA 60-69 Algebra
- MA 70-79 Graph Theory and Topology
- MA 80-89 Differential Equations
- MA 90-99 Advanced Topics

MANAGEMENT AND BEHAVIORAL SCIENCE (MB)

- MB 10-19 Management for Engineers (see also TO 60's)
- MB 20-29 Organizational Behavior/Personnel
- MB 30-39 Human Relations
- MB 40-49 Industrial Psychology
- MB 50-59 Law
- MB 60-69 Emerging Issues in Technical Management
- MB 80-89 Capstone Projects
- MB 90-99 Special Topics

MATERIALS CHARACTERIZATION (MC)

- MC 10-19 General
- MC 20-29 Surface and Interface Analysis
- MC 30-39 Characterization of Bulk Materials
- MC 40-49 Imaging and Image Processing (see also EM 10's and EM 70's)
- MC 50-59 Diffraction Techniques (see also EM 70's)
- MC 60-69 Non-Destructive Testing
- MC 90-99 Special Topics

MECHANICAL ENGINEERING (ME)

- ME 10-19 Mechanics, Dynamics and Vibrations (see also MP 10's and MS 10's)
- ME 20-29 Design
- ME 30-39 Heat and Mass Transfer
- ME 40-49 Fluid Mechanics (see also AE 20's)
- ME 50-59 Combustion and Power-Producing Devices
- ME 60-69 Thermal Environmental Engineering
- ME 70-79 Thermodynamics (see also MS 20's)

- ME 80-89 Advanced Mechanics
- ME 90-99 Special Topics

BUSINESS AND ADMINISTRATION (MG)

- MG 10-19 Managerial Accounting
- MG 20-29 Global Marketing Management
- MG 30-39 Managerial Economics
- MG 40-49 Financial Management
- MG 50-59 Management of Technology
- MG 60-69 Organizational Behavior and Cultural Environments
- MG 70-79 Legal Environment of Business
- MG 80-89 Global Strategic Management

MECHANICAL PROPERTIES (MP)

- MP 10-19 General (see also ME 10's)
- MP 20-29 Mechanics of Materials (see also ME 10's)
- MP 30-39 Deformation and Fracture Mechanisms
- MP 40-49 Multiphase Mechanics
- MP 50-59 Deformation Processing
- MP 60-69 Machining and Fabrication

MATERIALS SCIENCE (MS)

- MS 10-19 General (see also ME 10's)
- MS 20-29 Thermodynamics and Kinetics (see also ME 70's)
- MS 30-39 Materials Degradation
- MS 40-49 Solid State Chemistry (see also IC 30's)
- MS 50-59 Electronic, Atomic and Molecular Arrangements
- MS 90-99 Special Project

MANAGEMENT OF TECHNOLOGY (MT)

- MT 710-769 Management of Technology
- MT 910-960 Residencies
- MT 712 Field Research Project

PRODUCT AND PROCESS DESIGN (PD)

- PD 10-19 Design for Assembly
- PD 20-29 Design for Manufacturability
- PD 30-39 Facility Design and Material Handling
- PD 40-49 Manufacturing Processes (see also IC, MP and SP)
- PD 50-59 Materials Processing (see also EP 20's and IC 30's)
- PD 60-69 Flexible Automation (see also IS 50's and CT 80's)
- PD 70-79 Integration of CAD/CAM/CAE (see also ST 10's)
- PD 80-89 Environmentally Conscious Manufacturing
- PD 90-99 Advanced Topics

POLYMERIC MATERIALS (PM)

- PM 10-19 General
- PM 20-29 Rheology

PM 30-39 Processing of Polymers (see also MP 50's, MP 60's and PD 40's)
PM 40-49 Morphology and Molecular Structure

POWER SYSTEMS (PS)

PS 10-19 Power Systems Analysis
PS 20-29 High Voltage Engineering
PS 30-39 Energy Conversion
PS 40-49 Power Electronics (see also CR 20's, CR 30's, CT 40's and CT 70's)
PS 50-59 Operation of Power System/Stability & Control (see also CR 40's and CR 80's)
PS 60-69 Energy Management Systems/Planning, Design and Scheduling
PS 70-79 Electric Drives (see also CT 40's and CT 70's)
PS 80-89 Transmission Systems (see also CR 40's and CR 80's)
PS 90-99 Advanced Topics

QUANTITATIVE METHODS (QM)

QM 10-19 Operations Research (see also SP 20's)
QM 20-29 Linear Programming (see also SP 20's)
QM 30-39 Specialized Techniques
QM 40-49 Decision Analysis
QM 50-59 Systems Management or Engineering (see also MB 10's and TO 10's)

SOFTWARE ENGINEERING (SE)

SE 10-19 Software Engineering Methodology
SE 20-29 Life Cycle Models and Software Metrics
SE 30-39 Analysis and Design Techniques
SE 40-49 Programming Environments and Implementation Issues
SE 50-59 Testing and Reliability
SE 60-69 Productivity Measures and Quality Assurance
SE 70-79 Specification Languages and Other Language Issues
SE 80-89 Software Management, Psychology and Control Methods
SE 90-99 Advanced Topics

MANUFACTURING SYSTEMS PLANNING AND CONTROL (SP)

SP 10-19 Modeling and Analysis
SP 20-29 Production Ctrl & Scheduling (see also ST 30's, QM 10's and QM 20's)
SP 30-39 Materials Management and Logistics
SP 40-49 Strategic Planning (see also TO 20's and EF)
SP 50-59 Measurement and Sensing
SP 60-69 Manufacturing Management and Integration
SP 90-99 Advanced Topics

SOFTWARE TECHNIQUES (ST)

ST 10-19 CAE/CAD/CAM Tool Development (see also PD 70's)
ST 20-29 Real Time Software Systems
ST 30-39 Simulation (see also CR 40's, SP 10's and SP 20's)
ST 40-49 Computer Graphics
ST 50-59 Computer Networks (see also CC 80's and CA 20's)
ST 60-69 Computer System Security
ST 90-99 Special Topics

SYSTEMS ENGINEERING (SY)

SY 10-19 Systems Engineering Principles and Processes
SY 20-29 Systems Modeling and Analysis
SY 30-39 Systems Concepts of Strategic Cost Analysis
SY 40-49 Systems Optimization
SY 50-59 Systems Reliability
SY 60-69 Systems Management
SY 70-79 Logistics from Acquisitions Systems Engineering
SY 80-89 Systems Engineering Design

TELECOMMUNICATIONS (TC)

TC 00-09 Telecommunication Principles (see CC 10's)
TC 10-19 Telecommunication Technologies (see CC 80's)
TC 20-29 Data Communications (see ST 50's)
TC 40-49 Telecommunication Networks and Systems (see ST 50's, CC 80's)
TC 50-59 Personal and Wireless Telecommunications
TC 70-79 Telecommunication Systems Administration
TC 80-89 Telecommunication Standards, Policy and Regulations
TC 90-99 Special Topics

TECHNICAL OPERATIONS (TO)

TO 10-19 Information Systems (see also QM 50's)
TO 20-29 Forecasting (see also SP 20's and SP 40's)
TO 30-39 Marketing Management/Industrial Marketing
TO 40-49 Human Factors
TO 50-59 Industrial Engineering
TO 60-69 Project Management (see also MB 10's)
TO 70-79 Quality Control and Reliability (see also MA 50's)
TO 80-89 Production Management
TO 90-99 Special Topics

Course Listing

The following is a list of over 1300 NTU approved courses (with the corresponding number of credits) by course area designations, as of the time of printing. Because of NTU's association with more than 50 universities, this is a dynamic list, with courses frequently added or retired by these universities. It is therefore suggested that students refer to the NTU web site www.ntu.edu for an up-to-date list of courses.

Algorithms and Data Structures (AD)

AD 10-19	Data Structures		
AD 510-B	Data Structures (3.0)	AD 510-SC	Introduction to Programming Systems Design (4.0)
AD 710-F	Data Structures (3.0)	AD 711-R	Advanced Data Structures (3.0)

AD 20-29	Design and Analysis of Algorithms		
AD 720-A	Advanced Algorithms and Complexity (3.0)	AD 721-A	Sequential and Parallel Algorithms (3.0)
AD 520-B	Design and Analysis of Computer Algorithms (3.0)P	AD 521-C	Advanced Algorithms and Data Structures (3.0)
AD 520-CL	Analysis of Algorithms, I (3.0)	AD 722-C	Advanced Algorithms and Data Structures II (3.0)
AD 720-F	Combinatorial Optimization (3.0)	AD 723-E	Engineering Applications of Graphic Theory (3.0)
AD 520-H	Analysis of Algorithms (4.0)	AD 723-N	Graph Theory: Algorithms and Applications (3.0)
AD 520-K	Introduction to Algorithms (3.0)	AD 724-A	Resource Allocation and Scheduling (3.0)
AD 720-KS	Analysis of Algorithms (3.0)	AD 725-B	Analysis of Algorithms (3.0)
AD 720-M	Computational Models and Methods (3.0)	AD 526-AT	Genetic Algorithms (3.0)
AD 520-P	Design and Analysis of Algorithms (3.0)	AD 726-Q	Genetic Algorithms (4.0)
AD 720-R	Analysis of Algorithms (3.0)	AD 727-AT	Special Topics in Genetic Algorithms (3.0)

AD 30-39	Multiprocessor Algorithms (<i>see also CA 50's, CM 50's, and CS 60's</i>)		
AD 730-A	Parallel Algorithms and Architectures (3.0)	AD 530-H	Parallel Processing (4.0)
AD 530-C	Introduction to Parallel Computing: Architectures, Algorithms and Programming (3.0)	AD 730-R	Parallel Algorithms - Design and Analysis (3.0)
		AD 531-KS	Parallel Programming (3.0)

Aerospace Engineering (AE)

AE 10-19	Analysis (<i>see also MP 20's, ME 20's, and MS 60's</i>)		
AE 510-AT	Fundamentals of Orbital Mechanics (3.0)	AE 715-E	Computational Multibody Dynamics (3.0)

AE 20-29	Mechanics of Compressible Fluids (<i>see also ME 40's</i>)		
AE 523-M	Gas Dynamics (3.0)	AE 525-M	Air Breathing Propulsion (3.0)
AE 523-X	Intermediate Gas Dynamics (3.0)		

AE 30-39	Air Frame Design		
AE 730-SC	Spacecraft Systems Design (3.0)	AE 535-SC	Spacecraft Propulsion (3.0)
AE 731-SC	Space Environments and Spacecraft Interaction (3.0)	AE 735-Y	Space Propulsion (2.0)

Bridging: Computer Engineering, Computer Science and Software Engineering (BC)

BC 10-19 Fundamentals of Computer Engineering

BC 310-NJ Programming in C (1.0)
BC 311-C Structure of Computer Programming I (4.0)
BC 311-NJ Introduction to Computer Science I (3.0)
BC 312-C Structure of Computer Programming II (4.0)
BC 312-NJ Introduction to Computer Science II (3.0)
BC 315-E Object Oriented Programming Concepts (3.0)
BC 315-O Object-Oriented Programming and Visual C++ (3.0)

BC 316-N Fundamentals of Computer Science (3.0)
BC 317-B Software Development (3.0)
BC 317-F Concepts of Object-Oriented Design (3.0)
BC 318-F Component Software Development (3.0)
BC 318-NJ Applications Development for the World Wide Web/Java and Advanced Java (3.0)

BC 20-29 Digital Logic Design

BC 320-A Digital Logic Design (3.0)

BC 30-39 Data Structures

BC 330-A Non-Numeric Processing - Data Structures in Java (3.0)
BC 330-K Data Structures and Algorithms (3.0)
BC 330-NJ Programming, Data Structures, and Algorithms (3.0)

BC 330-Q Data Structures and Software Principles (4.0)
BC 331-K Intro to Advanced Studies in Computer Science I (3.0)
BC 332-K Intro to Advanced Studies in Computer Science II (3.0)

BC 40-49 Microprocessors and Assembly Level Programming

BC 340-A Intro to Computer Organization and Assembly Language (3.0)

BC 50-59 Operating System Principles

BC 350-A Operating Systems I (3.0)

BC 60-69 Digital System Design - Computer Architecture

BC 360-A Hardware Organization and Design (3.0)

BC 80-89 Discrete Structures

BC 380-C Discrete Structures of Computer Science (4.0)

BC 380-D Foundations of Computer Engineering (3.0)

Bridging: Electrical Engineering (BE)

BE 10-19 Circuits

BE 310-NJ Circuits and Systems I (3.0)
BE 310-U Electric Circuits (3.0)
BE 311-U Circuits and Systems (3.0)

BE 312-A Circuit Analysis I (3.0)
BE 313-A Circuit Analysis II (3.0)

BE 20-29 Electronics

BE 321-S Background Study in Electronics (3.0)
BE 322-A Digital Electronics (3.0)
BE 323-O Electronic Devices and Applications (3.0)

BE 324-O Network Analysis (3.0)
BE 327-A Semiconductor Devices and Materials (3.0)

BE 30-39 Electromagnetics

BE 330-U Introduction to Electromagnetic Fields (3.0)
BE 331-U Electromagnetic Fields and Waves (3.0)

BE 332-O Electromagnetic Fields (3.0)
BE 333-S Background Study in Electromagnetic Theory (3.0)

BE 40-59**Systems**

BE 341-A Signals and Systems(3.0)
 BE 345-A Random Signal Theory(3.0)

BE 355-X Electromechanical Energy Conversion (3.0)

Bridging: Undergraduate Certificate (BN)**BN 00-29 Undergraduate Certificate**

BN 300-NJ Computers and Society (3.0)
 BN 310-NJ Database System Design and Management (3.0)

BN 315-NJ Design of Interactive Systems/Human Computer Interfaces (3.0)

Bridging (BR)**BR 00-09 Mathematics**

BR 300-F Calculus I(3.0)
 BR 300-NJ Calculus I (4.0)
 BR 300-Q Topics in Applied Mathematics: Calculus Refresher (3.0)
 BR 301-F Calculus 2 (3.0)
 BR 301-NJ Probability and Statistics (3.0)
 BR 301-S Engineering Statics (3.0)

BR 302-S Linear Algebra (3.0)
 BR 303-NJ Calculus II (4.0)
 BR 304-NJ Differential Equations (4.0)
 BR 306-O Engineering Mathematics Review (3.0)
 BR 307-S Engineering Dynamics (3.0)

BR 40-49 Materials Science and Engineering

BR 342-CL Elements of Materials Science (3.0)

BR 50-59 Mechanical Engineering

BR 350-F Materials Requirements Planning (2.0)

BR 90-99 Special Topics

BR 390-F Technical Writing Intensive (4.0)

Computer Architecture (CA)**CA 10-19 Computer Architecture**

CA 510-C Computer Architecture (3.0)
 CA 710-E Modern Computer Architecture (3.0)
 CA 510-Q Computer System Organization (4.0)
 CA 510-SC Computer Systems Organization (4.0)
 CA 712-A Modern Computer Architecture (3.0)
 CA 512-B Digital Computer Design (3.0)
 CA 712-E Digital Systems Design (3.0)
 CA 712-F Computer Architecture (3.0)
 CA 712-S Advanced Computer Architecture (3.0)
 CA 714-A Advanced Computer Architecture I (3.0)
 CA 714-CA Graduate Computer Architecture (4.0)
 CA 714-E Computer Architecture and Design (3.0)
 CA 714-F Computer Architecture (3.0)

CA 514-H Advanced Computer Architecture (4.0)
 CA 514-M Computer Architecture (3.0)
 CA 514-N Computer Architecture (3.0)
 CA 714-O Digital Computer Design (3.0)
 CA 514-P Digital Computer Technology and Design (3.0)
 CA 714-R Computer Architecture Principles (3.0)
 CA 714-SC Computer Systems Architecture (3.0)
 CA 714-U Advanced Computer Architecture (3.0)
 CA 514-P Reconfigurable Computing (3.0)
 CA 518-CM Superscalar Processor Design (4.0)
 CA 718-Q High Performance Computer Architecture: Hardware and Software (4.0)

CA 20-29	Parallel Systems and Interconnection Networks (<i>see also CC 80's and ST 50's</i>)		
CA 720-A	Advanced Computer Architecture II (3.0)	CA 520-P	Architecture of Parallel Computers (3.0)
CA 720-B	Digital Computer Design (3.0)	CA 720-S	Concurrent Systems (3.0)
CA 720-E	Parallel Processing: Architectures, Algorithms and Technologies (3.0)	CA 521-P	Parallel and Distributed Computing (3.0)
CA 720-H	Architecture of Advanced Systems (4.0)	CA 725-F	Parallel Architectures for High Performance Computing (3.0)
CA 720-M	Advanced Computer Systems (3.0)	CA 726-A	VLSI Architectures for High-Performance Computing (3.0)
CA 720-N	Parallel and Distributed Processing (3.0)	CA 726-P	VLSI Architecture (3.0)
		CA 728-SC	Interconnection Networks (3.0)

CA 60-69	Microcomputers and Embedded Computer Systems		
CA 560-B	Microprocessors (3.0)	CA 765-A	Real-Time Systems (3.0)
CA 760-U	Embedded Computer Systems (3.0)	CA 765-U	Real-Time Systems (3.0)
CA 562-M	CISC Microprocessor System Design (3.0)		

CA 70-79	Interfacing and Memory Systems		
CA 775-R	Hardware-Software Interactions: Time Sharing Systems (3.0)		

CA 80-89	Interactive Computer Systems		
CA 780-D	Windows NT Hardware Engineering (3.0)		

Communications (CC)

CC 10-19	Communications/Statistical Communications and Signal Theory (<i>see also TC 20-59 and CT 10's</i>)		
CC 510-A	Communication Systems I (3.0)	CC 715-CA	Digital Communications (3.0)
CC 510-N	Communication and Information Systems (3.0)	CC 715-E	Introduction to Digital Communication Systems (3.0)
CC 710-SC	Communication Systems (3.0)	CC 715-M	Digital Communications (3.0)
CC 511-A	Communication Systems II (3.0)	CC 715-P	Digital Communications (3.0)
CC 711-O	Modern Communication Theory (3.0)	CC 716-O	Data Transportation and Protection (3.0)
CC 713-U	Analysis of Stochastic Systems (3.0)	CC 716-P	Advanced Digital Communications (3.0)
CC 714-A	Stochastic Processes (3.0)	CC 717-A	Signal Theory (3.0)
CC 714-E	Random Processes for Engineering Applications (3.0)	CC 718-B	Wireless Communication Networks (3.0)
CC 714-F	Applied Probability and Stochastic Processes (3.0)	CC 718-CL	Wireless Communication (3.0)
CC 714-M	Random Variables and Signals (3.0)	CC 718-F	Wireless Communications (3.0)
CC 714-P	Random Processes (3.0)	CC 718-J	Wireless Networks (3.0)
CC 714-R	Noise in Linear Systems (3.0)	CC 718-P	Wireless Communications Systems (3.0)
CC 715-A	Digital Communications (3.0)		

CC 20-29	Pattern Recognition and Remote Sensing		
CC 725-N	Wireless Networks (3.0)		

CC 30-39	Estimation and Detection Theory		
CC 730-F	Detection and Estimation Theory (3.0)	CC 732-J	Fundamentals of Radar Signal Processing (3.0)
CC 731-SC	Estimation Theory (3.0)		

CC 40-49	Information Theory and Coding		
CC 740-F	Error Correcting Codes (3.0)	CC 745-B	Information Theory (3.0)
CC 740-R	Error Correction Coding (3.0)	CC 746-DA	Cryptography and Data Security (2.0)
CC 740-S	Information Theory I (3.0)		

CC 50-59	Speech Processing		
CC 750-CA	Audio Signal Processing in Humans and Machines (3.0)	CC 750-J	Digital Processing of Speech Signals (3.0)

CC 60-69	Analog, Optical and Digital Signal Processing (see also CR 50's)		
CC 560-A	Digital Signal Processing I (3.0)	CC 763-J	Advanced Digital Signal Processing (3.0)
CC 760-C	Digital Signal Processing (3.0)	CC 763-N	VLSI Signal Processing Systems (3.0)
CC 560-E	Digital Signal Processing (3.0)	CC 764-CA	VLSI Signal Processing (3.0)
CC 760-F	Digital Signal Processing (3.0)	CC 764-J	Statistical Digital Signal Processing and Modeling (3.0)
CC 560-J	Fundamentals of Digital Signal Processing (3.0)	CC 565-A	Digital Signal Processing II (3.0)
CC 560-M	Digital Signal Processing (3.0)	CC 765-P	Digital Signal Processing Architecture (3.0)
CC 760-N	Analog and Digital Filter Design (3.0)	CC 766-F	Adaptive Signal Processing (3.0)
CC 760-P	Digital Signal Processing (3.0)	CC 766-J	Adaptive Filtering (3.0)
CC 560-SC	Introduction to Digital Signal Processing (3.0)	CC 766-S	Adaptive Signal Processing (3.0)
CC 561-E	Advanced Digital Signal Processing (3.0)	CC 766-SC	Adaptive Signal Processing (3.0)
CC 561-N	Digital Signal Processing (3.0)	CC 767-F	Electronics of Analog Signal Processing (3.0)
CC 562-M	Fourier Methods in Digital Signal Processing (3.0)	CC 769-J	Spatial Array Processing (3.0)
CC 563-DE	Statistical Signal Processing (3.0)		

CC 70-79	Image Processing and Radar Systems (see also IS 60's, EM 30's and EM 60's)		
CC 770-B	Digital Image Processing (3.0)	CC 770-M	Digital Image Processing I (3.0)
CC 570-CL	Digital Image Processing (3.0)	CC 770-SC	Introduction to Digital Image Processing (3.0)
CC 770-E	Digital Image Processing (3.0)	CC 772-CA	Digital Image Processing (3.0)
CC 770-J	Digital Image Processing (3.0)	CC 572-SC	Introduction to Digital Media Engineering (3.0)

CC 80-89	Telecommunications, LANS and Communication Networks (see also TC's, ST 50's and CA 20's)		
CC 781-R	Spread Spectrum and CDMA (3.0)	CC 785-SC	Satellite Communications (3.0)
CC 782-CA	High-Performance Communication Networks (3.0)	CC 786-E	Integrated Telecommunications Networks (3.0)
CC 582-P	High-Speed Networks (3.0)	CC 786-NJ	Principles of Broadband ISDN and ATM (3.0)
CC 782-R	Computer Communications (3.0)	CC 786-SC	Introduction to Broadband Network Architectures (3.0)
CC 784-CL	Broadband Networks (3.0)	CC 588-DE	Optical Fiber Communication (3.0)
CC 784-E	Broadband Networks and Multimedia Communications (3.0)		

Chemical Engineering (CH)

CH 10-19	Thermodynamics		
CH 711-DE	Chemical Engineering Thermodynamics (3.0)	CH 711-P	Thermodynamics I (3.0)
CH 711-K	Chemical Engineering Thermodynamics (3.0)	CH 711-R	Thermodynamics of Reaction and Phase Equilibria (3.0)
CH 711-NJ	Thermodynamics (3.0)		

CH 20-29	Transport Phenomena		
CH 725-B	Transport Phenomena (3.0)	CH 525-NS	Transport Phenomena (3.0)
CH 725-K	Transport Phenomena (3.0)	CH 725-R	Introduction to Transport Phenomena (3.0)

CH 30-39	Chemical Kinetics, Catalysis and Reactor Design		
CH 731-NJ	Kinetics of Reactions and Reactor Design (3.0)	CH 732-X	Kinetics and Catalysis (3.0)
CH 731-P	Chemical Reaction Engineering (3.0)	CH 733-K	Polymerization Reaction Engineering (4.0)

CH 40-49 Systems Analysis and Design

CH 740-K Statistical Quality and Process Control (3.0)
 CH 741-K Advanced Process Control (3.0)
 CH 741-O Advanced Chemical Process Control (3.0)
 CH 541-W Principles of Process Dynamics and Control (3.0)

CH 742-O Stagewise Operations (3.0)
 CH 743-K Heat Transfer (3.0)
 CH 743-O Process Heat Transfer (3.0)
 CH 744-O Topics in Model-Based Process Control (3.0)

CH 50-59 Chemical Engineering Mathematics

CH 751-K Computational Techniques in Engineering (4.0)
 CH 751-NJ Mathematical Methods in Chemical Engineering (3.0)
 CH 751-O Chemical Engineering Process Modeling (3.0)
 CH 751-P Chemical Engineering Process Modeling (3.0)
 CH 751-R Chemical Engineering Calculations (2.0)

CH 752-Y Nonlinear Analysis in Chemical Engineering (2.0)
 CH 753-K Statistical Analysis of Process Data (3.0)
 CH 754-O Optimization Applications (3.0)
 CH 555-M Bioseparations and Bioprocess Engr: Principles, Practice and Economics (3.0)

CH 60-79 Chemical Engineering Electives

CH 561-E Surface Science and Its Applications (3.0)
 CH 761-O Fundamentals of Polymer Engineering (3.0)
 CH 761-P Polymer Science and Technology (3.0)
 CH 561-Y Surface and Colloid Science (1.3)
 CH 762-O Polymer Processing (3.0)
 CH 562-P Polymer Rheology and Processing (3.0)
 CH 562-X Introduction to Polymer Processing (3.0)
 CH 562-Y Fuel Cell Engineering (2.0)

CH 563-M Rate-Controlled Separation Processes (3.0)
 CH 763-X Advanced Polymer Processing (3.0)
 CH 764-P Polymer Blends and Alloys (3.0)
 CH 565-P Chemical Processing of Electronic Materials (3.0)
 CH 766-K Fluidization and Gas-Solid Flow System (3.0)
 CH 767-W Introduction to System Identification (3.0)
 CH 568-P Life Cycle Concepts for the Environment (3.0)
 CH 775-X Biological Separations Processes (3.0)

CH 90-99 Chemical Engineering Bridging

CH 591-MS Foundations in Chemical Engineering I (3.0)

CH 592-MS Foundations in Chemical Engineering II (3.0)

Computational Methods and Theory (CM)**CM 10-19 Mathematical Logic and Automata Theory**

CM 510-B Elementary Theory of Computation (3.0)
 CM 510-C Formal Languages and Automata Theory (4.0)
 CM 710-D Automata Theory (3.0)
 CM 710-R Formal Languages and Computation Theory (3.0)

CM 510-S Theory of Computation (3.0)
 CM 710-W Theory of Formal Languages (3.0)
 CM 511-W Theory of Computation (3.0)

CM 20-29 Formal Languages

CM 720-R Computational Complexity (3.0)

CM 30-39 Computability and Computational Complexity

CM 730-A Theory of Computation (3.0)

CM 40-49 Numerical Techniques (see also CT 60's)

CM 740-A Advanced Numerical Analysis (3.0)
 CM 740-AT Applied Numerical Methods (3.0)
 CM 540-B Computational Methods (3.0)

CM 740-J Intro to Numerical Methods for Partial Diff. Equations (3.0)
 CM 741-A Numerical Analysis I (3.0)
 CM 742-A Numerical Analysis II (3.0)

CM 50-59 Methods for Parallel Computation (*see also CA 50's, CS 60's and AD 30's*)
CM 550-H Parallel Programming (4.0)

Circuit Theory (CR)

CR 20-29 Electronic Circuits (*see also PS 40's*)

CR 521-NM Electronic Testability - Systems to Integrated Circuits (3.0)
CR 524-M Electronic Instrumentation and Control Circuits (3.0)

CR 526-E Design-Oriented Analysis of Electronic Circuits (3.0)
CR 529-P RF Engineering (3.0)

CR 50-59 Analog/Digital/Adaptive Filter Design (*see also CC 60's*)

CR 750-Y Active Circuit Theory (2.0)

CR 551-E Analog Signal Processing and Filtering (3.0)

Computer Software (CS)

CS 20-29 Programming Languages

CS 520-A Programming Languages (3.0)
CS 520-C Programming Languages (3.0)
CS 720-R Programming Language Principles (3.0)

CS 720-SC Issues in Programming Language Design (3.0)
CS 721-B Theory of Programming Languages (3.0)
CS 722-S Theory of Programming Languages (3.0)

CS 30-39 Translator Design Techniques

CS 530-B Theory of Language Translation (3.0)
CS 530-CL Programming Languages and Translators (3.0)
CS 730-F Principles of Programming Languages (3.0)
CS 530-H Algorithmic Language Compilers (4.0)
CS 530-KS Translator Design I (3.0)
CS 530-M Compiling and Programming Systems (3.0)

CS 530-P Compiler Construction (3.0)
CS 531-H Introduction to Compiler Construction (4.0)
CS 732-P Data Flow Analysis of Programs (3.0)
CS 734-A Advanced Compiler Techniques (3.0)
CS 735-H Advanced Topics: Language Implementation (4.0)

CS 40-49 Operating Systems

CS 740-A Operating Systems II (3.0)
CS 540-B Operating Systems (3.0)
CS 540-C Operating Systems (3.0)
CS 740-CA Advanced Topics in Operating Systems (3.0)
CS 540-CL Operating Systems I (3.0)
CS 540-D Operating Systems (3.0)
CS 740-F Operating Systems and Systems Software (3.0)
CS 540-K Operating Systems (3.0)
CS 540-KS Operating System Practices (3.0)
CS 540-M Operating Systems (3.0)

CS 540-N Operating Systems and Systems Software (3.0)
CS 540-P Operating Systems Principles (3.0)
CS 540-Q Operating Systems Design (4.0)
CS 740-R Operating Systems Principles (3.0)
CS 540-SC Operating Systems (3.0)
CS 741-Q Advanced Operating Systems (4.0)
CS 743-N Advanced Operating Systems (3.0)
CS 743-R Distributed Operating Systems (3.0)
CS 745-KS Distributed Systems (3.0)
CS 746-KS Advanced Operating Systems (3.0)

CS 50-59 Database Systems

CS 550-A Information Systems (3.0)
CS 550-B Database Design (3.0)
CS 550-CL Database Systems (3.0)
CS 550-D Database System Design (3.0)
CS 750-F Data Base Management Systems (3.0)
CS 750-K Advanced Database Organization (3.0)
CS 750-KS Database Management Systems (3.0)
CS 550-N File Organization and Database Management (3.0)
CS 750-P Database Management Systems (3.0)
CS 550-Q Database Systems (4.0)
CS 750-R Database Management Systems (3.0)

CS 750-SC Database Systems (3.0)
CS 751-KS Database Design (3.0)
CS 752-NJ Advanced Database System Design (3.0)
CS 752-R Database Design (3.0)
CS 753-K Object-Oriented Information Systems (3.0)
CS 754-CL Topics in Database Systems (3.0)
CS 755-D Distributed Database Design (3.0)
CS 755-KS Distributed Databases (3.0)
CS 555-M Distributed Database Systems (3.0)
CS 758-KS Data Engineering (3.0)
CS 758-N Data Mining (3.0)

CS 60-69 Distributed Computer Systems (*see also CA 50's, CM 50's and AD 30's*)
 CS 760-NJ Client/Server Computing (3.0) CS 765-E Distributed Computing Systems (3.0)
 CS 761-F Network Computing (3.0)

CS 70-79 Multiprocessor Software Methods
 CS 770-A Simulation and Evaluation of Computer Systems and Networks (3.0)

CS 80-89 Modeling and Performance Evaluation
 CS 780-KS Advanced WWW Technologies (3.0)

CS 90-99 Advanced Topics
 CS 590-CN Virtual Reality Systems (3.0)

Control Theory (CT)

CT 10-19 Linear Systems (*see also CC 10's*)
 CT 510-S Background Study in Signals and Systems Analysis (4.0) CT 712-A Linear Systems Theory (3.0)
 CT 510-X Signals and Systems (3.0) CT 712-F Linear Systems Analysis (3.0)
 CT 711-X Dynamics of Controlled Systems (3.0)

CT 20-29 Feedback Control
 CT 520-A Feedback Control Systems (3.0) CT 521-P Principles of Mechatronic Control (3.0)
 CT 720-F Classical Control Theory (3.0) CT 722-P Linear Control and Design for Multivariable Systems (3.0)
 CT 720-GM Engineering System Modeling, Simulation and Analysis (3.0) CT 722-Q Control System Theory and Design (4.0)
 CT 520-P Management Decision and Control Systems: A Special New Millennium Edition (3.0) CT 525-NM Fuzzy Logic with Engineering Applications (3.0)
 CT 520-X Automatic Controls (3.0) CT 526-P Neural, Fuzzy, Genetic and Expert Systems (3.0)
 CT 721-A Control System Design (3.0) CT 526-X Intro to Artificial Neural Network and Fuzzy Logic (3.0)
 CT 527-A Intelligent Systems (3.0)

CT 40-49 Nonlinear Systems (*see also PS 40's and PS 70's*)
 CT 741-J Nonlinear Systems and Control (3.0)

CT 70-79 Digital Control (*see also PS 40's and PS 70's*)
 CT 570-A Digital Control of Dynamic Systems (3.0) CT 770-J Digital Control (3.0)
 CT 570-CL Digital Control Systems (3.0) CT 771-A Adaptive Filters (3.0)
 CT 770-DA Analysis and Design of Digital Control Systems (2.7) CT 572-X Computer Control of Machines and Processes (3.0)
 CT 570-E Digital Control Systems (3.0) CT 773-X Advanced Computer Control of Machines and Processes (3.0)
 CT 770-GM Digital Control Design and Applications (2.7) CT 574-X Design of Computer Control Systems (3.0)
 CT 570-H Digital Control and Digital Filters (3.0)

CT 80-89 Robotic Systems (*see also IS 50's and PD 60's*)
 CT 780-A Robotics (3.0) CT 780-X Advanced Automation and Robotics (3.0)
 CT 780-P Robotics: Theory and Practice (3.0)

CT 90-99 Applications of Control Theory
CT 793-AR Communications Networks for Motion/Industrial Control (3.0)

Digital Systems (DS)

DS 10-19 VLSI Design Applications (*see also IC 40's and 50's*)
DS 710-F Digital Hardware Synthesis (3.0)

DS 510-P Digital ASIC Design (3.0)

DS 30-39 Computer Arithmetic
DS 730-A Digital Computer Arithmetic (3.0)

DS 60-69 Digital Hardware Design (*see also IC 80's*)
DS 560-A Advanced Switching Theory (3.0)
DS 760-SC Logic Design and Switching Theory (3.0)
DS 763-CA Logic Synthesis for Hardware Systems (4.0)

DS 765-F Digital System Design with Hardware Description Languages (3.0)
DS 766-F Digital System Design and Interfacing with Verilog (3.0)

DS 70-79 Testing of Digital Hardware Systems
DS 770-A Testing and Diagnosis of VLSI Systems (3.0)
DS 770-E Test Generation for Automata (3.0)
DS 770-F Digital System Testing and Design for Testability (3.0)
DS 570-H Digital Systems Testing I (3.0)
DS 770-K Digital Systems Testing and Testable Design (3.0)

DS 770-NJ Design for Testability Principles (3.0)
DS 770-O Digital Systems Testing (3.0)
DS 770-P Logic Design for Testability (3.0)
DS 571-H Digital Systems Testing II (3.0)

DS 80-89 Fault Tolerant Systems
DS 780-A Fault Tolerant Systems (3.0)
DS 780-F Special Topics in Fault Tolerant Computing (3.0)
DS 780-N Fault-Tolerant Computation (3.0)
DS 780-R Fault-Tolerant Computing (3.0)

DS 780-S Fault Tolerant System Design (3.0)
DS 780-SC Fault Tolerant Computer Systems (3.0)
DS 780-U Fault Tolerant Systems (3.0)

Emerging Areas (EA)

EA 20-29 Multimedia
EA 520-CL Special Topics in Computer Science: Multimedia Information Systems (3.0)
EA 720-NJ Multimedia Presentations (3.0)
EA 520-P Multimedia Technology (3.0)

EA 722-B Multimedia Database Systems (3.0)
EA 724-SC Microsystems Technology for Multimedia (3.0)
EA 726-CL Multimedia Networking (3.0)

Economics and Finance (EF)

EF 10-19 Managerial or Cost Accounting
EF 710-AH Financial Methods for Engineers (3.0)
EF 510-CL Introduction to Accounting and Finance (4.0)
EF 710-D Financial Accounting (3.0)
EF 710-GM Managerial Accounting (2.0)
EF 710-N Engineering Accounting (3.0)

EF 710-NJ Concepts of Strategic Cost Analysis (3.0)
EF 510-T Cost Accounting (3.0)
EF 715-CU Finance and Accounting for Engineers (3.0)
EF 515-T Accounting For Engineering Management (3.0)
EF 516-GW Financial Accounting (2.0)

EF 20-29 Financial Management (*see also SP 40's*)
EF 720-GM Financial Management (2.0-3.0)
EF 720-N Engineering Finance (3.0)

EF 720-T Advanced Financial Management (3.0)
EF 721-B Engineering Economics and Financial Analysis (3.0)

EF 30-39 Engineering Economics
EF 530-CL Industrial Economics (3.0)
EF 530-CU Engineering Economics (3.0)
EF 530-K Principles of Engineering Economics (3.0)
EF 530-SC Engineering Economy (3.0)
EF 530-T Engineering Economy (3.0)
EF 735-A Manufacturing and Engineering Economics (3.0)
EF 535-M Engineering Economic Analysis (3.0)

EF 735-N Economic Decision Analysis (3.0)
EF 736-GM Applied Microeconomics: Theory, Forecasting and Policy (3.0)
EF 536-M Economic Decisions in Engineering (3.0)
EF 736-TN Advanced Engineering Economy (3.0)
EF 737-O Financial and Advanced Capital Investment Analysis (3.0)

EF 40-49 Managerial Economics
EF 740-GM Macroeconomics for Managers (2.0)
EF 741-B Systems Life Cycle Cost Estimating (3.0)

EF 541-P Applied Microeconomic Analysis (3.0)
EF 542-P The Economics of Information Goods (3.0)

Electromagnetics (EM)

EM 10-19 Lightwaves and Optics
EM 510-DE Opto-Electronics (3.0)
EM 710-E Radiometry and Detectors (3.0)
EM 711-E Introduction to Fourier Optics (3.0)
EM 711-J Fourier Optics and Holography (3.0)
EM 512-CL Modern Optics (3.0)
EM 513-NS Fiber Optics I (3.0)
EM 713-U Modern Optical Communications (3.0)
EM 713-W Fiber Optics (3.0)
EM 714-DA Optical Communications and Networking (2.7)

EM 514-NS Fiber Optics II (3.0)
EM 714-W Advanced Fiber Optics (3.0)
EM 715-E Optical Detectors and Detector Systems (3.0)
EM 716-E Introduction to Optical Design (3.0)
EM 717-E Introduction to Aberrations (3.0)
EM 718-E Diffraction and Interferometry (3.0)
EM 718-W Coherent Optics (3.0)
EM 719-E Optical Testing (3.0)

EM 20-29 Lasers and Quantum Electronics
EM 720-E Introduction to Optical Physics and Lasers (3.0)
EM 722-DE Integrated Optics (3.0)

EM 725-J Nonlinear Optics (3.0)

EM 30-39 Active and Passive Microwave Systems (*see also CC 70's and IC 70's*)
EM 530-A Microwave Engineering I (3.0)
EM 730-P Principles of Microwave Circuits (3.0)
EM 531-A Microwave Engineering II (3.0)
EM 531-D Microwave Engineering (3.0)
EM 732-A Active Microwave Devices (3.0)
EM 732-DE Microwave Devices and Circuits (3.0)
EM 532-E Active Circuit Design (3.0)

EM 734-SC Principles of Radar (3.0)
EM 735-A Microwave and RF Wireless Systems (3.0)
EM 535-P Radio Frequency Design for Wireless (3.0)
EM 736-A Active Microwave Circuits (3.0)
EM 736-N Microwave Electronics (3.0)
EM 736-P RF Amplifier and Oscillator Design (3.0)

EM 40-49 Field Theory
EM 540-CL Wave Transmission and Fiber Optics (3.0)
EM 740-E Electromagnetic Waves (3.0)

EM 740-F Electromagnetic Theory I (3.0)

EM 50-59 Antennas

EM 750-A Antenna Theory and Design (3.0)
 EM 550-E Antenna Theory and Design (3.0)
 EM 550-Q Antennas (3.0)

EM 751-A Phased Arrays (3.0)
 EM 552-N Antennas and Radiowave Propagation for Personal Communications (3.0)

EM 70-79 Scattering and Diffraction of Waves (see also MC 50's)

EM 770-F Electromagnetic Theory II (3.0)

EM 80-89 Computational Methods

EM 780-F Computational Methods in Electromagnetics (3.0)

Electrical Properties (EP)**EP 10-19 General**

EP 711-R Electron Theory of Solids for Materials Scientists I (3.0)

EP 20-29 Electronic Materials Processing (see also IC 30's and ES 10's)

EP 722-U Magnetism and Magnetic Materials (3.0)
 EP 725-P Materials Science and Processing of Semiconductor Devices (3.0)

EP 726-R Deposition and Properties of Thin and Thick Films (3.0)

EP 40-49 Physical Properties

EP 741-P Defects, Diffusion & Ion Implantation in Semiconductors (3.0)
 EP 545-CL Electronic and Magnetic Properties of Solids (3.0)

EP 748-U Electronic Properties of Materials (3.0)
 EP 749-B Electronic Structure of Engineering Materials (3.0)

Engineering Science (ES)**ES 50-59 Health Sciences**

ES 550-H Radiation Public Health (2.0)
 ES 554-A Occupational Biomechanics (3.0)

ES 755-NJ Safety Engineering Methods (3.0)
 ES 756-NJ Industrial Hygiene and Occupational Health (3.0)

ES 70-79 Civil Engineering/Science

ES 572-NS Introduction to Satellite Surveying (3.0)

ES 573-M GPS Surveying (3.0)

ES 80-89 Environmental Engineering (see also EV 40's and 80's)

ES 581-NM Indoor Air Pollution (3.0)

Environmental Systems Management (EV)**EV 05-09 Environmental Systems Management**

EV 706-NJ Pollution Prevention (3.0)
 EV 506-TN Industrial Pollution Prevention (3.0)

EV 507-N Integrated Waste Management (3.0)

EV 10-14	Laws and Regulations		
EV 711-NJ	Legal Aspects in Environmental Engineering (3.0)	EV 512-N	Environmental and Hazardous Waste Laws (3.0)
<hr/>			
EV 20-24	Risk Assessment		
EV 521-N	Risk Assessment and Health Effects (3.0)	EV 721-S	Engineering Risk Assessment for Hazardous Waste Evaluations (3.0)
EV 721-P	Environmental Exposure and Risk Analysis (3.0)		
<hr/>			
EV 25-29	Fate and Transport		
EV 726-N	Fate and Transport of Contaminants (3.0)	EV 727-NS	Fate and Transport of Environmental Contaminants (3.0)
<hr/>			
EV 40-45	Technology: Treatment		
EV 741-N	Physical and Chemical Treatment Methods (3.0)	EV 744-B	Control of Combustion Generated Air Pollution (3.0)
EV 741-NJ	Industrial Waste Control: Physical and Chemical Treatment (3.0)	EV 744-CU	Air Pollution Control Engineering (3.0)
		EV 744-NJ	Industrial Gas Cleaning (3.0)
EV 541-TN	Physicochemical Unit Processes (3.0)	EV 544-NS	Air Pollution Control System Design (3.0)
EV 742-N	Biological Waste Treatment and Incineration (3.0)	EV 544-P	Air Pollution Control (3.0)
EV 742-NJ	Industrial Waste Control: Biological Treatment (3.0)	EV 744-S	Air Pollution Control (3.0)
EV 542-P	Design of Water and Wastewater Facilities (3.0)	EV 544-TN	Air Quality Management/Pollution Control (3.0)
<hr/>			
EV 50-59	Water Applications		
EV 752-N	Ground Water Hydrology and Contamination (3.0)	EV 554-NS	Natural Water Pollution Control (3.0)
EV 552-NM	Ground Water Engineering (3.0)		
<hr/>			
EV 60-64	Air Applications		
EV 762-N	Air Pollution Management, Regulations and Public Policy (3.0)	EV 763-N	Air Quality Modeling (3.0)
		EV 563-P	Air Quality (3.0)
<hr/>			
EV 65-69	Land Applications		
EV 565-P	Engineering Principles of Solid Waste Management (3.0)		
<hr/>			
EV 75-79	Hazardous Waste		
EV 776-CU	Hazardous and Industrial Waste Management (3.0)	EV 577-N	Sources and Nature of Hazardous Waste (3.0)
<hr/>			
EV 80-89	Science/Engineering		
EV 581-N	Environmental Chemistry and Biology (3.0)	EV 584-NS	Soil Microbiology (3.0)
EV 581-NS	Chemical Theories of Environmental Engineering (3.0)	EV 785-N	Introduction to Environmental Toxicology (3.0)
EV 583-P	Physical Principles in Environmental Engineering (3.0)	EV 585-NS	Environmental Toxicology (3.0)
<hr/>			

EV 90-94	Special Topics		
EV 791-R	Environmental Policy (3.0)	EV 794-NT	Environmental Systems Management Special Topics (0.3-3.0)
EV 792-NJ	Environmental Systems Issues (3.0)		

Foreign Languages (FL)

FL 00-19	Technical and Business Japanese		
FL 501-X	Basic Technical Japanese I (3.0)	FL 504-X	Intermediate Technical Japanese II (3.0)
FL 502-X	Basic Technical Japanese II (3.0)	FL 505-X	Research in Japanese Technical Literature (3.0)
FL 503-X	Intermediate Technical Japanese I (3.0)	FL 506-X	Advanced Technical Japanese Seminar (3.0)

FL 20-29	Japanese Culture
FL 522-X	Japanese for Business and Industry (3.0)

Fast Track (FT)

FT 00-09	Fast Track - Computer Science		
FT 001-NT	Computer Organization (1.6)	FT 005-NT	Software Engineering (1.6)
FT 002-NT	Algorithms and Data Structures (1.6)	FT 006-NT	Operating Systems (1.6)
FT 003-NT	Computer Programming Languages (1.6)		
FT 004-NT	Foundations of Computer Science: Formal Languages and Automata (1.6)		

Integrated Circuits (IC)

IC 00-09	Electronic Packaging (see also EP 20's)		
IC 701-E	Electronic Packaging Principles (3.0)	IC 503-E	Microelectronic Packaging Materials (3.0)
IC 702-E	Electronic Packaging Design (3.0)	IC 506-NM	Microelectronic Reliability (3.0)
IC 702-P	Design of Electronic Packaging and Interconnect (3.0)		

IC 10-19	Electronic Materials (see also EP)		
IC 510-N	Introduction to Semiconductors (3.0)	IC 715-E	Solid State Optics (3.0)
IC 714-W	Semiconductor Material and Device Characterization (3.0)		

IC 20-29	Devices and Modeling (see also EP 30's)		
IC 720-M	Solid State Devices (3.0)	IC 722-W	Semiconductor Device Theory II (3.0)
IC 520-W	Fundamentals of Solid State Devices (3.0)	IC 724-CA	Solid-State Devices (4.0)
IC 721-W	Semiconductor Device Theory I (3.0)	IC 525-M	Advanced CMOS Device Technology (3.0)
IC 722-C	Semiconductor Device Physics: BJTs and FETs (3.0)	IC 727-A	Numerical Semiconductor Device Modeling (3.0)

IC 30-39	Fabrication and Process Modeling (see also EP 20's, EP 30's and MS 40's)		
IC 530-DE	Electronic Materials Processing (3.0)	IC 730-U	Semiconductor Device Design and Analysis (3.0)
IC 730-E	Advanced Microelectronic Processing (3.0)	IC 530-W	Semiconductor Material Processing (3.0)
IC 730-P	IC Technology and Fabrication (3.0)	IC 731-CA	Advanced IC Processing and Layout (3.0)

IC 731-E Advanced Physical Electronics (3.0)
IC 531-NM Microelectronics Test Engineering (3.0)
IC 532-E Vacuum Systems Engineering (3.0)
IC 532-TN Industrial Plasma Engineering I (3.0)

IC 533-TN Industrial Plasma Engineering II (3.0)
IC 535-NM Microelectronics Failure Analysis (3.0)
IC 736-H Thin Film Physical Vapor Deposition (3.0)

IC 40-49 Circuit and System Design (Including General VLSI) (see also DS 10's)

IC 740-W Digital Integrated Circuits and Systems (3.0)
IC 541-CA Introduction to Digital Integrated Circuits (4.0)
IC 742-A VLSI Design Principles (3.0)
IC 742-B VLSI Design (3.0)
IC 742-C VLSI Design I (3.0)
IC 742-CA Advanced Digital Integrated Circuits (3.0)
IC 742-F Design and Analysis of Digital Integrated Circuits (3.0)

IC 542-N Analog CMOS Circuits for Discrete-Time Signal Processing (3.0)
IC 742-O VLSI Digital Systems Design (3.0)
IC 542-S Introduction to VLSI Design (3.0)
IC 743-C VLSI Design II (3.0)
IC 743-F VLSI Design (3.0)
IC 743-S VLSI Design (3.0)

IC 50-59 VLSI Design Automation (see also DS 10's)

IC 750-C Computer-Aided Design I (3.0)
IC 750-CA Computer-Aided Design for Integrated Circuits (3.0)
IC 750-U Design of VLSI Systems (3.0)
IC 751-C Computer-Aided Design II (3.0)

IC 751-E CAD Algorithms and Techniques for VLSI (3.0)
IC 752-E Computer-Aided Engineering For Integrated Circuits (3.0)
IC 752-O Advanced VLSI Design and Applications (3.0)
IC 553-E Computer-Aided Logic Design (3.0)

IC 70-79 Analog Circuits (Including Specialized VLSI) (see also EM 30's)

IC 570-CA Linear Integrated Circuits (3.0)
IC 570-Q Linear Integrated Circuit Design (3.0)
IC 770-W Analog Integrated Circuits (3.0)
IC 771-CA Advanced Analog Integrated Circuits (3.0)
IC 771-DA MOS Analog Circuit Design (2.0)
IC 771-E Analog Integrated Circuits (3.0)
IC 771-F Analog Integrated Circuits (3.0)
IC 771-P Analog Electronics (3.0)
IC 771-R Bipolar Analog Integrated Circuit Design (3.0)

IC 771-W Advanced Analog Integrated Circuits (3.0)
IC 772-R MOS Analog Integrated Circuit Design (3.0)
IC 574-CA Integrated Circuits for Communications (4.0)
IC 774-DA Analog MOS IC Design for Signal Processing (2.0)
IC 774-E Advanced Analog Circuits (3.0)
IC 775-CA Advanced Integrated Circuits for Communications (3.0)
IC 776-CA Analysis and Design of VLSI-Analog-Digital Interface Integrated Circuits (3.0)
IC 776-DA Data Conversion Techniques and Circuits (2.0)

IC 90-99 Advanced Topics

IC 790-P Computer-Aided Circuit Analysis (3.0)
IC 792-CA Introduction to MEMS Design (3.0)
IC 792-F Integrated Circuit Fabrication Processes: Plasma Processing (3.0)

IC 592-NM Microelectronics Basics: Applied Reliability and CMOS Electronics (3.0)

Intelligent Systems (IS)

IS 10-19 General Methods for AI

IS 710-A Artificial Intelligence (3.0)
IS 710-B Problem Solving Methods in Artificial Intelligence (3.0)
IS 510-C Artificial Intelligence I (3.0)
IS 510-CL Artificial Intelligence (3.0)
IS 510-E Principles of Artificial Intelligence (3.0)
IS 510-H Artificial Intelligence (4.0)

IS 710-M Artificial Intelligence (3.0)
IS 510-N Artificial Intelligence - An Introduction (3.0)
IS 510-P Artificial Intelligence I (3.0)
IS 710-R Artificial Intelligence Concepts (3.0)
IS 510-S Artificial Intelligence (3.0)
IS 511-C Artificial Intelligence II (3.0)

IS 20-29 Expert/Knowledge-Based Systems

IS 520-C Expert Systems (3.0)
 IS 720-D Knowledge-Based Systems (3.0)
 IS 720-E Knowledge System Engineering (3.0)
 IS 520-KS Intro to Knowledge-Based Systems: Expert Systems (3.0)

IS 720-NJ Knowledge Based Systems (3.0)
 IS 720-R Expert Systems (3.0)
 IS 722-D Multimedia Intelligent Tutoring Systems (3.0)

IS 30-39 Programming Languages for AI

IS 730-N Logic Programming (3.0)

IS 50-59 Intelligent Robotic Systems (see also CT 80's and PD 60's)

IS 755-C Artificial Agents (3.0)

IS 60-69 Computer Vision (see also CC 70's and PD 60's)

IS 560-C Computer Vision (3.0)
 IS 560-CL Computational Techniques of Pixel Processing (3.0)
 IS 760-E Computer Vision (3.0)

IS 760-P Computer Vision (3.0)
 IS 561-CL Computer Vision (3.0)

IS 70-79 Machine Learning

IS 770-D Machine Learning (3.0)
 IS 772-C Predictive Learning from Data (3.0)

IS 773-A Neural Computation (3.0)

IS 80-89 Logic Programming and Deduction

IS 580-CL Natural Language Processing (3.0)

IS 780-W Introduction to Natural Language Processing (3.0)

IS 90-99 Neural Networks

IS 590-AT Neural Networks (3.0)
 IS 790-M Introduction to Neural Networks (3.0)
 IS 790-O Neural Networks (3.0)
 IS 790-R Neural Networks (3.0)
 IS 790-S Neural Network Design (3.0)

IS590-T Introduction to Neural Networks and Applications (3.0)
 IS 792-H Neural Networks and Adaptive Systems (3.0)
 IS 793-R Neural Networks for Computing (3.0)
 IS 595-P Introduction to Fuzzy Logic (3.0)
 IS 799-CU Neural Signals (3.0)

Mathematics (MA)**MA 20-39 Probability and Statistics**

MA 520-A Probability and Statistics for Engineers (3.0)
 MA 520-B Applied Probability and Statistics (3.0)
 MA 520-CL Introduction to Probability and Statistics (3.0)
 MA 720-CN Statistical Methods (4.0)
 MA 720-E Engineering Statistics (3.0)
 MA 720-GM Applied Statistics (2.0-3.0)
 MA 520-GW Mathematics and Statistics for Management (3.0)
 MA 520-M Statistical Inference (3.0)
 MA 520-N Probability and Statistics for Engineers (3.0)
 MA 720-P Experimental Statistics for Engineers (3.0)
 MA 520-Q Introduction to Probability Theory, I (3.0)
 MA 520-S Probability and Statistics (3.0)

MA 721-P Statistics for Management (3.0)
 MA 521-S Statistical Analysis (3.0)
 MA 722-E Probability and Statistics in Optics (3.0)
 MA 730-A Probability and Random Processes (3.0)
 MA 531-B Regression and Variance Analysis (3.0)
 MA 531-M Applied Regression Analysis (3.0)
 MA 731-P Design and Statistical Analysis of Experiments for Engineers (3.0)
 MA 532-B Sampling Theory (3.0)
 MA 532-M Sampling and Survey Techniques (3.0)
 MA 735-D Probabilistic Systems Analysis (3.0)

MA 40-49 Calculus/Complex Variables/Vector and Matrix Analysis

MA 740-GM Advanced Engineering Mathematics I (2.0)
 MA 541-M Vector Calculus (3.0)
 MA 742-J Math Methods of Applied Sciences I (3.0)
 MA 743-J Math Methods of Applied Sciences II (3.0)
 MA 544-B Complex Variables for Scientists and Engineers (3.0)
 MA 544-J Complex Analysis (3.0)

MA 544-M Introduction to Complex Analysis (3.0)
 MA 546-Q Linear Transformations and Matrices (3.0)
 MA 547-S Advanced Calculus I (3.0)
 MA 548-S Advanced Calculus II (3.0)
 MA 549-M Numerical Methods in Mechanical Engineering (3.0)

MA 60-69 Algebra

MA 760-F Mathematical Methods in Electrical Engineering I (3.0)
 MA 761-F Mathematical Methods in Electrical Engineering II (3.0)
 MA 562-S Abstract Algebra I (3.0)

MA 563-M Linear Algebra with Applications (3.0)
 MA 563-S Numerical Linear Algebra (3.0)
 MA 563-SC Linear Algebra (3.0)

MA 70-79 Graph Theory and Topology

MA 570-B Combinatorics and Graph Theory (3.0)

MA 571-CL Combinatorial Theory (3.0)

MA 80-89 Differential Equations

MA 780-A Mathematical Methods for Science and Engineering I (3.0)
 MA 580-J Classical Mathematical Methods in Engineering (3.0)
 MA 580-P Advanced Mathematics for Engineers and Scientists (3.0)
 MA 580-Q Mathematical Methods in Engineering and Science (4.0)
 MA 781-A Mathematical Methods for Science and Engineering II (3.0)
 MA 581-P Advanced Mathematics for Engineers and Scientists II (3.0)

MA 583-B Partial Differential Equations for Scientists and Engs (3.0)
 MA 583-CL Partial Differential Equations, I (3.0)
 MA 584-Q Topics in Applied Mathematics: Systems of Linear Differential Equation... (1.0)
 MA 584-S Ordinary Differential Equations (3.0)

MA 90-99 Advanced Topics

MA 790-CU Methods of Engineering Analysis I (3.0)

MA 791-CU Methods of Engineering Analysis II (3.0)

Management and Behavioral Science (MB)**MB 10-19 Management for Engineers (see also TO 60's)**

MB 710-AH Engineering Management Theory (3.0)
 MB 710-B Managing Human Resources in Engr Organizations (3.0)
 MB 710-CU Introduction to Engineering Management (3.0)
 MB 710-GM Management (2.0)
 MB 710-N Management for Engineers (3.0)
 MB 510-NJ Industrial Management (3.0)
 MB 710-O Managing the Engineering and Technical Function (3.0)
 MB 510-T Management for Engineers (3.0)
 MB 711-CU Leadership and Management (3.0)
 MB 712-AH Implementation of Technology (3.0)
 MB 712-CU Management of Research and Development (3.0)

MB 512-I Management of Technology (2.0-3.3)
 MB 712-LE Strategic Management of Technological Innovation (3.0)
 MB 512-N Managing Technology and Innovation (3.0)
 MB 712-SC Strategic Management of Technology (3.0)
 MB 712-Z Managing New Product Development (3.0)
 MB 713-B Technology and Technology Assessment (3.0)
 MB 713-J Analysis of Emerging Technologies (3.0)
 MB 714-AH Strategic Engineering Management (3.0)
 MB 714-B Engineering and Technology Planning (3.0)
 MB 715-B Principles of Engineering and Technology Management (3.0)
 MB 716-B Technology Planning (3.0)

MB 20-29 Organizational Behavior/Personnel

MB 720-NJ Behavioral Science in Engineering Organizations (3.0)
 MB 721-NJ Human Resource Information Systems (3.0)

MB 721-OD Sociotechnical Systems Design (3.0)
 MB 724-SC Management of Engineering Teams (3.0)

MB 30-39 Human Relations

MB 530-T Human Relations in Technical Management (3.0)
 MB 732-GM Human Resources Management (2.0)

MB 732-NJ Human Resource Management (3.0)
 MB 533-GW Conflict Management (3.0)

MB 40-49 Industrial Psychology

MB 540-A Industrial Psychology: A Modern Approach (3.0)
 MB 740-AH Engineering Management Structures and Systems (3.0)
 MB 740-AR Administrative Analysis (3.0)

MB 540-GW Organization, Management and Leadership (3.0)
 MB 540-TN Motivational Theories, Systems and Practices in Various Organizations (3.0)

MB 50-59 Law

MB 550-A Engineering Law and Ethics (3.0)
 MB 750-CU Engineering Contracts (3.0)
 MB 550-E Law for Engineers and Scientists (3.0)

MB 750-NJ Legal and Ethical Issues (3.0)
 MB 550-S Engineering Law and Contracts (2.0)
 MB 751-NJ Information Technology, Business and the Law (3.0)

MB 60-69 Emerging Issues in Technical Management

MB 760-LE Scientific & Technical Institutions in a Global Context (3.0)

MB 760-NJ Management Strategies for E-Commerce (3.0)

MB 80-89 Capstone Projects

MB 780-AH Graduate Research in Engineering Management (3.0)
 MB 780-I Graduate Research in Engineering Management (3.0)

MB 780-O Engineering Management Capstone Project (3.0)
 MB 780-W Engineering Management Capstone Project (3.0)

MB 90-99 Special Topics

MB 790-W Engineering Management Special Topics (1.0-3.0)
 MB 791-AH Labor Relations for Engineers (3.0)
 MB 794-NJ Facilities Maintenance (3.0)

MB 795-GM International Business (3.0)
 MB 597-X Japanese Business Systems (3.0)
 MB 798-GM Management Policy and Strategy (2.0)

Materials Characterization (MC)**MC 20-29 Surface and Interface Analysis**

MC 720-P Scanning Electron Microscopy (3.0)
 MC 721-P Advanced Scanning Electron Microscopy and Surface Analysis (3.0)

MC 722-P Scanned Probe Microscopy (3.0)

MC 30-39 Characterization of Bulk Materials

MC 731-P Fundamentals of Transmission Electron Microscopy (3.0)

MC 50-59 Diffraction Techniques (see also EM 70's)

MC 751-P Elements of Crystallography and Diffraction (3.0)
 MC 752-Y Bonding, Symmetry and Crystallography (2.7)

MC 553-CL X-Ray Diffraction (3.0)

MC 60-69 Non-Destructive Testing

MC 560-U Principles of Nondestructive Testing (3.0)

Mechanical Engineering (ME)

ME 10-19	Mechanics, Dynamics and Vibrations (<i>see also MP 10's and MS 10's</i>)		
ME 710-F	Advanced Dynamics (3.0)	ME 716-AT	Acoustic Wave Theory (3.0)
ME 510-M	Advanced Dynamics (3.0)	ME 716-M	Advanced Engineering Acoustics (3.0)
ME 710-Y	Principles of Dynamics (2.0)	ME 516-UM	Intermediate Dynamics and Vibrations (4.0)
ME 511-M	Kinematics (3.0)	ME 517-M	Mechanical Vibrations (3.0)
ME 711-X	Matrix Methods in the Design and Analysis of Mechanisms (3.0)	ME 717-O	Advanced Mechanical Vibrations (3.0)
ME 513-M	Machine Design (3.0)	ME 517-P	Principles of Structural Vibration (3.0)
ME 714-P	Advanced Machine Design (3.0)	ME 718-F	Theory of Elasticity (3.0)
ME 515-M	Engineering Acoustics (3.0)	ME 719-CU	Biomechanics of the Musculoskeletal System (3.0)

ME 20-29 Design

ME 720-A	Finite Element Analysis (3.0)	ME 721-W	Finite Elements for Engineers II (1.0)
ME 520-DE	Introduction to Finite Element Method (3.0)	ME 722-L	Advanced CAE Applications (3.0)
ME 720-F	Finite Element Method (3.0)	ME 722-W	Finite Elements for Engineers III (1.0)
ME 720-M	Applied Finite Element Analysis (3.0)	ME 523-E	Computer-Aided Analysis and Design of Mechanical Systems (3.0)
ME 720-P	Finite Element Analysis of Mechanical and Aeronautical Systems I (3.0)	ME 726-UM	Friction and Wear (3.0)
ME 720-W	Finite Elements for Engineers I (1.0)	ME 528-M	Multidisciplinary Design Optimization (3.0)
ME 721-CN	Matrix Methods of Structural Analysis (3.0)	ME 728-U	Engineering Design Methods (3.0)
ME 521-P	Introduction to Computer Aided Design (CAD) (3.0)	ME 529-P	Mechatronics Design (3.0)
ME 521-U	Finite Element Fundamentals with Applications (3.0)		

ME 30-39 Heat and Mass Transfer

ME 730-P	Heat Transfer Theory and Applications (3.0)	ME 537-N	Heat Transfer in Biomedical Sciences (3.0)
ME 531-N	Convection Heat Transfer (3.0)	ME 739-CL	Computational Heat Transfer and Fluid Flow (3.0)

ME 40-49 Fluid Mechanics (*see also AE 20's*)

ME 741-A	Advanced Fluid Mechanics (3.0)	ME 542-M	Intermediate Fluid Mechanics (3.0)
ME 541-N	Intermediate Fluid Dynamics (3.0)	ME 745-A	Viscous Fluids (3.0)
ME 741-Y	Fluid Mechanics (2.0)	ME 748-U	Advanced Fluid Flow (3.0)
ME 542-DE	Intermediate Fluid Mechanics (3.0)		

ME 50-59 Combustion and Power-Producing Devices

ME 550-DE	Combustion (3.0)	ME 752-Y	Energy Conversion II (2.0)
ME 551-M	Thermodynamics (3.0)	ME 558-P	Applications of Statistical Energy Analysis (SEA) (3.0)
ME 751-Y	Energy Conversion I (2.0)		

ME 60-69 Thermal Environmental Engineering

ME 563-P	Advanced Air Conditioning Design (3.0)	ME 768-F	Heat Transfer Processes in Microelectronic Devices (3.0)
----------	--	----------	--

ME 70-79 Thermodynamics (*see also MS 20's*)

ME 570-M	Thermal Stress Analysis (3.0)	ME 774-U	Statistical Thermodynamics for Engineers (3.0)
----------	-------------------------------	----------	--

ME 80-89 Advanced Mechanics

ME 780-CU Solid Mechanics (3.0)
ME 780-GM Continuum Mechanics (2.0)
ME 580-N Introduction to Solid Mechanics (3.0)
ME 780-S Continuum Mechanics (3.0)

ME 781-X Modeling and Simulation in Polymer Processing (3.0)
ME 783-CL Continuum Fluid Mechanics (3.0)
ME 786-DA Computational Methods in Nonlinear Mechanics (2.7)

ME 90-99 Special Topics

ME 791-CN Structural Mechanics (3.0)
ME 792-DE Sandwich Structures (3.0)
ME 593-DE Structural Dynamics Design (3.0)
ME 595-M Spray Theory Applications (3.0)

ME 596-N Introduction to Microelectromechanical Systems and Devices (3.0)
ME 799-DA Aerodynamics in Nature and Technology (2.7)
ME 599-M Intermediate Aerodynamics (3.0)

Business and Administration (MG)**MG 10-19 Managerial Accounting**

MG 710-F Managerial Accounting (3.0)
MG 710-NB Contemporary Managerial Accounting (3.0)

MG 710-O Theory and Practice of Financial Management (3.0)
MG 720-O Global Marketing Management (3.0)

MG 20-29 Global Marketing Management

MG 723-A Supply Chain Management (3.0)

MG 724-O Electronic Commerce and Interactive Marketing (3.0)

MG 30-39 Managerial Economics

MG 730-F Managerial Economics (4.0)

MG 735-LE Technology and Economic Analysis (4.0)

MG 40-49 Financial Management

MG 740-F International Finance Management (3.0)

MG 740-NB Managerial Finance (3.0)

MG 50-59 Management of Technology

MG 750-D Management of Technology and Innovation (3.0)
MG 750-FG Management Information Systems (3.0)

MG 753-CU Operations Management (3.0)
MG 753-NB Managerial Decision Making (3.0)

MG 60-69 Organizational Behavior and Cultural Environments

MG 760-FG Contemporary Management Concepts (3.0)
MG 760-NB Applied Organizational Behavior (3.0)
MG 760-O Management and Organizational Theory (3.0)

MG 763-FG The Challenge of Leadership (3.0)
MG 764-NB Managerial Skills (3.0)

MG 70-79 Legal Environment of Business

MG 770-O Legal Environment of Business (3.0)
MG 772-F An Introduction to Valuing E-Commerce Companies (1.0)

MG 773-O Legal Issues in Employment and Personnel Decisions (1.0)
MG 775-NB Electronic Business (3.0)

MG 80-89 Global Strategic Management
MG 780-FG Business Strategy (3.0)
MG 781-F The East Asian Crisis and Business from Miracle to Meltdown (3.0)

MG 783-NB Directed Reading or Research Toward a Single Market (3.0)

Mechanical Properties (MP)

MP 20-29 Mechanics of Materials (*see also ME 10's*)

MP 721-Y Finite Element Analysis I (2.0)
MP 722-Y Finite Element Analysis II (2.0)

MP 724-P Mechanical Behavior of Engineering Materials (3.0)
MP 726-E Constitutive Laws for Engineering Materials (3.0)

MP 30-39 Deformation and Fracture Mechanisms

MP 530-B Deformation of Engineering Materials (3.0)
MP 730-P Fracture Mechanics (3.0)
MP 730-Y Introduction to Fracture Mechanics (2.0)
MP 731-Y Advanced Theory of Fracture Mechanics (2.0)

MP 734-S Advanced Mechanics of Materials (3.0)
MP 536-M Deformation Processing (3.0)
MP 736-R Fracture of Brittle Materials (3.0)
MP 537-M Fracture of Materials (3.0)

MP 40-49 Multiphase Mechanics

MP 740-Y Mechanics of Composite Materials (2.0)
MP 741-P Mechanics of Composite Materials (3.0)
MP 542-H Advanced Composite Materials (3.0)
MP 542-P Composite Materials (3.0)
MP 742-Y Advanced Composites - Design and Manufacturing (2.0)
MP 543-DE Composite Materials Structures (3.0)

MP 744-DE Composite Materials (3.0)
MP 745-F Advanced Mechanics of Materials (3.0)
MP 746-Y High Temperature Composites (2.0)
MP 747-Y Mechanics of Solids (2.0)
MP 548-TN Introduction to Ceramic Matrix Composites (3.0)

MP 50-59 Deformation Processing

MP 751-UM Metalforming Plasticity (3.0)

Materials Science (MS)

MS 10-19 General (*see also ME 10's*)

MS 710-P Modern Concepts in Materials Science (3.0)
MS 714-U Powder Processing of Materials (3.0)
MS 714-Y Processing of Ceramics (2.0)
MS 715-R Materials Microstructure (3.0)
MS 516-M Steel: Classification and Properties for Application in Automobiles (3.0)

MS 716-R Science of Biomaterials I (3.0)
MS 718-R Emerging Technologies in Ceramic Engineering (3.0)
MS 719-CL Thin Films and Layers (3.0)

MS 20-29 Thermodynamics and Kinetics (*see also ME 70's*)

MS 522-CL Thermodynamics and Reactions in Solids (3.0)
MS 723-P Advanced Engineering Thermodynamics (3.0)
MS 525-M Phase Transformations in Solids (3.0)
MS 725-P Phase Transformations and Kinetics (3.0)

MS 725-Y Phase Transformations in Materials Systems (2.0)
MS 729-R Materials Thermodynamics (3.0)
MS 729-Y Diffusion in Solids (2.0)

MS 30-39 Materials Degradation

MS 534-CL Principles of Industrial Electrochemistry (3.0)
 MS 535-CL Corrosion of Metals (3.0)

MS 735-Y Theoretical Structural Metallurgy (2.0)

MS 40-49 Solid State Chemistry (see also IC 30's)

MS 743-P Defect Characterization of Electronic Materials (3.0)

MS 50-59 Electronic, Atomic and Molecular Arrangements

MS 751-P Defects and Diffusion in Solids (3.0)

MS 553-CL Lattice Vibrations and Point Defects (3.0)

MS 90-99 Special Project

MS 790-U Advanced Materials Experiments (1.0-4.0)

Management of Technology (MT)**MT 710-769 Management of Technology**

MT 710-LE Technology and Economic Analysis (4.0)
 MT 720-Z Competitive Advantage and Operations Strategy (3.0)
 MT 731-CU Management of Research and Development (3.0)
 MT 732-O Theory and Practice of Financial Management (3.0)
 MT 738-NT Managing and Leading Technical People (3.0)

MT 741-Z Managing New Product Development (3.0)
 MT 750-LE Strategic Management of Technological Innovation (3.0)
 MT 751-O Total Quality Management (3.0)
 MT 760-LE Scientific and Tech. Institutions in a Global Context (3.0)
 MT 761-J Analysis of Emerging Technologies (3.0)

MT 910-960 Residencies

MT 910-NT Program Foundation and Introduction (Residency 1) (0.5)
 MT 920-NT Field Research Project Methods (Residency 2) (0.5)
 MT 930-NT Public Policy Issues in Science and Technology
 (Residency 3) (0.5)
 MT 940-NT Current Issues in International Science and Technology
 (Residency 4) (0.5)

MT 950-NT Managing Technology in Changing Environments
 (Residency 5) (0.5)
 MT 960-NT International Study Mission (Residency 6) (0.5)

MT 712 Field Research Project

MT 712-NT Field Research Project (Independent Study) (3.0)

Product and Process Design (PD)**PD 10-19 Design for Assembly**

PD 710-P Design for Manufacturing and Assembly (3.0)

PD 20-29 Design for Manufacturability

PD 520-CL Product Design for Manufacturability (3.0)
 PD 520-P Product Engineering (3.0)
 PD 522-N Design for Manufacturability and Concurrent Engr (3.0)

PD 522-NM Design for Manufacturability (3.0)
 PD 525-N Integrated Design and Manufacturing (3.0)
 PD 728-AH Integrated Product and Process Design (3.0)

PD 30-39 Facility Design and Material Handling
PD 530-AH Manufacturing Systems and Facilities Design (3.0)

PD 733-A Principles of Industrial Exhaust Ventilation Design (3.0)

PD 40-49 Manufacturing Processes (see also IC, MP and SP)
PD 540-H Manufacturing Engineering (3.0)
PD 541-M Solidification of Castings (3.0)
PD 541-X Fundamentals of Injection Molding (3.0)

PD 545-M Materials Processing in Manufacturing (3.0)
PD 545-UM Materials in Manufacturing and Design (3.0)
PD 546-M Manufacturing Process Engineering (3.0)

PD 60-69 Flexible Automation (see also IS 50's and CT 80's)
PD 760-E Manufacturing Automation (3.0)
PD 760-O Robotics Application Issues (3.0)
PD 561-CL Affordable Automation (3.0)

PD 763-AR Automated Production (3.0)
PD 765-GM Automation Topics for Management (2.0)

PD 70-79 Integration of CAD/CAM/CAE (see also ST 10's)
PD 570-N Computer Integrated Manufacturing Systems (3.0)
PD 570-T Expert Systems in Manufacturing (3.0)

PD 771-O Computer Integrated Manufacturing (3.0)
PD 575-CL Flexible Manufacturing Systems (3.0)

PD 80-89 Environmentally Conscious Manufacturing
PD 580-E Microelectronics Manufacturing and the Environment (3.0)
PD 781-W Design for Environment (3.0)

PD 782-NJ Multi-Lifecycle Engineering (3.0)

Polymeric Materials (PM)

PM 10-19 General
PM 512-Y Polymeric Materials (2.0)
PM 715-R Polymer Composites (3.0)

PM 516-X Engineering Design with Polymers (3.0)

PM 20-29 Rheology
PM 721-UM Theory of Viscoelasticity: Response of Polymers (3.0)

PM 40-49 Morphology and Molecular Structure
PM 541-CL Introduction to Polymers (3.0)

PM 744-P Diffusion in Polymers (3.0)

Power Systems (PS)

PS 10-19 Power Systems Analysis
PS 511-S Introduction to Power Systems (3.0)
PS 512-S Power Systems Analysis (3.0)
PS 713-AR Electric Power Distribution Systems (3.0)

PS 713-U Analysis of Distribution Systems (3.0)
PS 715-W Power Transmission and Distribution (3.0)

PS 30-39**Energy Conversion**

PS 530-X Introduction to Electric Drive Systems (3.0)
 PS 731-M Energy Conversion (3.0)

PS 734-X Dynamics and Control of AC Drives (3.0)
 PS 735-O Direct Energy Conversion (3.0)

PS 40-49**Power Electronics** (see also CR 20's, CR 30's, CT 40's and CT 70's)

PS 541-C Power Electronics (4.0)
 PS 541-S Power Electronic Circuits (3.0)
 PS 541-X Power Electronic Circuits (3.0)
 PS 542-C Advanced Power Electronics (4.0)

PS 742-X Solid State Power Conversion (3.0)
 PS 744-E Power Electronics (3.0)
 PS 745-CU Power Electronics (3.0)
 PS 747-CU Power Electronics II (3.0)

PS 50-59**Operation of Power System/Stability and Control** (see also CR 40's and CR 80's)

PS 756-S Power System Protection and Relaying (3.0)
 PS 757-AR Electric Power Quality (3.0)

PS 757-S Understanding Power Quality (3.0)

PS 60-69**Energy Management Systems/Planning, Design and Scheduling**

PS 760-U Power System Operation in a Less Regulated Environment (3.0)

PS 761-O Power Economics and Regulation (3.0)

Quantitative Methods (QM)**QM 10-19****Operations Research** (see also SP 20's)

QM 510-A Deterministic Models: Applied Optimization (3.0)
 QM 510-CL Introduction to Operations Research: Deterministic Models (3.0)
 QM 710-CU Survey of Operations Research (3.0)
 QM 510-D Quantitative Methods I (3.0)
 QM 710-E Stochastic Modeling (3.0)
 QM 710-F Operations Research I (3.0)
 QM 710-GM Deterministic Models in Operations Research (2.0)
 QM 710-N Operations Research Models (3.0)
 QM 710-NJ Management Science (3.0)

QM 510-NS Survey of Operations Research Techniques (3.0)
 QM 510-P Introduction to Operations Research (3.0)
 QM 710-SC Introduction to Operations Research (3.0)
 QM 511-D Quantitative Methods II (Operations Research) (3.0)
 QM 711-F Operations Research II (3.0)
 QM 711-GM Management Science (3.0)
 QM 711-P Theory of Activity Networks (3.0)
 QM 712-E Operations Research Modeling (3.0)
 QM 712-GM Stochastic Models in Operations Research (2.0-3.0)

QM 20-29**Linear Programming** (see also SP 20's)

QM 720-A Linear Programming (3.0)
 QM 520-H Linear Programming and Network Flows (3.0)
 QM 520-S Linear Programming (3.0)

QM 721-A Nonlinear Programming and Engineering Design (3.0)
 QM 721-N Network Flows (3.0)
 QM 521-NS Nonlinear Programming (3.0)

QM 30-39**Specialized Techniques**

QM 730-A Integer Programming (3.0)
 QM 730-GM Statistical Methods for Managerial Decisions (2.0-3.0)
 QM 730-N Integer Programming (3.0)
 QM 730-OD Operations Research (3.0)
 QM 531-E Survey of Optimization Methods (3.0)
 QM 531-M Discrete Optimization Models and Algorithms (3.0)

QM 532-A Network Optimization (3.0)
 QM 532-M Industrial Applications of Statistics (3.0)
 QM 533-NS Large Scale Systems Engineering (3.0)
 QM 734-B Engineering Optimization (3.0)
 QM 535-NS Queuing Systems (3.0)

QM 40-49 Decision Analysis

QM 740-A Multi-Criteria Decision-Making and Decision Analysis (3.0)
 QM 740-B Systems Analysis and Decision Making (3.0)
 QM 540-GW Executive Decision Making (3.0)

QM 541-A Knowledge and Decision-Making (3.0)
 QM 542-E Engineering Decision Making Under Uncertainty (3.0)

QM 50-59 Systems Management or Engineering (see also MB 10's and TO 10's)

QM 750-B Systems Engineering Principles and Practices(3.0)

Software Engineering (SE)**SE 10-19 Software Engineering Methodology**

SE 510-A Software Engineering: Synthesis and Development (3.0)
 SE 710-B Software Design and Implementation (3.0)
 SE 510-C Software Engineering I (3.0)
 SE 510-E Software Engineering Concepts (3.0)
 SE 710-F Software Engineering I (3.0)
 SE 510-H Software Engineering Methods (4.0)
 SE 510-K Software Engineering (3.0)
 SE 710-KS Software Engineering (3.0)

SE 710-NJ Software Design and Production Methodologies (3.0)
 SE 510-P Software Engineering (3.0)
 SE 510-Q Software Engineering (4.0)
 SE 710-R Software Engineering (3.0)
 SE 711-F Software Engineering (3.0)
 SE 512-N Software Systems Engineering: An Enterprise Architecture Approach (3.0)

SE 20-29 Life Cycle Models and Software Metrics

SE 720-H Advd Topics in Software Engr-Software Measurement, Analysis and Evaluation (4.0)

SE 720-KS Software Measurement (3.0)
 SE 725-N Real-Time and Safety-Critical Systems (3.0)

SE 30-39 Analysis and Design Techniques

SE 730-D Object-Oriented Analysis and Design (3.0)
 SE 730-F C++ Object-Oriented Design (3.0)
 SE 730-K Object Oriented Analysis and Design (2.0)
 SE 730-N Object-Oriented Analysis and Design (3.0)
 SE 530-P Object-Oriented Languages and Systems (3.0)
 SE 530-S Object Oriented Design (3.0)
 SE 731-CL Topics in CS: Programing in C++ & Intro to Object Oriented Programming (3.0)
 SE 731-D Object-Oriented Programming (3.0)
 SE 531-KS Object Oriented Design and Development (3.0)
 SE 531-N Java for Programmers (3.0)
 SE 731-NJ Object-Oriented Programming in C++ (3.0)

SE 532-P Advanced Object-Oriented Systems (3.0)
 SE 533-N Software Requirements and Design Engineering (3.0)
 SE 734-P Advanced Topics in Object-Oriented Systems (3.0)
 SE 735-N User Interface Design (3.0)
 SE 735-NJ Design of Interactive Systems (3.0)
 SE 535-P Human Computer Interaction (3.0)
 SE 735-SC Specification and Design of User Interface Software (3.0)
 SE 736-F Enterprise Software Development (3.0)
 SE 737-F Adaptive Object-Oriented Software Development: The Demeter Method (3.0)
 SE 538-N XML, Java and the Enterprise (3.0)

SE 40-49 Programming Environments and Implementation Issues

SE 540-N Java Distributed Enterprise Computing (3.0)
 SE 741-F Building Virtual Environments (3.0)
 SE 742-N Software Generation and Maintenance (3.0)

SE 743-NJ Advanced Programming Environment and Tools (3.0)
 SE 745-SC Software Architectures (3.0)

SE 50-59	Testing and Reliability		
SE 750-B	Ensuring Software Reliability and its Integrity (3.0)	SE 750-R	Software Testing and Verification (3.0)
SE 750-KS	Verification and Validation (3.0)	SE 750-W	Software Verification, Validation and Testing (3.0)
SE 550-N	Software Testing and Quality Assurance (3.0)	SE 752-N	Software Reliability and Safety (3.0)
SE 750-P	Software Testing and Reliability (3.0)	SE 555-A	Software Engineering: Analysis and Evaluation (3.0)

SE 60-69	Productivity Measures and Quality Assurance		
SE 760-S	Software Quality Assurance (3.0)	SE 762-N	Software Metrics and Quality Engineering (3.0)

SE 70-79	Specification Languages and Other Language Issues		
SE 770-KS	Software Specification(3.0)	SE 772-KS	Specification and Verification of Reactive Systems (3.0)
SE 770-S	Software Specification(3.0)		

SE 80-89	Software Management, Psychology and Control Methods		
SE 580-N	Software Quality Management and ISO 9000(3.0)	SE 783-S	Software Process Management (3.0)
SE 780-NJ	Information Systems Evaluation (3.0)	SE 584-N	Software Project Planning and Management (3.0)
SE 580-P	Software Process and Risk Management (3.0)	SE 785-SC	Software Management and Economics (3.0)
SE 580-S	Software Project Management (3.0)	SE 786-NJ	Business Process Innovation (3.0)
SE 780-W	"Software Project, Process and Quality Management"(3.0)	SE 787-NJ	Management of Computer and Information Systems (3.0)
SE 783-KS	Software Management (3.0)		

SE 90-99	Advanced Topics		
SE 792-N	Software Acquisition Practices, Legal and Economic Issues (3.0)	SE 796-A	Empirical Methods for Computer Science and Engr (3.0)

Manufacturing Systems Planning and Control (SP)

SP 10-19	Modeling and Analysis		
SP 510-E	Modeling Manufacturing Systems 3.0)	SP 715-I	Data Dependent Systems (2.0)
SP 713-GM	Process Analysis (2.0)	SP 515-M	Analysis of Manufacturing Systems (3.0)
SP 514-I	Manufacturing and Dynamic System Modeling (2.0)		

SP 20-29	Production Control and Scheduling (see also <i>ST 30's</i> , <i>QM 10's</i> and <i>QM 20's</i>)		
SP 720-A	Advanced Production Planning and Control (3.0)	SP 520-TN	Advanced Production and Inventory Systems (3.0)
SP 720-E	Advanced Production Control (3.0)	SP 727-AR	Scheduling and Sequencing (3.0)

SP 40-49	Strategic Planning (see also <i>TO 20's</i> and <i>EF</i>)		
SP 540-CL	Technology and Policy Issues in Manufacturing Enterprises (3.0)	SP 745-CU	Principles and Practices of World Class Manufacturing (3.0)
SP 542-N	Manufacturing in a Global Era (3.0)	SP 545-Q	Valuation and Planning of New Products (3.0)
SP 743-D	Operations Strategy and Productive Systems Design (3.0)	SP 546-L	Principles and Practices of Lean Manufacturing (3.0)
SP 743-Z	Competitive Advantage and Operations Strategy (3.0)	SP 747-GM	Manufacturing Resource Planning (2.0)

SP 50-59 Measurement and Sensing
SP 554-P Metrology in Precision Manufacturing (3.0)

SP 557-CL Sensors and Logic Controls in Manufacturing (3.0)

SP 60-69 Manufacturing Management and Integration

SP 760-CA Manufacture of Consumer-Electronics and Electro-Mechanical Devices (3.0)
SP 760-CU Principles of Product Management (3.0)
SP 560-N Manufacturing Management Practices (3.0)
SP 761-P The Just-in-Time Production System (3.0)
SP 763-GM Elements of CIM for Management (2.0)

SP 564-N Strategies for Manufacturing Firms (3.0)
SP 765-GM Fundamentals of Manufacturing Engineering (2.0-3.0)
SP 565-N Modern Manufacturing Methods (3.0)
SP 566-M Product and Process Design (3.0)
SP 567-M Product Usability (3.0)

Software Techniques (ST)

ST 10-19 CAE/CAD/CAM Tool Development (see also PD 70's)

ST 510-A Design Automation (3.0)

ST 20-29 Real Time Software Systems

ST 720-N Real-Time Systems Analysis and Design (3.0)

ST 721-A Real-Time Computing (3.0)

ST 30-39 Simulation (see also CR 40's, SP 10's and SP 20's)

ST 531-CL Simulation (3.0)
ST 731-F Simulation Methodology and Applications (3.0)
ST 531-M Systems Simulation (3.0)
ST 531-N Computer Simulation Technology (3.0)
ST 731-OD Discrete Event Simulation (3.0)
ST 731-P Computer Simulation Techniques (3.0)

ST 731-U Simulation Modeling and Analysis (3.0)
ST 732-E Object Oriented Simulation/Discrete Event Models (3.0)
ST 532-M Simulation Design and Analysis (3.0)
ST 532-U Manufacturing Systems Modeling (3.0)
ST 534-A Systems Automation (3.0)

ST 40-49 Computer Graphics

ST 740-A Interactive Computer Graphics (3.0)
ST 540-C Computer Graphics (3.0)
ST 540-H Introduction to Computer Graphics (4.0)
ST 540-KS Interactive Computer Graphics (3.0)
ST 540-N Computer Graphics (3.0)
ST 540-SC Computer Graphics (3.0)

ST 741-A Advanced Computer Graphics and CAD (3.0)
ST 741-KS Computer Graphics (3.0-4.0)
ST 542-NM Advd Computer Graphics and Scientific Visualization (3.0)
ST 743-CA Computer-Aided Geometric Design and Modeling (3.0)
ST 546-A 3D Computer Animation and Desktop Video (3.0)

ST 50-59 Computer Networks (see also CC 80's and CA 20's)

ST 550-A Computer Networking I (3.0)
ST 750-A Computer Networking (3.0)
ST 550-E Fundamentals of Computer Networks (3.0)
ST 750-F Data Communication Networks (3.0)
ST 750-J Performance Analysis of Communication Networks (3.0)
ST 750-KS Advanced Computer Networks (3.0)
ST 550-M Introduction to Computer Communication Networks (3.0)
ST 750-N Data Communications (3.0)
ST 750-NJ Computer Network Design and Analysis (3.0)
ST 550-P Computer Networks (3.0)
ST 750-SC Computer Communication (3.0)
ST 750-W Computer Networks (3.0)
ST 751-U Advd Computer Networking and Data Communications (3.0)

ST 752-CL Computer Communication Networks (4.50)
ST 752-R Queueing Theory and Data Communications Networks (3.0)
ST 752-SC Design and Analysis of Computer Comm. Networks (3.0)
ST 753-P Performance Evaluation of Computer Networks (3.0)
ST 554-N Internetworking Protocols and Programming (3.0)
ST 754-NJ Internetworking and Higher Layer Protocols (3.0)
ST 554-P Internet Protocols and Architecture (3.0)
ST 755-KS Protocol Engineering (3.0)
ST 755-P Advanced Network Protocol Design (3.0)
ST 756-A Performance Evaluation (3.0)
ST 556-P Introduction to Computer Performance Modelling (3.0)
ST 757-E High Performance Distributed Computing Systems (3.0)
ST 758-NJ Network Interface Design (3.0)

ST 60-69**Computer System Security**

ST 560-CL Special Topics in Computer Science: Network Security (3.0)
 ST 560-M Internet Security Techniques (3.0)
 ST 760-P Networking System Security (3.0)
 ST 760-R Computer and Network Security (3.0)
 ST 760-S Network Security (3.0)

ST 760-U Information System Security (3.0)
 ST 761-S Computer Security Concepts (3.0)
 ST 761-U Information Warfare (3.0)
 ST 762-F Cryptography and Computer Security (3.0)
 ST 765-U Cryptography (3.0)

Systems Engineering (SY)**SY 10-19****Systems Engineering Principles and Processes**

SY 710-E The Systems Engineering Process (3.0)
 SY 510-N Systems Engineering Process (3.0)
 SY 710-SC Systems Engineering Methodology (3.0)

SY 710-T Systems Architecting (3.0)
 SY 711-E The Systems Engineering Process II (3.0)
 SY 719-SC Advanced Topics in Systems Engineering (3.0)

SY 20-29**Systems Modeling and Analysis**

SY 720-U Systems Engineering and Analysis (3.0)
 SY 521-N Systems Analysis Methods (3.0)
 SY 521-E Simulation Modeling and Analysis (3.0)

SY 521-T Systems Engineering and Analysis I (3.0)
 SY 721-U Applied Systems Engineering (3.0)
 SY 723-SC Systems Architecting (3.0)

SY 40-49**Systems Optimization**

SY 540-N Systems Optimization and Analysis (3.0)

SY 50-59**Systems Reliability**

SY 750-N Systems Reliability Engineering (3.0)

SY 60-69**Systems Management**

SY 560-N Systems Engineering Management (3.0)
 SY 562-N Systems Integration and Test (3.0)

SY 563-N Integrated Risk Management (3.0)

SY 70-79**Logistics from Acquisition Systems Engineering**

SY 570-N Logistics Systems Engineering (3.0)

SY 80-89**Systems Engineering Design**

SY 580-N Systems Engineering Design (3.0)

Telecommunications (TC)**TC 00-09****Telecommunication Principles (see CC 10's)**

TC 500-CU Telecommunications Theory and Applications (3.0)
 TC 502-CU Telecommunications Systems (3.0)
 TC 502-N Introduction to Telecommunications (3.0)

TC 702-O Telecommunications Systems (3.0)
 TC 704-CU Network Management (3.0)
 TC 705-CU Traffic and Queueing Theory (3.0)

TC 10-19**Telecommunication Technologies (see CC 80's)**

TC 512-CU Optical Communications (3.0)
 TC 512-N Fiber Optic Telecommunications (3.0)
 TC 715-N Digital Switching (3.0)

TC 716-N Digital Telephony (3.0)
 TC 719-CU Trends in Satellite Communications (3.0)

TC 20-29	Data Communications (<i>see ST 50's</i>)		
TC 721-CU	Data Communications I (3.0)	TC 526-CU	Cable Television, Video and Imaging (3.0)
TC 722-CU	Data Communications 2: LANs, MANs, and WANs (3.0)	TC 728-N	Video Compression and Transmission (3.0)
TC 40-49	Telecommunication Networks and Systems (<i>see ST 50's, CC 80's</i>)		
TC 741-CU	Digital Telecommunication Networks (3.0)	TC 744-F	Avd Topics - Traffic Mgmt ATM and Mobile Networks (3.0)
TC 741-F	Networks and Telecommunications (3.0)	TC 744-J	ATM Networks (3.0)
TC 741-N	Telecommunications Network Design (3.0)	TC 744-N	ATM Systems in Telecommunications (3.0)
TC 741-P	Telecommunication Network Design (3.0)	TC 746-N	Intelligent Network (3.0)
TC 743-N	SONET Systems and Technologies (3.0)	TC 747-N	Telecommunications Network Management (3.0)
TC 50-59	Personal and Wireless Telecommunications		
TC 751-CL	Topics in Telecomm. Networks: Wireless and Mobile... (3.0)	TC 752-N	Advanced Topics in Wireless Communication (3.0)
TC 751-CU	Wireless and Cellular Communications (3.0)	TC 554-P	Mobile Networks - Data Communications (3.0)
TC 751-N	Wireless, Cellular and Personal Telecommunications (3.0)	TC 758-N	Emerging Tech in Wireless - Bluetooth and WAP/WML (3.0)
TC 752-J	Personal and Mobile Communications (3.0)		
TC 70-79	Telecommunication Systems Administration		
TC 772-CU	Strategic Planning and Mgmt for Telecommunications (3.0)	TC 775-N	Wireless Management and Convergence (3.0)
TC 774-NJ	Management of Telecommunications (3.0)	TC 778-CU	Competitive Local Loops (3.0)
TC 80-89	Telecommunication Standards, Policy and Regulations		
TC 580-CU	Economics, Policy and Management (3.0)	TC 583-N	Telecommunications Management and Regulation (3.0)
TC 581-CU	Telecommunications Policy - Historical Perspective (3.0)	TC 788-CU	Telecommunications Standards (3.0)
TC 90-99	Special Topics		
TC 792-N	Telecommunications Software Design (3.0)	TC 794-N	Internet Telephony (3.0)
TC 792-CU	Network Programming (3.0)	TC 796-N	Switching and QoS Mgmt in IP Networks (Spec Topics) (3.0)

Technical Operations (TO)

TO 10-19	Information Systems (<i>see also QM 50's</i>)		
TO 710-D	Information Systems (3.0)	TO 711-F	Intro to Software Engineering & Computer Technology (3.0)
TO 710-F	PC Architecture and Systems Programming (3.0)	TO 711-NJ	Information System Principles (3.0)
TO 710-GM	Managing Information Technology (2.0)	TO 712-N	E-Commerce, Architectures and Technologies (3.0)
TO 510-N	Management of Information Technologies (3.0)	TO 512-P	E-Commerce Technology (3.0)
TO 30-39	Marketing Management/Industrial Marketing		
TO 735-GM	Marketing (3.0)	TO 735-VU	Marketing of Advanced Technologies (3.0)
TO 735-T	Advanced Marketing Management (3.0)	TO 736-NJ	Internet Marketing Strategy (3.0)
TO 40-49	Human Factors		
TO 740-A	Human Factors Design Engineering (3.0)	TO 542-B	System Safety Engineering (3.0)
TO 740-B	Human Reliability Analysis (3.0)	TO 542-GM	Safety and Human Factors (3.0)
TO 540-M	Human Factors in Engineering (3.0)	TO 542-M	Safety Engineering (3.0)
TO 540-N	Human Factors in Design and Manufacturing (3.0)	TO 542-NS	Design of Safe Systems (3.0)
TO 540-S	Human Factors in Engineering Design (3.0)	TO 542-T	Safety Engineering Management (3.0)
TO 540-TN	Human Factors Engineering (3.0)	TO 543-M	Applied Ergonomics (3.0)
TO 542-AT	Safety Engineering (3.0)		

TO 50-59 Industrial Engineering

TO 750-AH Quality Systems Management (3.0)
 TO 750-D Total Quality Management (3.0)
 TO 550-E Quality Engineering and Management (3.0)
 TO 550-N Total Quality Management in Manufacturing (3.0)
 TO 750-O Total Quality Management (3.0)
 TO 550-P Managing for Quality (3.0)
 TO 750-P Quality Engineering (3.0)
 TO 751-A Benchmarking, Productivity and Performance Measurement (3.0)

TO 751-AH Productivity and Quality Engineering (3.0)
 TO 751-CU Methods for Quality Improvement (3.0)
 TO 555-M Advanced Facilities Design (3.0)
 TO 756-GM Logistics and Simulation (3.0)
 TO 557-M Job Design (3.0)
 TO 758-CU Quality, Strategy, and Value Creation (3.0)

TO 60-69 Project Management (see also MB 10's)

TO 760-AH Engineering Project Management (3.0)
 TO 760-B Project Management (3.0)
 TO 760-CU Project Management Systems (3.0)
 TO 760-F Engineering Project Management (3.0)
 TO 760-GM Management of Engineering Projects (3.0)
 TO 560-GW Introduction to Project Management (3.0)
 TO 560-N Project and Risk Management (3.0)
 TO 760-O Project Management (3.0)
 TO 760-OD Project Management (3.0)
 TO 760-SC Engineering Project Management (3.0)
 TO 560-T Project Management (3.0)

TO 560-TN Project Management (3.0)
 TO 561-GW Planning and Scheduling (3.0)
 TO 761-NJ Project Control (3.0)
 TO 562-GW Directed Computational Project Management (2.0)
 TO 763-N Project Management-Hazardous Waste Program (3.0)
 TO 564-X Construction Project Management (3.0)
 TO 565-GW Risk Management (3.0)
 TO 566-GW Procurement and Contracting (3.0)
 TO 567-GW Managing Project Finances (2.0)
 TO 568-GW Project Estimating and Cost Management (3.0)
 TO 569-GW Project Management Applications (3.0)

TO 70-79 Quality Control and Reliability (see also MA 50's)

TO 770-A Quality Control and Reliability I (3.0)
 TO 770-B Advanced Product Assurance (3.0)
 TO 770-CU Applied Statistics for the Manufacturing and Process Industries (3.0)
 TO 770-E Advanced Quality Engineering (3.0)
 TO 770-F Introduction to Reliability Analysis and Risk Assessment (3.0)
 TO 770-GM Manufacturing Quality Assurance (2.0-3.0)
 TO 570-H Statistical Science and Process Improvement (3.0)
 TO 570-M Statistical Quality Control (3.0)
 TO 570-N Statistical Quality Control (3.0)
 TO 770-NJ Industrial Quality Control (3.0)
 TO 570-NS Advanced Quality Control (3.0)
 TO 570-O Industrial Quality Control (3.0)
 TO 770-OD Robust Engineering Design (3.0)
 TO 770-P Statistical Methods for Quality and Productivity Improvement (3)
 TO 771-B Basic Reliability Engineering (3.0)
 TO 771-E Reliability Engineering (3.0)

TO 571-M Reliability and Warranty (3.0)
 TO 571-N Engineering Reliability (3.0)
 TO 771-O Engineering Systems Reliability Evaluation (3.0)
 TO 771-OD Quality Assurance Management (3.0)
 TO 772-B Advanced Methods in Reliability Modeling (3.0)
 TO 772-E Maintainability Engineering (3.0)
 TO 772-OD Reliability and Maintainability (3.0)
 TO 773-B Basic Reliability Analysis (3.0)
 TO 773-E Reliability Testing (3.0)
 TO 773-Y Reliability in Product Design and Testing (2.0)
 TO 774-E Experiment Design and Regression (3.0)
 TO 574-M Design of Experiments (3.0)
 TO 574-O Industrial Experimentation (3.0)
 TO 574-TN Design of Experiments for Engineering Managers (3.0)
 TO 775-A Advanced Management of Quality (3.0)
 TO 775-E Advanced Experiment Design (3.0)
 TO 577-A Design of Experiments (3.0)
 TO 778-E Reliability and Quality Analysis (3.0)

TO 80-89 Production Management

TO 580-CL Production Management (3.0)
 TO 780-D Production Management (3.0)

TO 580-N Production Management (3.0)
 TO 780-T Advanced Production Management (3.0)

Trustees, Faculty and Staff

⌘ Board of Trustees ⌘

Kenneth S. Colmen
Consultant, Business Strategy
Technology Management

Carla L. Gude
Vice President, Technology
IBM Corporation

Jamie M. Lane
Vice President, Training and
Development, Motorola University

Thomas L. Martin, Jr.
President Emeritus
Illinois Institute of Technology

James L. Melsa
Dean, College of Engineering
Iowa State University

Alfred Moyé
Consultant
Hewlett-Packard Company

Herbert Rabin
Director, Eng. Research Center
The University of Maryland
College Park

Karl N. Reid
Dean of Engineering
Oklahoma State University

Raymond L. Vigil
Chief Operating Office for Learning
Lucent Technologies

Alumni Member:
Erwin H. Schwiebert
Vice President
The Schwiebert Group, Inc.

Ex Officio Members:
André G. Vacroux
President
National Technological University

Lionel V. Baldwin
NTU President Emeritus and
President, NTU Foundation

Peter Jones
President & CEO
Stratys Learning Solutions, Inc.

⌘ Staff ⌘

André G. Vacroux
President
National Technological University
vacroux@ntu.edu

Jeanne Breiner
Director, Admissions and Records
jeanne@ntu.edu

Ellen Christensen
Manager, Independent Student Program
ellen@ntu.edu

Gearold R. Johnson
Academic Vice President
gerry@ntu.edu

Nancy Margheim
Accounting Manager
nancy@ntu.edu

Beryl Younkin
Academic Coordinator
beryl@ntu.edu

⌘ Faculty ⌘

Academic Executive Committee

Gearold R. Johnson, Chair
National Technological University
(970) 495-6404 FAX (970) 498-0601
gerry@ntu.edu

Business Administration (MBA)

Gregory C. Mosier
Oklahoma State University
(405) 744-5118 FAX (405) 744-5180
gmosier@okstate.edu

Chemical Engineering

Robert L. Robinson, Jr.
Oklahoma State University
(405) 744-9110 FAX (405) 744-6338
rrobins@okstate.edu

Computer Engineering

Wayne P. Burleson
University of Massachusetts at Amherst
(413) 545-2382 FAX (413) 545-1227
burleson@ecs.umass.edu

Computer Science

Sartaj Sahni
University of Florida
(352) 392-1527 FAX (352) 392-1220
sahni@cis.ufl.edu

Electrical Engineering

Donald W. Novotny
University of Wisconsin-Madison
(608) 262-6926 FAX (608) 262-1267
novotny@enr.wisc.edu

Engineering Management

Charles S. Elliott
Arizona State University
(480) 965-1740 FAX (480) 965-8653
chuck.elliott@asu.edu

Environmental Systems Management

Timothy Ross
University of New Mexico
(505) 277-3459 FAX (505) 277-1988
ross@unm.edu

Management of Technology

Alden Bean
North Carolina State University
(919) 513-0166 FAX (919) 515-6943
a.s.bean@worldnet.att.net

Manufacturing Systems Engineering

Marvin F. DeVries
University of Wisconsin-Madison
(608) 262-1808 FAX (608) 265-2316
devries@enr.wisc.edu

Materials Science and Engineering

Mufic Akinc
Iowa State University
515-294-0738 FAX 515-294-5444
makinc@iastate.edu

Mechanical Engineering

Wade O. Troxell
Colorado State University
(970) 267-2021 or (970) 491-6618
FAX (970) 226-0795 or (970) 491-2827
wade@enr.colostate.edu

Microelectronics and Semiconductor Engineering

Thomas A. DeMassa
Arizona State University
(480) 965-3424 FAX (480) 965-3837
demassa@asu.edu

Software Engineering

Gearold R. Johnson (Acting)
National Technological University
(970) 495-6404 FAX (970) 498-0601
gerry@ntu.edu

Systems Engineering

Gearold R. Johnson (Acting)
National Technological University
(970) 495-6404 FAX (970) 498-0601
gerry@ntu.edu

Special Majors

Gearold R. Johnson

National Technological University
(970) 495-6404 FAX (970) 498-0601
gerry@ntu.edu

☪ Business Administration ☪ (MBA)

Graduate Faculty and Advisors

Gregory C. Mosier

Oklahoma State University
(405) 744-5118 FAX (405) 744-5180
gmosier@okstate.edu
Chair/Curriculum Committee Chair/
Advisor

Robert Crane

Northwestern University
(847) 467-7052 FAX (847) 491-8002
r-crane@nwu.edu
Curriculum Committee

Gordon V. Karels

University of Nebraska-Lincoln
(402) 472-3860 FAX (402) 472-5180
gkarels@unl.edu
Curriculum Committee/Advisor

Robert E. Markland

University of South Carolina
(803) 777-5035 FAX (803) 777-9123
bobbym@darla.badm.sc..edu
Curriculum Committee

Richard Peggnetter

Florida Gulf Coast University
(941) 590-7310 FAX (941) 590-7330
RPEGNETT@FGCU.EDU
Curriculum Committee

☪ Chemical Engineering ☪ Graduate Faculty and Advisors

Robert L. Robinson, Jr.

Oklahoma State University
(405) 744-9110 FAX (405) 744-6338
rrobins@okstate.edu
Chair/Curriculum Committee Chair/
Advisor

Hamid Arastoopour

Illinois Institute of Technology
(312) 567-3038 FAX (312) 567-8874
chearastoopo@minna.iit.edu
Curriculum Committee

Deran Hanesian

New Jersey Institute of Technology
(973) 596-3597 FAX (973) 596-8436
hanesian@tesla.njit.edu
Curriculum Committee

Edwin N. Lightfoot

University of Wisconsin-Madison
(608) 262-6934 FAX (608) 262-5434
enlight@engr.wisc.edu
Curriculum Committee

Carl T. Lira

Michigan State University
(517) 355-9731 FAX (517) 432-1105
lira@egr.msu.edu
Curriculum Committee

D. Alan Tree

Oklahoma State University
(405) 744-5957 FAX (405) 744-6338
tree@okstate.edu
Curriculum Committee

Dean L. Ulrichson

Iowa State University
(515) 294-6944 FAX (515) 294-2689
dlulrich@iastate.edu
Curriculum Committee

☪ Computer Engineering ☪ Graduate Faculty and Advisors

Wayne P. Burleson

University of Massachusetts at Amherst
(413) 545-2382 FAX (413) 545-1227
burleson@ecs.umass.edu
Chair/Computer Engineering
Curriculum Chair/Advisor

James E. Baker

Oklahoma State University
(405) 744-5151 FAX (405) 744-6187
E-mil: jbakerm@master.ceat.okstate.edu
Curriculum Committee

James A. Davis

Iowa State University
(515) 294-0659 FAX (515) 294-3637
davis@iastate.edu
Advisor

Francis S. Hill, Jr.

University of Massachusetts at Amherst
(413) 545-0767 FAX (413) 545-1227
hill@ecs.umass.edu
Curriculum Committee

Douglas W. Jacobson

Iowa State University
(515) 294-8307 FAX (515) 294-8432
dougj@iastate.edu
Curriculum Committee

Martha Sloan

Michigan Technological University
(906) 487-2845 FAX (906) 487-2949
masloan@mtu.edu
Advisor

Philip H. Swain

Purdue University
(765) 496-3103 FAX (765) 496-6384
pswain@purdue.edu
Advisor

☪ Computer Science ☪ Graduate Faculty and Advisors

Sartaj Sahni

University of Florida
(352) 392-1527 FAX (352) 392-1220
sahni@cis.ufl.edu
Chair/Computer Science Curriculum
Chair/Advisor

Ronald D. Bonnell

University of South Carolina
(803) 777-4311 FAX (803) 777-0722
bonnell@ece.sc.edu
Curriculum Committee/Advisor

C. Robert Carlson

Illinois Institute of Technology
(630) 682-6002 FAX (630) 682-6010

ia_carlson@alpha1.iit.edu
Curriculum Committee

James Collofello

Arizona State University
(480) 965-3733 FAX (480) 965-2751
james.collofello@asu.edu
Advisor

Douglas D. Dankel, II

University of Florida
(352) 392-1387 FAX (352) 392-1220
ddd@cis.ufl.edu
Advisor

Ben Huey

Arizona State University
(480) 965-3190 FAX (480) 965-2751
huey@asuvas.eas.asu.edu
Curriculum Committee

Gearold R. Johnson

National Technological University
(970) 495-6404 FAX (970) 498-0601
gerry@ntu.edu
Advisor

Bill Junk

University of Idaho
(208) 885-7530 FAX (208) 885-9052
billjunk@cs.uidaho.edu
Curriculum Committee

Mladen A. Vouk

North Carolina State University
(919) 515-7886 FAX (919) 515-7896
vouk@csc.ncsu.edu
Curriculum Committee

☪ Electrical Engineering ☪ Graduate Faculty and Advisors

Donald W. Novotny

University of Wisconsin-Madison
(608) 262-6926 FAX (608) 262-1267
novotny@engr.wisc.edu
Chair/Executive Committee
Chair/Technical Area Chair for
Power Systems/Advisor -
Electromagnetics and Power Systems

James J. Coleman

University of Illinois at Urbana-Champaign
 (217) 333-2555 FAX (217) 244-7645
 jcoleman@uiuc.edu
 Advisor - Integrated Circuits

Thomas A. DeMassa

Arizona State University
 (480) 965-3424 FAX (480) 965-3837
 demassa@asu.edu
 Executive Committee/Technical Area
 Chair for Integrated Circuits/Advisor -
 Integrated Circuits

William J. Eccles

Rose-Hulman Institute of Technology
 (812) 877-8135 FAX (812) 877-8895
 william.eccles@rose-hulman.edu
 Advisor - Communications

K. S. P. Kumar

University of Minnesota
 (612) 624-2006 FAX (612) 624-2841
 kumar@ece.umn.edu
 Associate Chair/Executive
 Committee/Technical Area Chair for
 Circuits/Advisor - Circuit Theory

Roland R. Mielke

Old Dominion University
 (757) 683-4750 FAX (757) 683-3220
 rmielke@odu.edu
 Executive Committee/Technical Area
 Chair for Control Theory/Advisor -
 Control Theory

Masoud Salehi

Northeastern University
 (617) 373-2446 FAX (617) 373-8970
 salehi@ece.neu.edu
 Executive Committee/Technical Area
 Chair for Communications

Robert J. Weber

Iowa State University
 (515) 294-8723 FAX (515) 294-1152
 weber@iastate.edu
 Executive Committee/Technical Area
 Chair for Electromagnetics

**Engineering Management
Graduate Faculty and Advisors****Charles S. Elliott**

Arizona State University
 (480) 965-1740 FAX (480) 965-8653
 chuck.elliott@asu.edu
 Chair/Curriculum Committee Chair/
 Advisor

John Aje

The University of Maryland, University
 College
 (301) 985-7039 FAX (301) 985-4611
 jaje@nova.umuc.edu
 Advisor

Thomas A. Barta

Iowa State University
 (515) 294-2378 FAX (515) 294-3524
 tabarta@iastate.edu
 Advisor

Richard J. Giglio

University of Massachusetts at Amherst
 (413) 545-0646 FAX (413) 545-0724
 giglio@ecs.umass.edu
 Curriculum Committee/Advisor

Robert Laney

University of Missouri-Rolla
 (573) 341-4578 FAX (573) 341-6990
 laney@shuttle.cc.umr.edu
 Advisor

David Mandeville

Oklahoma State University
 (405) 744-9130 FAX (405) 744-4654
 dmandev@okstate.edu
 Admissions and Advising
 Committee/Advisor

Robert E. Markland

University of South Carolina
 (803) 777-5035 FAX (803) 777-9123
 bobbym@darla.badm.sc.edu
 Curriculum Committee/Advisor

Halvard Nystrom

University of Missouri-Rolla
 (573) 341-4624 FAX (573) 374-6567
 nystrom@umr.edu
 Curriculum Committee

Karol I. Pelc

Michigan Technological University
 (906) 487-2663 FAX (906) 487-2944
 kipelc@mtu.edu
 Admissions and Advising
 Committee/Advisor

Ronald Perry

Northeastern University
 (617) 373-4844 FAX (617) 373-2921
 perry@coe.neu.edu
 Advisor

Jerry D. Westbrook

The University of Alabama in Huntsville
 (256) 824-6648 FAX (256) 824-6608
 westbrook@ise.uah.edu
 Advisor

Carl Wolf

New Jersey Institute of Technology
 (973) 596-3657 FAX (973) 596-3652
 wolf@admin1.njit.edu
 Admission and Advising Committee

**Environmental Systems
Management
Graduate Faculty and Advisors****Timothy Ross**

University of New Mexico
 (505) 277-3459 FAX (505) 277-1988
 ross@unm.edu
 Chair/Curriculum Committee
 Chair/Advisor

Roger Dickey

Southern Methodist University
 (214) 768-4229 FAX (214) 768-3845
 dickey@seas.smu.edu
 Curriculum Committee

Daryl Doyle

Kettering University
 (810) 762-7928 FAX (810) 762-9796
 ddoyle@kettering.edu
 Curriculum Committee

Peter Fox

Arizona State University
 (480) 965-1734 FAX (480) 965-0557
 peter.fox@asu.edu
 Curriculum Committee

N. Nirmala Khandan

New Mexico State University
 (505) 646-5378 FAX (505) 646-6049
 nkhandan@nmsu.edu
 Curriculum Committee

Howard Kimmel

New Jersey Institute of Technology
 (973) 596-3574 FAX (973) 642-1847
 kimmel@adm.njit.edu
 Curriculum Committee/Advisor

**Management of
Technology
Graduate Faculty and Advisors****Alden Bean**

North Carolina State University
 (919) 513-0166 FAX (919) 515-6943
 a.s.bean@worldnet.att.net
 Chair/Advisor

**Manufacturing
Systems Engineering
Graduate Faculty and Advisors****Marvin F. DeVries**

University of Wisconsin-Madison
 (608) 262-1808 FAX (608) 265-2316
 devries@enr.wisc.edu
 Chair/Curriculum Committee
 Chair/Advisor

Placid M. Ferreira

University of Illinois at Urbana-Champaign
 (217) 333-0639 FAX (217) 244-9956
 pferreir@uiuc.edu
 Curriculum Committee

Sudhakar M. Pandit

Michigan Technological University
 (906) 487-2153 FAX (906) 487-2822
 pand@mtu.edu Curriculum Committee

Wade O. Troxell

Colorado State University
 (970) 267-2021 or (970) 491-6618
 FAX (970) 226-0795 or (970) 491-2827
 wade@enr.colostate.edu
 Curriculum Committee/Advisor

Philip Wolfe
Arizona State University
(480) 965-0125 FAX (480) 965-8692
wolfe@asu.edu
Curriculum Committee

**⌘ Materials Science ⌘
and Engineering
Graduate Faculty and Advisors**

Mufic Akinc
Iowa State University
515-294-0738 FAX 515-294-5444
makinc@iastate.edu
Chair/Curriculum Committee
Chair/Advisor

Sreeramamurthy Ankem
The University of Maryland College
Park
(301) 405-5219 FAX (301) 314-9639
ankem@eng.umd.edu
Curriculum Committee

Rajendra K. Bordia
University of Washington
(206) 685-8158 (206) 543-2600
FAX (206) 543-3100
bordia@u.washington.edu
Curriculum Committee

Robert T. DeHoff
University of Florida
(352) 392-6661 FAX (352) 846-0326
rdeho@mse.ufl.edu
Curriculum Committee

Joseph I. Goldstein
University of Massachusetts at Amherst
(413) 545-0300 FAX (413) 545-0724
jigo@ecs.umass.edu
Curriculum Committee

John Hren
North Carolina State University
(919) 515-3568 FAX (919) 737-7724
johnhren@ncsu.edu
Curriculum Committee

Jerold Schultz
University of Delaware
(302) 831-8145 FAX (301) 831-1048
schultz@che.udel.edu
Curriculum Committee

**⌘ Mechanical Engineering ⌘
Graduate Faculty and Advisors**

Wade O. Troxell
Colorado State University
(970) 267-2021 or (970) 491-6618
FAX (970) 226-0795 or (970) 491-2827
wade@engr.colostate.edu
Chair/Curriculum Committee
Chair/Advisor

Sammy G. Shina
University of Massachusetts Lowell
(978) 934-2590 or 508-877-6109
FAX (978) 934-3048
sammy_shina@uml.edu
Curriculum Committee

Ephraim M. Sparrow
University of Minnesota
(612) 625-5502 or (612) 647-0787
FAX (612) 624-1398
esparrow@umn.edu
Curriculum Committee/Advisor

**⌘ Microelectronics and ⌘
Semiconductor Engineering
Graduate Faculty and Advisors**

Thomas A. DeMassa
Arizona State University
(480) 965-3424 FAX (480) 965-3837
demassa@asu.edu
Chair/Advisor

**⌘ Software Engineering ⌘
Graduate Faculty and Advisors**

Gearold R. Johnson (Acting)
National Technological University
(970) 495-6404 FAX (970) 498-0601
gerry@ntu.edu

Chair/Software Engineering Curriculum
Acting Chair/Advisor

Stephen M. Thebaut
University of Florida
(352) 392-1496 FAX (352) 392-1220
smt@cis.ufl.edu
Advisor

**⌘ Systems Engineering ⌘
Graduate Faculty and Advisors**

Gearold R. Johnson (Acting)
National Technological University
(970) 495-6404 FAX (970) 498-0601
gerry@ntu.edu
Acting Chair/Advisor

Terry Bahill
The University of Arizona
(520) -621-6561 FAX (520) 621-6555
terry@sie.arizona.edu
Curriculum Committee

Douglas Gemmill
Iowa State University
515-294-8731 FAX 515-294-3524
n2ddg@iastate.edu
Curriculum Committee

**⌘ Special Majors ⌘
Advisors**

General
Gearold R. Johnson
National Technological University
(970) 495-6404 FAX (970) 498-0601
gerry@ntu.edu

Communications
William J. Eccles
Rose-Hulman Institute of Technology
(812) 877-8135 FAX (812) 877-8895
william.eccles@rose-hulman.edu

Information Systems

Sartaj Sahni
University of Florida
(352) 392-1527 FAX (352) 392-1220
sahni@cis.ufl.edu

Mathematics

Donald F. St. Mary
University of Massachusetts at Amherst
(413) 545-0510 FAX (413) 545-1227
stmary@math.umass.edu

Optics

Richard Shoemaker
The University of Arizona
(520) 621-2825 FAX (520) 621-6778
shoemaker@optics.arizona.edu

Reliability/Product Assurance

Dimitri B. Kececioglu
The University of Arizona
(520) 621-6120 FAX (520) 621-8191
dimitri@u.arizona.edu

Reliability/Quality Engineering

Eileen Boardman
Colorado State University
(970) 484-5767 FAX (970) 493-6709
boardman@lamar.colostate.edu

Technical Management

Charles Elliott
Arizona State University
(480) 965-1740 FAX (480) 965-8653
chuck.elliott@asu.edu

Richard J. Giglio
University of Massachusetts at Amherst
(413) 545-0646 FAX (413) 545-0724
giglio@ecs.umass.edu

Telecommunications

H. Charles Baker
Southern Methodist University
(214) 343-3229 FAX (214) 343-3229
dr.b@seas.smu.edu

g Administrative Contacts g

Arizona State University

Charles S. Elliott

Director, Center for Professional Development
(480) 965-1740 FAX (480) 965-8653
E-mail: chuck.elliott@asu.edu

Auburn University

Richard Ruff

Acting Director Media Resource Center
(334) 844-4370 (334) 844-5722
FAX (334) 844-5715
ruffric@eng.auburn.edu

Boston University

Susan M. Kryczka
Director, Distance Education
(617) 358-1960 FAX (617) 358-1961
kryczka@bu.edu

Clemson University

Christian Przirembel

Associate Dean for Research and Graduate Studies
(864) 656-3200 FAX (864) 656-0859
E-mail:
chris.przirembel@eng.clemson.edu

Colorado State University

Debbie Sheaman

Distance Degrees
(877) 491-4336 (970) 491-5288
FAX (970) 491-7885
E-mail: dsheaman@learn.colostate.edu

Columbia University

Grace Chung

Exec. Director, Columbia Video Network
(212) 854-8210 FAX (212) 854-2325
E-mail: cvn-director@columbia.edu

Florida Gulf Coast University

Rosemary Meza

Program Coordinator, College of Business
(941) 590-7301 FAX (941) 590-7330
E-mail: rmeza@fgcu.edu

The George Washington University

James VanAlstine

Distance Learning Coordinator
(202) 994-2411 FAX (202) 994-2736
E-mail: mspmdl@gwu.edu

Georgia Institute of Technology

George Wright

Manager, Center for Distance Learning
(404) 894-8572 (404) 894-6921
FAX (404) 385-0322
E-mail:
george.wright@conted.gatech.edu

Illinois Institute of Technology

Holli Pryor-Harris

Director, Client Services, IITV
(312) 567-3167 FAX (312) 567-7517
E-mail: pryor@iit.edu

Iowa State University

Rebecca Sidler Kellogg

Director of Engineering Distance Education
(515) 294-4406 FAX (515) 294-6184
E-mail: sidler@iastate.edu

Kansas State University

Virgil Wallentine

Professor and Department Head
(785) 532-6350 FAX (785) 532-7353
E-mail: virg@cis.ksu.edu

Kettering University (formerly GMI)

Mary Rensberger

Director, Extension Learning
(810) 762-7479 FAX (810) 762-9935
E-mail: mrensber@kettering.edu

Lehigh University

Peg Kercesmar

Manager, Distance Learning
(610) 758-5794 FAX (610) 758-6269
mak5@lehigh.edu

Massachusetts Institute of Technology

Margaret McCabe

Administrative Assistant, Advanced Study Program
(617) 253-9890 FAX (617) 258-8831
E-mail: mmmccabe@mit.edu

Michigan State University

Kathy Kreh

Coordinator, Graduate Distance Education
(517) 432-2464 FAX (517) 353-7782
E-mail: kreh@egr.msu.edu

Michigan Technological University

Lynn A. Artman

Program Manager, Student Services
(906) 487-3170 (800) 405-4678
FAX (906) 487-2463
E-mail: laartman@mtu.edu

New Jersey Institute of Technology

Gale Tenen Spak

Associate Vice President for Continuing and Distance Education
(973) 596-8540 FAX (973) 596-3288
E-mail: spak@adm.njit.edu

New Mexico State University

Norris B. Green

Engineering Extended Service Instruction
(505) 646-4631/4923 FAX (505) 646-2976
E-mail: budgreen@nmsu.edu

North Carolina State University

Jim Fikry

Director of Graduate Extension Education
(919) 515-5440 FAX (919) 515-8415
E-mail: jim_fikry@ncsu.edu

Northeastern University

Linda Alosso

Asst. Director, Network Northeastern
(617) 373-5620 FAX (617) 373-5625
E-mail: l.alosso@neu.edu

Oklahoma State University

Laura Gann

Manager, Extension Programs
(405) 744-9227 FAX (405) 744-5033
E-mail: laugann@okstate.edu

Old Dominion University

Pat Beauter

Program and Admin Specialist
(757) 683-4244 FAX (757) 683-4898
E-mail: pbeauter@odu.edu

Purdue University

Ray Eberts

Director, Continuing Engineering Education
(765) 494-0212 FAX (765) 496-1196
E-mail: eberts@ecn.purdue.edu

Rensselaer Polytechnic Institute

Kim Scalzo

Director of Programs, Office of Professional and Distance Education
(518) 276-8351 FAX (518) 276-8026
E-mail: scalzk@rpi.edu

Southern Methodist University

Diane Urquhart

Associate Director, Graduate Registration and Scheduling
(214) 768-3037 FAX (214) 768-3778
E-mail: diane@seas.smu.edu

The University of Alabama in

Huntsville

Dawn Utley

Assistant Professor
(256) 824-6075 FAX (256) 824-6608
E-mail: utley@ise.uah.edu

The University of Alabama

Carroll M. Tingle

Director, Distance Education
(205) 348-9278 (800) 452-5971
FAX (205) 348-0249
E-mail: ctingle@ccs.ua.edu

University of Alaska Fairbanks

Robert Carlson

Chair, Civil and Environmental Engineering
(907) 474-6120 FAX (907) 474-6087
E-mail: ffrfc1@uaf.edu

The University of Arizona

Marsha Ham

Program Development Specialist
(520) 626-2071 FAX (520) 621-2099
E-mail: mham@u.arizona.edu

University of Arkansas
Karen Standley
Engineering Distance Education Center
(501) 575-6015 FAX (501) 575-8600
E-mail: standley@engr.uark.edu

University of California, Berkeley
Pamela Atkinson
Director, CalVIEW, Video Instruction
for the Engineering World
(510) 642-5776 FAX (510) 643-5877
E-mail: atkins@coe.berkeley.edu

University of California, Davis
Claire Daughtry
Manager, Instructional Television
Program
(530) 752-2850 FAX (530) 752-2561
E-mail: cdaughtry@ucdavis.edu

University of Colorado at Boulder
Vincent P. Micucci
Director, CATECS
(303) 492-6048 FAX (303) 492-5987
E-mail: micucciv@spot.colorado.edu

University of Delaware
Mary V. Pritchard
Director, UD Online
(800) 597-1444 (302) 831-6442
FAX (302) 831-3292
E-mail: maryvp@udel.edu

University of Florida
Arthur J. Zirger, Jr.
Coordinator, Outreach Engineering
Education Program
(352) 392-9672 FAX (352) 846-2255
E-mail: azirg@eng.ufl.edu

University of Idaho
Terri Gaffney
Assistant Director and Manager of
Academic Support
Engineering Outreach
(800) 824-2889 (208) 885-6373
FAX (208) 885-9249
E-mail: terrig@uidaho.edu

**University of Illinois at
Urbana-Champaign**
Linda Krute
Associate Director, Continuing
Engineering Education
(217) 333-6634 (800) 252-1360
FAX (217) 333-0015
E-mail: l-krute@uiuc.edu

University of Kentucky
Constance M. Baird
Director, Distance Learning Programs
(800) 828-0439 or (859) 257-8135
FAX (859) 257-9686
E-mail: bairdc@email.uky.edu

**The University of Maryland College
Park**
Arnold Seigel
Director, Instructional Television
Systems
(301) 405-4910 FAX (301) 314-9639
E-mail: as20@umail.umd.edu

**University of Massachusetts at
Amherst**
Mary L. McCulloch
Campus Coordinator, Distance
Education
(413) 545-0063 FAX (413) 545-1227
E-mail: mcculloch@vip.ecs.umass.edu

The University of Michigan
Kathy M. Friedrichs
Manager, Off-Campus Education
Programs
(734) 647-7173 FAX (734) 647-7196
E-mail: kamf@engin.umich.edu

University of Minnesota
Doug Ernie
UNITE Instructional Television
(612) 624-2332 FAX (612) 626-0761
E-mail: ernie@ece.umn.edu

University of Missouri-Rolla
Krista Chambers
Teleconference Program Specialist
(573) 341-4990 FAX (573) 341-6990
E-mail: krista@umr.edu

University of Nebraska-Lincoln
C. J. Bachman
Advisor/Coordinator, Distance and
Evening Programs
(402) 472-0400 FAX (402) 472-4345
E-mail: cbachman1@unl.edu

The University of New Mexico
David Kauffman
Associate Dean, School of Engineering
(505) 277-5522 FAX (505) 277-1422
E-mail: kauffman@unm.edu

University of South Carolina
Joseph H. Gibbons
Associate Dean of Academics
(803) 777-4177 FAX (803) 777-0027
E-mail: gibbons@engr.sc.edu

University of Southern California
Laura Richter
Administrative Support Manager
(213) 740-0114 FAX (213) 821-0851
E-mail: laurar@usc.edu

**The University of Tennessee,
Knoxville**
Caroline Bowers
Assistant Director
(865) 974-8772 (800) 670-8657
FAX (865) 974-6629
E-mail: bowers@outreach.utk.edu

University of Washington
Nancy Vercoutare
Student Services Manager for EDGE
(206) 685-2242 FAX (206) 685-7251
nancyv@rio.engr.washington.edu

University of Wisconsin-Madison
Helene Demont
Program Coordinator, Engineering
Outreach Program
(608) 262-5516 888-661-9551
FAX (608) 265-2833 or
toll free (877) 267-6172
E-mail: demont@engr.wisc.edu

Vanderbilt University
Andy Dozier
(615) 322-2762 FAX (615) 343-8006
E-mail: andy.dozier@vanderbilt.edu

Index

Academic Executive Committee (AEC)	6, 98	Deadlines	9, 12	Preadvising	11
Academic Information	16	Degree Programs	1, 26	Prerequisites	63
Academic Integrity	15	Delivery System and Facilities	6	Probation	17
Academic Organization	5	Denial of Admission	11	Program of Study Plan	17
Academic Standing	17	Discontinuing a Course	13	Provisional Admission Status	10, 11
Accreditation	6	Double Major	9	Purpose of NTU	4
Address	1	Dropping a Course	13	Quality Points	16
Administration of NTU Courses	14	Electrical Engineering	10, 36, 61, 99	Reapplication	11
Administrative Contacts	102	Electronic Access	1, 25	Records	17
Admission	9	Employer Requirements	12	Refunds	24
Admission Application Fee	9	Engineering Management	10, 39, 100	Registration	9, 12
Admission Application Form	9	Environmental Systems Management	10, 41, 100	Registration Deadlines	12
Admission Classification	10	Equivalency Examinations	17	Registration Requirements	12
Admission Policies and Procedures	9	Evaluations	15	Registration Status Changes	13
Advisor/Advising	6, 11	Examinations	14	Regular Admission Status	10
Alumni Association	19	Faculty	98	Repeating a Course	17
Appeals	17	Fast Track Certificate Program in CS	21, 34, 61	Retroactive Withdrawal	16
Application Deadline	9	FAX	1	Satellite/Videotape Delivery	63
Application Materials	9	Fees	9, 17, 18, 22, 23, 63	Security	14
Application Time	9	Foreign Transcripts	10	Seven-Year Rule	19
Audit Registration	12	Goals of NTU	4	Software Engineering	11, 55, 61, 101
Audit to Credit Change	13	Grade Point Average (GPA)	12, 13, 16	Special Majors Program	11, 59, 101
Automatic Admission Requirement	10	Grades	16	Special Topics Courses	63
Board of Trustees	5, 98	Graduate Faculty	5, 99	Staff	98
Bracket Line Information	64	Graduation	19	Student Records	17
Bridging Courses	61	Incomplete Grades	16	Student Responsibilities	15
Business Administration (MBA)	10, 26, 99	Independent Student	14	Student Support	14
Calendar, Academic	1	Institution Identification	64	Systems Engineering	11, 57, 101
Cancellation, Course	12	Instructors	14	Table of Contents	2
CD-ROM Delivery	63	Internet Delivery	63	Tax Deduction	24
Certificate of Completion Program	20	Mailing Address	1	Telephone	1
Change of Graduate Major	17	Major, Change of	17	Terms of Instruction	63
Chemical Engineering	10, 29, 62, 99	Management of Technology (MOT)	11, 23, 44, 100	Textbook Ordering Procedure	14
Class Schedule	1, 7, 9, 12, 14, 23, 63	Manufacturing Systems Engineering	10, 46, 100	Textbooks and Supporting Materials	23
Communication	6	Materials Science and Engineering	10, 48, 62, 101	Thesis Guidelines	18
Community Login	9, 12, 25	MBA - Business Administration	11, 26, 99	Total Information	14
Computer Engineering	10, 31, 61, 99	Mechanical Engineering	11, 50, 101	Transcripts	9, 17
Computer Science	10, 33, 61, 99	Microelectronics & Semiconductor Engr	11, 53, 101	Transfer Credit	22
Copyright Issues	14	Misrepresentation	10	Transfer Fee	22
Course Area Designations	64	Mission of NTU	4	Trustees	5, 98
Course Cancellations	12	MOT, Management of Technology	10, 23, 44, 100	Tuition and Fees	23
Course Delivery Methods	63	MS Thesis Guidelines	18	Undergraduate Bridging Courses	61
Course Listing	69	Non-Automatic Admission Requirements	11	Universities	7
Course Numbering System	64	Nondiscrimination Policy	5	University Administrative Contacts	102
Course Registration	9, 12	NTU Transcript	17	User Name and Password	12, 25
Course Requirements	14	Numbering System	64	Video-based Instruction	14
Course Viewing Guide	14	Objectives of NTU	5	Videotape Delivery	63
Courses for Degree	9	On-line Admission	9	Videotape Guidelines	14
Courses of Instruction	63	On-line Registration	9, 25	Viewing Guide	14
Credit Conversion	16	Optional Items	10	Vision of NTU	4
Credit Information	16	Organizational Chart	8	Web Delivery	63
Credit Load	16	Password	12, 25	Web Registration	12, 25
Credit Registration	12	Payments	24	Withdrawing from a Course	13, 16
Credit to Audit Change	13	Petitioning Denial of Admission	11	World Wide Web Access	25