ACADEMIC SENATE: SAN DIEGO DIVISION, 0002
UCSD, LA JOLLA, CA 92093-0002
(858) 534-3640
FAX (858) 534-4528

January 21, 2020

PROFESSOR CARLOS FM COIMBRA, Chair
Department of Mechanical and Aerospace Engineering

SUBJECT: Proposed Five-Year BS/MS Program and Updates to MS Requirements for PhD Students

At its November 12, 2019 meeting, the Graduate Council approved the Department of Mechanical and Aerospace Engineering's proposals to: 1. Establish a new five-year Bachelor of Science/Master of Science program; and 2. Update the MS requirements for PhD students who would like to obtain an MS degree. The Undergraduate Council also reviewed and supported the proposed BS/MS program.

The proposal to establish the BS/MS Program will be forwarded to the San Diego Division's Academic Senate Chair for placement on the February 18, 2020 Representative Assembly agenda for final approval.

The Council approved the proposed catalog copy and it will be included in the 2020-21 General Catalog update pending final approval of the BS/MS Program from the Representative Assembly.

Sincerely,

Lynn Russell, Chair
Graduate Council

cc: M. Allen
J. Antony
A. Burr
S. Constable
M. Corr
Z. Dake
C. Lyons
J. Moore
R. Rodriguez
L. Vong

ACADEMIC SENATE: SAN DIEGO DIVISION
UCSD, LA JOLLA, CA 92093-0002
(858) 534-3640
FAX (858) 534-4528

January 16, 2020

PROFESSOR LYNN RUSSELL, Chair
Graduate Council

SUBJECT: MAE Proposal to Implement Five-Year B.S/M.S. Program

Dear Professor Russell,

At its November 8, 2019 meeting, the Undergraduate Council reviewed the Department of Mechanical and Aerospace Engineering's proposal to establish a five-year contiguous B.S./M.S. program. The Council is supportive of the proposal and does not find any adverse impacts on the undergraduate program.

Sincerely,

Anthony Burr, Chair
Undergraduate Council

cc: S. Constable
M. Corr
L. Hullings
J. Moore
R. Rodriguez
J. Teranes

UC San Diego

Administrative Cover Sheet: New Academic Degree Programs/Remote Courses

DOCUMENT TYPE AND BRIEF DESCRIPTION

The MAE Department proposes implementation of a five-year BS/MS program. Students must complete all undergraduate degree requirements before transitioning into the MS program where they will be required to complete all of the same MS degree requirements as our general MS student population. Courses taken in the Senior (fourth) year of the undergraduate program that are not used to complete the BS degree requirements may be used to complete MS degree requirements.

HEAD OF INITIATING OFFICE

Name:	Title:	Department: Mechanical & Aerospace Engineering	Email:
Carlos F.M. Coimbra	Professor/Chair		mae-chair-l@ucsd.edu

Signature

Carlos F.M. Coimbra

RETURN DOCUMENT TO:

Name:	Email:	Phone:	Mail Code:
Zachary Dake, Dir. of Student Affairs (MAE)	zdake@eng.ucsd.edu	(858) 534-4065	0411

ROUTING ORDER	TITLE/NAME	SIGNATURE	DATE IN	DATE OUT
6	Executive Vice Chancellor of Academic Affairs: Elizabeth Simmons	Elizabeth H Simmons	11/1/19	11/5/19
5	Associate Vice Chancellor of Resource Administration: Steven Ross		10/30/19	10/30/19
4	Dean of Undergraduate Education: John Moore			
3	Dean of Graduate Education: James Antony	James Antony	10/25/19	10/25/19
2	Dean of the Jacobs School of Engineering: Albert Pisano	Albert P. Pisano	25OCT19	25 OCT 19
1	Department Chair: Carlos F.M. Coimbra	Carlos F.M. Coimbra	10/21/19	10/21/19

Please refer to Procedures for Administrative Review of New Academic Programs and Remote Courses for appropriate routing details.

UNIVERSITY OF CALIFORNIA, SAN DIEGO UCSD

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DEPARTMENT OF MECHANICAL AND
AEROSPACE ENGINEERING, MAIL CODE 0411

9500 GILMAN DRIVE
LA JOLLA, CALIFORNIA 92093-0411

October 21, 2019

TO: Those That It May Concern

RE: Administrative Review of Five-Year BS/MS Program in Mechanical & Aerospace Engineering

a. Proposed program start date: FA21 (with the department accepting applications in SP20)

b. Short description of the program:

The Mechanical & Aerospace Engineering Department proposes implementation of a five-year BS/MS program which will allow our top undergraduate students to transition directly into our MS program. Undergraduate students will submit applications to the department in spring quarter of their Junior (third) year and, if accepted, will submit official applications to the Graduate Division during their Senior (fourth) year. Students must maintain at least a 3.0 GPA and must complete all undergraduate degree requirements before transferring into the MS program. Once in the MS program, students will have the option to select either Plan I (Thesis) or Plan II (Comprehensive Examination) and will be required to complete all of the same degree requirements as our general pool of MS students. Courses taken in the Senior (fourth) year of the undergraduate program that were not counted toward the BS degree may be used to satisfy MS degree requirements.

c. Modality of the program: On-Site (UC San Diego Main Campus)

d. Two most closely related programs at UC San Diego:

In the Jacobs School of Engineering, the Bioengineering, Computer Science and Engineering, Electrical and Computer Engineering, Nanoengineering, and Structural Engineering departments all have similar five-year, contiguous BS/MS programs.

e. The number of new courses required for this program:

Zero new courses will be required for this program.

f. The number of new faculty required for the program:

   Zero new faculty will be required for the program.

g. Significant additional equipment or facilities needed for the program.

   No additional equipment or facilities will be required for the program.

h. Significant additional financial resources needed for the program.

   No additional financial resources will be needed for the program.

i. Significant additional library/learning resources needed.

   No additional library/learning resources will be needed.

Thank you for your consideration.

Sincerely,

Carlos F.M. Coimbra, Chair
Mechanical & Aerospace Engineering

UNIVERSITY OF CALIFORNIA, SAN DIEGO UCSD

BERKELEY • DAVIS • IRVINE • LOS ANGELES • MERCED • RIVERSIDE • SAN DIEGO • SAN FRANCISCO SANTA BARBARA • SANTA CRUZ

DEPARTMENT OF MECHANICAL AND
AEROSPACE ENGINEERING, MAIL CODE 0411

9500 GILMAN DRIVE
LA JOLLA, CALIFORNIA 92093-0411

Oct 3, 2019

Dear Graduate Council,

Please find enclosed requests from the Mechanical and Aerospace Engineering Department for curriculum changes to our graduate programs.

I. Implementation of B.S./M.S. Program
II. Updates to M.S. Degree Requirements for Ph.D. Students

Please address all correspondence to me (ccoimbra@ucsd.edu) and to Graduate Affairs Committee Chair, P. Rangamani (prangamani@ucsd.edu)

Sincerely,

Carlos F.M. Coimbra, Chair
Mechanical & Aerospace Engineering
University of California, San Diego

I. B.S./M.S. Program

A. Executive Summary

The Mechanical and Aerospace Engineering Department proposes implementation of a Five-Year B.S./M.S. Program. This program will allow current students in our undergraduate programs to apply for admission to the M.S. program during spring quarter of their Junior year. Applicants will be notified of their admissions results during the summer before the start of their senior year, when they would typically begin applying to graduate programs.

Implementation of this program was requested by our current undergraduate students during our recent Town Hall Meetings and IdeaWave Campaigns. The program would incentivise our top undergraduate students to commit to our M.S. program before applying to other programs.

B. Requested Changes

We propose to implement a B.S./M.S. program which will allow our top undergraduate students to transition into our M.S. program.

The B.S./M.S. program in MAE will be a contiguous Bachelor's/Master's Degree program for undergraduates in the Mechanical and Aerospace Engineering department who have maintained a good academic record in both departmental and overall course work. The program will be open only to UC San Diego Mechanical and Aerospace Engineering undergraduates. Participation in the program will permit students to transition directly to the MAE Master's program following receipt of the MAE Bachelor's degree. Students admitted to the program may choose between the Thesis Plan I and the Comprehensive Plan II to fulfill the M.S. degree requirements.

C. Rationale & Justification

Implementation of a B.S./M.S. program will add an incentive for our top undergraduate students to join our M.S. program by guaranteeing admission to the program before the typical admission timeline. Our top students will benefit from exposure to advanced topics in mechanical engineering and will be significantly more competitive for leadership positions within the engineering industry. The students will also benefit because GRE scores are not required. This exam poses

a financial burden on many applicants, and is statistically shown to adversely affect diversity if relied upon too heavily.

D. Curricular Requirements

Undergraduate students in the Mechanical and Aerospace Engineering department who are enrolled in the Bachelor's program and who have a cumulative GPA of a 3.0 will be eligible to apply to the B.S./M.S. degree program. Once admitted to the B.S./M.S. program, students must maintain a 3.0 cumulative GPA through completion of their Bachelor's degree. Students not satisfying these requirements may be re-evaluated for continuation in the program.

Admission to the B.S./M.S. program will be for the Fall term only. Students must complete and submit the MAE internal application for the B.S./M.S. program by the program deadline during the Spring quarter of their junior year. Applications will be reviewed and admission decisions will be given during the Summer term preceding their senior year, with a deadline to accept their offer shortly thereafter. Students must also complete the Graduate Division application after they are accepted by the MAE department.

<u>Requirements for MAE Internal Application</u>

1. Cumulative 3.0 GPA
2. 3 Letters of Recommendation
3. UCSD Transcript
4. Statement of Purpose

<u>Requirements for Graduate Division Application</u>

1. Cumulative 3.0 GPA
2. 3 Letters of Recommendation
3. UCSD Transcript
4. Transcripts for all institutions attended after high school
5. Statement of Purpose
6. GRE (not required)
7. TOEFL (not required)

Students admitted to the B.S./M.S. program will be required to complete the same Plan I or Plan II requirements as those in the regular M.S. program. Students must have received their B.S. degree before they will be eligible to enroll as a

graduate student in the department. Students will not be admitted to the M.S. program if they do not graduate from the B.S. program.

E. Relationship/Impact of Proposed Changes on Existing Academic Programs

Implementation of this program should not affect other Departments/Programs.

F. Academic and Administrative Resources

No additional Academic or Administrative resources will be required. Our current M.S. Advisor will advertise and screen applicants for eligibility and the Graduate Division has an existing process for other Departments with B.S./M.S. programs to which our Department will adhere. Once admitted to the program, B.S./M.S. students will take the same existing courses as the general M.S. student population.

G. Graduate Student Support

M.S. students in the MAE Department are generally self-supported, but are eligible for GSR and other ASE positions. As this new program will only affect the admissions process, students admitted to the program will be treated like all of our other M.S. students who enter through the typical admissions process.

II. M.S. Requirements for Ph.D. Students

A. Executive Summary

The Department proposes that our internal Department Qualifying Examination requirements for Ph.D. students satisfy the Plan II (Comprehensive Examination) requirements for Ph.D. students who would like to obtain an M.S. degree.

B. Requested Changes

The Department proposes the addition the following language to the General Catalog requirements for the Doctoral Degree Program:

"Obtaining an M.S. Degree: Ph.D. students may obtain the M.S. degree by completing the 36 units of coursework requirements described on the MAE website and by passing the PhD Department Qualifying Examination (DQE)."

C. Rationale & Justification

The updated M.S. Plan II (Comprehensive Examination) curriculum that was approved by the Graduate Council on February 25, 2018 and that went into effect in Fall 2018 requires our M.S. students to take four M.S.-level graduate courses that were designed to give our M.S. students an overview of material without going into Ph.D.-level depth. These new courses ensure that our M.S. degree recipients obtain a well-rounded background in Mechanical and Aerospace Engineering while limiting the number of M.S. students in our Ph.D.-level courses and thus, allow us to maintain high-quality instruction for our Ph.D. students.

The new Plan II curriculum is problematic for Ph.D. students who want to earn an M.S. degree along the way to their Ph.D. because Ph.D. students typically don't take the M.S.-level courses. The current catalog requirements result in three to four additional petitions per Ph.D. student to replace the M.S.-level courses required for the degree with Ph.D.-level courses that go into more subject matter depth.

D. Curricular Requirements

The requirements that we propose to fulfill the Plan II M.S. degree requirements for Ph.D. students are similar to the requirements of the internal Department Qualifying Examination which is generally taken by the end of a student's sixth quarter in the program. These were the M.S. Plan II requirements for all graduate students in our department prior to our Fall 2018 update.

The exam is based on material taught over 36 units (9 courses) in three areas:

- Major (4 courses)
- Minor (2 courses)
    - If the minor is chosen from a department other than MAE, the student must take two additional courses from an MAE Major area.
- Basic Science or Mathematics (3 courses).

Students and faculty can refer to the Graduate Course Structure for M.S. and Ph.D. Students for guidance on selecting courses.

A Ph.D. student entering the program without a Master's Degree must complete 36 units of coursework (9, 4-unit courses) with the following conditions:

- 6 of the 9 courses must be 200-level MAE courses, MUST be approved by the faculty advisor, and MUST be taken for a letter grade.
- 3 of the 9 courses must be 200-level or upper-division undergraduate courses in a STEM field, MUST be approved by the faculty advisor, and MUST be taken for a letter grade.

E. Relationship/Impact of Proposed Changes on Existing Academic Programs

The proposed update will have no effect on existing academic programs.

F. Academic and Administrative Resources

The proposed update will reduce the number of petitions required for our Ph.D. students to receive an M.S. degree saving faculty, student, department staff and Graduate Division staff time.

G. Graduate Student Support

The proposed changes will have no effect on graduate student support.

III. Supplementary Proposal Requirements

A. Catalog Copy

Mechanical and Aerospace Engineering (MAE)

[undergraduate program | courses | faculty]

STUDENT AFFAIRS:
180 Engineering Building II
Warren College
http://maeweb.ucsd.edu

All courses, faculty listings, and curricular and degree requirements described herein are subject to change or deletion without notice.

The Graduate Program

The Department of Mechanical and Aerospace Engineering (MAE) at UC San Diego offers graduate instruction leading to the **MS and PhD in engineering sciences** with a designated specialization in each of the following areas: aerospace engineering, applied mechanics, applied ocean sciences, engineering physics, and mechanical engineering.

In fall 2007, a new PhD specialization was introduced: computational science. Computational science seeks to gain understanding principally through the analysis of mathematical models on high performance computers. It is a blend of applications, computations, and mathematics. It is a mode of scientific investigation that supplements the traditional lab and theoretical models of acquiring knowledge. This is done by formulating mathematical models whose solutions are approximated by computer simulations.

The computational science specialization leverages the strength of the existing mathematics, science, and engineering departments. PhD students must demonstrate advanced undergraduate-level proficiency in numerical analysis and in computer algorithms and data structures.

For more information, please contact the MAE Graduate Affairs Office at mae-gradadm-l@ucsd.edu.

Admission to the graduate program is in accordance with the general requirements of the graduate division, which requires a BS and/or MS in some branch of engineering, the physical sciences, or mathematics; an overall GPA of 3.0; and three letters of recommendation from individuals who can attest to the applicant's academic or professional competence and to the depth of their interest in pursuing graduate study. In addition, all applicants are required to submit GRE General Test scores.

A minimum score of 550 on the paper based (80 on the IBT or 7 on the IELTS) Test of English as a Foreign Language (TOEFL) is required of all international applicants whose native language is not English and whose undergraduate education was conducted in a language other than English. Students who score below 600 on the TOEFL examination are strongly encouraged to enroll in an English as a second language program before beginning graduate work. (UC San Diego Extension offers an excellent English language program during the summer as well as the academic year.)

Applicants are judged competitively. Based on the candidate's background, qualifications, and goals, admission to the program is in one of two categories: MS or PhD. The MS designation is reserved for students currently interested in obtaining an MS but who at a later time may wish to continue in the doctoral program. Admission to the PhD program is reserved for qualified students whose final aim is a doctoral degree. An MS can be obtained during the PhD program. Policies for possible changes in status are given under "Master's Degree Program" below.

For more information on admission to our graduate program, please go to http://maeweb.ucsd.edu/grad/admissions.

Nonmatriculated students are welcome to seek enrollment in MAE courses via UC San Diego's Extension's Concurrent Enrollment program but an extension student's enrollment in an MAE graduate course must be approved by the instructor.

Five-Year BS/MS Program

Undergraduates in the MAE department who have maintained a good academic record in both departmental and overall course work are encouraged to participate in the five-year BS/MS program. Participation in the program will permit students to complete the requirements for the MS degree within one year following receipt of the BS degree. Complete details regarding admission to and participation in the program are available at the MAE Student Affairs office.

Admission to the Program

Students must submit an application for the BS/MS program by the program deadline during the spring quarter of their junior year. Applications are available at the MAE Student Affairs office. No GRE's are required for application to the BS/MS program. A GPA of at least 3.0 both overall and in the major and strong letters of recommendation are required to be considered for admission to the program. Students are encouraged to visit the MAE website or contact the MAE Student Affairs website for additional details and requirements.

In the winter quarter of the senior year, applications of students admitted to the program will be forwarded by the department to the UC San Diego Graduate Division. Each student must submit the regular graduate application and fee prior to the application deadline for their application to be processed. Students who have been accepted into the BS/MS program will automatically be admitted for graduate study beginning the following fall provided that they maintain an overall GPA of at least 3.0 through the winter quarter of the senior year. Graduate courses or up to twelve units of upper-division courses taken during the senior year that are not used to satisfy undergraduate course requirements may be counted toward the thirty-six units required for the MS degree.

Admission for graduate study through the BS/MS program will be for the Master of Science degree only. Undergraduate students wishing to continue toward the PhD degree must apply and be evaluated according to the usual procedures and criteria for admission to the PhD program.

Curriculum

Students in the five-year BS/MS program must complete the same requirements as those in the regular Plan I or Plan II MS program as detailed below. All requirements for the BS degree should be completed by the end of the senior (fourth) year, and the BS degree awarded prior to the start of the fifth year. Courses taken in the senior year may be counted toward the BS degree requirements or the MS degree requirements, but not both. Students must have received their BS degree before they will be eligible to enroll as graduate students in the department.

Master's Degree Program

The MS program is intended to extend and broaden an undergraduate background and/or equip practicing engineers with fundamental knowledge in their particular fields. The degree may be terminal or obtained on the way to the PhD. The degree is offered under both the Thesis Plan I and the Comprehensive Examination Plan II (see "Graduate Admission: Master's Degrees"). A strong effort is made to schedule MS level course offerings so that students may obtain their MS in one year of full-time study or two years of part-time study.

MS Time Limit Policy: Full-time MS students are permitted seven quarters in which to complete all requirements. While there are no written time limits for part-time students, the department has the right to intervene and set individual deadlines if it becomes necessary.

Master's Plan I—Thesis Defense

This plan of study involves both course work and research, culminating in the preparation of a thesis. A total of thirty-six units of credit is required: twenty-four units (six courses) must be in course work, and twelve units must be in research (MAE 299). The student's program is arranged, with prior approval of the faculty adviser, according to the following policies:

1. Course work must include at least sixteen units (four courses) of MAE 200-level courses.
2. Units obtained in MAE 205 or 299 may not be applied toward the course work requirement.
3. No more than a total of eight units of MAE 296 and 298 may be applied toward the course work requirement.
4. No more than twelve units of upper-division 100-level courses (engineering-based or technically serious) may be applied toward the course work requirement.
5. Only four units from the ENG series may be applied to the degree.
6. Twelve units of MAE 299 must be taken to fulfill the research requirement.

The thirty-six units are arranged into three areas of specialization, organized as follows:

- Specialization 1: Three courses (four units each course)
- Specialization 2: Three courses (four units each course)
- Specialization 3: Twelve units of MAE 299

The two areas of specialization must be chosen from the list below of MAE research areas. The third specialization can be one of the listed MAE areas or a math/science area.

Current MAE Research Areas

- Applied and Solid Mechanics
- Material Sciences
- Fluid Mechanics
- Thermal Sciences
- Engineering Physics
- Dynamics Systems and Controls
- Environmental Engineering
- Biomechanics
- Design

Students should reference the MAE Graduate Course Structure to see which courses fall into which of the research areas.

Students must maintain at least a B average (3.00 GPA) in the courses taken to fulfill the degree requirements. All required courses for a degree must be taken for a letter grade, with the exception of MAE 299 research units, which may be taken as S/U only. A thesis based on the research is written and subsequently reviewed by the thesis adviser and two other faculty members appointed by the dean of Graduate Studies. The review is normally an oral defense of the thesis.

Comprehensive Examination—Plan II

This plan of study involves course work only and culminates in a comprehensive written examination. A total of thirty-six units of credit (nine courses) are required. The student's program is arranged, with prior approval of the faculty adviser, according to the following policies:

1. At least twenty units (five courses) of MAE 200-level courses.
2. Units obtained in MAE 205 or 299 may not be applied toward the course work requirements.
3. No more than a total of eight units of MAE 296 and 298 may be applied toward the degree requirements.
4. No more than twelve units of upper-division 100-level courses (engineering-based or technically serious) may be applied toward the degree requirements.
5. Only four units from the ENG series may be applied to the degree.

These thirty-six units should be arranged into three areas of requirements, organized as follows:

- Required Course: One course (4 units):
  - MAE 208. Mathematics for Engineers
- Emphasis Courses: Four courses (4 units each) from the following list:
  - MAE 200. Controls
  - MAE 201. Mechanics of Fluids
  - MAE 202. Thermal Processes
  - MAE 203. Solid Mechanics and Materials
  - MAE 204. Robotics
  - MAE 206. Energy Systems
  - MAE 209. Continuum Mechanics Applied to Medicine/Biology
- Permitted Electives: Four courses (4 units each) from the MAE Graduate Student Course Structure

The **Comprehensive Examination** is a formal, written exam. It will include two to three questions from each of the required emphasis courses. The exam will be offered once in mid- to late spring quarter, and a make-up exam will be offered again in summer. If the exam is not completed with a passing grade, the student will be allowed to retake the exam one time within a twelve-month period. If the student fails a second time, he or she will not be awarded the MS degree.

Students must maintain at least a B average (3.00 GPA) in the courses taken to fulfill the degree requirements. All required courses for a degree must be taken for a letter grade, with the exception of MAE 299 research units, which may be taken as S/U only.

Change of Degree. Upon completion of the requirements for the MS, students admitted as MS only or MS candidates are not automatically eligible for admission to the PhD program. MS only candidates who subsequently wish to pursue a doctorate must submit an application for a change in status to their examining committee. If the recommendation is positive and the request approved, the student must submit a general petition for graduate

students to effect the change of status. In addition, the examining committee may recommend that the examination satisfy one of the three topics required in the departmental qualifying examination for the doctorate.

MS candidates who subsequently wish to pursue a doctorate must also submit an application for a change in status to their examining committee. In this case, a special examination is not required. The application, however, must be approved and signed by an MAE faculty member who expects to serve as the student's PhD adviser. When the request is approved, the student must submit a general petition for graduate students to effect the change of status. If the student elects the comprehensive examination plan for the MS, this examination may be used not only to fulfill the requirement for the MS, but also to satisfy one of the three topics required in the departmental qualifying examination for the doctorate. In fact, the MS examination may be part of the doctoral examination.

MS Program

To complete an MS with specialization in aerospace engineering, engineering physics, mechanical engineering, applied mechanics, or applied ocean sciences, students must complete a sequence of courses unique to their area. Students should consult with their faculty adviser, as well as the MAE Graduate Student Affairs Office, when choosing their courses.

Master of Advanced Studies in Medical Device Engineering (MAS)

The Department of Mechanical and Aerospace Engineering (MAE) offers a master's degree program in medical device engineering. This program targets working professionals in the fields of medical devices, instrumentation, and related areas. This program is for part-time students with an adequate background in engineering. All requirements for the degree can be completed in two years.

Admissions

Admissions requirements are equivalent to a master's of science degree in MAE except that work experience may be substituted for GRE test scores. Requirements are as follows:

- bachelor's degree in engineering, mathematics, or physics
- undergraduate GPA of at least 3.0
- GRE OR two years prior work experience or currently employed in a medical device company or related industry
- three letters of recommendation, one of which is recommended to be from the applicant's current employer
- TOEFL or TSE (international applicants only)

Final Project Capstone Requirement, No Thesis

The MAS in medical device engineering will require a four-unit capstone course sequence (three courses). This is a project-based course sequence where students work individually or in small teams. The object is to design a medical device and develop an engineering strategy to carry the project from prototype to implementation.

Courses

There are five required basic science and engineering courses (sixteen units) that deliver the core disciplinary knowledge in biology, mechanics, materials and physiology, and two required courses in business (four units). These courses are taught specifically to the students in the MAS program.

Seven required courses

- MDE 209. Mechanics and Transport Phenomena for Biomedical Device Design
- MDE 266. Biomaterials: Nano to Macroscale
- MDE 225A. BioBusiness: Small to Large I
- MDE 225B. BioBusiness: Small to Large II
- MDE 230. Life Sciences and Technologies
- MDE 231A. Fundamentals of Physiology and Anatomy I
- MDE 231B. Fundamentals of Physiology and Anatomy II

Three required elective courses

- MDE 210. Medical Devices: Clinical Perspectives
- MDE 240. Embedded System Design
- MDE 292. Computer-Aided Design of Medical Devices

Capstone course

- MDE 260 A, B, C. Design and Implementation of Medical Device Technology I, II, III (Capstone Design Project)

The capstone course sequence (four units) is offered exclusively to MAS students.

For more information on the MAS program, please visit maseng.ucsd.edu.

Doctoral Degree Program

The MAE PhD program is intended to prepare students for a variety of careers in research and teaching. Therefore, depending on the student's background and ability, research is initiated as soon as possible. In general, there are no formal course requirements for the PhD. All students, in consultation with their advisers, develop course programs that will prepare them for the MAE Departmental Qualifying Examination and for their dissertation research. However, these programs of study and research must be planned to meet the time limits established to advance to candidacy and to complete the requirements for the degree. Doctoral students who have passed the Departmental Examination may take any course for an S/U grade, with the exception of any course that the student's Departmental or PhD Qualifying Examination Committee stipulates must be taken in order to remove a deficiency. It is strongly recommended that all MAE graduate students take a minimum of two courses (other than research) per academic year after passing the Departmental Qualifying Examination. Specific details in this regard can be obtained from the MAE Student Affairs Office.

Doctoral Examinations: An MAE PhD student is required to pass three examinations. The first is a **Departmental Qualifying Examination (DQE)** that is intended to determine the candidate's ability to successfully pursue a

research project level appropriate for the doctorate. This first exam must be taken within the first six quarters of registration as a graduate student. The DQE is an oral examination by a committee of four persons (two of which must be in the MAE department) and is based on material taught over thirty-six units in three areas of study: a major area (four courses), a minor area (two introductory courses), and a study in mathematics or basic science (three courses). Students must submit a plan of study, approved by their adviser, to the Graduate Affairs Committee for final approval by the end of their second quarter of graduate study.

Students should reference the MAE Graduate Course Structure for a plan of study and to see which courses fall into which of the research areas.

Obtaining an MS Degree: Doctoral students may obtain the MS degree by completing the 36 units of coursework requirements described on the MAE website and by passing the PhD Department Qualifying Examination (DQE).

Teaching Experience is required of all MAE PhD students prior to taking the PhD Qualifying Exam. The teaching experience is defined as lecturing one hour per week in either a problem-solving section or regular lecture for one quarter in a course designated by the department. The requirement can be fulfilled by teaching assistant service or taken as a course for academic credit (MAE 501). Students must contact the Student Affairs Office to plan for completion of this requirement.

The **PhD Qualifying Examination** is the second examination required of MAE PhD students. In preparation for the PhD Qualifying Examination, students must have completed the Departmental Qualifying Examination and the Departmental Teaching Experience requirement, obtained a faculty research adviser, and have identified a topic for their dissertation research and have made initial progress. At the time of application for advancement to candidacy, a doctoral committee responsible for the remainder of the student's graduate program is appointed by the Graduate Council. The committee conducts the PhD Qualifying Examination, during which students must demonstrate the ability to engage in dissertation research. This involves the presentation of a plan for the dissertation research project. The committee may ask questions directly or indirectly related to the project and general questions that it determines to be relevant. Upon successful completion of this examination, students are advanced to candidacy and are awarded the candidate in philosophy degree (see "Graduate Admission" section in this catalog). The **Dissertation Defense** is the final PhD examination. Upon completion of the dissertation research project, the student writes a dissertation that must be successfully defended in an oral examination and public presentation conducted by the doctoral committee. A complete copy of the student's dissertation must be submitted to each member of the doctoral committee approximately four weeks before the defense. It is understood that the copy of the dissertation given to committee members will not be the final copy, and that the committee members may suggest changes in the text at the time of the defense. This examination may not be conducted earlier than three quarters after the date of advancement to doctoral candidacy. Acceptance of the dissertation by the Office of Graduate Studies and the university librarian represents the final step in completion of all requirements for the PhD.

There is no formal foreign language requirement for doctoral candidates. Students are expected to master whatever language is needed for the pursuit of their own research.

PhD Time Limit Policy. Precandidacy status is limited to four years. Doctoral students are eligible for university support for six years (engineering physics, seven years). The defense and submission of the doctoral dissertation must be within seven years (engineering physics, eight years).

Evaluations. In the spring of each year, faculty advisers evaluate each doctoral student's overall performance in course work, research during the past academic year, and prospects for financial support for the next year. A written assessment is given to the student. If a student's work is found to be inadequate, the faculty adviser may determine that the student cannot continue in the doctoral program and will recommend dismissal to the dean of Graduate Studies.

Joint Doctoral Program with San Diego State University

The Department of Mechanical and Aerospace Engineering at UC San Diego participates in a joint doctoral program with the Graduate Group in Applied Mechanics at SDSU. The program leads to the degree of doctor of philosophy in engineering sciences (applied mechanics). Participants in the program are required to spend one year enrolled at UC San Diego; their dissertation research is carried out under the supervision of an SDSU faculty member. Information regarding admission may be obtained from the departmental Student Affairs Office.

PhD in Mechanical and Aerospace Engineering with Specialization in Multiscale Biology

As of fall 2010, the UC San Diego campus is offering a new PhD specialization in multiscale biology that will be available to doctoral candidates in participating programs that span four divisions: Biological Sciences, Physical Sciences, Jacobs School of Engineering, and Health Sciences at UC San Diego.

The PhD specialization is designed to allow students to obtain standard basic training in their chosen field within the biological sciences, physical sciences, engineering, and health sciences with training in integrative and quantitative analysis across multiple scales of biological organization from molecule to organism in health and disease into their graduate studies. It trains a new cadre of PhD scientists and provides a unique interdisciplinary education at the interfaces between the biological, medical, physical and engineering sciences.

The specific objectives of this program are

1. **Focused collaboration** across nine graduate degree programs at UC San Diego to train a new generation of cross-disciplinary scientists
2. **State-of-the-art interdisciplinary training** through a new technology-centered hands-on graduate laboratory course curriculum
3. **Novel emphasis on research** aimed at integrative and quantitative analysis across multiple scales of biological organization from molecule to organism in health and disease

Students in the specialization are required to take at minimum three laboratory courses and serve as a TA one course. Courses offered are as follows:

Lab	Course Numbers	Title	Contributing Programs or Departments	Instructors	Quarter
1	BENG 283 Chem 28/BIOM 283	Supramolecular Complex Characterization	Chemistry and Biochemistry, Bioinformatics	Komives (Chemistry and Biochemistry), Bafna (Computer Science and Engineering)	Spring
2	BENG 276 Chem 276 Math 276 PHARM 276	Numerical Analysis for Multi-Scale Biology	Chemistry and Biochemistry, Mathematics, Bioengineering	McCammon (Chemistry and Biochemistry), Holst (Mathematics), Sejnowski (Biological Sciences) McCulloch (Bioengineering)	Spring
3	NEU 260 Chem 260	Light and Electron Microscopy of Cells and Tissues	Neuroscience, Chemistry and Biochemistry, Molecular Pathology,	Martone, Sosinsky, Ellisman (Neurosciences), Baker (Chemistry and Biochemistry), Hanein (Pathology)	Spring

			Biology		
4	BENG 278 RAD 278	Magnetic Resonance Imaging	Radiology, Bioengineering	Wong, Buxton, Frank, Liu (Radiology), Dale (Neurosciences)	Winter
5	PHYS 245 BGGN 265	Optical Imaging of Structure and Function in Excitable Systems	Physics, Neurosciences, Radiology, Bioengineering, Medicine, Biology	Kleinfeld (Physics), Wang (Biological Sciences), Berns (Bioengineering)	Spring
6	BENG 277 BIOM 287	Tissue Engineering	Bioengineering, Biomedical Science, Pediatrics, Pharmacology	Sah, Christman, Varghese (Bioengineering), Nigam (Pediatrics), Evans (Pharmacology)	TBA
7	BENG 260 BGGN 260	Neurodynamics	Bioengineering, Biology	Cauwenberghs (Bioengineering)	Winter

Prospective students must apply and be admitted into the PhD program in mechanical and aerospace engineering described previously. (For more information, see the Mechanical and Aerospace Engineering Graduate program and/or the Interfaces Graduate Training Program administered within the Department of Chemistry and Biochemistry, 4010 York Hall, Revelle College.)