Undergraduate Biomedical Engineering Preparation:

1. **Molecular Biomedical Engineering** (e.g., BME 3010-Fall, no lab version of BME 3010-Fall, BEE 3600-Spring). If you have not taken at least one course, then take at least three credits as a technical elective course (see technical electives section). Please note that BEE 3600 satisfies both the Molecular BME and Cellular BME "Undergraduate BME Preparation" requirements. If completed, please list courses already taken:

2. **Cellular Biomedical Engineering** (e.g., BME 3020-Spring, no lab version of BME 3020-Spring, BEE 3600-Spring). If you have not taken at least one course, then take at least three credits as a technical elective course (see technical electives section). Please note that BEE 3600 satisfies both the Molecular BME and Cellular BME "Undergraduate BME Preparation" requirements. If completed, please list courses already taken:

3. **Quantitative Engineering Physiology I** (renal, respiratory, cardiovascular, and musculoskeletal systems) (e.g., BME 4010-Fall or BME 4810-Spring). If you have not taken at least one course, then take at least three credits as a technical elective course (see technical elective section). Please note that BME 4810 satisfies both Quantitative Engineering Physiology I and II "Undergraduate BME Preparation" requirements. If completed, please list courses already taken:

4. **Quantitative Engineering Physiology II** (chemical and electrical control and communication systems) (e.g., BME 4020-Spring or BME 6501-Spring or BME 4810-Spring). If you have not taken at least one course, then take at least three credits as a technical elective course (see technical elective section). Please note that BME 4810 satisfies both Quantitative Engineering Physiology I and II "Undergraduate BME Preparation" requirements. However, students interested in orthopedic biomechanics are strongly encouraged to take BME 4010. If completed, please list courses already taken:

Undergraduate Biology Preparation:

1. **Molecular and Cellular Biology**, e.g., Biochemistry (e.g., BIOMG 3300-Fall or Spring), Genetics (e.g., BIOMG 2810-Fall or Spring), Cell Biology (e.g., BIOMG 4320-Spring), Microbiology (e.g., BIOMI 2900-Fall or Spring). If you have not taken at least one course, then take at least three credits as a technical elective course (see technical elective section). If completed, please list courses already taken:

2. **Physiology**, e.g., Neurobiology (e.g., BIONB 2220-Spring), Animal Physiology (e.g., BIOAP 3110-Fall), Mammalian Physiology (e.g., BIOAP 4580-Spring), Developmental Biology (e.g., BIOMG 3850-Fall), Embryology (e.g., BIOMG 4890-Spring-NOT OFFERED THIS YEAR). **Taking both BME 4010 and BME 4020 satisfies this requirement.** If you have not taken at least one course, then take at least three credits as a technical elective course (see technical elective section). If completed, please list courses already taken:
## Engineering Fundamentals

Complete one of the following sets of courses (all courses for a letter grade, GPA no less than 2.7, no grade less than a C). Because these courses are undergraduate engineering courses, the Engineering College will not count them in the 30 credits required for an M.Eng. degree. If you have taken these courses previous to coming to the Cornell BME M.Eng. program, then the requirement is completed (please list course).

### For students interested in cellular engineering, tissue engineering, and/or drug delivery ("CBE"):

1. **ENGRD 2190** – Mass and Energy Balances (also CHEME 2190). Fall. 3 credits. Corequisite: physical chemistry course or permission of instructor. It will greatly simplify your curriculum if you take this course or its equivalent before starting your MEng program. Self study is permitted and we can provide a syllabus!

2. Choose one of the following:
   a. **CHEME 3230** – Fluid Mechanics. Spring. 3 credits. Prerequisites: CHEME 2190 and MATH 2930.
   b. **CEE 3310** – Fluid Mechanics. Fall; usually offered in summer for Engineering Co-op Program. 4 credits. Pre-or corequisite: ENGRD 2020.

3. **CHEME 3240** – Heat and Mass Transfer. Fall. 3 credits. Prerequisite: CHEME 3230.

4. **CHEME 3900** – Chemical Kinetics and Reactor Design. Spring. 3 credits. Prerequisites: CHEME 3130 AND CHEME 3230.

### For students interested in bio electronic devices and electrophysics ("ECE"):

1. **ENGRD 2100** – Introduction to Circuits for Electrical and Computer Engineers (also ECE 2100). Fall or Spring. 4 credits. Corequisites: MATH 2930 and PHYS 2213. It will greatly simplify your curriculum if you take this course or its equivalent before starting your MEng program. Self study is permitted and we can provide a syllabus!


3. **ECE 3030** – Electromagnetic Fields and Waves. Fall or summer. 4 credits. Prerequisites: grade of C or better in PHYS 2213, PHYS 2214, MATH 2930, MATH 2940, and ECE/ENGRD 2100.

4. **ECE 3150** – Introduction to Microelectronics. Spring. 4 credits. Prerequisite: ECE/ENGRD 2100.

### For students interested in sequences, signals, images, and video ("ECE"):

1. **ENGRD 2100** – Introduction to Circuits for Electrical and Computer Engineers (also ECE 2100). Fall or spring. 4 credits. Corequisites: MATH 2930 and PHYS 2213. It will greatly simplify your curriculum if you take this course or its equivalent before starting your MEng program. Self study is permitted and we can provide a syllabus!

2. **ECE 2200** – Signals and Systems. Spring (soon fall also). 4 credits. Prerequisites: MATH 2930 and CS1112 OR CS 1132. Corequisite: MATH 2940.

3. **ENGRD 3100** – Introduction to Probability and Random Signals (also ECE 3100). Fall or summer. 4 credits. Prerequisites: MATH 2940, PHYS 2213, or equivalents.

4. **ECE 4110** – Random Signals in Communications and Signal Processing. Fall. 4 credits. Prerequisite: ECE 2200 and ECE 3100, or equivalent.
Masters of Engineering  
BS Life Science curriculum

For student interested in Biomechanics ("MAE" AND "MSE"):

1). Solid Mechanics: Choose one of the following:


Option a). would be strengthened by also taking

MAE 3250 – Analysis of Mechanical and Aerospace Structures. Fall and often Summer. 3 credits. Prerequisites: ENGRD 2020 and MAE 2120

MAE 3250 has a prerequisite of MAE 2120 Mechanical Properties and Selection of Engineering Materials. Spring and sometimes Summer. 3 credits. Prerequisites: ENGRD/TAM 2020 (Statics) with minimum of C- (strictly enforced); MATLAB programming at level of CS 1112 or CS 1132.

2). Fluid Mechanics: Choose one of the following:


The ENGRD 2020 prerequisite is described above, the ENGRD 2210 corequisite is described below, and the second prerequisite is ENGRD 2030 Dynamics (also TAM 2030). Fall and Spring. 3 credits. Prerequisite: ENGRD/TAM 2020. Corequisite: MATH 2930. Required lab and section.

b). CEE 3310 Fluid Mechanics. Fall and often Summer. 4 credits. Prerequisite: ENGRD 2020.

c). BEE 3310 Bio-Fluid Mechanics. Fall and Summer. 4 credits. Prerequisites: ENGRD 2020 and engineering math sequence.

3). Thermodynamics: Choose one of the following:

a). ENGRD 2210 Thermodynamics (also MAE 2210). Fall, Spring, and sometimes Summer. 3 credits. Prerequisites: MATH 1920 (Multivariable Calculus for Engineers) and PHYS 1112 (Physics I, Mechanics).

b). MSE 3030 Thermodynamics of Condensed Systems (also MSE 5830). Fall. 4 credits. Prerequisites: PHYS 2214 (Physics III: Oscillations, Waves, and Quantum Physics) and MATH 2940 (Linear Algebra for Engineers).

Mathematics Fundamentals:

MATH 1910 – Calculus for Engineers
MATH 1920 – Multivariable Calculus for Engineers
MATH 2930 – Differential Equations for Engineers
MATH 2940 – Linear Algebra for Engineers

OR

BME 5400 – Biomedical Computation (allowed to use in cellular engineering concentration as well)
# Masters of Engineering

**BS Life Science curriculum**

## Requirements for Everyone (10 Credits):

<table>
<thead>
<tr>
<th>Credits</th>
<th>Course Description</th>
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<tr>
<td>3</td>
<td>Engineering design: BME 5500 - Product Engineering and Design in Biomedical Engineering. Fall.</td>
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<tr>
<td>6</td>
<td>MEng Project (6 credits): BME 5910 - (2 credits-1st semester) and BME 5920 - (4 credits- 2nd semester)</td>
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<td>1</td>
<td>BME Seminar (graded S/U): BME 5010 Bioengineering Seminar. Fall or Spring.</td>
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</tbody>
</table>

## Concentration (12 credits minimum in your MEng program—need at least 1 course in each of the areas either in your MEng program or previously):

**Cellular engineering, tissue engineering, and drug delivery concentration (below is a list of courses available for this concentration):**

### Fall Courses:
- CHEME 5430 – Bioprocess Engineering
- BME 5850 – Practice in Tissue Engineering
- BME 5400 – Biomedical Computation
- BME 6310 - Principles of Drug Delivery

### Spring Courses:
- BME 7600/BEE 7600 – Nucleic Acid Engineering
- AEP 5520 – Physics of Life
- CHEME 5440 - Systems Biology in Biotechnology and Medicine
- BME 6410 – Biomedical Engineering Analysis of Proteins for Medicine
- BME 5600 - Biotransport and Pharmaceutical Delivery
- BME 6650 – Principles of Tissue Engineering (offered next 2012-2013)

## Biomedical mechanics and biomaterials (below is a list of courses available for this concentration):

### Fall Courses:
- BME 5810 – Soft Tissue Biomechanics
- BME 6640/MAE 6640 – Mechanics of Bone

### Spring Courses:
- BME 5390/FSAD 4390 – Biomedical Materials and Devices for Human Body Repair
- BME 5620/MSE 5620 – Biomineralization: The Formation and Properties of Inorganic Biomaterials
- BME 6501 - Natural Engineering: Developmental Biology Paradigms for Regenerative Medicine
- BME 5690/MAE 5690 - Clinical Biomechanics of Musculoskeletal Tissues
- MAE 4640/BME 4640 - Orthopaedic Tissue Mechanics
- MSE 4610 – Biomedical Materials and their applications

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Last Updated 7/13/2011
Masters of Engineering  
BS Life Science curriculum

Bioinstrumentation and diagnostics (below is a list of courses available for this concentration):

**Fall Courses:**
- BEE 6590 – Biosensors and Bioanalytical Techniques
- BME 4110 – Science and Technology in Human Health
- BME 6180 – Principles of Medical Imaging
- BME 6670/AEP 6630 – Nanobiotechnology
- BME 7310 – Advanced Biomedical Engineering Analysis of Biomedical Systems
- ECE 5040 - Neural and Bioelectronic Interfaces

**Spring Courses:**
- BME 4910/BIONB 4910 – Principles of Neurophysiology
- BME 5780/ECE 5780 – Computer Analysis of Biomedical Images
- BME 6260 – Biomedical Optics, Imaging, and Spectroscopy

Optional Technical Electives:

Courses that are automatically approved are:

1). Any course at the 5000 level or above offered by the College of Engineering  
2). Any course at the 4000 level or above offered by the Department of Physics (College of Arts and Science), the Department of Chemistry and Chemical Biology (College of Arts and Sciences), or the various departments in the College of Agriculture and Life Sciences or the College of Arts and Sciences that participate in the Biological Sciences.  
3). Any courses in the Johnson Graduate School of Management in the NBA or NCC categories at 5000 level or above (e.g., NBA 5070 - Entrepreneurship for Scientists and Engineers. Fall or Spring).

Please list courses to be taken as part of your MEng degree program at Cornell:

____________________  ______________________  ______________________
# BME MEng – Life Science

**Paper Schedulizer**

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<thead>
<tr>
<th>Fall</th>
<th>Spring</th>
<th>Fall</th>
<th>Spring</th>
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<tr>
<td><strong>These classes count toward the 30 credit requirement</strong></td>
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<td>BME 3010</td>
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<td>BME 3600</td>
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**The following categories below don’t count toward the 30 credit requirement**

**Engineering Fundamentals**

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Life Science Graduation Checklist

Undergraduate Biomedical Engineering Preparation:

__ BME 3010  __ BME 3020  __ BME 4010  __ BME 4020

Or List Equivalent Courses: ________________________________________________

Undergraduate Biology Preparation:

_______ Biochemistry

Or List Equivalent Courses: ________________________________________________

_______ Physiology

Or List Equivalent Courses: ________________________________________________

Requirements for Everyone:

__ BME 5500  __ BME 5010  __ BME 5910  __ BME 5920

Concentration areas:

Cellular Engineering, Tissue Engineering, and Drug Delivery

________________________  __________________________

Biomedical Mechanics and Biomaterials

________________________  __________________________

Bioinstrumentation and Diagnostics

________________________  __________________________

Optional Technical Electives:

________________________  __________________________  __________________

Engineering Fundamentals:

________________________  __________________________  __________________

Completed at another institution: ____________________________________________
Mathematics Fundamentals:

___ BME 5400

OR

___ MATH 1910 – Calculus for Engineers
___ MATH 1920 – Multivariable Calculus for Engineers
___ MATH 2930 – Differential Equations for Engineers
___ MATH 2940 – Linear Algebra for Engineers

Completed at another institution: ____________________________

Changes to your curriculum might cause you not to graduate. Please consult with Dr. Peter Doerschuk before making any changes to your curriculum. Original curriculum must be returned to Belinda Floyd.

_________________  __________  ___________________  __________
Peter Doerschuk    Date                  Student               Date

___ Total credits must be greater than 30 with no grade lower than a C- and at most 2 credits S/U
___ Cumulative GPA