

UCLA

**CHEMICAL & BIOMOLECULAR
ENGINEERING DEPARTMENT**

**ACADEMIC YEAR
2018-2019**



**STUDENT INFORMATION HANDBOOK
AND
GRADUATE DEGREE REQUIREMENTS**

TABLE OF CONTENTS

DEPARTMENTAL ROSTER

Faculty	3
Staff	4
Visiting/Temporary Faculty	4
Adjunct Faculty	4

FACULTY RESEARCH AREAS 5

GENERAL REFERRALS

Undergraduate Student Matters	6
Graduate Student Matters	6
Departmental Student Employment Matters	6

GENERAL INFORMATION

Housing Information.....	7
Keys	7
Parking	7
Departmental Mail.....	7
Telephone	7
Food: Coffee, Breakfast, Lunch & Dinner	7
Books and Supplies	7
HSSEAS Material and Building Services	7
Lab Safety Training	8

GRADUATE PROGRAM DEGREE REQUIREMENTS

Graduate Course Information	9
Master's Degree	10
Doctoral Degree	13
Termination of Graduate Study and Appeal of Termination	15

ATTACHMENTS

Recommended M.S. Program Timeline	
M.S. Course Study Plan	
Recommended Ph.D. Program Timeline	
Ph.D. Course Study Plan	
Study List Approval Form	

CHEMICAL & BIOMOLECULAR ENGINEERING FACULTY

REGULAR FACULTY	E-MAIL	OFFICE & PHONE	LAB & PHONE
Nasim Annabi Assistant Professor	nannabi@ucla.edu	5531-H Boelter Hall Ext. 7-5917	7520/7524/7514/7506 Boelter Hall
Jane P. Chang Professor	jpchang@seas.ucla.edu	5532-D Boelter Hall Ext. 6-7980	Engineering V 1021, Ext. 3-3308
Yvonne Chen Assistant Professor	yvchen@ucla.edu	5532-G Boelter Hall Ext. 5-2816	7678 Boelter Hall
Panagiotis D. Christofides Professor and Chair	pdc@seas.ucla.edu	5532-F Boelter Hall Ext. 4-1015	4264 Boelter Hall Ext. 5-4189
Yoram Cohen Professor	yoram@ucla.edu	5531-C Boelter Hall Ext. 5-8766	5651/5819 Boelter Hall Ext. 6-1297
James Davis Professor & Associate Vice Chancellor for Information Technology & CIO	jdavis@conet.ucla.edu	2329 Murphy Hall Ext. 6-0011	6809 Boelter Hall Ext. 6-7948
Carlos Guio Assistant Professor			
Yunfeng Lu Professor	luucla@ucla.edu	5531-G Boelter Hall Ext. 4-7238	6810, 6819 Boelter Hall Ext. 4-9782
Vasilios Manousiouthakis Professor	vasilios@ucla.edu	5549 Boelter Hall Ext. 6-0300	4266 Boelter Hall Ext. 6-6152
Harold G. Monbouquette Professor and Assoc. Dean	hmonbouq@ucla.edu	5531-D Boelter Hall Ext. 5-8946	7820 Boelter Hall Ext. 6-3866
Junyoung Park Assistant Professor	Jop@ucla.edu	5531-F Boelter Hall Ext. 7-5746	
Philippe Sautet Professor	sautet@ucla.edu	5531-J Boelter Hall Ext. 5-8485	3563 Boelter Hall
Dante Simonetti Assistant Professor	dasimonetti@ucla.edu	5532-G Boelter Hall Ext 7-0169	5800 Boelter Hall
Samanvaya Srivastava Assistant Professor	samsri@ucla.edu	5531-D Boelter Hall Ext 5-7563	6673 Boelter Hall Ext 6-7189
Yi Tang Professor	yitang@seas.ucla.edu	5531-H Boelter Hall Ext. 5-0375	7534, 7538, 7564 Boelter Hall, Ext. 5-9538
EMERITI FACULTY			
Eldon L. Knuth Professor Emeritus	elknuth@ucla.edu	5531-J Boelter Hall Ext. 5-8485	-
Ken Nobe Professor Emeritus	nobe@seas.ucla.edu	5288 Boelter Hall Ext. 5-2447	-
A. R. Frank Wazzan Professor & Dean Emeritus	wazzan@seas.ucla.edu	6288 Boelter Hall Ext. 61598	-

CHEMICAL & BIOMOLECULAR ENGINEERING DEPARTMENT STAFF

ADMINISTRATIVE STAFF	E-MAIL	OFFICE & PHONE
William H. Beard Industrial Liaison	beard@seas.ucla.edu	5532-E Boelter Hall Ext. 6-7947
Miguel Perez Student Affairs Officer	miguel@seas.ucla.edu	5532-A Boelter Hall Ext. 5-1203
Alain De Vera Management Services Officer	alain@ucla.edu	5531-M Boelter Hall Ext. 4-1015
Joann Jue Fund Manager	jjue@seas.ucla.edu	5531-A Boelter Hall Ext. 5-9063
Karina Revilla Administrative Officer	krevilla@seas.ucla.edu	5531 Boelter Hall Ext. 5-2046

VISITING/PART-TIME FACULTY	E-MAIL	OFFICE & PHONE
		5506 Boelter Hall Ext. 5-9788
Dr. Sidney Yuan Lecturer	swyuan@ucla.edu	5531 Boelter Hall Ext. 5-2046

ADJUNCT FACULTY	E-MAIL	OFFICE & PHONE

Official Mailing Address

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Los Angeles, California 90095-1592
www.chemeng.ucla.edu

UCLA Telephone Prefixes

(310) 206-XXXX
(310) 267-XXXX
(310) 794-XXXX
(310) 825-XXXX

FACULTY RESEARCH AREAS

Nasim Annabi, Assistant Professor

- Biomaterials design
- Cell and tissue engineering
- Microengineered 3D tissue constructs

Jane Chang, Professor

Plasma Processing and Material Synthesis

- Surface and Gas-phase Reaction Kinetics
- Solid-state Interfacial Properties
- Synthesis and chemical processing of multifunctional materials
- First principle simulations

Yvonne Chen, Assistant Professor

- Synthetic biological circuits for medical applications
- Engineering chimeric antigen receptors

Panagiotis Christofides, Professor, Chair & Undergrad Advisor

Process Control and Applied Mathematics

- Control of Nonlinear and Distributed Parameter Systems
- Networked and Fault-Tolerant Control
- Process Dynamics, Monitoring and Control
- Multi-Scale Systems Simulation and Control

Yoram Cohen, Professor

Polymer Science and Transport Phenomena

- Water Purification and Desalination
- Membrane Science and Technology
- Surface Nano-Restructuring with Polymers
- Polymerization Reaction Engineering
- Environmental Multimedia Transport, Exposure and Impact Analysis of Nanoparticles
- Artificial Neural Networks Analyses of Chemical and Environmental Processes

James F. Davis, Professor and Assoc. Vice-Chancellor,

Information Technology

Intelligent Systems in Process, Control, Operations, Design

- Smart Process Systems
- Decision Support Systems
- Data Analysis & Interpretation
- Knowledge-Based Systems
- Statistical, Neural & Pattern Recognition Systems

Louis J. Ignarro, Professor

Regulation and modulation of NO production

Junyoung Park, Assistant Professor

Integrative Metabolomics to Understand Human Diseases And Enhancing CO₂ Utilization

Yunfeng Lu, Professor

Semiconductor Manufacturing, Nanotechnology

- Self-Assembly and Hierarchical Materials
- Energy Storage and Conversion
- (Fuel Cells, Solar Cells, & Thermoelectrics)
- Nanostructured Materials and Devices
- Biomimetic Materials and Systems
- Adaptive and Responsive Biomaterials

Vasilios Manousiouthakis, Professor

Process Design, Dynamics and Control

- Linear and Nonlinear Control Systems Design
- Process and Control Systems Design for Electronic Material Manufacturing
- Waste Minimization through Chemical Process Synthesis
- Separation Network Synthesis

Harold G. Monbouquette, Professor & Assoc. Dean

Biochemical Engineering

- Biosensors
- Design of Biologically Derived Capsules for Separations, reaction Compartmentalization, and Drug Delivery
- Biotechnological Applications of Extremely Thermophilic Microbes
- Nanopatterning with Static or Electrophoretically Mobile, Photocatalytic Nanoparticles

Philippe Sautet, Professor and Graduate Advisor

Modeling Surfaces and Nanomaterials for Energy, Catalysis and Biomolecular Applications

Samanvaya Srivastava, Assistant Professor

- Charge-driven self assembly
- Organic-inorganic hybrid materials
- Structure and dynamics of soft materials at the nanoscale
- X-ray and neutron scattering techniques
- Rheology
- Polymer and nanomaterial synthesis and functionalization

Dante Simonetti, Assistant Professor

Heterogeneous Catalysis, Catalytic Reaction Systems, Adsorption Processes

- Conversion of natural gas and biomass to fuels and chemicals
- Purification of hydrocarbon and aqueous streams
- Catalysis in condensed phases
- Design of new catalysts and adsorbents

Yi Tang, Professor

- Natural Product Biosynthesis
- Artificial Biomaterials Biosynthesis

GENERAL INFORMATION

Please see the appropriate people listed below regarding various departmental matters.

UNDERGRADUATE STUDENT MATTERS

AIChE (American Institute of Chemical Engineering) Student Chapter

Faculty Advisor: Professor Vasilios Manousiouthakis

Undergraduate Advising

- Professor Panagiotis Christofides is the general departmental Undergraduate Advisor.

GRADUATE STUDENT MATTERS

Graduate Admissions

- See Miguel Perez

Graduate Academic Advising

- See Professor Philippe Sautet

Graduate Student Affairs

- Contact Miguel Perez
- 5532-A Boelter Hall
Phone number (310) 825-1203

See Miguel Perez for graduate student affairs matters, degree requirements, financial support processing.

Graduate Seminar Series

- See Prof. Yvonne Chen

DEPARTMENTAL STUDENT EMPLOYMENT MATTERS

Readerships

- See the appropriate faculty member instructing the course to express interest in being considered as a Reader
- Applications are available from Alain De Vera

Research Assistantships

- Consult with research advisor
- See Miguel Perez for employment processing

Teaching Assistantships

- E-mail Miguel Perez at miguel@seas.ucla.edu to express your interest in being considered for a TA assignment. See page 14 for more information about teaching experience.

Graduate Forms, Petitions and Applications

<https://grad.ucla.edu/campus-resources/forms/>

GENERAL INFORMATION

Housing Information

- 270 De Neve Drive, Campus
- For Off-Campus Housing Information call 825-4491.
- For On-Campus Housing Information call 825-4271.
- Also, check the classified ads in the Daily Bruin, web site ,
<http://www.dailybruin.ucla.edu>
- UCLA Housing Office web sites: <http://www.cho.ucla.edu>
<http://housing.ucla.edu/>

Keys See Karina Revilla

Parking See Miguel Perez

Departmental Mail

- Each graduate student is assigned an individual mailbox in 5531-B Boelter Hall. Your name is affixed **below** your mailbox. Check your mailbox regularly for important schedules and announcements.

Telephone - Departmental telephone numbers:

- **Main Phone Line (310) 825-2046**
- **FAX number (310) 206-4107**

Food: Coffee, Breakfast, Lunch, & Dinner

UCLA has a variety of eateries throughout the campus, the list below are the ones close to the Chemical & Biomolecular Engineering Department:

- HSSEAS Café on the 5th Floor of Boelter Hall, room 5800W
- Kerckhoff Coffee House near Ackerman Student Union
- Ackerman Student Union has many eateries, a pizza shop, salad bar, ice cream parlor and a convenience store.

Books and Supplies - Ackerman Student Union Bookzone

HSSEAS Materiel and Building Services

- HSSEAS operates a machine shop, a tool crib, carpentry shop and electrical shop for use by students and faculty. The shop is located in Engineering I.
Contact: Delia Garnes and Michael O'Leary, 5-2186
- Audiovisual and Slide Making Services are available at 2685 Boelter Hall.
Contact: Marlon Williams, 5-3732
- Shipping and Receiving is located at 14-108 Engineering IV.
Contact: Mac Daley, 6-4809

SAFETY IS # 1 PRIORITY

New Laboratory Personnel Training

All new students **MUST** complete the following before starting their research:

- 1) Laboratory Safety Training Program.
 - 2) Formal training covering University policy concerning an individual's right and responsibilities relative to lab safety.
- Lab. Safety Fundamental Concepts and Lab. Safety Course:
<http://map.ais.ucla.edu/go/1003938>
 - [Lab Safety Training Matrix:](http://ehs.ucla.edu/Pub/Lab%20Training%20Matrix.pdf)
<http://ehs.ucla.edu/Pub/Lab%20Training%20Matrix.pdf>

Required Lab Safety Training

Laboratory Safety Fundamental Concepts is required annually for all students and employees attending classes, working or conducting research in any laboratory environment at UCLA. This course is offered free of charge by Environment, Health and Safety. To register, please email training@ehs.ucla.edu

This class will provide an overview of laboratory safety requirements, and is required by all laboratory personnel. Topics of discussion include: the recognition and mitigation of laboratory hazards; the use of engineering controls, administrative controls and personal protective equipment; working safety with chemicals, the use of MSDSs, procedures for disposing of hazardous chemical waste, and fire safety precautions for the laboratory. *Required annually for all laboratory employees and student workers in laboratories.* Schedule can be accessed via <http://map.ais.ucla.edu/go/1003938> or go to the Website of the UCLA EHS.

Chinese Translation: LSFC has been translated into Mandarin Chinese to provide a supplemental training resource for students attending this lab safety training course.

Annual Lab Safety Online Refresher Training: After successful in-class completion of LSFC, the online refresher must be completed annually. See the link to the right for the Laboratory Safety Online Refresher.

Although the Laboratory Safety Fundamental Concepts is required to begin work in the lab, it is likely not the only safety training needed. Check with your research advisor for a list of required safety trainings.

CHEMICAL & BIOMOLECULAR ENGINEERING DEPARTMENT

GRADUATE PROGRAM DEGREE REQUIREMENTS

Graduate Course Information

The Department of Chemical & Biomolecular Engineering offers the Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees in Chemical Engineering.

Graduate Advisor

Prof. Philippe Sautet
Phone: (310) 206-3980
tsegura@ucla.edu

Student Affairs Officer

Miguel Perez
Phone (310) 825-1203
miguel@seas.ucla.edu

Graduate Course Information:

All graduate students must be enrolled in a minimum of **12 units** per quarter to maintain full-time Status. This requirement may be satisfied by taking 590-series courses. Enroll in 2-12 units to fulfill the graduate requirement. Courses are listed by academic advisor.

- ❖ **597B** - Preparation for the Ph.D. oral or written exam.
- ❖ **597C** - Preparation for the Ph.D. qualifying exam (the Prospectus)
- ❖ **598** - Preparation for the Master's thesis research
- ❖ **599** - Preparation for the Ph.D. dissertation
- ❖ **299** - the Departmental Seminar is **required** for all graduate students during each academic year quarter of residence.

*Graduate Students assigned as Teaching Assistants **must enroll** in 4 units of the Teaching Apprentice Practicum course **375**, listed by course instructor.

Vacation

Graduate students are entitled to administrative holidays given by the University. Students are also allowed for 2 week vacation time. However, they must consult their research advisers to determine a mutually agreeable time period for the vacation time. Vacations should not interfere with duties as TAs and progress to degree.

Annual Progress Report

At the end of each academic year every PhD student submits a short report describing the progress made, the tasks yet to be completed and a projected schedule for completion to the degree. The report is submitted to the Graduate Adviser and must be signed by the research adviser and one other member of the dissertation committee.

Funding Opportunities including Travel:

Every graduate student gets \$1000 from Graduate Division for conference travel.

We encourage you to apply for funding through the Graduate Division Office Website.

<https://grad.ucla.edu/funding/financial-aid/>

<https://grad.ucla.edu/funding/financial-aid/funding-for-continuing-students/doctoral-student-travel-grants/>

Thesis Master's Degree

**Please see www.gdnet.ucla.edu/gasaa/pgmrq/chmengr.asp
for the most current information*

Advising

Each department in the Henry Samueli School of Engineering and Applied Science has a faculty graduate adviser. Students who specialize in semiconductor manufacturing are assigned to the faculty graduate adviser for semiconductor manufacturing. A current list of graduate advisers can be obtained from the Office of the Associate Dean for Academic and Student Affairs, 6426 Boelter Hall, Henry Samueli School of Engineering and Applied Science.

Students are normally assigned a faculty research adviser upon admission to the School. The department will consider changing an adviser upon written request from the student.

During the second quarter in residence, students should arrange an appointment as early as possible with their faculty research adviser to plan the proposed program of study towards the M.S. degree. Continuing students are required to confer with their research adviser during the time of enrollment each quarter so that progress can be assessed and the study list approved.

During the first quarter in residence, students in who specialize in semiconductor manufacturing should arrange for an appointment with the graduate adviser for this specialization, and obtain an approved plan of study for the semiconductor specialization. The program of study may be changed only with the approval of the adviser.

Based on the quarterly transcripts, student records are reviewed at the end of each quarter by the departmental graduate adviser and Associate Dean for Academic and Student Affairs. Special attention is given if students were admitted provisionally or are on probation. If their progress is unsatisfactory, students are informed of this in writing by the Associate Dean for Student Affairs.

Students who receive teaching or research assistantships must receive approval from their research adviser or the departmental graduate adviser to add or drop courses.

Students are strongly urged to consult with the departmental Student Affairs Officer and/or the Office of Academic and Student Affairs regarding procedures, requirements, and the implementation of policies. In particular, advice should be sought on advancement to candidacy for the M.S. degree, and on the use of the Filing Fee.

Areas of Study

Specialization in semiconductor manufacturing. The specialization requires that the student have advanced knowledge of processing semiconductor devices on the nanoscale. This knowledge is assessed in a comprehensive examination.

Foreign Language Requirement

None.

Course Requirements

The requirements for the M.S. degree are a thesis, nine courses (36 units), and a 3.0 grade-point average in the graduate courses. Chemical Engineering 200, 210, and 220 are required. Two courses must be taken from regular offerings of the department, and two courses may be Chemical Engineering 598, involving work on the thesis. The remaining two courses may be taken from those offered by the department, or from any other field in life sciences, physical sciences, mathematics, or engineering. At least 24 units must be in letter-graded 200-level courses.

Specialization in semiconductor manufacturing. Students in this specialization are required to complete 10 courses (44 units) with a minimum 3.0 grade-point average overall and in graduate courses. A minimum of five (20 units) 200-series courses are required. Students are required to take Chemical Engineering 104C and 104CL, 270, and 270R; Electrical Engineering 123A; Materials Science and Engineering 121. In addition, students must select two elective courses from the department's list of electives, and two elective courses from elective offerings from the Departments of Electrical Engineering and Materials Science and Engineering, with a minimum of two of these in the 200 series. Approved elective courses include: Chemical Engineering C219, C214, C218, 223, C240; Electrical Engineering 124, 221A, 221B, 223, 224; Materials Science and Engineering 210 and 223.

Students in the specialization of semiconductor manufacturing who have been undergraduates or graduates at UCLA and who have already taken some of the required courses may substitute electives for these courses. However, no courses taken while not enrolled in the specialization may be counted toward the 10-course requirement for the degree. A program of study encompassing the course requirements must be submitted to the graduate adviser for approval before the end of the student's first quarter in residence.

All master's degree candidates are required to enroll in Chemical Engineering 299 during each quarter of residence.

A program of study which encompasses these requirements must be submitted to the departmental Student Affairs Office for approval before the end of the student's second quarter of residence.

Undergraduate Courses. No lower division courses may be applied toward graduate degrees. In addition, the following upper division courses are not applicable toward graduate degrees: Chemical Engineering 102A, 199; Civil Engineering 106A, 108, 199; Computer Science M152A, M152B, 199; Electrical Engineering 100, 101, 102, 103, 110L, M116L, 199; Materials Science and Engineering 110, 120, 130, 131, 131L, 132, 150, 160, 161L, 199; Mechanical and Aerospace Engineering 102, 103, 105A, 105D, 199.

Teaching Experience

Not required.

Field Experience

Specialization in semiconductor manufacturing. Students are required to take Chemical Engineering 270R, a directed research course, in the field, working at an industrial semiconductor fabrication facility. The proposed research must be approved by the graduate adviser for semiconductor manufacturing and the industrial sponsor of the research.

Comprehensive Examination Plan

This plan is only for students in the specialization in semiconductor manufacturing. Students take Chemical Engineering 597A to prepare for a comprehensive written examination. The examination tests for knowledge of the engineering principles of semiconductor manufacturing. In case of failure, the examination may be repeated once with the consent of the graduate adviser for the specialization. Second failure of the examination leads to a recommendation to the Graduate Division for termination of graduate study.

Thesis Plan

This plan is for all M.S. degree students who are not in the semiconductor manufacturing program. These students must complete a thesis. Students should consult the graduate adviser for details on the thesis plan. Thesis-plan students nominate a three-member thesis committee that must meet University regulations and be approved by the Graduate Division, as outlined in *Standards and Procedures for Graduate Study at UCLA*.

Time-to-Degree

The average length of time for students in the M.S. program is 6 quarters. The maximum time allowed for completing the M.S. degree is three years from the time of admission to the M.S. program in the School. See attached for a typical program.

Specialization in semiconductor manufacturing. Students in this specialization must complete the degree in two years (six quarters). The program may be completed in one calendar year (three quarters and a summer session) by enrolling in three courses per quarter and for one summer session. Students who are enrolled less than full-time must complete the degree in three years (nine quarters).

Semiconductor Manufacturing Master's Degree

**Please see www.gdnet.ucla.edu/gasaa/pgmrq/chmengr.asp
for the most current information*

Advising

Students who specialize in semiconductor manufacturing are assigned to the faculty graduate adviser for semiconductor manufacturing. A current list of graduate advisers can be obtained from the Office of the Associate Dean for Academic and Student Affairs, 6426 Boelter Hall, Henry Samueli School of Engineering and Applied Science.

Students are normally assigned a faculty research adviser upon admission to the School. The department will consider changing an adviser upon written request from the student.

During the second quarter in residence, students should arrange an appointment as early as possible with their faculty research adviser to plan the proposed program of study towards the M.S. degree. Continuing students are required to confer with their research adviser during the time of enrollment each quarter so that progress can be assessed and the study list approved.

During the first quarter in residence, students in who specialize in semiconductor manufacturing should arrange for an appointment with the graduate adviser for this specialization, Prof. Jane Chang, and obtain an approved plan of study for the semiconductor specialization. The program of study may be changed only with the approval of the adviser.

Based on the quarterly transcripts, student records are reviewed at the end of each quarter by the departmental graduate adviser and Associate Dean for Academic and Student Affairs. Special attention is given if students were admitted provisionally or are on probation. If their progress is unsatisfactory, students are informed of this in writing by the Associate Dean for Student Affairs.

Students who receive teaching or research assistantships must receive approval from their research adviser or the departmental graduate adviser to add or drop courses.

Students are strongly urged to consult with the departmental Student Affairs Officer and/or the Office of Academic and Student Affairs regarding procedures, requirements, and the implementation of policies. In particular, advice should be sought on advancement to candidacy for the M.S. degree, and on the use of the Filing Fee.

Areas of Study

Specialization in semiconductor manufacturing. The specialization requires that the student have advanced knowledge of processing semiconductor devices on the nanoscale. This knowledge is assessed in a comprehensive examination.

Foreign Language Requirement

None.

Course Requirements

Specialization in semiconductor manufacturing. Students in this specialization are required to complete 10 courses (44 units) with a minimum 3.0 grade-point average overall and in graduate courses. A minimum of five (20 units) 200-series courses are required. Students are required to take Chemical Engineering 104C and 104CL, 270, and 270R; Electrical Engineering 123A; Materials Science and Engineering 121. In addition, students must select two elective courses from the department's list of electives, and two elective courses from elective offerings from the Departments of Electrical Engineering and Materials Science and Engineering, with a minimum of two of these in the 200 series. Approved elective courses include: Chemical Engineering C219, C214, C218, 223, C240; Electrical Engineering 124, 221A, 221B, 223, 224; Materials Science and Engineering 210 and 223.

Students in the specialization of semiconductor manufacturing who have been undergraduates or graduates at UCLA and who have already taken some of the required courses may substitute electives for these courses. However, no courses taken while not enrolled in the specialization may be counted toward the 10-course requirement for the degree. A program of study encompassing the course requirements must be submitted to the graduate adviser for approval before the end of the student's first quarter in residence.

All master's degree candidates are required to enroll in Chemical Engineering 299 during each quarter of residence.

A program of study which encompasses these requirements must be submitted to the departmental Student Affairs Office for approval before the end of the student's second quarter of residence.

Undergraduate Courses. No lower division courses may be applied toward graduate degrees. In addition, the following upper division courses are not applicable toward graduate degrees: Chemical Engineering 102A, 199; Civil Engineering 106A, 108, 199; Computer Science M152A, M152B, 199; Electrical Engineering 100, 101, 102, 103, 110L, M116L, 199; Materials Science and Engineering 110, 120, 130, 131, 131L, 132, 150, 160, 161L, 199; Mechanical and Aerospace Engineering 102, 103, 105A, 105D, 199.

Teaching Experience

Not required.

Field Experience

Specialization in semiconductor manufacturing. Students are required to take Chemical Engineering 270R, a directed research course, in the field, working at an industrial semiconductor fabrication facility. The proposed research must be approved by the graduate adviser for semiconductor manufacturing and the industrial sponsor of the research.

Comprehensive Examination Plan

This plan is only for students in the specialization in semiconductor manufacturing. Students take Chemical Engineering 597A to prepare for a comprehensive written examination. The examination tests for knowledge of the engineering principles of semiconductor manufacturing. In case of failure, the examination may be repeated once with the consent of the graduate adviser for the specialization. Second failure of the examination leads to a recommendation to the Graduate Division for termination of graduate study.

Time-to-Degree

Specialization in semiconductor manufacturing. Students in this specialization must complete the degree in two years (six quarters). The program may be completed in one calendar year (three quarters and a summer session) by enrolling in three courses per quarter and for one summer session. Students who are enrolled less than full-time must complete the degree in three years (nine quarters).

Doctoral Degree

**Please see www.gdnet.ucla.edu/gasaa/pgmrq/chmengr.asp
for the most current information*

Advising

Each department in the Henry Samueli School of Engineering and Applied Science has a faculty graduate adviser. A current list of graduate advisers can be obtained from the Office of the Associate Dean for Academic and Student Affairs, 6426 Boelter Hall, Henry Samueli School of Engineering and Applied Science.

Students in the Chemical and Biomolecular Engineering Department are assigned a faculty graduate adviser upon admission to the School. The department will consider changing an adviser upon written request from the student.

Provisionally admitted students meet with the program adviser upon matriculation to plan a course of study to remedy any deficiencies.

During the second quarter in residence, students should arrange an appointment as early as possible with their faculty research adviser to plan the proposed program of study toward the Ph.D. degree. Continuing students are required to confer with their research adviser during the time of enrollment each quarter so that progress can be assessed and the study list approved.

Based on the quarterly transcripts, student records are reviewed at the end of each quarter by the departmental graduate adviser and Associate Dean for Student Affairs. Special attention is given if students were admitted provisionally or are on probation. If their progress is unsatisfactory, students are informed of this in writing by the Associate Dean for Academic and Student Affairs.

Students who receive teaching or research assistantships must receive approval from their research adviser or the departmental graduate adviser to add or drop courses.

Students are strongly urged to consult with the Student Affairs Officer and/or the Office of Academic and Student Affairs regarding procedures, requirements, and implementation of the policies. In particular, advice should be sought on advancement to candidacy, on the procedures for taking Ph.D. examinations, and on the use of the Filing Fee.

Foreign Language Requirement

None.

Course Requirements

All Ph.D students are required to take six courses (24 units). All of these units must be letter-graded 200 level courses. Students can choose three out of five core Chemical Engineering courses which are 200,210,220,245 and a graduate Engineering Mathematics course. Two additional courses must be taken from those offered by the Department. The

final course can be selected from offerings in life sciences, physical sciences, mathematics or engineering. Students are encouraged to take more courses in their field of specialization. These minor field courses should be selected in consultation with their research adviser. A minimum 3.33 grade-point average in graduate courses is required. A program of study to fulfill the course requirements must be submitted for approval to the departmental Student Affairs Office no later than one quarter after successful completion of the preliminary oral examination.

All Ph.D. students are required to enroll in Chemical Engineering 299 during each quarter of residence, and 495A during thesis 1st quarter.

For information on completing the Engineer degree, students should see [Engineering Schoolwide Programs](#) in *Program Requirements for UCLA Graduate Degrees*.

Teaching Experience

At least three quarters of teaching experience are highly recommended. During the quarters when they serve as teaching assistants, students are required to enroll in Chemical Engineering 375. Chemical Engineering 495A is required for all new graduate students. International students are required to register for the Test of Oral Proficiency (TOP), in order to become TAs.

Written and Oral Qualifying Examinations

Academic Senate regulations require all doctoral students to complete and pass University written and oral qualifying examinations prior to doctoral advancement to candidacy. Also, under Senate regulations the University oral qualifying examination is open only to the student and appointed members of the doctoral committee.

In addition to the University requirements, graduate students admitted to the CBE PhD program are required to pass the **Preliminary Written Examination (PWE)** to demonstrate their proficiency in at least Three (3) of the 5 Undergraduate CBE Core Areas selected as the following:

Transport Phenomena – Mandatory for all PhD students **and**

Students must choose in Fall Thermodynamics **or** Reaction Engineering **or both**. If students choose only one, then:

Students must choose Biomolecular Engineering **or** Engineering Mathematics, offered in Fall.

The PWE will be offered at the End of the Winter Quarter of each academic year. If students fail the PWE, they can retake it only for the second time during the following Spring Quarter. Each PWE section will be 2 hours long and open book. A textbook will be identified for each PWE section by the faculty to assist in student preparation. Possible textbooks: Transport Phenomena, Bird, Stewart and Lightfoot, Chemical Reaction Engineering, Fogler, and Chemical Engineering Thermodynamics, Smith and Van Ness.

Textbooks for the Biotechnology and Engineering Mathematics courses will be identified.

After completion of the required courses for the degree and passing the PWE, each student must pass the written and oral qualifying examinations. These examinations focus on the student's dissertation research and are conducted by a doctoral committee consisting of at least four faculty members nominated by the department in accordance with university regulations. Three members including the chair, are inside members and must hold faculty appointments in the department. The outside member must be a UCLA faculty member in another department. Students are required to have a 3.33 grade point average in graduate coursework to be eligible to take these examinations.

The written qualifying examination consists of submission of a dissertation research proposal that provides a clear description of the problem considered, a literature review of the current state of the art, and a detailed explanation of the research plan that will be followed to solve the problems. The student submits his/her dissertation research proposal to the doctoral committee before the end of the winter quarter of the student's second year of academic residence. The written research proposal must be submitted to the committee at least two weeks prior to the (oral) examination to allow the members sufficient time to evaluate the work.

The University Oral Qualifying examination consists of an oral defense of the dissertation research, and is administered by the doctoral committee. The written dissertation must be submitted to the committee at least two weeks prior to the oral defense to allow the members sufficient time to evaluate the work.

Advancement to Candidacy

Students are advanced to candidacy upon successful completion of the written qualifying examination.

Doctoral Dissertation

Every doctoral degree program requires the completion of an approved dissertation that demonstrates the student's ability to perform original, independent research and constitutes a distinct contribution to knowledge in the principal field of study.

Final Oral Examination (Defense of Dissertation)

Required for all students in the program.

Time-to-Degree.

From admission to graduate student status (including work for the master's degree), the PhD students are expected to complete their degree requirements in 20 quarters (this includes Summer Quarter). Doctoral students are expected to Advance to Candidacy by the Spring Quarter of their second year in residence or by the 7th quarter. All Ph.D. candidates are expected to present a departmental oral seminar during their fourth year of academic residence. With input from their research adviser, students may petition to postpone this seminar. After the departmental seminar, students should complete their dissertation research within the next one to two years. See attached for a recommended time line for PhD

program.

Termination of Graduate Study and Appeal of Termination

University Policy

A student who fails to meet the above requirements may be recommended for termination of graduate study. A graduate student may be disqualified from continuing in the graduate program for a variety of reasons. The most common is failure to maintain the minimum cumulative grade point average (3.00) required by the Academic Senate to remain in good standing (some programs require a higher grade point average). Other examples include failure of examinations, lack of timely progress toward the degree and poor performance in core courses. Probationary students (those with cumulative grade point averages below 3.00) are subject to immediate dismissal upon the recommendation of their department. University guidelines governing termination of graduate students, including the appeal procedure, are outlined in *Standards and Procedures for Graduate Study at UCLA*.

A recommendation for termination is reviewed by the school's Associate Dean for Academic and Student Affairs.

Additional Departmental Policies

Master's Candidates

In addition to the university policies noted above, a student may be recommended for termination for

- (1) Failure to maintain a grade point average of 3.0 in all courses and in those in the 200 series.
- (2) Failure to maintain a grade point average of 3.0 in any two consecutive terms.
- (3) Failure to complete the thesis to the satisfaction of the committee members.
- (4) Failure to maintain satisfactory progress toward the degree within the three-year time limit for completing all degree requirements.

Doctoral Candidates

In addition to the university policies noted above, a student may be recommended for termination for

- (1) Failure to maintain a grade point average of 3.3 in all courses and in any two consecutive quarters.

- (2) Failure of the preliminary oral examination.
- (3) Failure of the written and oral qualifying examination.
- (4) Failure to advance to candidacy.
- (5) Failure of a required final oral examination (defense of the dissertation).
- (6) Failure to obtain permission to repeat an examination from an examining committee.
- (7) Failure to maintain satisfactory progress toward the degree within the specified time limits.

Typical schedule for the MS program (subject to revision in the 2016/17 academic year)

CHEMICAL & BIOMOLECULAR ENGINEERING DEPARTMENT RECOMMENDED M.S. PROGRAM TIMELINE

	FALL QUARTER	WINTER QUARTER	SPRING QUARTER
1ST YEAR	Chm Eng 200 Chm Eng 210 Chm Eng 220 Chm Eng 299 Chm Eng 598 *SUBMIT COURSE STUDY PLAN	Chm Eng 298 Chm Eng 299 Chm Eng 598 Elective ¹ Elective ¹	Chm Eng 298 Chm Eng 299 Chm Eng 598 Elective ¹
2ND YEAR	Chm Eng 298 Chm Eng 299 Chm Eng 598 Elective ¹ *NOMINATE MASTERS COMMITTEE *COMPLETE FORM FOR ADVANCEMENT TO CANDIDACY	Chm Eng 298 Chm Eng 299 Chm Eng 598 *THESIS FILING/GRADUATION	

¹Consult with the Graduate Adviser or research advisor. Three of the four electives must be 200 level, letter-graded courses. Two of the three must be a ChE course; the remaining course may be taken in any field of science, mathematics, or engineering.

Last update: 8/28/07

Typical schedule for the PhD program (subject to revision in the 2016/17 academic year)

CHEMICAL & BIOMOLECULAR ENGINEERING DEPARTMENT RECOMMENDED PH.D. PROGRAM TIMELINE

	FALL QUARTER	WINTER QUARTER	SPRING QUARTER
1ST YEAR	Chm Eng 200 Chm Eng 210 Chm Eng 220 Chm Eng 299 Chm Eng 597B Preliminary Oral Evaluation	Chm Eng 298 Chm Eng 299 Chm Eng 597C Elective ¹ Elective ¹	Chm Eng 298 Chm Eng 299 Chm Eng 597C Elective ¹ *SUBMIT COURSE STUDY PLAN *NOMINATE DOCTORAL COMMITTEE
2ND YEAR	Chm Eng 298 Chm Eng 299 Chm Eng 597C	Chm Eng 298 Chm Eng 299 Chm Eng 597C *SUBMIT RESEARCH PROPOSAL (7TH WEEK) *PH.D. ORAL QUALIFYING EXAM/ ADVANCEMENT TO DOCTORAL CANDIDACY (9TH WEEK)	Chm Eng 298 Chm Eng 299 Chm Eng 599
3RD YEAR	Chm Eng 298 Chm Eng 299 Chm Eng 599	Chm Eng 298 Chm Eng 299 Chm Eng 599	Chm Eng 298 Chm Eng 299 Chm Eng 599 *ORAL PROGRESS REPORT
4TH YEAR	Chm Eng 298 Chm Eng 299 Chm Eng 599	Chm Eng 298 Chm Eng 299 Chm Eng 599	Chm Eng 298 Chm Eng 299 Chm Eng 599 *FILE DISSERTATION/ GRADUATION

¹Consult with the Graduate Adviser or research advisor. All must be 200 level, letter-graded courses. Three are required. Two of the three must be CHE; the remaining course may be in any field of science, mathematics, or engineering.

Last update: 05/06/07