

March 24, 2006

PROFESSOR TONYA KUHL, Chair
Graduate Group in Biomedical Engineering
Chemical Engineering and Materials Science

RE: Biomedical Engineering – Revised degree requirements

Dear Professor Kuhl,

At its meeting of March 17, 2006, Graduate Council considered and approved your October 21, 2005 request for changes to the Biomedical Engineering degree requirements. Thank you for working with the Educational Policy Committee (EPC) on the proposed revisions and on the additional clarifications that the committee requested. These changes are outlined in your letter of January 16, 2006 to Graduate Council. The EPC recommended Council's approval of your March 10, 2006 revision of the Biomedical Engineering degree requirements and the Checklists for the Cellular and Molecular Systems track and the Musculoskeletal Biomechanics track. Graduate Council concurred.

In order to assist graduate programs and Graduate Studies in keeping accurate records of when degree requirement changes are approved by Graduate Council, we will send you the electronic version of the approved degree requirements to which we have added the revision and approval dates. The Office of Graduate Studies also will keep copies in its files.

Sincerely,



Andrew Waterhouse, Chair
Graduate Council

/lsw

Enclosure

c: Carolyn de la Peña
Christal Winter

c w/o encl:
Edward Caswell-Chen
Jeffery Gibeling

ATTACHMENT 7.7
Graduate Council Meeting
March 17, 2006


Biomedical Engineering – Degree requirement changes

The Educational Policy Committee recommends Council's approval of these degree requirement changes. The checklists for the tracks will be posted on the Graduate Council page of the MySenate Website and available at the meeting. The last four pages of the Graduate Student Handbook were not copied.

UC DAVIS: BIOMEDICAL ENGINEERING GRADUATE GROUP

DATE: October 21, 2005

TO: Graduate Council
C/O Lee Wilce, Graudtae Studies

FROM: Tonya Kuhl, Chair
Biomedical Engineering Graduate Group 

RE: **Biomedical Engineering - Changes to Degree Requirements**

Our Graduate Group Membership recently approved, via e-mail ballot, the following changes to our BME Degree Requirements:

1. Change in tracks of study. We are combining the Therapeutics track, Microsystems track, and Bioinformatics track under the Cellular and Molecular Engineering track. These areas of focus will continue to be available within the Cellular and Molecular Systems track. This change was approved by our Executive Committee in December of 2003.
2. Switching from Plan A to Plan C for the Ph.D. The only difference between Plan A & Plan C is the minimum size of the committee. We currently require 3 dissertation readers and 5 final exam members. Plan C requires a minimum of 3 dissertation committee members who will both read the dissertation and serve on the final exam committee. Students will still have the option of more members on the committee and will be advised that more input on their dissertation project is better.
3. Membership of exam and thesis committees clarified. Committees are required to have representation from the fields of engineering & biology/medicine. The graduate advisor continues to have approval power of the committee composition. Committee membership is not restricted by College affiliation but rather by knowledge area.
4. Format restructuring to move all committee membership information to one location.
5. Substitution of our graduate level physiology course (BIM 204) for the undergraduate course (NPB 101) in our core course requirements. BIM 204 was designed to fulfill this requirement and was approved by the Academic Senate on 11/3/03.
6. Clarification of procedures for establishing a Major Professor.

Biomedical Engineering Graduate Group
University of California, Davis

BIOMEDICAL ENGINEERING
GRADUATE STUDENT
HANDBOOK

Revised March 10, 2006

Approved by Graduate Council on March 17, 2006

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UNIVERSITY OF CALIFORNIA, DAVIS

GRADUATE STUDY IN BIOMEDICAL ENGINEERING

I. INTRODUCTION

Welcome to graduate study in Biomedical Engineering! The purpose of this Handbook is to supplement the general information available to graduate students in 1) the Announcement of Graduate Studies, 2) the College of Engineering Graduate and Undergraduate Bulletin, and 3) the Graduate Study Requirements on the Biomedical Engineering web site. More explicitly, it serves as the official record of graduate program requirements in Biomedical Engineering. This Handbook contains specific information on registration procedures, program planning, financial aid, faculty advisers, examination requirements and various other items of interest to graduate students in the Biomedical Engineering Graduate Group (BMEGG). Most programs of study can be planned with the help of the information presented here. Incoming graduate students should acquaint themselves with the contents of the Handbook to achieve maximum benefit from the programs available. Most of the activities required in normal progress through our degree program are described herein.

The Biomedical Engineering Graduate Group offers three programs of study and research leading to the M.S. and Ph.D. degrees. These programs or tracks of study are Biomedical Imaging, Cell and Molecular Systems, and Musculoskeletal Biomechanics. Each track prepares students for professional work in the effective integration of engineering with biological and medical sciences, including modeling of biological systems and the design of devices and procedures useful for human and veterinary medicine. The BMEGG is a broad interdepartmental program that is best suited for students who are capable of and comfortable with considerable independence. The program is designed to provide sufficient flexibility to meet both the needs and interests of individual students and the changes of emphasis in this new and rapidly growing field. While assuring competence in engineering and biological sciences, the tracks are intended to meet the conflicting demands for flexibility, breadth and depth of training, and limitation of training time. A minimum core program is required of all students. Various additional course combinations identified in the program tracks provide breadth and depth of training and adequate exposure to analysis, design, experimentation, and communication. Some substitutions to maintain flexibility are permitted, but the resulting program for each student is reviewed to assure that it meets the standards the faculty deem necessary to prepare the student for successful professional endeavors after graduation.

II. ACADEMIC RESOURCES

A. Graduate Advisers

Because the BMEGG is a broad interdepartmental program, each student's program of study will necessarily include research in a specific area of specialization. For this reason, upon matriculation, each student is assigned to a Graduate Adviser in the track in which it is anticipated that the thesis or dissertation research will fall - Biomedical Imaging, Cell and Molecular Systems, and Musculoskeletal Biomechanics. Adviser assignments will be changed if the student changes his/her area of specialization.

The Graduate Adviser to which a student is assigned is that student's first source of academic information and provides assistance with the details of the BMEGG. The Graduate Adviser's signature is the only signature recognized as official by Graduate Studies on a variety of forms and petitions used by graduate students. In particular, the Graduate Adviser is responsible for the following:

1. Review and approval of the program of study for every graduate student.
2. Review and action on each petition of a graduate student to take courses on an S/U basis and to make recommendations on petitions of graduate students to either drop or add courses beyond the deadlines.
3. Review and approval of petitions for advancement to candidacy for the Master's degree and recommendations for the composition of the committee for the Master's theses.
4. Recommendations, after consultation with the student and the student's Major Professor, for composition of Ph.D. Qualifying Examination and Dissertation Committees.
5. Periodic review of student progress towards degree objectives, and, in particular, reviewing an annual report concerning each student's progress toward completion of degree requirements.
6. Review and recommendations to the Dean of Graduate Studies of applications for admission, reentry, change of major, change of degree objective, and for the approval of Planned Educational Leaves.

The Graduate Adviser is available for consultation by direct appointment. The Graduate Adviser will adhere to all deadlines established by Graduate Studies. It is the responsibility of the student to meet these deadlines.

Graduate Program Coordinator Christal Winter cdwinter@ucdavis.edu 752-2611

Graduate Group Chair Tonya Kuhl tkuhl@ucdavis.edu 754-5911

Tracks of Study Graduate Advisers

Biomedical Imaging: Jinyi Qi qi@ucdavis.edu 754-6142

Cellular and Molecular Systems: Scott Simon sisimon@ucdavis.edu 752-0299

Musculoskeletal Biomechanics: Maury Hull mlhull@ucdavis.edu 752-2660

B. Major Professor

The Major Professor is the faculty member who supervises the research that precedes the preparation of a student's thesis or dissertation. The student is responsible for meeting with faculty who have research projects in their area of research, in order to identify a potential Major Professor. The BMEGG recommends that new students investigate potential lab matches by talking to current students, sitting in on lab meetings, and participating in lab rotations. By the end of the third quarter of enrollment, each graduate student must select a Major Professor.

He/she will be in charge of the BIM 299 research course work, will assist with the selection of courses, and is normally the Chair of a student's Thesis (MS) or Dissertation (PhD) Committee.

C. Graduate Program Coordinator

Christal Winter is the student's first source of administrative information and assistance. New graduate students must register with the Graduate Program Coordinator, fill out a graduate student information form, and receive copies of the Graduate Study Handbook. Continuing students should fill out a new form whenever their local or office addresses change.

D. Advisory Committees

Various advisory committees including the Ph.D. Qualifying Exam Committee and M.S. Thesis or Dissertation Committee will guide each student during the progress toward a graduate degree. One attribute of an appropriately constituted advisory committee is that the faculty members represent broadly the various disciplines included in Biomedical Engineering as well as the area of the student's primary interest. The Graduate Adviser must endorse these members and nominate them for approval by the Graduate Council; it is within the adviser's purview to reject the student's selections if he/she deems that the committee is not appropriately constituted.

III. ADMISSION

Admission to graduate standing normally requires a minimum undergraduate GPA of 3.25 (out of 4.00) and a minimum quantitative score on the Graduate Record Examination of 700. The combined verbal and quantitative scores should be at least 1200. However, admissions decisions are made on a case-by-case basis. For students who have completed an MS degree, a minimum graduate GPA of 3.50 is normally required. A student may apply for admission for either an MS or a PhD. The MS is not prerequisite to the PhD, and completing the MS requirements does not guarantee admission to the PhD program. An MS student may continue if approval is obtained from the Biomedical Engineering Graduate Admissions Committee. When accepted initially into the PhD program, the student may plan his or her program so as to obtain both degrees, if desired.

We encourage online applications for admission into either program (MS or PhD). Follow the instructions on the [Graduate Admissions](#) page. Printed copies can also be obtained there. After completing this application, contact the Biomedical Engineering Graduate Group to obtain additional information:

Graduate Program Coordinator
Biomedical Engineering Graduate Group
University of California
One Shields Avenue
Davis, CA 95616-5294
(530) 752-2611
bmegradgrp@ucdavis.edu

Prospective students must also complete a [BME Graduate Group application](#) and declare a track of study. In addition to the application forms and transcripts, the program requires three letters

of recommendation and the Graduate Record Examination scores (general test only). Your application is not complete until these items are also received along with the application fee. These materials will be reviewed by Graduate Studies and the Biomedical Engineering Graduate Admissions Committee, after which the student will be notified of their decision.

IV. REQUIREMENTS FOR DEGREES

Minimum Requirements: As a guide in preparing the required program of study, a minimum program has been specified in addition to the requirements of the College of Engineering and the Graduate Council. It is important to note that the University (through the Graduate Council of the Academic Senate and the Office of Graduate Studies), the College of Engineering, and the Graduate Group each have their own sets of requirements and that a student must satisfy all three sets. In this document, the most *restrictive* requirements of the three sets are defined to provide the most useful, concise and thorough guidelines. The student must not be misled, however, by less stringent requirements found in other documents. Students may satisfy degree requirements in effect at the time of their admission or requirements in effect at any time during their graduate studies.

A. Preparation

The group expects strong competence in mathematics and engineering as necessary for successful completion of graduate study. Prior course work in these areas is emphasized in the evaluation of applications. Although some of this training can, in principle, be acquired after admission to the Group, this generally necessitates extending the time to degree. For example, students are cautioned that taking the Math 21 series in the program is the equivalent of a full year delay. Having this series completed prior to entry is highly desirable. For both M.S. and Ph.D. students it is also recommended that as much of the other general preparation coursework as possible be completed prior to beginning graduate study. Finally, the amount of financial support provided by the Graduate Group to students with significant deficiencies in preparation may be limited.

Students entering the biomedical engineering graduate program for M.S. and Ph.D. degrees are expected to have completed the following courses or their equivalents. Deficiencies can be filled during the first few quarters of graduate school. Descriptions of the courses listed below can be found in the General Catalog. To determine course equivalence, consult a Graduate Adviser. Note that Quarter Units = 1.5 x Semester Units. Note that the M.S. degree is NOT a prerequisite for the Ph.D. program in BME.

General Undergraduate Preparation for Masters and Doctoral Degrees

Course Topic	UC Davis equivalent	Quarter Units
• Physics	PHY 9A-9C	15 units
• Physics	PHY 9D	4 units*
• Mathematics	MAT 21A-21D, 22A, 22B	22 units
• Biology	BIS 1A	5 units
• Chemistry	CHE 2A	5 units

• Engineering (programming)	ENG 6	4 units
• Engineering (circuits)	ENG 17	4 units
• Engineering (materials)	ENG 45	4 units*
• Engineering (elect systems)	ENG 100	3 units
• Statistics	STA 130A	4 units

*Students electing the Biomedical Imaging track are required to have taken a course in modern physics (PHY 9D or equivalent), but not necessarily engineering materials (ENG 45 or equivalent). Students electing the Musculoskeletal Biomechanics track are required to have taken an engineering materials course but not necessarily a modern physics course.

Courses numbered 100 and above, not taken to satisfy graduate program prerequisites, may count toward fulfilling graduate unit requirements. Courses numbered 99 and below do not count toward graduate unit requirements. Please consult a Graduate Adviser for details.

B. Courses Available

There are many courses suitable for building options in various specialties within the general area of Biomedical Engineering. Among these courses are a number in the biomedical engineering curriculum, which are listed in Appendix I. Outside of the biomedical engineering curriculum, courses are offered in a wide variety of subject areas in biology and medicine as well as engineering. Subject areas in biology and medicine include anatomy (human and veterinary), biochemistry (human and veterinary), genetics, physiology and other physiological sciences, microbiology (human and veterinary) and molecular and cellular biology. Subject areas in engineering include biological systems, chemical, civil and environmental, electrical and computer, materials science and mechanical. A number of appropriate mathematics, physics, and chemistry courses are also available. Descriptions of individual courses are given in the UC Davis General Catalog.

C. Track Specific Course Work and Approval of Program of Study

Core course requirements and total units are the same for all students. Within each track of study, Biomedical Imaging, Cell and Molecular Systems, and Musculoskeletal Biomechanics, there are track specific courses that must be taken to satisfy degree requirements.

Each student's program of study must be approved by their Major Professor and signed by the Biomedical Engineering Graduate Adviser corresponding to the track that the student intends to pursue. **Students must file a preliminary program of study with the graduate group within the first two weeks of the first quarter of enrollment.** The program of study is to be updated by students annually; the appropriate Graduate Adviser must approve any changes.

For both M.S. and Ph.D. students, the form provided with the checklist of track-specific program requirements should be used. This will be the formal record of the proposed set of courses to satisfy the requirements for the Degree listed in the section, "Course Requirements for Degrees". Copies of the Program of Study and changes thereto must be filed with the Graduate Adviser and the Graduate Program Coordinator. Students may change their track of study prior to advancement to candidacy with the approval of both their current track adviser and the track adviser in the requested track of study.

D. M.S. Degree Requirements – Plan I (Thesis)

1. Course Work

The requirements for a Master of Science degree in Biomedical Engineering are completion of a minimum of 32 units of coursework approved by the Graduate Adviser, including three core courses (below), and an M.S. thesis approved by a three-member faculty committee. These courses must be taken for a letter grade, the minimum acceptable grade is B- and the minimum overall GPA is 3.00. S/U-graded courses, e.g., research 290C and 299 and seminar 290 courses, do not count toward the 32-unit requirement. Each M.S. student must pass the 3 core courses (BIM 202, BIM 204 and BIM 281) and additional track specific course requirements.

To provide breadth in both biological sciences and engineering, at least 8 units of the 32-unit total are required in courses emphasizing biological sciences. The BIM 202 and BIM 204 core courses satisfy this requirement. At least 12 units of the 32-unit total must be graduate-level engineering courses (those numbered 200 – 289). The remaining 12 units must be either advanced undergraduate (courses numbered 100 - 189) or graduate courses (200 – 289). Students must enroll in the BIM 290 seminar course (1 unit) during each quarter it is offered until advancement to candidacy. A signed petition from a Graduate Adviser is required to excuse enrollment in BIM 290. Students select courses in consultation with their Major Professor and Graduate Adviser for the track of study.

2. Thesis

A research project and resulting thesis are major components of the MS degree program (Plan I); a non-thesis option (Plan II) is not available. Usually 12-15 units of research completed under the BIM 299 course number are required. The thesis research is carried out under the supervision of the Major Professor chosen by the student. Well before completion of the thesis work, the student, together with the Major Professor, should identify two additional members of the Thesis Committee. The thesis must demonstrate the student's proficiency in research methods and scientific analysis, and a thorough knowledge of the state-of-the-art of the student's chosen field. Alternatively, the thesis must demonstrate the student's ability to apply known techniques to realize a novel result. Thus, a Master's thesis may take the form of:

- a. an original research contribution of limited scope.
- b. an advanced design project, either analytical or experimental.

The student must file the original thesis with the Office of Graduate Studies and a copy with the BMEGG. The Major Professor and members of the Thesis Committee may also request copies. An exit seminar summarizing the thesis research is strongly encouraged.

M. S. Thesis Committee Membership

A Thesis Committee is appointed to evaluate the merits of the M.S. thesis submitted by a student. The chairperson of this committee for a BMEGG graduate student is required to be a member of the BMEGG and is normally the Major Professor. The other members, minimum of two, are generally faculty members from any department at UC Davis, selected in consultation with the Major Professor, nominated by the Graduate Adviser and approved by the Graduate Council. In addition, either visiting professors at UC Davis, faculty

members at other universities or industrial researchers holding doctoral degrees may serve as members of the committee. In these cases, approval must be obtained from the Graduate Council. To obtain this approval, the candidate must provide the Graduate Adviser with a brief statement indicating the appointee's affiliation and title, what degree he/she holds and evidence that the prospective appointee has special expertise that cannot be duplicated on the campus. The Graduate Council must approve all appointments to the thesis committee.

D. Ph.D. Degree Requirements (Plan C)

1. Course Work

The requirements for the Doctor of Philosophy degree in Biomedical Engineering are completion of a minimum of 48 units of coursework approved by the Graduate Adviser, including four core courses (BIM 202, BIM 204, BIM 281 and BIM 284), and a dissertation approved by a three or more member faculty committee (Plan C). The M.S. degree is NOT a prerequisite for the Ph.D. program. Courses must be taken for a letter grade; the minimum acceptable grade in any course is a B- and the minimum overall GPA is 3.50. S/U-graded courses, e.g., research 290C and 299 and seminar 290 courses, do not count toward the 48-unit requirement.

At least 12 units of the 48-unit total are required in courses emphasizing biological sciences. The BIM 202 and BIM 204 core courses satisfy 9 of the 12 units required. At least 24 units of the 48-unit total must be graduate-level engineering courses (those numbered 200 – 289). The remaining 12 units must be advanced undergraduate (courses numbered 100 - 189) or graduate courses (200 – 289). Students must enroll in BIM 290 seminar course (1 unit) during each quarter it is offered until advancement to candidacy. Students select courses in consultation with their major professor and graduate adviser for the track of study.

2. Examinations

The Biomedical Engineering Graduate Group offers the Ph.D. degree under Plan C and requires three examinations:

Examination 1 is a written preliminary examination usually taken after four quarters of study and no later than the end of the sixth quarter of enrollment (excluding summer quarters). It is a comprehensive test of the material covered in the four graduate core courses and fundamental concepts based on the content of prerequisite coursework. The purpose of this exam is to test the student's ability to integrate information from the various courses and to solve analytical problems. The examination is written and graded by appropriate faculty in the BME Graduate Group. Possible grades are pass, conditional pass, retake (once only), and fail. This examination is usually offered during the Winter or Spring Quarters once each year but may be given twice in a year under special circumstances.

Examination 2: is an oral Qualifying Examination taken upon completion of the coursework described in the track-specific requirements and within one year of passing Examination 1. **The examination must be completed either within three months following completion of the required coursework or sooner,** depending on the Graduate Adviser's assessment of the student's progress. Students who do not complete the examination within the prescribed time frame will be subject to dismissal from the program unless the Graduate Adviser has granted a written extension with specified conditions. The purpose of the qualifying examination is

to assess a student's potential for completing dissertation research that will be of sufficient quality to merit publication in a peer-reviewed journal. Once students have passed the exam and advanced to candidacy, they are not required to take any additional course work.

For this exam, a dissertation plan will be prepared according to the NIH format (including a statement of scientific aims, a section on background and significance, presentation of any preliminary work, and a description of methods) in consultation with the student's major professor. At least two weeks prior to the examination, the plan must be submitted to each member of the oral Qualifying Examination Committee. The plan must be sufficiently detailed to appreciate the importance of the biomedical problem, the relationship of the problem to previous relevant research, and the engineering methods that will be used or developed to solve the problem including their justification. The plan is defended before a 5-member committee with representation both from engineering and biology/medicine.

Ph.D. Qualifying Exam Committee

In preparation for the Qualifying Examination (Examination #2), students, in consultation with their Major Professor, must identify a Ph.D. Committee composed of five faculty members and complete the Ph.D. Qualifying Exam Application Form. The Major Professor can be a member of the committee, but may not chair it. At least three committee members must be BME Graduate Group members. At least one member must be from outside the BME Graduate Group. The Graduate Adviser must endorse these members and nominate them for approval by the Graduate Council; it is within the adviser's purview to reject the student's selections if he/she deems that the committee is not appropriately constituted. One attribute of an appropriately constituted committee is that the faculty members represent broadly the various disciplines included in Biomedical Engineering as well as the area of the student's primary interest. The Graduate Council must approve all appointments to the examination committee.

Examination 3 is an oral examination taken at least one year after Examination 2 and after preparation of a written Ph.D. dissertation. Each student will defend the scientific integrity and presentation of his/her dissertation before a 3 or more member Dissertation Committee. This examination either may be restricted to the members of the committee or it may be open to faculty members and guests. The Chair of the Examining Committee completes the Plan C Defense Form and submits it to the Office of Graduate Studies by the final examination date listed on the academic calendar.

Ph.D. Dissertation Committee

The Dissertation Committee is appointed to evaluate the merits of the Ph.D. dissertation submitted by a student. Students, in consultation with their Major Professor, must identify a Ph.D. Dissertation Committee composed of at least three faculty members and complete the Candidacy for the Degree of Doctor of Philosophy – Plan C Form. The chairperson is required to be a member of the BMEGG and is normally the Major Professor. The Graduate Adviser must endorse these members and nominate them for approval by the Graduate Council; it is within the adviser's purview to reject the student's selections if he/she deems that the committee is not appropriately constituted. One attribute of an appropriately constituted committee is that the faculty members represent broadly the various disciplines included in Biomedical Engineering as well as the area of the student's primary interest. The Graduate Council must approve all appointments to the

examination committee.

3. Dissertation

The recipient of a Ph.D. degree is understood to possess thorough knowledge of a broad field of learning and to have given evidence of distinguished accomplishment in that field. The degree is a demonstration of critical ability and powers of imaginative synthesis. The degree also signifies that the recipient has presented a doctoral dissertation containing an original contribution to knowledge in his or her chosen field of study. The doctoral dissertation must demonstrate the ability to carry out a program of advanced research and to report the results in accordance with standards observed in recognized scientific journals.

The doctoral dissertation is based upon research carried out under the guidance of a Major Professor who is a member of the Graduate Group in Biomedical Engineering. A minimum of two additional faculty members aid in guiding the research program and constitute the Ph.D. Dissertation Committee. Although there is close communication between the student and the Major Professor, consultations shall also occur at reasonable time intervals (six months) between the candidate and the Ph.D. Dissertation Committee meeting as a group. Further, to improve communication between the candidate and the committee, the candidate should regularly submit short abstracts, similar to those required at scientific meetings, stating the progress or the difficulties which are encountered. This continuous flow of information will improve the guidance of the committee during the execution of the project.

The student must file the original dissertation with the Office of Graduate Studies and a bound copy with the Biomedical Engineering Graduate Group.

V. REGISTRATION REQUIREMENTS

Graduate students on the Davis campus are officially students of Graduate Studies. Graduate work is performed under the supervision of faculty members who are organized in groups and departments. Because of this organizational structure, graduate students have to satisfy both the requirements of Graduate Studies and of BMEGG.

A. Graduate Studies Requirements

The College of Engineering Graduate and Undergraduate Bulletin contains the requirements for admission to graduate status in the College, as well as the program requirements for advanced degrees.

University policy requires continuous registration for students from the first quarter of enrollment in a program until completion of the degree, unless the student is:

1. on approved leave of absence (see Planned Educational Leave Program) or
2. qualified for filing fee status.

A student who fails to register except under these conditions is regarded as having withdrawn from the University.

Part-time status is available only to students who are unable to pursue their studies full-time because of full-time employment, health conditions, or family obligations. Part-time students may enroll in no more than 6 units of credit during any quarter; they are not eligible for employment as either a teaching assistant or a graduate student researcher; students on F-1 or J-1 visas are not eligible for part-time status. Applications for part-time status are available from the BMEGG or the Dean of Graduate Studies.

Full time graduate students are expected to enroll in a minimum of 12 units of 100 and 200 level courses, with a maximum of 16 units. Students appointed as TAs are normally limited to a maximum of 12 units of coursework.

B. Biomedical Engineering Graduate Group Requirements

All graduate students are required to enroll in the BIM 290 Seminar each quarter during which the course is offered until advancement to candidacy. Full-time graduate students are required to complete at least 12 units of upper division or graduate credit (including 290 and 299) per quarter of residence each academic year. Part-time graduate students are required to complete at least 6 units of upper division or graduate credit (including 290 and 299) per quarter of residence each academic year. Ph.D. students who have not taken the Qualifying Examination are required to take at least 4 units of formal coursework each quarter exclusive of 290 and 299.

C. Adding/Dropping Courses

Courses may be added any time up to the twelfth day of the quarter and may be dropped up until the 10th or 20th day of the quarter depending on the course. After this time, if a student wishes to drop a course, he or she must obtain a late drop petition from Graduate Studies. On this petition the student must state a legitimate reason why he or she wishes to drop the class, obtain the approval of the Graduate Adviser, and submit it to the Dean of Graduate Studies for approval. This may be done until the time of the final examination.

A student wishing to either add or drop a course after the final examination must submit a petition to the Registrar's Office for consideration by the Grade Change Committee. Such petitions are approved only in unusual and compelling circumstances.

VI. ADVANCEMENT TO CANDIDACY

Every M.S. student must file an official application for Advancement to Candidacy after completion of at least one-half of the course requirements for the degree and at least one quarter before completion of all degree requirements. In the case of the Ph.D. degree, Advancement to Candidacy may not occur until the student has passed the Qualifying Examination. The forms are available at the Office of Graduate Studies, 250 Mrak Hall or at <http://gradstudies.ucdavis.edu/forms/forms.htm>

VII. REVIEW OF STUDENTS' PROGRESS

To aid in the timely completion of their programs, all students' progress will be reviewed at least

once a year by the BMEGG Graduate Advisers. The Graduate Advisers are charged with identifying students whom they feel are not making satisfactory progress, who are not maintaining minimum levels of academic standing, or who are otherwise not achieving for any reason the standards of the Biomedical Engineering Graduate Group. Should a student not make satisfactory progress, then, depending upon the considered severity of the problem, the Graduate Advisers, after consultation with the Major Professor, may address a letter to the student, to the Major Professor, to the Graduate Dean, or to any combination of these. This will state the problem and suggest a program of action that may include disqualification from further graduate study. Every effort should be made to anticipate scholastic difficulties. Students should consult with their instructors when difficulties emerge and should also take advantage of tutoring assistance available from colleagues through the graduate student group.

VIII. RESIDENCE AND SCHOLARSHIP

A. Residence Requirement

Candidates for the M.S. degree must be in residence at least three academic quarters. A student is in academic residence when enrolled in at least 4 units of approved upper division or graduate courses, including research. Two regular six-week summer sessions may be counted as the equivalent of one quarter. Arrangements can be made to satisfy part of the residence requirement by study on another campus of the University of California.

Students working toward a Ph.D. must be registered and in University residence for a minimum of six regular quarters. Two consecutive regular summer sessions may be counted as the equivalent of one regular quarter if at least 2 units are taken in each summer session. A student is in academic residence when enrolled in at least 4 units of approved upper division or graduate courses, including research.

B. Transfer Credit

Though ordinarily all work for the M.S. degree is done in residence, some work taken elsewhere may be credited toward the degree. The normal limit for such transfer work is 6 units from another institution or up to one-half of the unit requirement from another campus of the University, provided that the units were not used to satisfy the requirements for another degree. The following regulations apply specifically to the transfer of units toward M.S. degree requirements.

1. Units of work taken elsewhere than the University of California may not be used to reduce the minimum residence requirements.
2. Courses taken in an undergraduate program at UC Davis can be transferred to a student's graduate record if it can be certified that these courses were not used to fulfill undergraduate degree requirements.
3. A maximum of 12 units of coursework taken under concurrent status through University Extension at UC Davis can be transferred to the graduate record.
4. Requests for transfer credit must be submitted in writing to the Graduate Adviser, and

must be accompanied by an official transcript if the courses in question were taken from University Extension or from any campus other than UC Davis.

C. Satisfactory/Unsatisfactory Grading Option

Students are permitted to include one course in their programs (other than 290 and 299 courses) per quarter taken on a Satisfactory/Unsatisfactory basis. However, this course(s) will not be counted towards satisfying program degree requirements.

D. Standards of Scholarship Required by the Biomedical Engineering Graduate Group

1. Only courses in the 100 and 200 series in which the student receives a grade of at least "B-" or "S" may be counted in satisfaction of the requirements for both the M.S. and Ph.D. degrees. A course in which a student receives a "C" or lower cannot be used to satisfy the unit requirements. For courses in which a student receives a "C+", the student may petition to have this course satisfy the unit requirements. Courses in the 300-400 series may be accepted if they have been approved for credit by the Graduate Council.

2. Candidates for a M.S. degree must maintain an average of at least 3.00 grade points per unit in all upper division and graduate courses elected during their residence as graduate students at the University of California. Application for advancement to candidacy may be made if the average is only slightly below 3.00 and if the student is currently enrolled in course work, the successful completion of which will give him/her the required 3.00 average. Even if advanced, then the student must attain a minimum grade point average of 3.00 before the degree will be awarded.

3. Candidates for a Ph.D. degree must maintain an average of at least 3.50 grade points per unit in all upper division and graduate courses elected during their residence as graduate students at the University of California. Applications for the qualifying examination and advancement to candidacy may be made if the average is only slightly below 3.50 and if the student is currently enrolled in course work, the successful completion of which will give him/her the required 3.50 average. Even if advanced, then the student must attain a minimum grade point average of 3.50 before the degree will be awarded.

4. Courses graded "S/U" will not be counted in determining grade point averages.

E. Minimum Progress Requirements

Full-time students enrolled in a M.S. program are expected to adhere to the following timetable:

	<u>Academic Quarter</u>
a. Submit preliminary program of study to Adviser	1
b. Choose a Major Professor	2
c. Update program of study with Adviser	4
d. Choose a thesis project and committee	4
e. Complete course work (excluding 299)	6
f. File thesis	≤ 7

Full-time students enrolled in the Ph.D. program and who have entered with adequate preparation are expected to adhere to the following timetable:

	<u>Academic Quarter</u>
a. Submit preliminary program of study to Adviser	1
b. Choose a Major Professor	3
c. Update program of study with Adviser	4
d. Pass Preliminary Examination (Exam #1)	5
e. Complete course work (excluding 299)	6
f. Choose a dissertation topic and committee	7
g. Pass Qualifying Examination (Exam #2)	8
h. File dissertation and pass Dissertation Defense (Exam #3)	≤13

The exceptions would be for students who must complete a period of remedial coursework and for part-time students. For students completing the remedial coursework, the same requirements apply following the remedial period.

For part-time students, the same requirements apply, but the consecutive quarters of enrollment listed above are to be multiplied by two.

IX. WITHDRAWAL, LEAVES, AND INTERCAMPUS EXCHANGE

A student who either withdraws or breaks registration without filing for the Planned Educational Leave Program is not guaranteed readmission; his or her application for readmission will be subject to the same review as a new application.

A. Withdrawal

Leaving the University during a quarter entails obtaining a withdrawal petition from the Registrar's Office, having it approved as directed, and then filing it with the Registrar. Failure to follow this procedure may result in an "F" grade being given for each course in which the student is enrolled.

B. Planned Educational Leave Program (PELP)

The Planned Educational Leave Program is designed to allow students to suspend their program of study for good cause (i.e., illness, temporary departure from the University for employment or research away from the campus, preparing for examinations if doing so at a distance from campus, financial problems, personal problems), leave the campus, and be guaranteed the right to return later to resume academic work with a minimum of procedural difficulty. A fee is charged for application to this program. The signature of the Graduate Adviser on the PELP application guarantees the student the right to resume study during the quarter specified on the form. Further information is given on the Application for Planned Educational Leave Program, available from the Graduate Program Coordinator.

PELP is recommended for those students who are certain of the quarter in which they plan to return and who plan to be away no longer than three quarters. If they are not certain of their return date, then it is suggested that the Readmission Application be used. PELP may also be used as a means of withdrawal if a student leaves in the middle of the quarter and the period of the leave is to be for more than one quarter.

1. Duration of Leave

The minimum Planned Educational Leave is one full quarter; the maximum is three quarters. Students may shorten leaves by submitting a written request at least eight weeks prior to the start of the quarter in which he or she plans to re-enroll. Both the Graduate Adviser and the Dean of Graduate Studies must indicate their approval. A student may also lengthen the leave by a written request submitted to the Graduate Adviser and the Dean at least three weeks prior to the start of the quarter in which he or she had planned to return.

2. Availability of University Services

A student on leave shall not be eligible to receive normal University services during the period of the PELP, except as follows:

- a. Placement and Student Employment Services
- b. Advising and Counseling
- c. Housing

Students living in residence halls or married student housing on campus at the time of enrollment in PELP may be provided space if no regularly registered student will be denied space at the time of acceptance of the PELP application. For clarification and for exceptions to the above statement, the student should consult the Housing Office or the regulations that accompany the PELP application.

d. Financial Support

Grants and other financial aid are discontinued for the period of the leave, but financial aid counseling is available.

e. Optional Health Services

A student on PELP may purchase, at his or her own option, a Health card which will entitle him or her to full student health benefits.

3. Academic Credit

Students on PELP are not eligible to enroll in concurrent courses on the Davis campus and may not earn academic credit at Davis during the period of the leave.

4. Employment

University employment of graduate students on PELP is discouraged, although students may be appointed to salary titles ordinarily used for support of graduate students, such as Teaching Assistant, Teaching Fellow, Associate-In, Graduate Reader, or Graduate Student Researcher, for 1 quarter upon approval of a Request for Exception to Policy by the Dean of Graduate Studies.

C. Intercampus Exchange

Any graduate student in good standing who has completed at least one quarter in residence at Davis and who wishes to study temporarily at another UC campus may apply through the Intercampus Exchange Program by obtaining the approval of the Graduate Adviser, the Chairperson of the Department or Group in which they wish to study on the host campus, and the Dean of Graduate Studies on both the home and host campuses. Fees must be paid at the home campus and registration packets must be completed at both campuses. The Intercampus Exchange student has library, health center and other student privileges on the host campus, but is considered as a graduate student in residence on the home campus. The grades obtained in courses on the host campus are transferred to the home campus and entered on the official record. Applications for Intercampus Exchange may be obtained from the Graduate Program Coordinator and should be filed with the home campus Graduate Division three weeks prior to the beginning of the quarter in which the student wishes to participate in the program. A separate application is required for each quarter the student wishes to attend another campus.

The Intercampus Exchange Program is intended to provide a student on one campus of the University the opportunity to enroll in occasional courses not available on his/her home campus. It is not intended as a substitute for intercampus transfer.

It is the policy of the BMEGG to approve applications for Intercampus Exchange only after the student has submitted a program of study and on the approval of the student's Graduate Adviser.

X. FINANCIAL SUPPORT AVAILABLE TO STUDENTS IN THE BIOMEDICAL ENGINEERING GRADUATE GROUP

A. Fellowships and Scholarships

1. Graduate Studies Based

The Graduate Student Support section of the Office Graduate Studies normally handles matters concerning centrally administered fellowships and scholarships. This office should be contacted for relevant information concerning sources, eligibility requirements, and amounts (<http://gradstudies.ucdavis.edu/support/studsup.htm>). Note: to be eligible for fellowships, domestic students must complete the Free Application for Federal Student Aid (FAFSA) available at <http://www.fafsa.ed.gov/>.

2. BMEGG Based

Fellowships are also provided directly by the BMEGG. Students interested in being considered for a program-based fellowship should apply before the January 15 deadline of each year to be considered for the following academic year. The primary criteria used in granting fellowships are academic performance as measured by GPA, degree objective, and progress towards degree objective. Fellowship funds can only be disbursed during the academic year and can be given as a non-resident tuition fellowship (NRTF), as registration fee fellowship, and as a stipend that has no restriction. Note: to be eligible for fellowships, domestic students must complete the Free Application for Federal Student Aid (FAFSA) available at <http://www.fafsa.ed.gov/>.

3. Other

Beyond the fellowship support available from the above internal sources, substantial opportunities exist for obtaining support from outside sources. Sources of pre-doctoral funding for Biomedical Engineering graduate students are the National Science Foundation, National Institutes of Health, and Department of Defense. To be considered for an award from these sources, students must apply during their first quarter of their first year of graduate study. Applications are available from the Graduate Advisers. Only students with exceptional GPAs will be competitive for fellowship support from these sources. Although the application process is lengthy, the reward is worth the investment because the award amounts typically cover all fees and living expenses for a multi-year period.

B. Teaching Assistantships

Teaching Assistantships (TAs) are provided by various departments and programs across the UCD campus. Any graduate student can apply for a TA position in any program that offers a course for which the student is qualified. The student must apply through the program of interest and there is no restriction on the number of applications that can be made at any one time. Thus to improve the chances of obtaining a TA position, it is beneficial to make multiple applications.

Theoretically, TA positions are given to the most qualified applicants. However, in practice, many programs give preference to students in that program. Programs that have provided TA positions to BMEGG students in the past include the following:

Department of Mechanical and Aeronautical Engineering
Department of Chemical Engineering and Materials Science
Program in Exercise Biology
College of Biological Sciences
Department of Mathematics

The amount of funding depends on the level of the appointment. Two levels of appointments are normal. A 50% appointment, which is the maximum, requires a time commitment of about 20 hours/week and yields a stipend of about \$1571/month while a 25% appointment yields half of these numbers. In either case, the appointment also provides a registration fee remission.

C. Graduate Student Researchers

Graduate Student Research (GSR) positions are provided by individual faculty members. Students interested in GSR support must approach faculty who are conducting sponsored projects where the skills possessed by the student may be used to advantage. Usually students work as a GSR on a project which also serves to satisfy the thesis or dissertation requirement. However this is not always the case.

As with the TA appointments, the amount of funding for a GSR depends on the level of the appointment. For a 50% appointment, which is the maximum during the academic year, the time commitment is a minimum of 20 hours/week but may be much more, and the salary is about \$1300/month for a GSR step III. Appointment at a higher step involve higher pay. GSR appointments may be made at any level between 25% and 50% during the academic year. If the level is 25% or more, then the appointment also carries with it payment of full registration fees.

Note that it is possible to combine GSR and TA awards to reach the maximum level. Students may receive 100% appointments during the summer quarter with approval of the Graduate Group Chair and if the Major Professor is able and willing to provide the additional financial support.

D. Work/Study Awards

Work/Study awards are provided by the BMEGG. Work/Study awards are made available through sources of federal funding. To be considered for such an award, students must first file a completed Free Application for Federal Student Aid (FAFSA) available on-line at <http://www.fafsa.ed.gov/>. To be considered for the following fiscal year beginning July 1, this form must be filed before the deadline at the beginning of the preceding March. Based on financial information that each student provides on the FAFSA form, the Graduate Financial Aid Office will determine the amount of eligibility if any. Students eligible to receive a work/study award will be considered provided that a request is made from the program at the time of the Call for Requests. This Call goes out to faculty and students usually at the end of the Spring Quarter. Awards are made based on a number of criteria that consider degree objective, academic record (both GPA and progress), major professor, financial need, and receipt of previous awards.

A work/study award pays approximately 75% of a 25% GSR step I salary for one quarter. The balance is paid from a research account of the student's Major Professor. More than one unit may be awarded to a student during the academic year and summer quarter. If the award is given for an academic quarter, then the award also pays 75% of the registration fees for that quarter. Although awards are given primarily for 25% appointments, it is still possible to be supported at the maximum level that is 50% by supplementing the award with an additional 25% appointment as either a GSR or a TA.

E. Loans

Loans are provided through the Office of Financial Aid. As with Work/Study awards, students desiring loans must fill out the FAFSA form. Eligibility for loans is determined from the information provided on this form.

APPENDIX I GRADUATE COURSES IN BIOMEDICAL ENGINEERING

See <http://www.bme.ucdavis.edu/academics/courses.php> for the most up-to-date course listings.