

Mork Family Department of Chemical Engineering and Materials Science

USC Viterbi
School of Engineering



Chemical Engineering Handbook

Please note that this document is from before the department of Chemical Engineering and Materials Science merged. Everything that refers to department below refers only to the Chemical Engineering Program. Please ask questions if you have any.

SUPPLEMENTAL INFORMATION FOR GRADUATE STUDIES

IN CHEMICAL ENGINEERING

The Department of Chemical Engineering at USC offers graduate programs leading to the M.S., Engineer, and Ph.D. degrees. The general requirements are outlined in the University Catalogue and the School of Engineering Bulletin. The following information is intended to supplement the information contained in the University Catalogue and the Engineering Bulletin for graduate studies in Chemical Engineering (Ch.E.). Requirements for the individual programs are specified in more detail in the following sections.

For the M.S. degree, obtained through completion of the required course work, three areas of emphasis are currently offered:

Biochemical Engineering

Polymers and Materials

Energy (oil and gas)

In addition, a fourth area, Electrochemical Engineering, can also be emphasized by taking several courses that are offered by various departments in the School of Engineering. Another area of focus, manufacturing, is currently being developed.

For each area of emphasis, several appropriate graduate and upper-level undergraduate courses are offered. For example, in the area of biochemical engineering, Tissue

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Engineering (Ch.E. 554), Separation and Bioseparation Processes (Ch.E. 560), and Biochemical Engineering (Ch.E. 489) are currently offered.

MASTER DEGREE REQUIREMENTS

1. General Requirements

The general requirements for admission to the M.S. program and completion of the M.S. degree are specified in Table I. Admission to the M.S. program requires satisfactory passing of the GRE. The Advisor may specify additional requirements deemed necessary for completion of the M.S. degree. The M.S. degree program in Ch.E. is designed such that most students with a B.S. Ch.E. may complete all requirements within three semester (1 ½ years). Although completion within one calendar year (2 academic semesters plus 1 summer semester) is possible in some cases.

2. Course Requirements

Currently there are several basic chemical engineering disciplines offered in the Ch.E. department. The core courses in these areas are listed in Table II. A minimum of 5 core courses is required. Of the 28 units required for the M.S. degree a maximum of 12 units may be credited towards electives courses (including directed research).

Two options are available for a program leading to the M.S. degree: (A) Coursework route, (B) Thesis route. The latter involves the preparation of a Master's Thesis written in acceptable format and approved by the advisor. Option B is required of all M.S. candidates receiving financial support in the form of assistantships or fellowships from the Ch.E. Department or University. General curriculum guidelines for the two options are shown in Table III.

ENGINEER DEGREE REQUIREMENTS

1. General Requirements

The general requirements for admission to the Engineer Degree program and completion of the Engineer degree are specified in the University Catalog and in Table V.

2. Course Requirements

In addition to the basic chemical engineering requirements selected for completion of a M.S. degree, the candidate is required to specialize in one other field of engineering.

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Students who elect the Engineers Degree will need to take an additional 30 units beyond the 28 taken at the Master's level. General curriculum requirements are shown in Table V.

3. The Engineer's Qualifying Examination (E.Q.E.)

The purpose of this examination is to test the ability of the candidate to independently perform creative and original engineering analysis and design. The examination consists of a written report and oral defense thereof and it is taken during the last semester of coursework. Suitable topics for the E.Q.E. include a critique of an existing solution to an engineering problem, development of a new solution to problems of engineering interest, engineering analysis of a chemical engineering process, etc.

DOCTOR OF PHILOSOPHY DEGREE REQUIREMENTS

1. General Requirements

The general requirements for admission to the Ph.D. program and completion of the Ph.D. degree are specified in the University catalog and in Table VI.

1. Course Requirements

The Ph.D. program is a research oriented program. A minimum of 60 units of credit are required. Most of these units are selected in a special field of interest and in a research topic. A minimum of 7 core courses are required. General curricula guidelines are shown in Table VII. The last 24 units of course work (excluding Ch.E. 794) must be taken in residence at USC, uninterrupted by work elsewhere, and a minimum of two semesters of full time research must be performed in residence at USC.

Within the first semester of full time graduate study, the Ph.D. student should select a research advisor and a research field. If the student is uncertain as to the ultimate research interests, the student should elect research (Ch.E. 590) under the supervision of one or more faculty members. It is strongly recommended that the student select a research topic as soon as possible. Delay in such selection will eventually result in prolonging the time required to complete the program. The Ph.D. program must be

completed within eight years after beginning graduate work at USC.

3. The Ph.D. Screening Examination

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At the end of the second semester of full time graduate study, Ph.D. students are required to take the Ph.D. Screening Examination. The latter is a written examination of basic undergraduate chemical engineering and it is intended to test the knowledge of the students in fundamentals of chemical engineering. The decision to permit the student to become a Ph.D. aspirant is based on the screening examination, the overall academic performance and the successful definition of a research topic.

After passing the Screening Examination the student is expected to devote a substantial portion of time to research and to be on campus at least half time.

4. The Doctoral Qualifying Examination (D.Q.E.)

At the completion of the course requirements and during or immediately following the fourth semester of full time graduate study, Ph.D. aspirants are required to take the Doctoral Qualifying Examination (D.Q.E.). Request for permission to take the D.Q.E. must be filed in the Graduate School Office at least sixty days before completion of the examination. The primary function of the D.Q.E. is to verify the aspirant's ability to perform original and creative research, and to report upon it.

The examination consists of two parts:

- a. A written research proposal in acceptable format to be distributed to the five member committee by the aspirant at the initiation of a month-long examination period. This proposition should consist of a detailed discussion of the proposed research project including literature surveys, past research accomplishments and future plans. It is expected that a substantial portion of the proposition is generated by the student himself.
- b. An oral defense of the above proposal before the entire committee. The student is responsible for scheduling the oral examination at the convenience of the members of the committee.

Both portions of the D.Q.E. must be completed within one month. All committee members must be present for the oral portion of the D.Q.E. More than two votes are sufficient to record the examination as a failure. The D.Q.E. may be repeated only once at the discretion of the committee, in a period not less than six months and not later than one year after the date of the first examination. After passing the D.Q.E., the student is expected to be on campus full time.

A student is officially admitted to candidacy for the Ph.D. degree if the student has successfully: (a) passed the Screening Examination, (b) completed a minimum of 24

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units, (c) passed the D.Q.E.

5. Research and Dissertation

After admission to candidacy, the student should reduce the committee to three members including one member outside the Department (Ph.D. Dissertation Committee), and the student must register in Ch.E. 794 each semester, except for the summer session, until the dissertation is completed. The candidate is expected to devote full time to research. The candidate should make arrangements to meet with the committee at least once a year, in order to evaluate progress towards the dissertation. The Chair of the committee will immediately thereafter file a brief summary of the meeting in the student's Departmental record.

6. The Final Oral Examination (F.O.E.)

At the completion of the dissertation the candidate is required to take the Final Oral Examination (F.O.E.). The primary function of this examination is to determine to the satisfaction of the candidate's dissertation committee that the candidate has achieved the scholarly advancement and power of investigation demanded by the University and the School of Engineering for final recommendation for the doctorate.

The examination consists of two parts:

- a. A written Ph.D. Thesis in acceptable format.
- b. An oral examination including a formal seminar presentation by the candidate. Requirements and guidelines for the F.O.E. are in accordance with those specified in the University catalogue

FINANCIAL ASSISTANCE

The sources of information on financial assistance are:

- a. The Graduate School - information and applications for Federal fellowships and loans, State scholarships, and University fellowships.
- b. Director of Student Aid - fellowships and loans.

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- c. Engineering Committee on Financial Aid to Students - fellowships and loans.
- d. Financial Aid Office - workstudy program.
- e. The Chemical Engineering Department:
 - I. Departmental fellowships
 - II. Teaching assistantships
 - III. Research assistantships

All students receiving financial aid from the University are expected to be on campus full time. This includes research and teaching assistants and recipients of fellowships administered by the University. All such students must notify their Guidance Committee Chairman where they can be reached during work hours.

TABLE I

GENERAL REQUIREMENTS FOR THE M.S. DEGREE

- a. Acceptance by the Graduate Admissions Office and the Chemical Engineering Department's Graduate Admissions Committee based on GPA (grade point average), GRE (Graduate Record Examination) and letters of reference.
- b. Maintenance of an active file with the Department of Chemical Engineering (to be updated each semester).
- c. Satisfaction of all conditional requirements for regular admission within a period acceptable to the University.
- d. Satisfaction of course requirements and maintenance of a GPA of 3.0 or greater in all graduate course work. The minimum GPA must be earned on all course work applied toward the master's degree and on all 400-level and above course work attempted at USC beyond the bachelor's degree.

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TABLE II

REQUIRED AND ELECTIVE COURSES

A. Chemical Engineering Core Courses

- a. Modeling and Analysis of Chemical Engineering Systems (Ch.E. 501)
- b. Thermodynamics for Chemical Engineers (Ch.E. 530)
- c. Viscous Flows (Ch.E. 540)
- d. Mass Transfer (Ch.E. 541)
- e. Chemical Engineering Kinetics and Reactor Analysis (Ch.E. 542)
- f. Heat Transmission (Ch.E. 544)

B. Recommended Electives (Selection should be discussed and approved by student's Advisor in writing).

ChE 410, ChE 472, ChE 474L, ChE 477, ChE 478, ChE 489, ChE 502, ChE 521, ChE 522, ChE 523, ChE 531, ChE 560, ChE 554, ChE 572, ChE 582, ChE 596, ChE 599 or selected graduate courses from other Engineering and Science Departments.

C. Research and Thesis Courses

- a. Directed Research and Independent Study (Ch.E. 590, 690, 790)
- b. M.S. Thesis (Ch.E. 594)
- c. Ph.D. Thesis (Ch.E. 794)

In these courses final reports are required. Reports must be received before the end of each semester and will be judged for approval by the research advisor and assigned a grade Pass/Fail. In general, the student is expected to spend an average of three hours per week per unit of credit elected. Students should acquire the necessary background for research through self-study or by judicious selection of courses.

A student enrolling in Directed Research should confer with the research advisor within

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the first week of classes of each semester and must provide progress reports periodically.

A student enrolling in Ch.E. 594 is expected to provide by the end of the semester any of the following alternatives:

- a. An original literature review not related to work previously or concurrently performed under a Ch.E. 590 assignment.
- b. A theoretical analysis, computation or experimental investigation which may be related to a Ch.E. 590 assignment.

A student enrolling in Ch.E. 794 should demonstrate by the end of each semester satisfactory progress towards completion of a thesis, including a written or oral report to the G.C.

TABLE III

COURSE REQUIREMENTS FOR THE M.S. DEGREE

I. General Curriculum

A. Coursework Route*:

Core Courses: 18 units or 15 units

Elective Courses: 9 units or 12 units

Seminar 1 unit 1 unit

TOTAL: 28 units 28 units

B. Thesis Route*:

Core Courses: 15 units

Elective Courses: 4-6 units

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Directed Research 2-4 units

M.S. Thesis 4 units

Seminar Courses 1 unit

TOTAL: 28 units

Other curricula are possible and may be implemented on the student's initiative.

*as approved by Guidance Committee

2. Recommended Curriculum for M.S. Students Who Elect Specialization in Polymer Science and Engineering (other specializations can be designed in consultation with the Guidance Committee)

A. Coursework Route*:

Core Courses: 15 units

Elective Polymer Courses*: 9 units

Seminar 1 unit

TOTAL: 28 units

* Elective courses includes: Ch.E. 472, 474L, 475, 476, 477, 478, 572 or polymer related courses in other departments as approved by the advisor.

B. Thesis Route*:

Core Courses: 15 units

Elective Polymer Courses*: 4 units

Directed Research 4 units

M.S. Thesis 4 units

Seminar 1 unit

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TOTAL: 28 units

* Elective courses includes: Ch.E. 472, 474L, 475, 476, 477, 478, 572 or polymer related courses in other departments as approved by the advisor.

Other curricula are possible and may be implemented on the student's initiative.

*as approved by the advisor.

TABLE IV

GENERAL REQUIREMENTS FOR THE ENGINEER DEGREE

- a. Completion of all M.S. degree requirements in Chemical Engineering. This prerequisite may be waived only under exceptional circumstances.
- b. Maintenance of an active file with the Department Chairman and with the committee members. (To be updated each semester).
- c. Satisfaction of the course requirements and maintenance of a GPA of 3.0 or greater in all 30 units applicable to the Engineer degree. The minimum GPA must be earned on all course work applied toward the master's degree and on all 400-level and above course work attempted at USC beyond the bachelor's degree.
- d. Passage of the E.Q.E. and formation of a Guidance Committee (with consists of 3 faculty members)

TABLE V

COURSE REQUIREMENTS FOR THE ENGINEER DEGREE

I. General Curriculum

- a. Core Courses Minimum 6 units

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b. Three Courses in a Field of Engineering other than Ch.E. 9 units

c. Electives (including Ch.E. 590 and 690;

maximum of 6 units in 690) 14 units

d. Seminar Courses 1 unit

TOTAL: 30 units

TABLE VI

GENERAL REQUIREMENTS FOR THE Ph.D. DEGREE

a. B.S. or M.S. degree in an engineering or science oriented discipline.

b. Acceptance by the Graduate Admission Office and the Chemical Engineering Department's Graduate Admissions Committee based on the GRE (Graduate

Record Examination) and courses taken.

c. Passage of the Ph.D. Screening Examination.

d. Satisfaction of course requirements and maintenance of an active file with the Department Chairman and with all Committee members. (To be updated each semester.)

e. Passage of the D.Q.E.

f. Maintenance of a GPA of 3.0 or greater in all graduate courses. The minimum GPA must be earned on all course work applied toward the master's degree and on all 400-level and above course work attempted at USC beyond the bachelor's degree.

g. Presentation of a thesis and passage of the Final Oral Examination.

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TABLE VII

COURSE REQUIREMENTS FOR THE PH.D. DEGREE

General Curriculum:

- a. Core Courses 21 units
- b. Electives (Including Ch.E. 590, 690, 790) 33 units
- c. Seminar Courses 2 units
- d. Thesis (Ch.E. 794), minimum of 4 units

TOTAL: 60 units