

**Core Topics Requirements for the MS and PhD Degrees
Department of Biomedical Engineering**

1. Introduction

The Joint Department of Biomedical Engineering has an interest in ensuring that its M.S. and Ph.D. graduates demonstrate a certain level of skill in topics fundamental to biomedical engineering. To meet this goal, all M.S. and Ph.D. students will be required to select courses in three engineering core topic areas as detailed below. Further, Ph.D. students will be required to meet grade level requirements in their life science and engineering core topic courses in order to proceed to the written and oral doctoral preliminary exams.

2. Engineering Core Topic Courses

Engineering core topic courses are in general the introductory graduate-level (100-level at UNC or 500-level at NC State) courses in any particular topic area. Students are required to select courses in three different topic areas. Note that taking two courses in the same topic area counts as only a single topic area.

2.1. Initial Engineering Core Topic List

The following will constitute the initial core topic list.

Topic	Courses
Biomaterials	BMME 112: Biomaterials TE 566: Polymeric Biomaterials Engineering
Biomechanics	BMME 102: Biomechanics BME 541: Biomechanics
Biomodeling	BMME 153: Biomathematical Modeling BMA 567: Modeling of Biological Systems
Biosystems	BME 525: Bioelectricity BMME 132 Linear Control Theory
Instrumentation	BMME 111: Biomedical Instrumentation I BMME 154: Microelectrode Techniques BME 522: Medical Instrumentation
Signal Processing	BMME 121: Digital Signal Processing
Biomedical Imaging	BMME 141: Medical Imaging: Ultrasound, MRI, and Optical BMME 142: Medical Imaging: X-ray, CT, and Nuclear
Bioinformatics	3 credits from GNET 210, 211, 212, 213, 214, 215, and/or 216. ST 590A Bioinformatics I
Computer Applications	BMME 120 Real-time Computer Applications
Other Specialty	Reserved for courses with exceptional approval (Sec. 2.4)

Blue courses are UNC-based; Red courses are NCSU-based

2.2. Management of the Engineering Core Topics List

Management of the core topics list will be the responsibility of the Graduate Curriculum Committee. All requests for changes to the list, including addition of new topic areas, addition of courses to existing topic areas, and deletions will be directed to the committee. All changes must be voted on and passed by a majority of members of the committee. The committee will be

responsible for publishing the core topics list and requirements to the department website, and for ensuring that it is kept current.

2.3. *Guidelines for Engineering Core Topics Courses*

The following guidelines should be followed in determining whether a course is appropriate for inclusion as a core topics course:

- It must have substantial graduate-level engineering content.
- It must be relevant to one of the subdisciplines of biomedical engineering.
- It must be at least 100 (UNC) or 500 (NCSU) level.
- It must be at least three credits. A series of related courses totaling at least three credits may also apply.
- It must be graded. Pass/fail courses are not acceptable.
- It must not be an independent study course.

2.4. *Exceptional Approvals by DGS/DGP*

Students may request approval to apply to the core topics requirement a course not found on the list. The Directors of Graduate Studies/Programs may grant *exceptional approval* for such a course if it is found to meet the guidelines for core topics courses (Sec. 2.3). The DGS/DGP will also determine to which core topic area the course applies. A course may be designated “Other Specialty” if it does not fit well into an existing topic area.

Once each semester, the DGS and DGP will report to the Graduate Curriculum Committee a list of courses receiving exceptional approval. The committee must consider these for addition to the core topics list. The committee may dispose of a proposed course in one of three ways:

- It may be added to the core topics list, either to an existing core topic area or with a newly added topic area. In this case, the course will no longer be considered an exceptional-approval course for that student or any others who have taken it.
- The committee may choose not to add the course to the list, but allow the DGS/DGP to approve that course for other students in the future as an exceptional-approval course. The course remains an exceptional-approval course for any and all students who apply it to the core topics requirement.
- The committee may choose not to add the course to the list, and ask that the DGS/DGP not approve that course in the future for any other students. In this event, the course remains an exceptional-approval course for the student in question (that student may apply it to the core topics requirement), but no other students may use it.

A student may have no more than one exceptional-approval course among the three core topics courses.

Special topics courses meeting the guidelines for core topics courses may receive exceptional approval, but will not be added to the core topics list.

2.5. *Students with Advanced Standing*

Students with graduate-level coursework from other programs or universities have additional options for applying courses to the core topics requirement:

- If a student *transfers* a course, it becomes a part of the student’s program of study and can be approved by the DGS/DGP as an equivalent to a course on the core topics list. If the course is not considered to fall into one of the existing topic areas by DGS/DGP, it may still be approved by DGS/DGP (consistent with guidelines for core topics courses above) and will be

considered an exceptional-approval course. Note that the student must officially make the course a part of the program of study; simply having taken the course in the past is not sufficient.

- A student may apply to the core topics requirement any advanced course that lists a core topics course as prerequisite. The advanced course then applies to the core topic in which its prerequisite is listed. In the case of an advanced course with multiple prerequisites in different topic areas, the student may choose the core topic area to which it will apply.

3. Grade Level Requirements for the Ph.D. Degree

Ph.D. students must meet certain grade requirements in their core topics courses in order to continue on to the written and oral preliminary exams.

3.1 Courses used in the Determination of Ph.D. Core Topic Requirements

Five courses will be considered in the determination of whether a student may continue on to the written and oral preliminary exams. These are:

- Three engineering core topics courses
- Two life science courses. In most cases, these will be BMME 151 and 251 or BMME 181 and 281 or PHYS 503 and 504.

If other graduate-level courses of at least three credits are applied to meet the life sciences requirement, the grades in those courses will be used.

If a student has multiple combinations of courses that apply to the core topics requirement, he or she may use the combination most advantageous.

3.2. Grade Requirements

Ph.D. students are expected to complete the core topic requirements in the first two years of study. In the five courses listed above, students must meet the following minimum requirements:

- At least three courses with a grade of A or A- at NCSU or H at UNC;
- No course with a grade of C+, C, or C- at NCSU or L at UNC.

Note that the determination is made by *course*, not number of credits. Courses of 3, 4, or 5 credits all count the same toward this requirement.

If a course sequence of two or more related courses is to be used to meet this requirement, it will be counted as an A or H grade if at least half of the credits applied are graded A, A-, or H and none are graded C+, L, or below. A course sequence will be counted as a B or P grade if at least half of the credits applied are graded B- or P or above.

3.3. Remedies

Students who do not meet the minimum grade requirements in the first two years of study should be encouraged to stop at the M.S. degree. However, with approval of the advisor, students may retake a course or take another course to apply to the requirements.

4. Transition Plan

The common qualifying exam will continue to be offered in its current form for at least two years after this proposal goes into effect. Students entering the program in Spring, 2005 or before may choose to apply the old rules (passing the common qualifying exam) or the new rules (core topics requirements), whichever they feel is most advantageous. Students entering in Fall, 2005 or after may not opt for the qualifying exam.

5. Summary of M.S. Requirements

M.S. students will have to meet the following requirements to fulfill the core topics requirement:

- Passing grades in one course in each of three engineering core topic areas (note that taking two courses in one topic area only counts as a single topic area);
- Eight credits in graduate-level life science topics;
- Three credits in graduate-level statistics;
- Six credits in graduate-level engineering mathematics.

Additional requirements for the M.S. degree will include:

- A plan of work completed and approved by the committee;
- A written or oral exam administered by the student's advisory committee that should address the integration of material learned from the student's coursework with the research thesis created by the student (It may be combined with the presentation of the research thesis.);
- A presentation of the research thesis in a public forum;
- A final signed copy of the thesis, approved by committee members;
- An approved course in the responsible conduct of research.

6. Summary of Ph.D. Requirements

Ph.D. students will have to meet the following requirements to fulfill the core topics requirement:

- One course in each of three engineering core topic areas (note that taking two courses in one topic area only counts as a single topic area);
- Eight credits in graduate-level life science topics;
- Achievement of the grade level requirements detailed in Section 3;
- Three credits in graduate-level statistics;
- Six credits in graduate-level engineering mathematics.

Additional requirements for the Ph.D. degree will include:

- A plan of work completed and approved by the committee;
- At least two course periods taught or public seminars presented;
- A written doctoral preliminary exam administered by the student's Ph.D. committee that should address the integration of material learned from the student's coursework with the research topic and the ability of the student to perform Ph.D.-level research (The exact form of the exam to be determined by the Ph.D. committee);
- An oral doctoral preliminary exam administered by the student's Ph.D. committee that should address the research work to be undertaken, to verify that it is worthy of a Ph.D. degree, and to evaluate the ability of the student to undertake Ph.D.-level research;
- A presentation of the research dissertation in a public forum;
- A final oral exam administered by the student's Ph.D. committee in which the candidate defends the dissertation;
- A final signed copy of the dissertation, approved by committee members;
- An approved course in the responsible conduct of research.