

Graduate Student Handbook

Department of Chemical and Biochemical Engineering  
University of Maryland Baltimore County  
Baltimore, MD 21250

August 2007

## **Application for Admission to the Department**

The Department's admission requirements and procedures correspond to the requirements set forth by the UMBC Graduate School. Students who do not have an undergraduate degree in chemical engineering may apply for admission to the Department. However, upon admission, these students should consult with the Departmental Graduate Program Director (GPD) to determine whether additional courses which are remedial in nature need to be taken, in addition to the required courses listed below.

## **Master of Science Degree Requirements**

A minimum of 30 credit hours work in technical areas relating directly to Chemical Engineering is required for the Master of Science degree. The candidate for the Master of Science degree has the choice of following a plan of study either with or without a thesis.

## **Minimum Graduate Course Requirements**

The candidate must maintain a B average in courses. A maximum of 9 credits of 400 level courses taken from other disciplines may count towards the course requirements subject to prior approval. A list of approved 400-level courses is described elsewhere in this handbook. Normally, 9 of the required credit hours of course work are the major core courses ENCH 610, 630, and 640. Students are also required to take an advanced level mathematics course. For the 2004-5 academic year this course is MATH 404.

## **Transfer of Credit**

A maximum of 6 semester hours of graduate course work taken at other regionally accredited institutions may be applied toward the Master's degree. The GPD and the graduate school must agree that the specific courses are appropriate to, and acceptable in, the student's program; and the student is responsible for providing an official transcript of this work to the Graduate School, along with appropriate course descriptions and syllabi. No credit transfer will be allowed for any courses which have been used in fulfillment of the requirements of any other degree.

Due to academic and procedural differences between U.S. regionally accredited and foreign institutions, credit from foreign universities is not normally acceptable for transfer.

The grades of transfer work do not affect the grade point average of the work taken at the UMBC.

Transfer work cannot be used to satisfy the requirements for upper level courses in a student's program. The required credits of 600 level or above must be part of the work taken at UMBC.

The request for transfer of credit shall be submitted to the Graduate School for approval at the earliest possible time.

### **Master of Science Thesis Option**

Under the Master of Science Thesis Option, 6 credits of the required credit hours are devoted to Research (ENCH 799). **Candidates for the Master of Science Thesis Option are required to pass an oral qualifying examination given near the end of the first year of study.** Upon completion of the research, the student prepares a thesis related to their research and must pass a final oral examination which includes an open seminar on the research project. The time and location of the seminar must be publicized so that it can be attended by all interested persons.

A maximum of 3 credit hours of Special Problems (ENCH 648) may be used to partially fulfill the course requirements under the Master of Science Thesis Option.

### **Master of Science Non-Thesis Option**

Under the Master of Science Non-Thesis Option, no more than 6 of the required credits can be devoted to Special Problems (ENCH 648).

### **BS/MS Degree Program**

Undergraduate students in the department who have a cumulative grade point average of at least 3.0 may apply for admission to the BS/MS degree program. Students should normally apply to the Department for pre-admission to the BS/MS program in their junior year by filling out and submitting a pre-admission application, which consists of a transcript and one letter of reference from a faculty member in the department. During the senior year, students in the BS/MS program must apply to the UMBC Graduate School for admission. Students applying to the BS/MS program are not required to take the GRE examination.

Both thesis and non-thesis options are available to students in the BS/MS program. Course requirements in the BS/MS program are the same as those listed above for the thesis and non-thesis options of the regular MS program. However, students in the BS/MS program are allowed to count 9 credits of elective courses taken to fulfill their BS degree requirements toward the course requirements for the MS degree, provided that these courses are dual level 400/600 level courses and were taken at the 600-level.

Students in the thesis option should select a research advisor during the junior year and begin their research no later than the summer between the junior and senior years.

### **Doctor of Philosophy Requirements.**

The Chemical Engineering Program requirements for the Doctor of Philosophy degree are summarized below. Additional requirements are imposed by the UMBC Graduate School, and are documented in its catalog.

It is the responsibility of the student to ensure that all Graduate School and Chemical Engineering Department requirements are met. Questions regarding the requirements may be directed to the Chemical Engineering GPD.

The Doctor of Philosophy Degree is awarded only upon sufficient evidence of high attainment in scholarship and the ability to engage in independent research in the field of Chemical Engineering. It is not awarded for the completion of course and seminar requirements, no matter how successfully completed.

A minimum of 27 credit hours of approved courses are required. Appropriate courses taken while earning the Master of Science degree from the Department may be used in partial fulfillment of this requirement. Normally 9 of these 27 credits are obtained from the major core courses ENCH 610, 620, 630. In addition, students are required to take advanced biochemistry and mathematics courses. For the 2005-6 academic year these courses are Chem 437 and Math 404. A maximum of 9 credits of 400-level courses taken from other disciplines may count towards the course requirements subject to prior approval. A list of approved courses is described elsewhere in this handbook.

Candidates for the Doctor of Philosophy degree must receive a B average in course work and must receive at least a B grade in the five required courses listed above. A minimum of 18 credit hours of Thesis Research (ENCH 899) is required. Students are also required to take either ENGL 393 or 393E (Technical Writing). Course credits obtained from Thesis Research (ENCH 899) and ENGL 393 do not count toward the required 27 credit hours of course work. Only two courses taken from the series of courses ENCH 660, 662, 664, and 666 may be used to satisfy the requirement for 27 credit hours of course work.

Students whose native language is not English are required to pass the TA spoken English examination administered by the UMBC graduate school at the level of 3 or higher.

All graduate students who enter the department are required to submit a ranked list of three choices for graduate advisor in order to be assigned a graduate advisor by the department. This list will be used by the department when determining who the graduate advisor will be for a particular student. Students will be assigned an advisor after passing the written qualifying examination.

To be considered for Doctor of Philosophy candidacy a student must meet the following requirements:

- 1. Satisfactory performance on a comprehensive written examination.** The examination is intended to test the student's expertise in chemical engineering and may be taken no more than twice. This examination is taken during the student's first year. A description of this examination is given elsewhere in this handbook.

**2. Satisfactory performance on an oral qualifying examination that covers the student's intended thesis work.** This examination is required of both Master of Science Thesis Option and Doctor of Philosophy students and is taken at the start of the student's second year. A description of this examination is given elsewhere in this handbook.

**3. Successful preparation and presentation at an open seminar of a proposal on the research topic selected by the student.** The time and location of the seminar must be publicized so that the seminar can be attended by all interested persons. The examining committee for the proposal examination consists of at least four persons. At least three of these four persons must be tenure-track or tenured faculty members in the department who have full-time appointments. This definition includes full-time faculty members in the department who have joint appointments, even if their tenure resides outside the department. Following the seminar the examining committee conducts an oral examination of the student on the area of the proposed research. Students should take this examination at the beginning of their third year.

4. Those who pass the qualifying and research proposal examinations are considered to be Ph.D. candidates. A student must be admitted to candidacy within five years after admission to the doctoral program. Admission to candidacy normally is associated with an increase in stipend. A student must be admitted to candidacy at least two full sequential semesters before the date on which the doctor degree will be conferred.

**5. The final oral defense of the Ph D dissertation is conducted by a committee recommended by the graduate faculty advisor and approved by the Vice President for Graduate Studies and Research.** This committee should consist of the same examining committee of four persons which constituted the proposal examination with one person added. In the event that not all of the persons who served on the proposal examination are available to serve on the dissertation defense committee, substitutions may be made. However, the final makeup of the dissertation defense committee must in all cases consist of at least three faculty members from the department (as defined in point 3 above) and at least one person from outside the department. The candidate may only take the final oral defense twice. The time and location of the defense must be publicized so that the defense can be attended by all interested persons. Students must complete all of their program for the degree, including the dissertation and final oral examination, within four years after admission to candidacy.

### **Transfer of Credit**

A maximum of 21 semester hours of graduate course work taken at other accredited institutions may be applied toward the Ph.D degree. The GPD must agree that the specific courses are appropriate to, and acceptable in, the student's program; and the student is responsible for providing an official transcript of this work to the Graduate School along with appropriate course descriptions and syllabi.

Due to academic and procedural differences between U.S. regionally accredited and foreign institutions, credit from foreign universities will be considered on a case to case basis.

The grades of transfer work do not affect the grade point average of the work taken at UMBC. A grade of A from another institution cannot balance a grade of C earned at UMBC.

No credit transfer will be allowed for any courses which have been used in fulfillment of the BS degree. The request for transfer of credit shall be submitted to the Graduate School for approval at the earliest possible time.

### **Transfer of Qualifying Examination**

Transfer of a passing grade on a qualifying exam is rare, however, a petition for considering transfer of the qualifying examination can be made.

### **Good Standing Status**

Students are considered to be in good standing with the UMBC Graduate School if they maintain a grade point average of 3.0. Students not in good standing with the Graduate School are considered to be on probation and must, in consultation with the GPD, agree to a time frame and procedure to re-establish good standing status. Students must also make every effort to conform to the time limits contained in the "Checklist for Satisfactory Progress" described elsewhere in this handbook.

### **400-level courses Approved for Satisfying Course Requirements**

Biol 414 (Eukaryotic Genetics and Molecular Biology)

Biol 422L (Microscopy in the Biological Sciences)

Biol 434 (Microbial Molecular Genetics)

Biol 456 (Plant Molecular Biology)

Chem 431 (Chemistry of Proteins)

Chem 432 (Advanced Biochemistry)

Chem 433 (Biochemistry of Nucleic Acids)

Chem 435 (Biochemistry of Complex Carbohydrates)

Chem 441 (Physical Chemistry of Macromolecules)

Chem 442 (Physical Biochemistry)

Chem 443 (Molecular Spectroscopy and Biomacromolecules)

Chem 444 (Molecular Modeling)

Math 441 (Numerical Modeling)

Math 481 (Mathematical Modeling)

### **Comprehensive Written Examination (written qualifier).**

The examination is given every January and June. Students entering the PhD program with a previous degree in chemical engineering are required to take the exam for the first time one semester after arrival (ie. Students arriving in the Fall 2005 will take the exam for the first time in January 2006). If students do not have a previous degree in Chemical Engineering, they may elect to defer the exam until the end of their second semester in residence.

The exam consists of 3 parts, each given separately, over a two to three day period. Each component of the exam takes about 2 hours. The exams are in the areas of Thermodynamics, Kinetics and Reaction Engineering, and Transport Phenomena. The exams cover undergraduate material as taught at UMBC. For students uncertain of their ability in any of the areas, they would be advised to sit in on the undergraduate class in that area their first semester at UMBC. This is especially true of thermodynamics, where graduate and undergraduate material are particularly different.

The nature of the exam questions and number of questions is a strong function of the faculty writing the exam. They can, at their discretion, provide copies of other course material to students, however, no old files of written qualifying exams are given out.

Text books for each of the courses that make good references include Smith and Van Ness – Chemical Engineering Thermodynamics, Fogler – Chemical Reaction Engineering, and Bird, Stewart and Lightfoot – Transport Phenomena.

In the past several years, Dr. Bayles and Dr. Good have written the Thermodynamics Exam. Dr. Bayles contributes many questions, with a part of the exam open book, and a part closed book. Dr. Good typically contributes 2 questions that are open book. Drs. Good, Castellanos and Marten have written the Kinetics exam, all open book, normally two or three questions total, but multiple parts to each question. Drs. Frey and Ross have written the transport exam, all open book. Dr. Frey asks very thought provoking questions (not easy to describe). Dr. Ross asks questions that test basic understanding and problem solving in transport phenomena. In all cases, problem solving skills are probably more important than memorization.

If students fail part of the exam, they only need to retake the part that was failed. If students fail to pass the exam on the second taking, students will be asked to leave the program with an MS degree. Along with the change in degree typically comes a change in funding status.

### **Oral Qualifying Exam**

An oral qualifying exam is taken after the first year of study of all thesis students (MS or PhD). The exam has two parts, a written report, no more than 10 pages, that summarizes the importance of the problem the student has chosen for a thesis topic, some salient review of the literature, a summary of preliminary results and their analysis, and a discussion of their significance, and a preliminary plan for future work. Appendices that include tables and figures may be included.

The second part of the exam is an oral presentation, approximately 30 minutes long, which covers the highlight of the report. Following the presentation, a committee of 3 faculty (advisor plus 2 others randomly chosen) will question the student. The focus of the questioning will be on understanding of the importance of the problem to be addressed, understanding the methods and analysis used (especially as they relate to chemical engineering principles), and the reasonableness of the plan of research proposed (is it achievable within a period of 4 years by an

average student, will the data collected address the hypothesis posed by the students, is there a reasonable plan for gaining access to needed equipment, is the analysis possible).

It is particularly important that if a student chooses to talk about a kinetic analysis of their data, that they know what kind of reactor model (batch, plug flow, semibatch, or other flow reactor) that they are using, and how to appropriately describe reacting systems within that reactor. If a student chooses to talk about measurement of equilibrium binding constants, that they know how those constants are related to enthalpy, temperature, and other relevant kinetic and thermodynamic parameters. The easiest way to fail the oral qualifying exam is to loose site of how the experiments being performed or modeling being done is related to fundamental principles that all chemical engineers should know.

As with the written qualifying exam, students get two opportunities to pass the exam. For students entering in Fall 2005, they will take the exam for the first time in Fall 2006, and for the second time, if necessary, in Spring 2007.