

Introduction

This manual is designed as a general reference for graduate students and faculty in the Department of Civil, Structural and Environmental Engineering (CSEE). Policies and procedures of the Department, the School of Engineering and Applied Sciences (SEAS) and the Graduate School of the University at Buffalo, The State University of New York are listed. Specific types of information in this manual include:

- summary of admissions policies and procedures, and financial aid opportunities
- information on advisement and registration
- summaries of degree programs and requirements
- general information about faculty, personnel, and physical facilities in the department
- general course information and guidelines for degree conferral.

Other booklets that should be consulted by graduate students include:

- Graduate Student Manual: Policies and Procedures for Graduate Students, Office for Graduate Education, University at Buffalo, The State University of New York
- Policies and Procedures for Graduate Assistantships and Fellowships, Office for Graduate Education, University at Buffalo, The State University of New York
- Guide to Financial Assistance for Graduate Students, Office for Graduate Education, University at Buffalo, The State University of New York.

URL address for Office for Graduate Education is <http://www.grad.buffalo.edu>

These booklets contain information and requirements for the various degrees, in addition to what is in this manual. Departments and programs may specify requirements for a degree more rigorous than those listed in other booklets. Therefore, when there appears to be a conflict in requirements as listed in the various booklets, the more rigorous requirements must be satisfied. Students also may want to obtain a copy of Student Rules and Regulations from the Division of Student Affairs. This booklet deals with standards of conduct, behavior, housing, student activity centers, and student finances and records.

Additional information for the University at Buffalo, the School of Engineering and Applied Sciences (SEAS), and the Department of Civil Engineering is available in various electronic formats on the world-wide web (Internet). URL addresses for some of these sites are:

- CSEE Department <http://www.civil.buffalo.edu>
- SEAS <http://www.eng.buffalo.edu>
- University at Buffalo <http://wings.buffalo.edu>

- The Multidisciplinary Center for Earthquake Engineering Research (MCEER) and the Great Lakes Program (GLP), both housed within the department, also have home pages at <http://mceer.buffalo.edu> and <http://www.buffalo.edu/glp/>, respectively.
- Individual faculty members may be contacted by e-mail using addresses provided in the faculty section of this manual.

Admissions

The CSEE Department currently offers Master of Engineering (M.Eng.), Master of Science (M.S.), and Doctor of Philosophy (Ph.D.) degrees in civil engineering. In addition, SEAS offers an M.S. degree in Engineering Science, with a specialization in Environmental Science. This degree program is administered through the Department and is designed for students having baccalaureate degrees in natural science or engineering. Students without civil engineering backgrounds are not eligible for admission to a civil engineering degree program, unless they are prepared to make up courses that would normally be included as part of an undergraduate engineering curriculum.

All applications for admission to graduate study in civil engineering must be approved by the Director of Graduate Studies. Applicants to the Master's program are normally admitted with undergraduate degrees in engineering, or in natural science if applying for the Environmental Science Program (see below). All applicants for masters degrees must have an undergraduate grade point average of at least 3.0 (based on a 4 point system), and Ph.D. applicants must have a grade point average of at least 3.4 in their graduate work. M.Eng. applicants who are New York State residents may be eligible for a full or partial tuition scholarship depending on availability of funds. Students with undergraduate degrees outside of civil engineering may be required to complete remedial undergraduate coursework in Civil Engineering before beginning their graduate programs. Any remedial work may not be used to satisfy graduate course requirements.

Other supporting documents for admission include score reports for the Graduate Record Examination (GRE), which must be submitted for those applicants requesting financial aid, the Test of English as a Foreign Language (TOEFL), for applicants from non-English speaking countries, a personal statement, and three letters of reference. Letters of reference are preferable from academic referees, but employment supervisors also may be used. Financial Statement Forms also must be submitted by applicants from outside the United States or Canada. The minimum GRE score to be considered for financial aid is 1200 (combined verbal and quantitative scores) and minimum TOEFL score for admission is 550 (paper-based) or 213 (computer-based). Students achieving a TOEFL score below 550 (or 213) will be required to participate in Intensive English Language Institute courses (at their own expense) before they can enroll in regular courses. International students are not admitted provisionally or given non-matriculant status.

Financial Assistance

Research and teaching assistantships are awarded on a competitive basis to M.S. and Ph.D. students with outstanding qualifications. The stipend for such awards ranges from \$11,400 to \$14,000 per academic year and, contingent upon annual appropriation by the New York State legislature, includes a full tuition scholarship. Health insurance is normally covered as well, so that the total support including stipend, tuition scholarship and health insurance is approximately \$16,000 for New York State residents and \$20,000 for out-of-state residents. Teaching and Research Assistants are expected to aid faculty members in the instructional and research programs for about 20 hours per week during the academic year, including the semester break period in January. Applicants and admitted students also may be nominated for fellowships (e.g., Presidential, NSF, Woodburn), which provide an extra stipend, along with a teaching or research assistantship.

M.Eng. and M.S. applicants who are New York State residents and have undergraduate GPAs of at least 3.0 (on a 4.0 system), but have not been awarded assistantships, may be eligible to receive full or partial tuition scholarships depending on availability of funds. These scholarships will generally be awarded on a "first-come, first-served" basis.

Typically, teaching and research assistantships, with tuition scholarships, are awarded on an annual basis. Current students should maintain communication with their faculty advisors to determine appropriate funding arrangements and new applicants desiring financial aid should check the appropriate box on the application. Deadlines for submission of applications for admission and financial aid are:

- **For fall support - January 15 of same year**
- **For spring support - September 15 of preceding year**

Research support is generally administrated by the faculty members directing the projects and not by the department. However, faculty members consult with the Director of Graduate Studies concerning the availability of qualified students seeking support.

A score of 55 (out of 60) on the SPEAK test is required for all international graduate assistants. The purpose of the SPEAK test is to assess the spoken English proficiency of non-native speakers of English and to measure their degree of comprehensibility in English. The SPEAK test is given the week before each semester begins. New students must register with the Intensive English Language Institute during orientation to take this test. Continuing students must register the week before that.

Normally, Teaching Assistantships are awarded to entering M.S. or Ph.D. students for one academic year. For students whose programs require more than one year, it is expected that research funding should be obtained for continued support. Occasionally a Teaching Assistantship may be renewed for a second year in exceptional cases based on the student's academic performance in graduate courses and assigned duties and recommendations from the student's advisor. The time limits for university support of graduate students are two years for a Master's program and four years for a Ph.D. program including, in the latter case, the support received for a Master's program at the

University at Buffalo. Tuition scholarship awards may not exceed 30 credit hours for a Master's degree or 72 credit hours for a Ph.D.

Advisement and Registration

Upon admission, each student is assigned a preliminary advisor. The preliminary advisor will: (1) work with the student to decide coursework that should be taken during the first and second semesters; (2) help with any general questions a student may have about the program, opportunities for research or funding; and (3) help the student find a permanent advisor (who may or may not be the same person as the preliminary advisor). For M.Eng. students, the advisor is the coordinator for the specific M.Eng. program to which the student has applied (see section on M.Eng. program for more information). All M.S. and Ph.D. students must select, with mutual agreement, a permanent advisor by the beginning of their second semester of full-time studies. The permanent advisor then serves as the chairman of the student's committee. Other faculty members may be included in an M.S. committee and at least two additional faculty members must be chosen for a Ph.D. committee. Faculty from other departments also may participate on a student's committee. The student's advisor will help to form the committee.

Graduate study is individual in nature and requires frequent interaction of the student with advisors and other professors. The principal advisor must be consulted in the planning of coursework and research for each semester and in the preparation of the Application to Candidacy and other forms that must be submitted before graduation. Deadlines for most paperwork are given in section 3.3 of this manual. Other consultations may be arranged by the student as needed. An advisor also may be of assistance and provide counsel in noncurricular matters, such as health, housing, deficiencies in reading, speaking, or writing. When necessary, an advisor may counsel a student to review academic goals, alter course of study, or terminate work at the University.

All students, after consultation with their advisors, are required to register on dates specified in the class schedule booklet available from the Office of Records and Registration. Students enrolling for graduate study for the first time should report to the Department Offices in Jarvis and Ketter Halls at least one to two weeks prior to the first day of classes. International students registering for the first time should report to the Office of International Education in Talbert Hall for assistance on housing, visa status, and orientation before coming to the department office.

Scholastic Standing

1. A minimum cumulative average of "B" (3.0 points) is to be maintained for all graduate work. In addition, no more than two "Cs" are allowed. A course in which a grade of "I" (incomplete) is obtained may not be included in a degree program and must be removed within one year or the University will automatically convert it to an "F" grade. (An "I" will automatically be converted to an "F" for purposes of TAP after one semester by regulation of the State Education Department.)

2. A student whose average is less than 3.0 at the beginning of a semester is considered to be on probation and must raise his/her average to a 3.0 by the end of that semester.
3. A student will be required to withdraw if he/she:
 - a) has received an "F" (failure) in any course or has received more than two "Cs"
 - b) has a cumulative grade point average of less than 3.0 at the end of two consecutive semesters
 - c) has failed in a second attempt at the Ph.D. qualifying examination (see Section 2.6); or
 - d) is found guilty of academic dishonesty as stated in Student Rules and Regulations - Section III, paragraph 5.00: "The development of intelligence and strengthening of moral responsibility are two of the most important aims of education. Fundamental to the accomplishment of these purposes is the duty of the student to perform all of his or her required work without illegal help.

The following actions constitute major forms of academic dishonesty among students:

- (a) submission to satisfy academic requirements of material previously submitted in whole or in substantial part in another course, without prior and expressed consent of the instructor
- (b) plagiarism: copying material from a source or sources and submitting this material as one's own without acknowledging the particular debts to the source (quotations, paraphrases, basic ideas), or otherwise representing the work of another as one's own;
- (c) cheating: receiving information from another student or other unauthorized source or giving information to another student with intention to deceive while completing an examination or individual assignment;
- (d) falsification of forms of computer data or reports, forging an instructor's name or initials, or submitting a report, paper, materials, computer data, or examination (or any considerable part thereof) prepared by any person other than the student responsible for the assignment; or
- (e) procurement, distribution, or acceptance of examinations, laboratory results, or confidential academic materials without prior and expressed consent of the instructor."

Seminars

Seminars in the major interest areas of the department are scheduled on a regular basis during the school year and attendance is required for all full-time graduate students. Notices are generally posted in the hallways of both Ketter and Jarvis Halls.

Miscellaneous

Keys

Permission to obtain office and laboratory keys must be granted by the Department Chair. Keys may be obtained from one of the departmental secretaries once permission is approved. A \$5 deposit is required for each key, which is refunded when a key is returned. Offices and laboratories should always be locked at night and/or whenever they are unoccupied. All keys must be returned to the department at the conclusion of a student's graduate program.

Offices and Desks

Office and desk space, if available, is assigned to full-time students by the Department Chair. The order of priority for desk assignments is as follows: teaching assistants, research assistants, full-time Ph.D. students, full-time M.S. and M.Eng. students, part-time Ph.D. students and part-time M.S. and M.Eng. students. It may not be possible for every student to be assigned desk space.

Mail

Mail may be picked up from mailboxes in the corridor outside of Room 212 Ketter Hall or in the mailroom in 207 Jarvis Hall. Incoming mail is usually distributed before noon. All students should check their mailboxes regularly to learn of any important announcements. Outgoing mail can be deposited in the department office. Students should have all personal mail sent to their local residences rather than to the University address.

Telephones

A number of laboratories have phone service restricted to University calls and incoming calls. The main department phone number is 645-2114. Each office has its own extension. If long distance calls of an official nature are required, they should be made through the advisor's phone and a charge slip completed listing the date, phone number, and person/company called. Under no circumstances will COLLECT calls be accepted on any department phone. Personal calls should be made at pay phone stations.

Bulletin Boards

Bulletin boards are maintained in a variety of locations in both Ketter and Jarvis Halls. Seminar, course and examination announcements, job openings, meeting notices, contests, information of current and recent research interest, and other general information will be posted on these bulletin boards. The general CSEE graduate student bulletin board is located outside of the department office in the corridor of Ketter Hall.

Copying

There are two main copiers for department use, one in the department offices in Ketter Hall and the other in Room 207 Jarvis Hall. These copiers may only be used by graduate students copying material associated with a research project or with a teaching assignment, and then only with the express written permission of a faculty member. The amount of copying done on these copiers should generally be limited to less than 50 copies. Large copy volumes should be taken to the University copy service in Jacobs Hall (Quick Copy Center). For students on research projects, an account to use a copier in the Science and Engineering Library (SEL) also can be arranged through the research project director. Any personal copying, including copying of notes, homework/exam solutions,

journal articles, and thesis drafts is not permitted on department copiers. Public copy machines are located in SEL and in Makin' Copies in the UB Commons (across the street from Jarvis Hall).

Typing

Typing a thesis or report is the responsibility of the student. Students should not ask department or research secretaries to do any typing; such requests should come from faculty members. Word processing software is available on all of the computer systems and can be used for manuscript preparation. The thesis or report can then be printed by a laser printer for a fee. Word processing software on personal computers located in 208 Ketter Hall and around campus also can be used to prepare a thesis or report. The student must be sure to use a printer of appropriate quality for preparation of the final copy of a thesis or report. University letterhead paper should not be used unless the letter is for official University business and the student's advisor has approved its use.

Computer Resources

Computer time is available to all graduate students, and all students should obtain e-mail and UNIX accounts from the Computing Center in Fronczak Hall, or by following the directions that can be obtained at consultation sites such as 101 Bell Hall. SUN workstations also are available at a large number of campus sites. A University account can be obtained for SUN workstations from the Computing Center in Fronczak Hall. SEAS also maintains extensive computer facilities for support of academic and research activities. An Engineering UNIX account can be obtained by applying at the SEAS computer facility in Bell Hall, after receiving a University UNIX account. The CSEE Department also maintains several networks of personal computers and additional personal computers are available at other public sites on campus and are available for use by students. A separate account must be set up in order to use the Department's PC labs. These machines may be used for class and research work.

Machine Shop

Machine shop facilities are located on the ground floor in Jarvis Hall. Students may borrow equipment and use certain machine tools with supervision and prior approval of the shop foreman. Such use is limited to research and is not for personal work.

Safety

Safety precautions should be followed at all times. When in the shop or laboratories, all students must follow all safety rules and procedures. The student should become familiar with all relevant safety requirements and procedures before using any laboratory or shop equipment.

Deadlines

It is the responsibility of the student to submit the proper paperwork on time to both the Department and the Graduate School and in all other respects satisfy the general requirements for a degree as specified in the Graduate Student Manual of the Graduate School. Each graduate student must become familiar with these University regulations. The Degree Conferral Timetable for Receipt of Paperwork is given each semester in the University course timetables and is also summarized in Section 3.3 of this manual.

Areas of Study

The CSEE Department offers advanced study and research designed to educate students in a broad range of technical areas, including:

- Computational Engineering Mechanics
- Construction Engineering and Management
- Environmental Engineering and Science
- Geomechanics and Geotechnical Engineering
- Structural and Earthquake Engineering

Graduate study and research programs can be designed to allow for study in two or more related areas, specialization in one area, or a program of study can be designed for work in some other specialized or newly evolving area of Civil, Structural and Environmental Engineering. For example, a student can select courses from different areas of study to emphasize the area of computational mechanics or GIS applications in engineering. The choice is made by the student along with the student's graduate advisor or major professor along with the advisory committee. Typical programs and course requirements for the areas listed above are given in Section 3 of this document. Proposed M.Eng., M.S., and Ph.D. programs for other areas must be approved by the Director of Graduate Studies in consultation with the Department Graduate Studies Committee and must include applicable basic core courses prescribed by the department.

A student who wishes to petition for waiver from any of the policies and procedures presented in this manual should consult with his or her advisor and the Director of Graduate Studies.

School of Engineering and Applied Sciences Policies

Transfer of credits taken at other universities

- a) A maximum of 6 transfer credits of graduate course work may be applied toward the 30 credit hour requirement for a Master's degree.
- b) A maximum of 30 transfer credits may be applied toward the 72 minimum credit hour requirement for the Ph.D. degree (this normally comes from a master's degree).
- c) Only courses applicable to the engineering degree are acceptable as transfer credit, and the Department must approve all transfer credit.
- d) Only those graduate courses completed with grades of "B" or better are eligible for consideration as transfer credit. However, the grade of the transferred course will not be counted towards the student's grade point average at U.B.

Informal courses (Independent Study, Individual Problems)

- a) Informal courses usually include Independent Study, Individual Problems, and Special Topics courses, which are taught on an informal basis and do not have formal catalogue descriptions. These courses require a complete narrative

- description on a special form designed for this purpose which includes the signatures of the student, instructor, and the Director of Graduate Studies. A copy of this form must be included with the student's Application to Candidacy for each such informal course taken for credit.
- b) A maximum of 6 credit hours of informal course work may be applied toward the minimum 30 credit hour requirement for the Master's degree.
 - c) Excluding those credits applied towards the Master's degree, a maximum of 6 additional credit hours of informal course work may be applied towards the minimum 72 credit hour requirements for the Ph.D. degree.

Graduate credit for undergraduate courses

- a) A student wishing to use an undergraduate course for graduate credit must submit a petition during the first week of classes to the Graduate School for approval and this petition must include a clear statement from the instructor of the course regarding what special additional work will be required of the student to qualify for graduate credit. Copies of these petitions must be included in the Application to Candidacy. Retroactive approval will not be granted. Remedial courses, taken to make up deficiencies in a student's undergraduate background, will not be considered for graduate credit.
- b) Only courses at the 400 level will be considered for graduate credit, and a maximum of two such courses may be applied toward a graduate degree. This maximum limit applies to the entire Master's and Ph.D. program.
- c) Undergraduate courses that carry 4 or more semester hours of credit will receive a maximum of 3 semester hours of graduate credit.

Thesis/Project/Dissertation credits applicable toward degree

The following limits are imposed on thesis, project, and dissertation credits which are applicable toward graduate degree requirements:

- a) M.Eng. degree: 3 to 6 credit hours for engineering project plus course work.
- b) M.S. degree with research: 3 to 6 credit hours for thesis or 3 credit hours of project plus at least 24 credit hours of course work.
- c) Ph.D. degree: Between 12 and 24 credit hours for dissertation must be applied toward the 72 credit hour requirement for the Ph.D. degree. The student is required to plan the actual number of credits for the doctoral dissertation with his or her advisor. At least 18 credit hours of course-work is required beyond the Master's degree. A maximum of 30 credit hours from a Master's degree may be applied toward the 72 credit hour requirement for the Ph.D. degree. Of these, no more than 6 credit hours may be derived from a Master's thesis or project.

Nonapplicable Credits

Credits in the following courses are not applicable towards the minimum requirements for Master's and Ph.D. degree programs:

- a) Supervised Teaching
- b) Supervised Research
- c) Departmental Seminar
- d) English Language Courses

Deadlines

It is the responsibility of the student to meet all deadlines specified by the Graduate School. Students should consult the Graduate Student Policies and Procedures Manual of the Graduate School for further information.

Grading Policy

- a) The grade of "L" should be used for Thesis, Project and Dissertations.
- b) All other grades in courses applicable to the degree must be letter grades ("A", "B", "C", "D").
- c) The grade of "I" automatically changes to "U" if not removed within two semesters, plus the intervening summer as established by the academic calendar. "J" grades (invalid grade) must be changed to letter grades within one semester or they will revert to "F". The student is responsible for the removal of temporary grades such as "I" or "J", within the allowed time period.

Monitoring student progress

- a) A Master's student admitted on a provisional basis must demonstrate his or her ability to perform satisfactorily at the graduate level before being admitted to degree candidacy. The department will specify the conditions in the letter of admission offering provisional status.
- b) A graduate student is officially considered to be a student for the Ph.D. degree only upon successful completion of the departmental Ph.D. qualifying examination.
- c) Satisfactory progress for a graduate student requires a minimum GPA of at least 3.0. A student is placed on probation if his or her GPA falls between 2.5 and 3.0 at the end of any grading period.
- d) A student will be considered for dismissal if:
 - i) a grade of "F" is earned in any course that could be applied to the degree;
 - ii) more than two grades are obtained from among "C", "D", and "U" in courses which could be applied to the degree;
 - iii) the conditions of provisional admission have not been satisfied within one semester after admission;
 - iv) probationary status has not been removed after one semester;
 - v) the cumulative grade point average for courses which could be applied to the degree falls below 2.5 at the end of any grading period; or,
 - vi) the student is found guilty of academic dishonesty according to existing regulations.

Required grade point average

A graduate student must earn an average of at least 3.0 for all courses taken for graduate credit which could be applied toward the degree. Accordingly, graduate course work in excess of that applied toward the credit requirement for the degree will be included in the computation of the student's GPA. A student whose GPA is below 3.0 will be put on probation and must raise his or her GPA to over 3.0 by the end of the following semester, according to rules in the previous section. Normally, letter grades are not given for project, thesis or dissertation, so the required grade point average must be maintained for regular academic courses.

Ph.D. Advisory Committee

The advisory committee, which oversees administration of the qualifying exam and the dissertation of a Ph.D. student must be composed of a major professor from the Department who is a member of the graduate faculty, and at least two additional members who hold the rank of assistant professor or higher in the University Faculty, at least one of which also is from the department. Additional members of the committee may be chosen from faculty outside the department, depending on the interests and needs of a particular student.

The Outside Reader

In addition to the main advisory committee members, the Ph.D. dissertation must be examined by an outside reader who will report his or her evaluation in a letter to the Dean of the Graduate School. This letter must be in the student's file before the dissertation defense can be scheduled and the degree can be awarded (see the Graduate School Policies and Procedures Manual for specific details, and also Section 2.6 below).

Time limits for degree

- a) M.Eng./M.S. - Four years from the first registration date in the graduate program, excluding approved leaves of absence.
- b) Ph.D. - Seven years from the first registration date in the graduate program, excluding approved leaves of absence.

Petition for an extension of time limit requires Departmental and SEAS approval through the Director of Graduate Studies. The student must be currently making active progress towards the degree. The petition will be presented to the SEAS divisional committee for approval before being submitted to the Graduate School. The petition must clearly delineate reasons for the extension, present a schedule for progress and set a deadline for completion of the program. The extension of time limit is normally granted for a maximum period of one year.

Application to Candidacy

The primary purpose of the Application to Candidacy is to serve as a useful planning document for the student and the student's committee, as well as to indicate to the Graduate School the student's intended degree date. As such, it is important for the student to prepare and submit the Application to Candidacy at an early stage of his or her candidacy (the timetable for submission of paperwork listed in Section 3.3 should be followed). The Application to Candidacy includes a summary of courses that are to be applied toward the degree. The following additional points should be noted with regard to the Application to Candidacy:

- a) The Application to Candidacy must be accompanied with a preliminary abstract of the dissertation, project, or thesis, a transcript of all coursework listed on the Application, official transcripts to document any transfer credits, and informal course descriptions (for independent study or special topics courses).
- b) Major revisions which are necessary in the Application to Candidacy (e.g., significant change in topic or abstract, adding and/or deleting more than two courses, changing major advisor, etc.) must be accomplished by resubmitting the

- Application to Candidacy to the Graduate School for approval by the divisional committee.
- c) Minor changes (e.g., adding and/or deleting one or two courses, changing thesis titles, changing committee members other than the major advisor, etc.) may be made using the Graduate Petition Form.
 - d) The Application to Candidacy for the Ph.D. degree must be filed within one year of passing the Ph.D. qualifying examination.
 - e) All Applications to Candidacy must be submitted at least four months prior to the expected degree date.

An approved Application to Candidacy must be on file before a student may submit a Full-Time Status Form.

Leaves of absence

- a) A petition for leave of absence should be filed prior to the start of the semester in which the leave is to begin.
- b) Leaves of absence will normally be granted for only one year at a time.
- c) Leaves of more than one semester require valid justification and documentation from the student and the student's advisor. Documented cases of financial hardship, illness, or compulsory military service constitutes valid justification.
- d) A student who leaves the program after completion of some graduate work but has not been given an approved leave of absence must reapply and be readmitted as a new student.
- e) Continued leaves of absence beyond two years will not be granted.

Time limit for tuition scholarships

- a) The maximum limit for tuition scholarship for students in the Master's program is 30 credit hours (minus transfer credits) or two years, whichever comes first. The maximum limit for tuition scholarships for Master's students who are otherwise unfunded is one academic year.
- b) The maximum limit for tuition scholarship for students in the Ph.D. program is 72 credit hours (minus transfer credits) or four years, whichever comes first.
- c) Lecturers are employees of the University and are not eligible for tuition scholarships.
- d) A petition for extension of time for a tuition scholarship should be filed prior to the start of the semester for which the scholarship is sought.

Time limit for support on state lines

- a) The maximum limit on state support for students in the Master's program is two years.
- b) The maximum limit on state support for students in the Ph.D. program is two years of support beyond the Master's degree or four years beyond the Bachelor's degree.
- c) A petition for extension of the time limit for support in state positions should be filed prior to the start of the semester for which the waiver is sought. Such petitions will be approved only in exceptional circumstances.
- d) SEAS tuition scholarship policies are established by the Associate Dean of Graduate Studies in consultation within the Graduate Academic Program Committee.

Specific Department Requirements

In addition to degree requirements and regulations of the Graduate School and School of Engineering and Applied Sciences, the following specific requirements of the Department must be met to complete all of the requirements for a graduate degree:

Course grades

For both Master's and Ph.D. degrees - A "B" average (3.00) is required for all courses taken (not to include thesis, project, "S/U" and "L" grades). Any grade of "I" not removed will be considered as a "C" grade for the purpose of computing this average.

Project, Thesis, Dissertation

A grade of "S" or an assigned letter grade must be attained and a hardbound copy of the project, thesis, or dissertation must be presented to the department before the M-form will be signed.

Time Limits

- a) Master's degree (M.Eng./M.S.) - Two calendar years from the date of the first registration exclusive of up to only one year of approved leave of absence for full-time students or six calendar years from the first registration date in the graduate program, excluding approved leaves of absence, for part-time students.
- b) Ph.D. degree - Four calendar years from admission to the Ph.D. program exclusive of up to only one year of approved leave of absence.

Core Curriculum

It is the policy of the department that all graduate students shall participate in the departmental core program to the extent specified. This is a basic requirement for the M.S. and Ph.D. degrees. Students in these degree programs must take one course in mathematics and choose one of two courses in mechanics, either fluids or solids. The only exception to this rule is when a student can demonstrate that he/she has already taken an equivalent course before coming to UB. In this case the student should take an alternative course, as specified by the Graduate Studies Committee. While high performance in all graduate work is important, excellent grades in core courses are particularly significant in the faculty's assessment of a student's potential to pursue a Ph.D.

The courses comprising the core are selected to insure that advanced degree recipients from the department have knowledge in the basic mechanics and mathematics that are the "fundamental language" of civil engineering. Core courses may be changed from time to time. The current core program is as follows:

Mechanics: (Solids) CIE 511 Advanced Mechanics of Solids
or
(Fluids) CIE 546 Environmental Fluid Mechanics

Mathematics: CIE516 Advanced Mathematics for Civil Engineers

Master's Programs

Master of Engineering

The Master of Engineering (M.Eng.) program in Civil Engineering is meant to provide post-graduate training for students wishing to improve their knowledge base in engineering and to gain additional design capability, past the undergraduate degree. It is a design and practice-oriented program suitable for students planning to pursue a professional career in consulting, industry and government service. Students may choose from five different areas of concentration: (1) Construction Engineering and Management; (2) Earthquake Engineering, (3) Environmental Engineering; (4) Geomechanics and Geotechnical Engineering; and (5) Structural Engineering and Design. General degree requirements include at least 24 credits of approved graduate coursework and 6 credits of Engineering Project, which includes writing and presenting a project report. The program is designed to be completed within 9 - 11 months for full-time students.

It is expected that most students in the program will be studying full-time and will start their programs in the fall semester. However, allowances will be made for part-time students and for students wishing to start in the spring. The project will generally be a group project for full-time students; part-time students also may participate in the group project or may complete an individual project depending on scheduling. Specific requirements are listed below for each of the M.Eng. program areas. Modifications of the programs are possible, with approval of the student's advisor. Students admitted to the M.Eng. program may not automatically transfer to the M.S. program - students interested in this change must petition the Department Graduate Studies Committee and go through the usual evaluation procedures for the M.S. program.

General M.Eng. degree admission requirements include:

- Baccalaureate degree in Civil Engineering or a closely related engineering field; for the Construction Engineering and Management area, degrees are also acceptable from Architecture, Management or Law, though some remedial coursework may be required.
- Minimum undergraduate grade point average of 3.0 (based on a 4.0 system) - applicants who do not meet this requirement will be evaluated on an individual basis.
- For students from non-English speaking countries, a TOEFL score above 550 (or 213 on computer-based test)

Certain basic undergraduate course work is considered essential for all students who will receive the M.Eng. degree in civil engineering. Usually these requirements are fulfilled by an ABET accredited B.S. degree in engineering. The B.S. Civil Engineering program would normally include the following material:

- Calculus and Differential Equations
- Probability and Statistics
- Engineering Mechanics
- Structural or Environmental Design
- Soil Mechanics
- Fluid Mechanics and Hydraulics

Tutorial-type graduate credits or undergraduate credits taken to remove deficiencies will not be accepted as satisfying part of the 30 credit hour requirement except as noted above or unless written request has been made to and prior approval obtained from the student's major professor and the Director of Graduate Studies at the start of the program.

Registration in CIE 557 and/or CIE 558 is required for the engineering project part of the M.Eng. program. When appropriate, an interested third party (e.g., from industry or government), along with the student and the student's graduate advisor, may be involved in the conduct of the project. Joint involvement is viewed as a positive aspect of the professionally oriented M.Eng. program.

Construction Engineering and Management

Overview:

Construction has been and will continue to be an important activity which is responsible for providing and maintaining facilities which provide fundamental support for our modern societies. The Construction Engineering and Management Program concentrates on building decision making skills based on a thorough knowledge of engineering and management fundamentals, and the use of computers and new technologies for the management of time, money, people and materials and equipment. Graduates from the program are well equipped to build careers related to constructing and maintaining new and existing infrastructure and to provide leadership in sustainable development.

Course Requirements:

Fall Semester

Required

CIE 591 Construction Estimating
 CIE 592 Construction Planning and Scheduling
 Elective
 Elective
 CIE 557 Engineering Project (3 credits)

Electives

CIE 506 Legal Aspects of Civil Engineering Practice
 CIE 507 Geographic Information Systems
 CIE 516 Advanced Math for Civil Engineers
 CIE 525 Concrete Structures

CIE 527 Design and Construction of Structural Systems
CIE 535 Geoenvironmental Engineering

Spring Semester Required

CIE 593 Construction Project Management
CIE 594 Computer Applications in Const.
CIE 597 Construction Safety and Health
Elective
Elective

Electives

CIE 508 Probabilistic Analysis and Design
CIE 524 Steel Structures
CIE 531 Design and Construction of Earth Structures
CIE 558 Engineering Project (3 credits)
CIE 589 Assessment and Repair of Structures
CIE 595 Construction Equipment & Technology
CIE 596 Expert Systems in Civil Engineering

Note: Elective courses may be taken in other areas of Civil Engineering, in other engineering disciplines or other university programs, provided that they satisfy graduate degree requirements and have the approval of the student's advisor.

Earthquake Engineering

Overview:

As the entire nation has now adopted seismic design requirements in building codes, there is a national need for engineering professionals who are properly educated and trained to handle earthquake-resistant design of new structures and seismic retrofitting of existing structures. The M.Eng. program in Earthquake Engineering is meant to provide post-graduate training for students wishing to improve their knowledge base in earthquake engineering.

Course Requirements:

Fall Semester Required

CIE 519 Structural Dynamics and Earthquake Eng. I
CIE 525 Concrete Structures
CIE 527 Design and Construction of Structural Systems
Elective
CIE 557 Engineering Project (3 credits)

Electives

CIE 520 Random Vibrations & Stochastic Structural Dynamics

CIE 526 Finite Element Structural Analysis
CIE 591 Construction Engineering

Spring Semester Required

CIE 505 Earthquake Engineering Seminar (3 credits)
CIE 524 Metal Structures **or**
CIE 521 Plastic Analysis and Design
CIE 534 Earthquake Eng. And Foundation Analysis **or**
CIE 619 Structural Dynamics and Earthquake Eng. II
Elective
CIE 558 Engineering Project (3 credits)

Electives

CIE 508 Probabilistic Analysis and Design
CIE 512 Structural Reliability and Safety
CIE 619 Experimental Methods in Structural Eng.
CIE 625 Aseismic Base Isolation
CIE 626 Passive and Active Structural Control
CIE 644 Seismology

Environmental Engineering

Overview:

Students in the Environmental Engineering and Science Program work together to develop a greater understanding of the physical, chemical and biological processes that influence the health of our environment, and use this knowledge to pursue innovative solutions for its protection. The program thrives on a strong partnership among faculty, students, and the general community. Graduates of the program are prepared for employment opportunities in:

1. the development, design and management of new and innovative treatment processes for water, wastewater, and hazardous wastes
2. modeling the fate and transport of contaminants and assessing their impact on environmental quality*

Course Requirements:

Fall Semester Required

CIE 546 Environmental Fluid Mechanics
CIE 564 Chemical/Biological Principles in Environmental Engineering
CIE 557 Engineering Project (3 credits)
Elective
Elective

Electives

CIE 535 Geoenvironmental Engineering
CIE 550 Hydrologic Engineering
CIE 569 Hazardous Waste Management
CIE 641 Advanced Topics in Groundwater Engineering

Spring Semester Required

CIE 543 Water Quality Modeling
CIE 556 Physiochemical Unit Processes
CIE 558 Engineering Project (3 credits)
Elective
Elective

Electives

CIE 541 Groundwater Engineering
CIE 552 Water Resources Engineering
CIE 554 Numerical Methods in Water Resources and Environmental Engineering
CIE 655 Environmental Engineering Design
CIE 662 Methods of Pollutant Analysis
CIE 664 Organic Chemical Principles in Environmental Engineering

* More information on the program can be found at www.eng.buffalo.edu/ees

Geotechnical Engineering

Overview:

Geotechnical engineering plays a vital role in the design and construction of the nation's civil infrastructure against natural forces as well as for its maintenance and rehabilitation. It also deals with the challenging task of maintenance of the quality of our land and groundwater resources. The program in Geotechnical and Foundation Engineering is designed as a practice-oriented degree program and is well suited for those students who wish to pursue a professional career in design and construction of geotechnical and geoenvironmental facilities. Specialized topics include: foundations, ground improvement, seismic retrofitting of slopes and embankments and retaining walls, landfills, below-ground waste containment, soil clean-up.

Course Requirements:

Fall Semester Required

CIE 535 Geoenvironmental Engineering
Elective
Elective
Elective
CIE 557 Engineering Project (3 credits)

Electives

CIE 526 Finite Element Methods
CIE 529 Pavement Design
CIE 530 Mechanical Behavior of Materials
CIE 569 Hazardous Waste Management
CIE 591 Construction Cost Estimating
CIE 592 Construction Planning and Scheduling

Spring Semester

Required

CIE 533 Structural Design & Const. of Foundations
Elective
Elective
Elective
CIE 558 Engineering Project (3 credits)

Electives

CIE 531 Design and Construction of Earth Structures
CIE 534 Earthquake Eng. & Foundation Dynamics
CIE 541 Groundwater Engineering
CIE 593 Project Management
CIE 623 Plastic Behavior of Materials
CIE 630 Geotechnical In-situ and Laboratory Testing

Structural Engineering

Overview:

The Structural Engineering and Design Program focuses on structural engineering research, education and training. Specialized topics include: design and analysis of different types of structural systems with an emphasis on bridges and tall buildings, project management and construction estimating and planning aspects of such building and bridge projects. As the entire nation is now subject to seismic design code requirements, an emphasis is placed on earthquake resistant design of new structures and the seismic retrofitting of existing structures.

Course Requirements:

Fall Semester

Required

CIE 519 Structural Dynamics and Earthquake Eng. I
CIE 525 Concrete Structures
CIE 527 Design and Construction of Structural Systems
Elective
CIE 557 Engineering Project (3 credits)

Electives

CIE 520 Random Vibrations & Stochastic Structural Dynamics
CIE 521 Plastic Analysis and Design
CIE 526 Finite Element Structural Analysis
CIE 591 Construction Engineering
CIE 592 Construction Planning and Scheduling

Spring Semester

Required

CIE 524 Steel Struct. **or** CIE 521 Plastic Analysis
CIE 593 Project Management
Elective
Elective
CIE 558 Engineering Project (3 credits)

Electives

CIE 508 Probabilistic Analysis and Design
CIE 512 Structural Reliability and Safety
CIE 528 Advanced Composite Structures
CIE 533 Structural Design & Const. of Foundations
CIE 534 Earthquake Eng. & Foundation Dynamics
CIE 616 Experimental Methods in Structural Eng.
CIE 619 Structural Dyn. and Earthquake Eng. II
CIE 623 Plastic Behavior of Materials
CIE 625 Aseismic Base Isolation
CIE 626 Passive and Active Structural Control

For all M.Eng. programs, upon completion of the project, an oral presentation should be given and one bound copy of the engineering project must be submitted to the department. *The bound copy must have a cover page that lists names of the advisor and committee members (as appropriate), with spaces for their signatures. The bound copy must be submitted before the M-Form will be signed.*

Master of Science

The Master of Science (M.S.) program is intended to serve a variety of people and purposes. Therefore, in place of rigidly structured programs, students are encouraged to develop their programs in accord with their interests and in consultation with their advisors. Suggested programs have been outlined in several departmental areas (see below) and required courses, in addition to the departmental core courses, are listed. For the M.S. in Civil Engineering degree, students generally write a thesis, although an all-course option is available, as described below. All M.S. students must complete 30 semester credits of approved graduate coursework, which must include 6 credit hours from the core curriculum as described in Section 2.4 of this manual. Additional course requirements may be specified by individual program areas (see Section 3.2). M.S. students in the Environmental Science program are exempt from the core course requirements of Section 2.4, but may have other requirements as listed below. Undergraduate credits or graduate tutorial courses (individual problems, supervised study, etc.) taken to remove deficiencies will not be accepted as part of the 30 credit hour

requirement. Graduate tutorial courses are to be used for advanced graduate study only when a specialty graduate course is not available. One undergraduate course (400 level only) may be taken for graduate credit if the course will be of benefit to the student's M.S. program (however, the requirements stated in Section 2.2.3 must be satisfied).

Each student, in consultation with his/her advisor, will choose one of the options below, preferably within the first semester of study.

1. Thesis or project option - Students electing this option must register for at least 3, and no more than 6, credits of thesis (CIE 559 and/or 560) or a maximum of 3 credit hours of project (CIE 557 or CIE 558). Coursework to satisfy the remaining required credit hours will be determined in consultation with his/her advisor. Each student also must successfully defend the thesis. This process will start with the student preparing a first draft of the thesis, in consultation with his/her advisor. Upon completion of a "reader's copy", the student's committee members will have one week to review the document and decide whether revisions are required or if the defense can be scheduled. If revisions are necessary, then additional time will be needed for further review. Once the thesis is ready for defense, general announcements must be posted one week prior to the defense and a copy of the thesis should be made available with the department secretary. The defense should consist of an oral presentation, about 30 minutes long, with an additional 10 to 15 minutes for general questions, after which the defense will continue with the student's graduate committee only. Questions and discussion will be based on the work done for the thesis and on general core course material. After the defense the committee will determine whether the student has successfully defended the thesis or whether additional work is required.
2. All-Course option - For this option, students will complete 6 credit hours of approved electives in place of a thesis. The coursework will be planned in conjunction with the student's major advisor. Each student also must pass a comprehensive examination, which will be scheduled at the conclusion of the student's program of study. This examination will normally be similar to the first part of the Ph.D. qualifying exam (Part 1a - See Section 2.6.2).

After successfully completing a thesis defense, the candidate must submit two bound copies of the thesis to the Graduate School and one bound copy to the department, along with a signed M-form. The thesis must include a cover page listing the student's advisor and committee members (as appropriate), along with spaces for their signatures. The student's major advisor and committee also may request a bound copy. It is the student's responsibility to supply all necessary copies of the thesis (draft and final), as required by the M.S. committee. The M-Form will not be signed until a bound copy of the thesis is submitted.

For those M.S. candidates who desire to pursue a Ph.D. degree, evidence of talent for independent research is a prerequisite. When a thesis is not written, some other written evidence to demonstrate this talent may be required.

Sample M.S. (Civil Engineering) programs are shown below for each of the major areas of concentration in the department. Course descriptions are provided in Section 3.5. Of course, each student should develop a program with the approval of his or her major advisor.

M.S. Computational Engineering Mechanics

Required Core Courses (6 credit hours)

CIE 511 Advanced Mechanics of Solids (F) **or**
CIE 546 Environmental Fluid Mechanics (F)

CIE 516 Advanced Mathematics for Civil Engineers (F)

Required Courses (9 credit hours)

CIE 526 Finite Element Structural Analysis (F)
CIE 617 Advanced Finite Elements (S)
CIE 645 Boundary Element Methods (S)

Electives in Structural Engineering

CIE 508 Probabilistic Analysis and Design (S)
CIE 512 Structural Reliability and Safety (F)
CIE 519 Structural Dynamics and Earthquake Engineering I (F)
CIE 520 Random Vibration
CIE 619 Structural Dynamics and Earthquake Engineering II (S)

Electives in Geotechnical Engineering

CIE 530 Mechanical Behavior of Materials (F)
CIE 533 Structural Design and Construction of Foundations (S)
CIE 534 Earthquake Engineering and Foundation Dynamics (S)
CIE 623 Plastic Behavior of Materials

Electives in Environmental Engineering

CIE 541 Groundwater Engineering (S)
CIE 546 Environmental Fluid Mechanics (F)
CIE 554 Numerical Methods in Water Resources and Environmental Engineering (S)
CIE 641 Advanced Topics in Groundwater Engineering (F)

Electives in Mechanical, Chemical and Electrical Engineering

A flexible program can be designed by the student and the faculty advisor.

Research (up to 6 credits)

Either: (1) CIE 559 and/or 560 Thesis (3 to 6 Credit Hours)
(2) Electives (6 credit hours) and comprehensive examination

*Student may select electives from the suggested list or from other approved University graduate courses, with advice and consent of advisor.

M.S. Construction Engineering and Management Program

Required Core Courses (6 credit hours)

CIE 511 Advanced Mechanics of Solids (F)
CIE 516 Advanced Mathematics for Civil Engineers (F)

Required Courses (12 credit hours)

CIE 591 Construction Estimating and Cost Control (F)
CIE 592 Construction Planning and Scheduling (F)
CIE 593 Project Management (S)
CIE 594 Computer Applications in Construction Management (S)

Electives* (6 credit hours)

CIE 506 Legal Aspects of Civil Engineering Practice
CIE 507 GIS Applications in Civil Engineering (F)
CIE 508 Probabilistic Analysis and Design (S)
CIE 524 Steel Design (S)
CIE 525 Concrete Structures (F)
CIE 526 Finite Elements (F)
CIE 529 Pavement Design (F)
CIE 531 Design and Construction of Earth Structures (S)
CIE 535 Geo-Environmental Engineering (F)
CIE 589 Assessment, Repair and Retrofit of Structures (S)
CIE 595 Construction Technology and Equipment (F)
CIE 596 Expert Systems in Civil Engineering (S)
CIE 597 Construction Safety and Health Management (S)

Research (up to 6 credits)

Either: (1) CIE 559 and/or 560 Thesis (3 to 6 Credit Hours)
(2) Electives (6 credit hours) and comprehensive examination
(3) CIE 557 or CIE 558 Project (3 credit hours)

*Student may select electives from the suggested list or from other approved University graduate courses, with advice and consent of advisor.

M.S. Program in Environmental Engineering

Required Core Courses (6 credit hours)

CIE 516 Advanced Mathematics for Civil Engineers (F)
CIE 546 Environmental Fluid Mechanics (F)

Required Courses (9 credit hours)

CIE 543 Water Quality Modeling (S)
CIE 556 Physicochemical Unit Processes (S)
CIE 564 Chemical Principles in Environmental Engineering (F)

Electives* (minimum 9 credit hours)

CIE 541 Groundwater Engineering (S)
CIE 550 Hydrologic Engineering (F)
CIE 552 Water Resources Planning and Development (S)
CIE 554 Numerical Methods in Water Resources and Environmental Engineering (S)
CIE 567 Advanced Unit Operations and Processes (S)
CIE 569 Hazardous Waste Management (F)

CIE 641 Advanced Topics in Groundwater Engineering (F)
CIE 655 Environmental Engineering Design (S)
CIE 662 Methods of Pollutant Analysis (S)
CIE 664 Organic Chemistry in Environmental Engineering (S)

Research (up to 6 credit hours)

Either: (1) CIE 559 and/or 560 Thesis (3 to 6 credit hours)
(2) Electives (6 credit hours) and comprehensive examination
(3) CIE 557 or CIE 558 Project (3 credit hours)

*Student also may select from other approved University graduate courses with advice and consent of advisor.

M.S. Program in Environmental Science

Students should consult their advisors.

M.S. Program in Geomechanics and Geotechnical Engineering

Required Core Courses (6 credit hours)

CIE 511 Advanced Mechanics of Solids (F)
CIE 516 Advanced Mathematics for Civil Engineers (F)

Required Courses (6 credit hours)

CIE 530 Mechanical Behavior of Materials (F)
CIE 533 Structural Design and Construction of Foundations (S)

Electives* (12 credit hours)

CIE 526 Finite Element Method (F)
CIE 529 Pavement Design (F)
CIE 531 Design and Construction of Earth Structures (S)
CIE 534 Earthquake Engineering and Foundation Dynamics (S)
CIE 535 Geoenvironmental Engineering (F)
CIE 617 Adv. Finite Elements
CIE 623 Plastic Behavior of Materials
CIE 630 Geotechnical In Situ and Lab Testing
CIE 644 Seismology (S)
CIE 645 Boundary Element Methods (S)

Research (up to 6 credit hours)

Either: (1) CIE 559 and/or 560 Thesis (3 to 6 credit hours)
(2) Electives (6 credit hours) and comprehensive examination
(3) CIE 557 or CIE 558 Project (3 credit hours)

*Student may select electives from the suggested list or from other approved university graduate courses with the advice and consent of advisor.

M.S. Program in Structural and Earthquake Engineering

Required Core Courses (6 credit hours)

CIE 511 Advanced Mechanics of Solids (F)

CIE 516 Advanced Mathematics for Civil Engineers (F)

Required Courses (12 Credit Hours)

CIE 519 Structural Dynamics and Earthquake Engineering I (F)

CIE 524 Steel Structures (S) or CIE 521 Plastic Analysis

CIE 525 Concrete Structures (F)

CIE 526 Finite Element Structural Analysis (F)

Electives (6 credit hours)*

CIE 508 Probabilistic Analysis and Design (S)

CIE 512 Structural Reliability and Safety (F)

CIE 513 Stability

CIE 517 Plates and Shells (S)

CIE 520 Random Vibration

CIE 528 Composite Structures (S)

CIE 530 Behavior of Materials (F)

CIE 533 Structural Design and Construction of Foundations (S)

CIE 534 Earthquake Engineering & Foundation Dynamics (S)

CIE 596 Expert System

CIE 616 Experimental Methods in Structural Engineering

CIE 617 Advanced Finite Elements (S)

CIE 619 Structural Dynamics and Earthquake Engineering II (S)

CIE 621 Elasticity (F)

CIE 623 Plastic Behavior of Materials (S)

CIE 625 Aseismic Base Isolation (S)

CIE 626 Structural Control (S)

CIE 644 Seismology (S)

CIE 645 Boundary Element Methods (S)

Research (up to 6 credit hours)

Either: (1) CIE 559 and/or 560 Thesis (3 to 6 credit hours)

(2) Electives (6 credit hours) and comprehensive examination

(3) CIE 557 or CIE 558 Project (3 credit hours)

*Student may select electives from the suggested list or from other approved university graduate courses with advice and consent of advisor.

Ph.D. Program

General requirements

The Ph.D. degree provides an opportunity for students to pursue a program of research in a specialized area and to develop a dissertation that embodies the results of original research and gives evidence of high scholarship. The procedures for satisfying the requirements for the Ph.D. degree in Civil, Structural and Environmental Engineering at UB consist of four (4) principal parts:

- Successful completion of an approved program of graduate coursework;
- Passing the in-class, take-home, and oral parts of the Ph.D. qualifying examination; and
- Defense and approval of the Ph.D. dissertation.

A program must contain a well-defined major area of study and must have the approval of the student's Ph.D. advisement committee and the Graduate School. Formal approval of a student's program is obtained through filing the Application to Candidacy as described in other sections of this document. Programs in pure science or mathematics devoid of applied elements, on the one hand, or programs in technology that are deficient in scientific or mathematical background on the other are not generally acceptable for the Ph.D. in Civil, Structural and Environmental Engineering. The first two parts of the Ph.D. program are administered by the student's Ph.D. examination committee while the second two parts are supervised by his/her dissertation committee. In many cases, these two committees consist of the same faculty members. In addition to these requirements, students must meet the minimum residency requirement of two complete academic years of full-time study at UB of which two semesters are continuous full-time study not already applied to the Master's degree. A student must maintain continuous registration until all degree requirements have been fulfilled. If such registration is not possible, the student must secure an approved leave of absence from the Graduate School.

Applicants to a Ph.D. program are expected to have a M.S. degree or equivalent including the M.S. core course requirements. Students who are studying for the M.S. degree at UB must apply to the department for readmission before starting a Ph.D. program. This application should be made no later than two months prior to anticipated receipt of the M.S. degree or prior to completion of the second year of study whichever comes first.

The Ph.D. program consists of a minimum of 72 credit hours beyond the Bachelor's degree. A maximum of 30 credit hours from the Master's degree can be credited towards the Ph.D. At least 42 credit hours beyond the Master's degree are normally required for the Ph.D. degree which will include from 12 to 24 credit hours for dissertation and at least 18 hours of course work. However, no matter how many credit hours are allocated for the dissertation on a student's transcript, the quality of a dissertation is the crucial consideration and should reflect a minimum of one year of full-time work.

The program of coursework is formulated by the student and his/her advisor in the first or second semester after admission to the Ph.D. program. Core course requirements, as specified in Section 2.4, must be satisfied assuming these courses (or equivalent) were not taken as part of a Master's program. Individual program areas may require a minor concentration or grouping of courses (see below). For the Ph.D. degree, a QPA of 3.0

must be maintained for all courses taken not including dissertation, project, S/U and L grades, and supervised teaching. Students with a QPA less than 3.0 will be placed on probation. A student whose QPA remains less than 3.0 after two semesters or falls below 2.5 or who receives an "F" grade in any course, or receives more than two "C", "D", or "U" grades, that student will be required to withdraw from the program (also see Section 1.5).

Qualifying examination

Each student desiring to be admitted to formal candidacy for the Ph.D. degree will be required to take a qualifying examination conducted by the department. The first step in this process is for the student to identify an advisor and other committee members. The preliminary advisor will work with the student to formulate the initial stages of course work in preparation for the qualifying examination, and select other potential members of the Ph.D. committee. The other members of the Ph.D. committee usually reflect the major directions in the student's core program. The committee must include at least three members (including the main advisor), two of which must be from the Department of Civil, Structural and Environmental Engineering and one may be from outside the department. The examination should take place after the second semester of registration for the Ph.D. degree and will be scheduled twice a year, once in August and once in January.

All students planning to take the qualifying exam must submit a written request, signed by the student's advisor and committee members, to the Director of Graduate Studies at least two weeks prior to the exam date.

The qualifying examination will consist of three parts. The qualifying examination must be completed within three semesters of enrolling in the Ph.D. program.

Part I A written comprehensive examination will be given with a choice of problems designed to test underlying mathematical and physical concepts covered in appropriate core courses. This part of the exam will be closed-book and in-class and will last four hours. All students will be required to solve an advanced math and an advanced mechanics (either solid or fluid) problem and three additional problems chosen from the student's area of concentration. Problems will be provided by the instructors of the core courses being tested. A total of five problems are to be completed. A passing grade for this part of the exam is normally 60%.

Part II At the conclusion of the in-class exam, students will be given a take-home exam designed by the student's Ph.D. committee. This exam is designed to test the assimilation of knowledge gained in coursework and the ability to formulate solutions, or solution approaches to new, or open-ended kinds of problems. The objective of this part of the exam is to evaluate a student's ability to carry out creative problem solving essential to the successful completion of a doctoral degree. Students will be given one to two weeks to complete this part of the exam.

At the conclusion of Parts I and II, the committee may choose to have a follow-up oral exam (Part III). The oral exam may take the form of a Ph.D. dissertation proposal defense. Following this exam, if held, the committee should report the results of the exam to the student and to the Director of Graduate Studies within two weeks of completing the qualifying examination. In the event a student does not pass, the committee will make a

recommendation regarding whether the student should be allowed to take the exam a second time. A student may take the exam a maximum of two times. Even when a student passes, the committee may recommend certain coursework that should be taken to strengthen areas of possible weakness. An Application to Candidacy for the Ph.D. degree will not be signed until a student passes the qualifying exam.

Dissertation and defense

Upon satisfactory completion of the qualifying examination, the Ph.D. committee will assume responsibility for directing the dissertation work that will be carried out under the guidance of the candidate's permanent advisor (major advisor). The dissertation must be original and must represent a significant contribution to the state of knowledge in the candidate's area of concentration. An outside reader also must be designated for a Ph.D. dissertation. The outside reader should be knowledgeable in the field, and normally would have a Ph.D. degree. Although UB faculty from other departments are allowed, the Graduate School strongly encourages academics from other institutions to be outside readers. Potential conflicts of interest must be avoided. The outside reader must review the dissertation and submit an evaluation form to the Graduate School before the dissertation defense can be scheduled.

The final academic requirement to be satisfied by a candidate is the oral defense of his or her dissertation followed by questions from the Ph.D. committee, other invited examiners, and the audience at large. All faculty and graduate students are invited to attend. Passing this examination indicates that the Ph.D. committee is satisfied that the student possesses a true understanding of the material related to and contained in his or her dissertation. After successfully completing the dissertation defense, the candidate must submit a microfilm and copyright billing form plus one unbound copy of the dissertation to the Graduate School and one bound copy of the dissertation to the department. *A cover page must be included in the bound copy, listing the Ph.D. advisor and committee members, with spaces for their signatures.* The original signed M-form must be submitted along with the other materials noted above to the Graduate School prior to published dates for degree conferral. *The M-Form will not be signed until the bound copy is submitted to the department.*