UC DAVIS
MATERIALS SCIENCE AND ENGINEERING

GRADUATE STUDENT HANDBOOK

2019

Contents

Degrees in Materials Science and Engineering

The graduate program in materials science and engineering provides students with a personal experience within a large research university. Students have one-on-one access to our faculty members while being given a true interdisciplinary mentoring experience from faculty both within and outside the department in fields such as biomedical engineering and textiles and clothing. This unique graduate program structure lends itself well to the highly interdisciplinary nature of the field and allows students to research multiple facets of materials science and engineering.

Thanks to our individualized mentoring and research opportunities, our graduate students are well-prepared for careers in either academia or industry. Graduate students interested in industry jobs are particularly well-prepared for research and development positions. Our students are often able to quickly find jobs with some of the top technology companies and research labs in the nation due to our proximity to both the Bay Area and multiple national labs. Doctoral graduate students interested in careers in academia gain the dual experience of teaching and research that ensures that they are well-prepared for a faculty or postdoctoral research position.

Within our department, we offer three distinct degrees: the Master of Engineering, the Master of Science, and the PhD.

Master of Engineering

The one-year Master of Engineering (M.Eng.) degree is the most flexible degree we offer. With a wide variety of elective courses to choose from, students can mold the degree to fit their interests and goals, whether they include training in additional engineering, computer science or management courses.

Students with a background in any science or engineering-related field are encouraged to apply. Minimum qualifications for the degree involve a full year of physics, chemistry and engineering-level math, including linear algebra and differential equations. No prior research experience is required, though demonstration of success in some undergraduate core coursework in materials science and engineering will strengthen your application.

The M.Eng. degree can be completed at full-time or part-time status and is open to both recent graduates and those currently in the workforce. The majority of our master's students find jobs in industry after graduation.

Students Entering Fall 2019 and earlier

Course Requirements

Students will begin with the core courses for the degree and our "Preparing for Graduate Student Success" course (EMS 200), which will match them with a major professor by the end of the first fall quarter. The five core courses are listed below:

EMS 260: Advanced Thermodynamics of Solids.
EMS 262: Advanced Topics in Structure of Materials.
EMS 264: Transport Phenomena in Materials Processes.

EMS 272: Advanced Functional Properties of Materials.
EMS 274: Advanced Mechanical Properties of Materials.

For electives, students can select from any available upper-division undergraduate course (courses numbered 100-199) or graduate-level course (courses numbered 200-299). Popular electives include those from physics, chemistry, computer science, management and other engineering disciplines. In consultation with their major professor, students will select courses each quarter based on their career goals and aspirations.

Sample Schedule (Full-time student)

Fall		Winter		Spring	
EMS 260	4	EMS 272	4	Elective (1XX/2XX)	3-4
EMS 262	4	EMS 274	4	Research/Individual Study	8-9
EMS 264	4	Elective (1XX/2XX)	4	*Capstone Project*	
EMS 200	1	*Advance to Candidacy*		*Graduate*	

Capstone Project

The capstone project is a report, usually completed in the last quarter of study, about how the coursework relates to the projects in the student's major professor's lab. This report may consist of experimental, theoretical or computational work and should be directed towards the solution of a specific scientific or engineering problem. This report is then graded by three faculty members, including the major professor, on a pass, no pass or fail basis. Since the M.Eng. is a coursework-based degree, there is no need to write a thesis.
Further information on the capstone project may be found in the full degree requirement: https://programs.gs.ucdavis.edu/api/doc/3092

Students Entering Fall 2020 and later

Course Requirements

Students will begin with the core courses for the degree under the guidance of an assigned Graduate Advisor. The Graduate Advisor serves as the major professor for one Master of Engineering cohort. The five core courses are listed below:

EMS 260: Advanced Thermodynamics of Solids.
EMS 262: Advanced Topics in Structure of Materials.
EMS 264: Transport Phenomena in Materials Processes.
EMS 272: Advanced Functional Properties of Materials.
EMS 274: Advanced Mechanical Properties of Materials.

For electives, students can select from two tracks.

Track A: Capstone Course

Students who select this track will take anywhere from two to three elective courses, and two graduate capstone project courses in their second year. For electives, students can select from any available upper-division undergraduate course (courses numbered 100-

199) or graduate-level course (courses numbered 200-299). Popular electives include those from physics, chemistry, computer science, management and other engineering disciplines. In consultation with their major professor, students will select courses each quarter based on their career goals and aspirations.

During the graduate capstone project courses, students will work either individually or in small groups to pursue design projects intended to provide advanced experience in the processing, selection and evaluation of engineering materials. Each individual or group will generate an experimental plan and will conduct any necessary experiments with the general assistance of the instructor or graduate advisor/major professor. The courses will culminate in a final capstone project detailing the results of the design project and the connections to the fundamentals of materials science and engineering learned in the core curriculum.

Track A Sample Schedule (Full-time student)

Fall		Winter		Spring	
EMS 260	4	EMS 272	4	Elective (1XX/2XX)	4
EMS 262	4	EMS 274	4	Elective (2XX)	4
EMS 264	4	EMS 280A	4	EMS 280B	4
		Advance to Candidacy		*Graduate*	

Track B: Internship

Students who select this track will also take anywhere from two to three electives but will participate in an internship during their last quarter. In Winter Quarter, students will enroll in one unit of internship credit to work on securing an internship with the help of the graduate advisor/major professor and the Internship and Career Center. Once an internship has been secured, students should enroll in at least 10 units of EMS 292: Internship in Spring Quarter. During Spring Quarter, students are expected to provide an interim progress report at the mid-point of the quarter detailing progress and activities at the internship. At the conclusion of the internship, the student will submit a final capstone report (approx. 15 to 30 pages) on activities completed during the internship and how the activities relate to the broader field of Materials Science and Engineering.

Track B: Sample Schedule (Full-time student)

Fall		Winter		Spring	
EMS 260	4	EMS 272	4	Elective (2XX)	3
EMS 262	4	EMS 274	4	EMS 292	9
EMS 264	4	EMS 292	1		
		Elective (1XX/2XX)	3	*Capstone Report*	
		Advance to Candidacy		*Graduate*	

Master of Science

The Master of Science (M.S.) degree is aimed at preparing students for careers in research and development, or for further study in the field. Like the doctoral degree, the M.S. degree combines coursework and research, but with a more limited scope of the research project and thesis to reflect the shorter time-to-degree. After graduation, the

majority of our master's students find jobs in industry or continue on to another advanced degree, such as a PhD.

Course Requirements

Students will begin with the core courses for the degree and our "Preparing for Graduate Student Success" course (EMS 200), which will match them with a major professor over the course of the first fall quarter. The core courses are listed below:

EMS 260: Advanced Thermodynamics of Solids
EMS 262: Advanced Topics in Structure of Materials
EMS 264: Transport Phenomena in Materials Processes
EMS 268: Advanced Materials Characterization (students entering Fall 2020 and later)
EMS 272: Advanced Functional Properties of Materials
EMS 274: Advanced Mechanical Properties of Materials

For electives, students can select from any available upper-division undergraduate course (courses numbered 100-199) or graduate-level course (courses numbered 200-299). Popular electives include those from physics, chemistry, computer science, management and other engineering disciplines. In consultation with their major professor, students will select courses each quarter based on their career goals and aspirations.

Students are also expected to complete two quarters of EMS 290: "Department Seminar," which requires them to attend a majority of the weekly departmental lectures by visiting scholars in the field. This course exposes graduate students to the latest advances in materials science and engineering.

Sample Schedule (Full-time student)

Year 1 - Fall		*Winter*		*Spring*	
EMS 260	4	EMS 272	4	Elective (1XX/2XX)	3-4
EMS 262	4	EMS 274	4	Elective (1XX/2XX)	3-4
EMS 264	4	EMS 268*	4	EMS 299: Research	4-6
EMS 200	1	EMS 299	1-4		
EMS 290	1	Elective (1XX/2XX)**	3-4		

* Students entering Fall 2020 or later
** Students entering Fall 2019 or earlier

Year 2 - Fall		*Winter*		*Spring*	
EMS 299	11	EMS 299	12	EMS 299	12
EMS 290	1	*Advance to Candidacy*		*File Thesis*	
				Graduate	

Thesis

The master's thesis is a scholarly piece of computational, experimental or theoretical research that is rigorous in approach in terms of design, methodology and analysis. Students advancing to candidacy should prepare an outline of their thesis, which should include a critical evaluation of the methods and limitations of the research project and a

full description of the experimental design, protocols and data analysis. There are no limitations on the length or the number of publications required.

The degree requirements provide more description for the M.S. thesis: https://programs.gs.ucdavis.edu/api/doc/3092

Doctoral Degree (Ph.D.)

The doctoral (Ph.D.) degree prepares students to solve complex, long-term research problems. Students can expect to graduate in four to five years and to work on a large research project, culminating in a dissertation. The majority of our doctoral graduates end up in industry careers, usually in research and product development positions. Others go on to careers in academia, either as a postdoctoral researcher or an assistant professor.

Course Requirements

Doctoral students complete the same core courses as the master's degree students, but have additional examinations along the way that test both the breadth and depth of their materials science and engineering knowledge. Over the course of the first fall quarter, students will be matched with a major professor through the "Preparing for Graduate Student Success" course (EMS 200). The core classes are listed below:

EMS 260: Advanced Thermodynamics of Solids.
EMS 262: Advanced Topics in Structure of Materials.
EMS 264: Transport Phenomena in Materials Processes.
EMS 268: Advanced Materials Characterization (students entering Fall 2020 and later)
EMS 272: Advanced Functional Properties of Materials.
EMS 274: Advanced Mechanical Properties of Materials.

For electives, students can select from any available upper-division undergraduate course (courses numbered 100-199) or graduate level course (courses numbered 200-299) in a science or engineering discipline. Doctoral students are encouraged to select any physics, chemistry, mathematics or engineering-related courses that will assist them in preparing for their dissertation research.

Students are also expected to enroll in EMS 290: "Department Seminar" every quarter during their first year. The course requires students to attend a majority of the weekly departmental lectures by visiting scholars in the field, exposing them to the latest advances in materials science and engineering.

Sample Schedule (Full-time student, Years 1 and 2)

Year 1 - Fall		*Winter*		*Spring*	
EMS 260	4	EMS 272	4	Elective (1XX/2XX)	3-4
EMS 262	4	EMS 274	4	Elective (1XX/2XX)	3-4
EMS 264	4	EMS 268*	4	EMS 299: Research	4-6
EMS 200	1	EMS 290	1	EMS 290	1
EMS 290	1	Elective (1XX/2XX)**	3-4	*Preliminary Exam*	

* Students entering Fall 2020 or later
** Students entering Fall 2019 or earlier

Year 2 - Fall		*Winter*		*Spring*	
Elective (2XX)	4	Elective (2XX)	3-4	EMS 299	11
Elective (2XX)	3-4	EMS 299	7-8	EMS 290	1
EMS 299	3-4	EMS 290	1	*Qualifying Exam*	
EMS 290	1			*Advance to Candidacy*	

In years three and four, students will enroll in 12 units of research (EMS 299) each quarter and begin working on dissertation research and writing until graduation at the end of year four or five. If the major professor holds weekly group meetings, students can enroll in EMS 290C (1 unit). Note that this class is distinct from EMS 290: Seminar.

Transferring Coursework

Graduate-level coursework completed at another institution may be substituted for elective or required coursework in some cases, depending on the content of the course. If a graduate-level course was taken during the student's undergraduate degree program, the student must prove that the course was not used to satisfy the bachelor's degree requirements. Transferred courses are evaluated through an internal process by the instructor of the course at UC Davis. If approved, the course is waived for the student. The waived course does not formally appear on the UC Davis transcript as a transferred course, but does appear on the internal Program of Study form (Appendix A) as satisfying the course requirements for the degree.

Preliminary Exam

Taken in spring quarter of your first year, this exam consists of a 10-minute presentation followed by 20 minutes of questioning by a committee consisting of five faculty members. Prior to the exam, students prepare a one-page abstract containing a general overview and critical assessment of two to three research articles. Beginning Fall 2020, students may choose from a subset of articles chosen by a pre-determined committee, which may or may not include the student's major professor. Also in Fall 2020, the presentation will be extended to 15 minutes. The exam assesses the student's ability to communicate a solid understanding of fundamental scientific and engineering concepts, particularly in the context of your research topic. Students must complete all core courses and maintain at least a 3.25 GPA to be eligible to take the exam.

Qualifying Exam

Like the preliminary exam, the qualifying exam contains both a written and an oral portion. The written portion consists of a 10-15 page dissertation research proposal and bibliography that follows a format similar to an NSF or NIH grant proposal. After distributing the proposal to the committee, the student prepares a 30-35 minute oral presentation, during which a faculty committee will question the student. The qualifying exam committee consists of four graduate program faculty members and one external faculty member. Major professors are not allowed to participate on the qualifying exam committee.

Exit Seminar

After students complete their dissertation, they will present their research to the department prior to scheduling an appointment with Graduate Studies to submit their dissertation. At least two of the dissertation committee members must be present at the exit seminar. If the seminar is successfully completed, the committee will sign off on the dissertation signature page. Note that original signatures are required. Scanned images or electronic signatures will not be accepted.

Designated Emphases (DE)

Doctoral students have the unique opportunity to participate in an affiliated designated emphasis (DE). A DE is similar in concept to an undergraduate minor. Students will be required to complete additional coursework and must have a faculty member from that DE serve on both the qualifying exam committee and the dissertation committee. Students who successfully complete the DE will have a notation included on their diploma and transcript. The Materials Science and Engineering graduate program is affiliated with three designated emphases:

- Biophotonics and Bioimaging: https://biophotonics.bme.ucdavis.edu/
- Biotechnology: http://deb.ucdavis.edu/
- Nuclear Science: http://dens.physics.ucdavis.edu/

Milestones

Beginning Graduate School

Most new students arrive in Davis in early-to-mid-September, as housing leases generally begin on September 1st. You'll want to start looking for housing right away, as vacancies can fill up quickly. Additionally, Graduate Studies at UC Davis has created a Facebook group for admitted students, so you can connect with other new graduate students. This group will also be an important resource for the most up-to-date announcements regarding Graduate Studies orientation.

Steps to Attend UC Davis

1. Submit your Statement of Intent to Register (SIR) at the bottom of your Graduate Studies admission email.
2. Doctoral students: return your signed funding offer letter.
3. Create a UC Davis computing account.
4. Send in your official transcripts
5. Submit your Statement of Legal Residency.

Once these five steps have been completed and verified by a staff advisor, you will receive information regarding registration for classes. You should also begin registering for mandatory orientations and trainings.

The First Year

Finding a Major Professor

You can expect at least one main milestone in your first year—finding a major professor. During fall quarter, students participate in "Preparing for Graduate Student Success" (EMS 200), which matches you with a major professor. In general, you should plan to meet with at least three to four faculty members by the midway point of the quarter. Attending group meetings is also a great way to meet a faculty member's students and learn about current research projects. From there, you should narrow your preferences down to the top three research groups you would like to join. Preferences are then collected from the faculty, and the department chair, the graduate program chair and staff advisors meet to match students and faculty. This process is usually complete by the end of fall quarter.

The expectation is that doctoral students will choose a funded project with a graduate program faculty member. If a doctoral student elects to pursue a doctoral degree with an unfunded project then the Graduate Program Chair will inform the student in writing of the consequences such a decision will have on the financial offer made to the doctoral student at the time of admission. If a student chooses a faculty outside of the graduate program, the student must find a faculty member within the graduate program to serve as a co-chair.

Changing Your Major Professor

Under certain circumstances, the graduate program recognizes that there may be valid reasons for a graduate student to want to change the major professor. If a student should

choose to request a change in major professor, the graduate program will make every effort to be helpful and to ensure that this is not a barrier to completion of the degree. However, it is important to note that a change in a major professor may result in loss of extramural support for the doctoral student since the graduate program cannot always assure the doctoral student that a funded project will be available when the change in major professor is made. Furthermore, such a change may increase the time to degree.

If a student wants to change their major professor, they should take the below steps:
1. Graduate student should inform the Graduate Program Chair (GPC) in writing and give reasons for the requested change.

2. The GPC must meet with the student within one week of receipt of the written notice to discuss options available to the student and the possible consequences if the request is acted upon. The GPC will provide the student with a written summary of the discussion, and the student must acknowledge in writing that they understand the implications that may result from a change in major professor. The student has one week following the meeting with the GPC to decide whether to proceed with a change in major professor or request mediation to resolve any conflict with the major professor. All discussions between the student and GPC shall be confidential to this point.

3. If the GPC has explored all the options available and discussed them with the student, the student still wishes to proceed with the request, the GPC will inform the student's current major professor and the Department Chair, then help the student identify a new major professor. The student is expected to be an active participant in this process, including scheduling meetings with prospective new major professors and attending group meetings.

4. Once a new major professor has been assigned to the student, all responsibility for the student's funding, lab space, desk space and advising will be transferred to the new major professor within four weeks.

Advancing to Candidacy

Master's Students

Once students have completed the majority of their coursework and have formed their capstone project (M.Eng.) or thesis (M.S.) committee, they can advance to candidacy. Students must also have a 3.0 GPA and be in good academic standing. The process for advancing involves filling out a Graduate Studies' advancement to candidacy form.

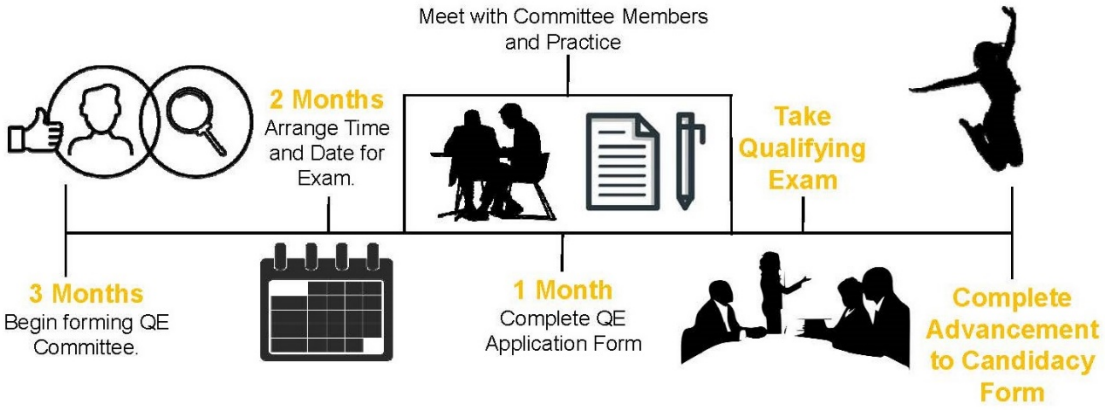
If you need help forming your committee, consult your thesis or capstone project advisor to determine which other faculty would be appropriate additional readers. Committee members do not need to be part of the graduate program faculty or even the university (additional paperwork will be required in this case). The major professor will usually serve as the chair of the committee.

Doctoral Students

You may advance to candidacy after successfully passing the qualifying exam. You should select your qualifying exam committee in consultation with your major professor,

as the major professor cannot serve on this committee. The committee should include one faculty member from outside the Materials Science and Engineering graduate program.

After determining the committee membership and selecting a chair, you should work with the faculty to determine a mutually agreeable time and date, allowing for the exam to last up to three hours. Once this has been agreed upon, email an advising staff member to reserve a room and begin the process of completing the Graduate Studies' qualifying exam application. This form should be completed at least four weeks before the exam date. Prior to the exam, you should meet with your committee members and practice your presentation for your lab group members and other fellow graduate students.



Once you pass the qualifying exam, you should advance to candidacy as soon as possible by completing the Candidacy for the Degree of Doctor of Philosophy, Plan B form. Like the master's thesis committee and the qualifying exam committee, students may select a faculty member from outside of the graduate program and the university to serve on the dissertation committee. For the latter, additional paperwork will be required. In most cases, the major professor will serve as the dissertation committee chair.

Graduation

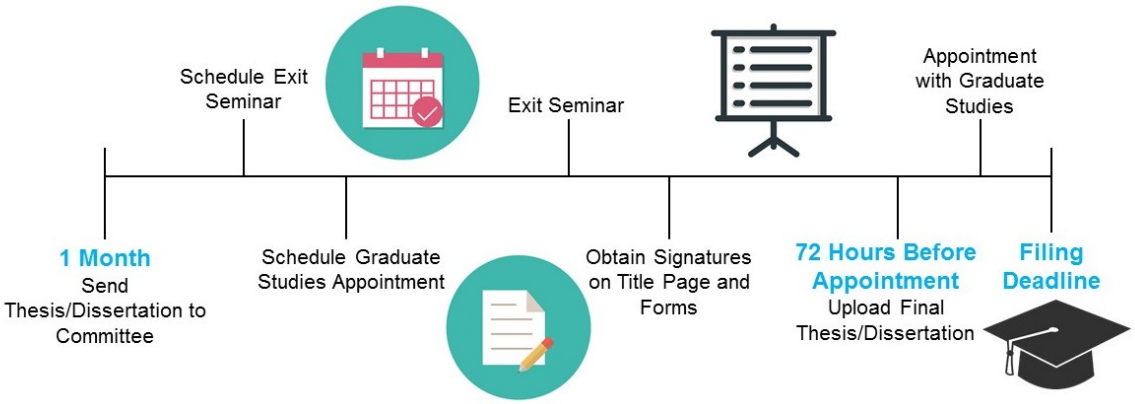
Prepare

In order to graduate in a particular quarter, you need to make sure that you are in good standing and are registered or are in filing fee status. You should have advanced to candidacy at least one quarter before filing to graduate, and you should check to make sure your thesis or dissertation committee is up to date. If you've changed your committee, be sure to fill out a Graduate Studies' reconstitution of committee membership form at least a quarter prior to graduating.

Planning to File

Planning ahead to file your thesis or dissertation is essential. The filing deadlines posted on the Graduate Studies webpage are a good place to start. Once you know which quarter you want to graduate in, you can determine when you need to start finalizing your dissertation and scheduling your exit seminar. Keep in mind that faculty are allowed at least four weeks for review of the thesis or dissertation.

Once your committee gives you the go-ahead, you should find a mutually agreeable date and time for your exit seminar and schedule it with an advising staff member. Then, schedule your Graduate Studies appointment by emailing gradservices@ucdavis.edu.This appointment should take place after the exit seminar. It's important to review the Graduate Studies candidate degree completion lists for all the forms and surveys you need to complete and bring with you to your appointment. Before you leave UC Davis, be sure to complete the department exit form.



Commencement

Graduate Studies commencement is held once a year in June, separate from the event conducted by the College of Engineering for undergraduate students.

Registration and Courses

All full-time students should be enrolled in 12 units each quarter to ensure eligibility for employment and access to university services, such as health care. For all Materials Science and Engineering degree programs, the core courses should be taken in the first two quarters of enrollment (fall and winter), followed by electives selected in consultation with your major professor or graduate advisor.

We know students are curious about selecting their electives, so we've identified a list of several common electives (also listed in Appendix B). This list should be used to guide your discussion with your major professor. Students often select electives from the Departments of Chemistry, Physics and other engineering disciplines, as well as from Materials Science and Engineering. Please be sure to complete the appropriate program of study form found in Appendix A) by the end of your first year.

If you have identified a major professor and are actively conducting research, use the link on our website to locate the course registration number for your major professor. Please take care to ensure that you are enrolled in the correct section of EMS 290C (1 unit for group meeting), and 299 (variable units for conducting research). EMS 290C should not be confused with EMS 290: Department Seminar. EMS 290C is a course used to evaluate your attendance and performance in your lab's weekly group meeting. If your group does not have a weekly group meeting, you do not need to enroll in the 290C.

If you plan to go on a planned educational leave (PELP), contact your graduate program coordinator to complete the necessary paperwork before you register. PELP may be used when you need to take a break from your studies to take care of a personal, medical, or financial problems. PELP is considered to a non-registered status, meaning you are not able to utilize university resources.

If you plan to be out of the state for the entirety of the quarter in order to perform your research, you should complete an in absentia application and register as normal in 12 units. In absentia registration should only be used after you have advanced to candidacy and should not exceed six quarters. Student registered in this status will be charged reduced fees but may still serve as a graduate student researcher.

Academic Difficulty

Academic Probation and Disqualification

The below is a summary of academic probation and disqualification as it relates to the graduate program. Complete information and definitions on academic probation and disqualification can be found on the Graduate Studies website: https://grad.ucdavis.edu/resources/graduate-student-resources/academic-information-and-services/warnings-probation-and

Qualitative

If a student is not meeting the major professor's expectations for timely progress towards achieving an advanced degree as reflected in unsatisfactory progress reports submitted through the Student Progress Assessment system, the major professor has the right to terminate funding. However, the graduate student should be informed in writing at least one quarter in advance that this being considered, and the student must be informed of the conditions that must be met to avoid termination of funding. Circumstances may arise that require funding to be terminated with less than three months' notice (e.g. change of major professor, gross neglect of graduate studies, Graduate Studies Petition for Exception to Policy (PEP) denial). If less than three months' notice is given, the Department Chair and Graduate Program Chair must be apprised by the major professor before such action is taken.

Quantitative

Graduate students are subject to probation for quantitative reasons by Graduate Studies if the quarterly or cumulative GPA falls below 3.0, or if students accumulate 8 or more units of incomplete (I) or unsatisfactory (U) grades. Students cannot advance to candidacy if they are on academic probation.

Time to Degree

Doctoral students may be placed on academic probation by Graduate Studies if the dissertation is not submitted within four calendar years from the date they pass the qualifying exam. Further information on this policy may be found on the Graduate Studies website: https://grad.ucdavis.edu/resources/graduate-student-resources/academic-information-and-services/degree-requirements/normative

Appendix A – Program of Study

UC DAVIS
MATERIALS SCIENCE AND ENGINEERING

Master of Engineering Program of Study

Name:_____ Year Entered:_____

Core Courses – 20 Units

Course	Quarter	Units	Grade
EMS 260		4	
EMS 262		4	
EMS 264		4	
EMS 272		4	
EMS 274		4	

Total Units _____

Elective Courses and Research Project – 16 units (**Fall 2019 and earlier**)

Course	Quarter	Units	Grade
EMS 299		9	

Total Units _____

Elective Courses – 16 units (**Fall 2020 and later**)

☐ Track A (Capstone Project)

Course	Quarter	Units	Grade
EMS 280A		4	
EMS 280B		4	

Total Units _____

☐ Track B (Internship)

Course	Quarter	Units	Grade
EMS 292		1	
EMS 292		9	

Total Units _____

Notes:

_____

Graduate Advisor Signature Date

_____

Graduate Program Coordinator Signature Date

UC DAVIS
MATERIALS SCIENCE AND ENGINEERING

Master of Science Program of Study

Name:_____ Year Entered:_____

☐ **2011 Degree Requirements (Fall 2019 or earlier)**
☐ **2019 Degree Requirements (Fall 2020 and later)**

Core Courses (**20 units** or **25 units**)

Course	Quarter	Units	Grade
EMS 260		4	
EMS 262		4	
EMS 264		4	
EMS 272		4	
EMS 274		4	

Total Units _____

Elective Courses (**16 units** or **8 units**)

Course	Quarter	Units	Grade

Total Units _____

Notes:

_____
Major Professor Signature Date

_____
Graduate Program Coordinator Signature Date

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MATERIALS SCIENCE AND ENGINEERING

PhD Program of Study

Name:_____ Year Entered:_____

☐ **2011 Degree Requirements (Fall 2019 or earlier)**
☐ **2019 Degree Requirements (Fall 2020 and later)**

Core Courses (**20 units** or **25 units**)

Course	Quarter	Units	Grade
EMS 260		4	
EMS 262		4	
EMS 264		4	
EMS 272		4	
EMS 274		4	

Total Units _____

Elective Courses (**18 units** or **12 units**)

Course	Quarter	Units	Grade

Total Units _____

Notes:

_____
Major Professor Signature Date

_____
Graduate Program Coordinator Signature Date

Appendix B- Recommended Electives

The electives listed below are a few recommended classes to help you and your major professor guide your coursework to complement your research objectives, though it is in no way a comprehensive list of all the courses available. The list will be updated annually with any new courses approved by major professors and graduate advisors.

Biological Materials

BIM 202: Cell and Molecular Biology for Engineers (4 units)
BIM 214: Cell Mechanics (4 units)
BIM 262: Molecular Biophysics (4 units)
BIM 289A: Cellular and Molecular System Engineering (4 units)
BPH 241: Membrane Biology (3 units)
ECH/EMS 245: Micro- and Nano-Technology in Life Sciences (4 units)
EMS 288: Physical Biology of Cells (4 units)
FST 202: Physical Chemistry of Foods (3 units)

Chemical Engineering

ECH 170: Introduction to Colloid Surface Phenomena (3 units)
ECH 254: Colloid and Surface Phenomena (4 units)
ECH 264: Emulsions, Microemulsions, Bilayers (4 units)
ECH 253A: Advanced Fluid Mechanics (4 units)

Chemistry

CHE 210A: Quantum Chemistry (3 units)
CHE 222: Chemistry of Nanoparticles (3 units)
CHE 226: Principles of Transition Metal Chemistry (3 units)
CHE 228C: Solid State Chemistry (3 units)

Civil Engineering

ECI 244: Life Cycle Assessment (4 units)
ECI 245A: Applied Environmental Chemistry – Inorganic (4 units)
ECI 268: Infrastructure Economics (3 units)

Computational

CHE 204: Mathematical Methods in Chemistry (3 units)
ECH 261: Molecular Modeling (4 units)
ECS 223: Parallel Algorithms (4 units)
ECS 289K: Scientific Computing (1-3 units)
STA 135: Multivariable Data Analysis (4 units)
MAE 207: Engineering Experiments and Uncertainty (4 units)

Electrical, Optical and Magnetic Properties

EEC 146A: Integrated Circuits Fabrication (3 units)
EEC 150A: Signals and Systems I (4 units)
EEC 236: Nonlinear Optical Applications (3 units)
EEC 237B: Laser Physics II (4 units)
EEC 242: Advanced Nanostructured Devices (3 units)
EEC 289L: Solid State Devices and Physical Electronics (3 units)
ECH/EMS 246: Photovoltaics and Solar Cells (3 units)
EMS 288: Glass – Science and Technology (4 units)

PHY 108: Optics (3 units)
PHY 240A: Condensed Matter Physics (3 units)
PHY 243A: Surface Physics of Materials (3 units)
PHY 243B: Surface Physics of Materials (3 units)
PHY 243C: Surface Physics of Materials (3 units)
PHY 250: Special Topics (3 units) (Topic varies by instructor)

Engineering Education
ECI 289C: Engineering Education Lesson Design I (2 units)

Fiber and Polymer Science
FPS 250A-F: Special Topics in Polymer Fiber Science (4 units)

Imaging and Spectroscopy
BIM 289B: Biomedical Imaging (4 units)
CHE 205: Spectroscopy (3 units)
CHE 216: Magnetic Resonance Spectroscopy (3 units)
CHE 240: Advanced Analytical Chemistry (3 units)
CHE 241B: Laser and X-Ray Spectroscopy (3 units)
CHE 241E: Microscopy and Imaging (3 units)
EMS 230: Fundamentals of Electron Microscopy (3 units)
EMS 230: Electron Microscopy Lab (2 units)

Management
MGT 255: New and Small Business Ventures (3 units)
MGT 250: Technology Competition and Strategy (3 units)
MGT 251: Management of Innovation (3 units)
MGT 267: Teams and Technology (3 units)
MGT 290: Topics in General Management (3 units)

Mechanical Properties
EMS 248: Fracture of Engineering Materials (3 units)
EMS 249: Fatigue Mechanisms (3 units)
MAE 250C: Mechanical Performance of Materials (4 units)

Nuclear Science
BIM 243: Radiation Detectors in Biomedical Applications (4 units)
GEL 227: Stable Isotope Biogeochemistry (4 units)
GEL 251: Advanced Topics in Isotope Geochemistry and Cosmochemistry (3 units)
PHY 224A: Nuclear Physics (3 units)
PHY 245A: High-Energy Physics (3 units)
PHY 252B: Techniques of Experimental Physics (3 units)

Thermodynamics
ECH 252: Statistical Thermodynamics (4 units)
EMS 244: Interaction of Materials and their Environment (3 units)