# MEng Biomedical Engineering

This document provides a definitive record of the main features of the programme and the learning outcomes that a typical student may reasonably be expected to achieve and demonstrate if s/he takes full advantage of the learning opportunities provided. This programme specification is intended as a reference point for prospective students, current students, external examiners and academic and support staff involved in delivering the programme and enabling student development and achievement.

## Programme Information

<table>
<thead>
<tr>
<th>Award(s)</th>
<th>MEng</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programme Title</td>
<td>Biomedical Engineering</td>
</tr>
<tr>
<td>Programme code</td>
<td>BH9C</td>
</tr>
<tr>
<td>Awarding Institution</td>
<td>Imperial College London</td>
</tr>
<tr>
<td>Teaching Institution</td>
<td>Imperial College London</td>
</tr>
<tr>
<td>Faculty</td>
<td>Faculty of Engineering</td>
</tr>
<tr>
<td>Department</td>
<td>Department of Bioengineering</td>
</tr>
<tr>
<td>Associateship</td>
<td>City and Guilds of London Institute (ACGI)</td>
</tr>
<tr>
<td>Mode and Period of Study</td>
<td>4 academic years full-time</td>
</tr>
<tr>
<td>Cohort Entry Points</td>
<td>Annually in October</td>
</tr>
<tr>
<td>Relevant QAA Benchmark Statement(s) and/or other external reference points</td>
<td>Master’s awards in Engineering UK-SPEC</td>
</tr>
<tr>
<td>Total Credits</td>
<td>ECTS</td>
</tr>
</tbody>
</table>

### FHEQ Level

- Level 7

### EHEA Level

- 2nd cycle

### External Accreditor(s)

- Institution of Engineering and Technology (IET)
- Institution of Mechanical Engineers (IMechE)
- Institute of Materials, Minerals and Mining (IOM3)
- Institute of Physics and Engineering in Medicine (IPEM)

## Specification Details

<table>
<thead>
<tr>
<th>Student cohorts covered by specification</th>
<th>2016/17 entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person responsible for the specification</td>
<td>Professor Martyn Boutelle</td>
</tr>
<tr>
<td>Description of Programme Contents</td>
<td></td>
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</tbody>
</table>

Students are admitted with high grades in three to five STEM subjects. The first year is designed to ensure that all students achieve a common breadth and depth of knowledge in Mathematics, Physics, Chemistry, Biology and Medical Science. The second year builds upon the first year to provide a platform for specialisation.

Practical skills (that complement technical modules) are gained in the first two years in the context of wet and dry laboratories. Design, test and build activities start in the first year, and group working is introduced in fresher’s week, as collaboration in interdisciplinary teams is a key feature of working as a professional Biomedical Engineer. The second year includes a substantial group project. Broader issues such as Ethics are also covered.

In the first two years all modules are compulsory and are delivered in the department. Thereafter students may elect to take some modules in other departments of the Faculty of Engineering. Our students attend the same lectures and take the same assessments as the senior year students in the hosting department. This confirms that the first two years have provided a solid platform for specialisation. The knowledge, understanding and skills acquired throughout the Faculty will be translated into a Bioengineering themed final year individual project.

After two years of compulsory courses (taught in-house) progression on to the third year of the MEng course requires an overall mark of at least 60%. The Director of Courses has the discretion to condone a near miss to this requirement. Otherwise, students are obliged to move to the third year of the BEng programme. The MEng programme has three pathways: Electrical Engineering, Mechanical Engineering and Bioengineering. The pathway choice determines the modules that are compulsory and a set of optional modules. However, there is still scope to take optional modules outside the pathway.

Students entering the final year have no courses that are compulsory, but can choose all of their courses. This allows them to follow the topics that may have caught their interest, or for them to keep their options open. Much of the final year is spent on their individual project, and this is reflected in the mark weighting of the project.

<table>
<thead>
<tr>
<th>Learning Outcomes</th>
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</table>

The programme has been designed so that graduates will be able to demonstrate the following UKSPEC general learning outcomes:

**Knowledge and Understanding:**
- The underlying scientific principles, engineering mathematics and computational tools that underpin Biomedical Engineering.
- The core concepts, principles and theories of Electrical Engineering, Mechanical Engineering, Materials Engineering deployed in a Biological and Medical context.
- Innovative and creative engineering solutions applied to healthcare problems and quality-of-life issues.
- Moral and ethical issues (including professional conduct) and the role of the Professional Engineering Institutes.
**Intellectual Abilities:**
- The application of engineering principles to the analysis and design of Biomedical applications.
- The application of functional decomposition to manage the development of large scale complex systems.
- Critical evaluation of information gathered from academic and technical resources.

**Practical Skills:**
- Develop graduate attributes including global challenges, business and economics, humanities.
- Plan and safely execute experiments in diverse types of laboratories.

**General Transferable Skills:**
- Build team working and communication skills.

**Additionally, MEng graduates will be able to demonstrate:**
- Greater depth and breadth of knowledge and understanding of engineering applied to healthcare problems and quality-of-life issues.
- Additional application of knowledge and understanding in individual and group project work.

The Imperial Graduate Attributes are a set of core competencies which we expect students to achieve through completion of any Imperial College degree programme. The Graduate Attributes are available at: [www.imperial.ac.uk/students/academic-support/graduate-attributes](http://www.imperial.ac.uk/students/academic-support/graduate-attributes)

**Entry Requirements**

<table>
<thead>
<tr>
<th>Academic Requirement</th>
<th>Minimum A<em>AA overall (or equivalent) to include A</em> in Mathematics, A in Physics and an A in Further Mathematics or Chemistry or Biology.</th>
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</thead>
<tbody>
<tr>
<td>Non-academic Requirements</td>
<td>None</td>
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</table>

Applicants may be invited to attend an interview with one or more members of academic staff.

**English Language Requirement**

Standard Requirement: IELTS 6.5 with a minimum of 6.0 in each element or equivalent


**Learning & Teaching Strategy**

| Scheduled Learning & Teaching Methods | Lectures.  
|--------------------------------------|---------------------------------------------------
|                                      | Tutorials and Study groups.  
|                                      | Dry laboratories in Electrical Engineering; Mechanical Engineering, Microcontrollers workshop, Computing, Mathematics, and Wet laboratories to handle Biological and Chemical materials. |
E-learning & Blended Learning Methods
- Virtual Learning Environment using Blackboard.
- Lectures recorded using Panopto.
- Anonymous feedback using Learning Catalytics, and Mentimeter.
- YouTube videos.

Project Learning Methods
- Final year individual project.
- Group project work including peer review.

Assessment Strategy

Assessment Methods
- Assessed coursework includes problem sheets, evaluation of laboratory/technical/project (including planning) reports, oral and poster presentations, academic tutorials, viva-voce examinations.
- Examinations include in-class, mastery (online/written) and written examinations.

Academic Feedback Policy

Feedback will be provided on coursework within two weeks of submission. Feedback may be provided in one of a number of formats, including:

- Oral (during or after lectures)
- Personal (discussion with academics during office hours)
- Interactive (problem solving tutorials with GTAs & study groups)
- Written (solutions/model answers to coursework)

In line with College policy, feedback will not be provided on written examinations. Preliminary results will be provided to students as alpha-grades. Numerical results will be published after the meeting of the final Board of Examiners.

Re-sit Policy

Eligibility for resits is determined by the Examination Board in line with the College policy. The Department of Bioengineering does not normally offer resits in September. Students with marginal failure may be offered a supplementary qualifying test in place of a re-sit opportunity.

The Departmental policy on resits for each year can be found in the regulation documents found at: [http://www.imperial.ac.uk/bioengineering/admin/current-undergraduate-students/](http://www.imperial.ac.uk/bioengineering/admin/current-undergraduate-students/)

The College’s Policy on Re-sits is available at: [www.imperial.ac.uk/registry/exams/resit](http://www.imperial.ac.uk/registry/exams/resit)

Mitigating Circumstances Policy

The College’s Policy on mitigating circumstances makes provision for Boards of Examiners to use their discretion where extenuating circumstances are independently corroborated and are judged by
the advisory panel to be of sufficient severity to have substantially affected a student’s performance.

The College’s Policy on Mitigating Circumstances is available at: [www.imperial.ac.uk/registry/exams](http://www.imperial.ac.uk/registry/exams)

### Programme Structure

<table>
<thead>
<tr>
<th>Year One</th>
<th>Pre-session</th>
<th>Term One</th>
<th>Term Two</th>
<th>Term Three</th>
<th>Term Four</th>
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<tbody>
<tr>
<td>Core Modules</td>
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<td>6</td>
<td>9</td>
<td>1</td>
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<td>Projects</td>
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<th>Term Two</th>
<th>Term Three</th>
<th>Term Four</th>
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<tr>
<td>Core Modules</td>
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<th>Term Two</th>
<th>Term Three</th>
<th>Term Four</th>
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<table>
<thead>
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<th>Pre-session</th>
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<th>Term Two</th>
<th>Term Three</th>
<th>Term Four</th>
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</thead>
<tbody>
<tr>
<td>Elective Modules</td>
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<td>1-6</td>
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<tr>
<td>Projects</td>
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### Assessment Dates & Deadlines

#### Year One

<table>
<thead>
<tr>
<th>Assessment Type</th>
<th>Dates</th>
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<tr>
<td>Written Examinations</td>
<td>December/January and May/June</td>
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<tr>
<td>Coursework Assessments</td>
<td>Continuous</td>
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<tr>
<td>Project Deadlines</td>
<td>June</td>
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<tr>
<td>Practical Assessments</td>
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#### Year Two

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<th>Assessment Type</th>
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<td>Written Examinations</td>
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<tr>
<td>Coursework Assessments</td>
<td>Continuous</td>
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<td>Project Deadlines</td>
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</tr>
<tr>
<td>Practical Assessments</td>
<td>Continuous</td>
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<td>Year Three</td>
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<td>------------------------------------------------</td>
</tr>
<tr>
<td>Written Examinations</td>
<td>December/January and May/June</td>
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<td>Coursework Assessments</td>
<td>Continuous</td>
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<td>Project Deadlines</td>
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<td>Practical Assessments</td>
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<table>
<thead>
<tr>
<th>Year Four</th>
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</thead>
<tbody>
<tr>
<td>Written Examinations</td>
<td>December/January and May/June</td>
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<tr>
<td>Coursework Assessments</td>
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<td>Project Deadlines</td>
<td>June</td>
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<tr>
<td>Practical Assessments</td>
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### Assessment Structure

<table>
<thead>
<tr>
<th>Year 1: Core modules x 15</th>
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<th>11.1%</th>
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<tbody>
<tr>
<td>Year 2: Core modules x 14</td>
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<td>22.2%</td>
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<tr>
<td>Year 3: Core modules x 4</td>
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<td>33.3%</td>
</tr>
<tr>
<td>Elective modules x 4</td>
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<td></td>
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<tr>
<td>Third year group project</td>
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<td></td>
</tr>
<tr>
<td>Year 4: Elective modules x6</td>
<td>60</td>
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<tr>
<td>MEng Individual Project</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td>100%</td>
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</table>

### Rules of Progression

The MEng degree mark is calculated with the year weightings 1:2:3:3, so year 4 counts as 1/3 of the overall degree mark.

In order to pass the **first year** examinations and qualify to progress to the second year, the candidate must achieve a pass mark in every assessment. In addition they must achieve an aggregate mark of at least 40% for Electrical Engineering Labs, Vibrations and Waves, Biomolecular Engineering 1 and Programming 1.

In order to pass the **second year** examination and qualify to progress to the third year, the candidate must achieve a pass mark in each assessment.

To proceed on the MEng programme, a student will normally be expected to achieve an aggregate year 2 mark of at least 60%. Students with an aggregate mark between 55% and 60% may be considered for progression on to the MEng at the discretion of the Director of Courses.

In order to pass the **year 3** examination and proceed to year 4 of the MEng degree, the candidate must satisfy the conditions for years 1 and 2 and following conditions on subjects taken for year 3:

1. (a) achieve a pass mark for each compulsory course
2. (b) achieve an overall average mark of at least 40% across the optional courses
3. (c) achieve a pass mark in the group project.

In general, the regulations for courses taken outside of the Bioengineering Department will follow those of the host Department except under exceptional circumstances where the final decision lies with the Director of Undergraduate Studies of Bioengineering.

Students who do not fulfil the requirements to pass year 3 MEng at first attempt are required to transfer to, and proceed onto the final year of, the BEng course.

In order to pass the **year 4** examination and graduate from the MEng degree the candidate must satisfy the conditions for years 1, 2 and 3 and following conditions on subjects taken in the
Bioengineering Department for year 4:

(a) achieve an overall average mark of at least 40% across the optional courses taken
(b) achieve a pass mark in the final year project.

In addition, the regulations for courses taken outside of the Bioengineering Department will follow those of the host Department except under exceptional circumstances where the final decision lies with the Director of Undergraduate Studies of Bioengineering.

If a student attains a mark below the pass mark in no more than one exam or item of coursework in their final year, but their aggregate is above 40% such that the failed mark is no further away from 40% than their aggregate is above 40%, and their performance in similar subjects is satisfactory enough to demonstrate their competence, the Examiners may, at their discretion, and taking into account information about the student's performance on the entire course, consider the exam a pass and allow the student to graduate.

**Final Degree Classifications**
Third – a student must achieve an aggregate mark of 40%
Lower Second – a student must achieve an aggregate mark of 50%
Upper Second – a student must achieve an aggregate mark of 60%
First - a student must achieve an aggregate mark of 70%
<table>
<thead>
<tr>
<th>Year</th>
<th>% Year Weighting</th>
<th>Module</th>
<th>% Module Weighting</th>
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<tbody>
<tr>
<td>Year One</td>
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<td>Mathematics 1</td>
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<td></td>
<td></td>
<td>Molecules, Cells and Processes</td>
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<tr>
<td></td>
<td></td>
<td>Electromagnetics 1</td>
<td>4.7%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Logic and Digital Systems</td>
<td>9.3%</td>
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<tr>
<td></td>
<td></td>
<td>Medical Science 1</td>
<td>9.3%</td>
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<tr>
<td></td>
<td></td>
<td>Electrical Engineering 1</td>
<td>9.3%</td>
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<tr>
<td></td>
<td></td>
<td>Mechanics 1</td>
<td>9.3%</td>
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<tr>
<td></td>
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<td>Heat and Mass Transport 1</td>
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<td></td>
<td></td>
<td>Bioengineering in Action</td>
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<td></td>
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<td>Wet Lab Skills</td>
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<td>Electronic Build Project</td>
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<td>Vibrations and Waves</td>
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<td></td>
<td>Biomolecular Engineering 1</td>
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<tr>
<td></td>
<td></td>
<td>Programming 1</td>
<td>4.7%</td>
</tr>
<tr>
<td>Year</td>
<td>% Year Weighting</td>
<td>Module</td>
<td>% Module Weighting</td>
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<td>Year Two</td>
<td>22.2%</td>
<td>Mathematics 2</td>
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<td>Engineering Design Project</td>
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<td>Electromagnetics 2</td>
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<td>Biomolecular Engineering 2</td>
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<td></td>
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<td>Programming 2</td>
<td>7.69%</td>
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<td></td>
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<td>Medical Science 2</td>
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<td>Electrical Engineering 2</td>
<td>7.69%</td>
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<td></td>
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<td>Mechanics 2 Solids</td>
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<td>Heat and Mass Transport 2</td>
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<td></td>
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<td>Signals and Systems</td>
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<td>Control Systems</td>
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<td></td>
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<td>Wet Lab Skills</td>
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<td>Mechanics Workshop</td>
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<tr>
<td>Year</td>
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<td>Module</td>
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<tr>
<td>Year Three</td>
<td>33.3%</td>
<td>Modelling in Biology</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physiological Imaging and Monitoring</td>
<td>10%</td>
</tr>
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<td></td>
<td></td>
<td>Biomedical Instrumentation</td>
<td>10%</td>
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<tr>
<td></td>
<td></td>
<td>Biomedical Advanced and Computational Stress Analysis</td>
<td>10%</td>
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<tr>
<td></td>
<td></td>
<td><strong>EITHER</strong>: 2 x modules from elective group (A) and 2 x modules from elective group (B)</td>
<td>10% each</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>OR</strong> 3 x modules from elective group (A) and 1 x module from elective group (B)</td>
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<tr>
<td></td>
<td></td>
<td>MEng Third Year Group Project</td>
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<td>Year Four</td>
<td>33.3%</td>
<td>MEng Individual Project</td>
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<td>At least 2 x modules from elective group (C)</td>
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<td></td>
<td>Up to 3 x modules from elective group (D)</td>
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<td></td>
<td></td>
<td>1 x module from elective group (E)</td>
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## MEng Biomedical Engineering (Mechanical Engineering Pathway)

<table>
<thead>
<tr>
<th>Year</th>
<th>% Year Weighting</th>
<th>Module</th>
<th>% Module Weighting</th>
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<td></td>
<td></td>
<td>Biomechanics</td>
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<td></td>
<td></td>
<td>Physiological Fluid Mechanics</td>
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<td>Biomedical Advanced Computational Stress Analysis</td>
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<tr>
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<td><strong>EITHER</strong>: 2 x modules from elective group (K) and 2 x modules from elective group (L)</td>
<td>10% each</td>
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<tr>
<td></td>
<td></td>
<td><strong>OR</strong> 3 x modules from elective group (K) and 1 x module from elective group (L)</td>
<td>10% each</td>
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<td></td>
<td></td>
<td>MEng Third Year Group Project</td>
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<td>Year Four</td>
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<td>MEng Individual Project</td>
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<td>At least 2 x modules from elective group (M)</td>
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<td>Up to 3 x modules from elective group (N)</td>
<td>10% each</td>
</tr>
<tr>
<td></td>
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<td>1 x module from elective group (O)</td>
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<td>Digital Signal Processing</td>
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<td><strong>OR</strong> 3 x modules from elective group (F) and 1 x module from elective group (G)</td>
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<td>Up to 3 x modules from elective group (I)</td>
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## Indicative Module List – MEng Biomedical Engineering (Electrical Engineering Pathway)

<p>| Code     | Title                                      | Core/Elective | Year | L&amp;T Hours | Ind. Study Hours | Placement Hours | Total Hours | % Written Exam | % Course-work | % Practical | FHEQ Level | ECTS |
|----------|--------------------------------------------|---------------|------|-----------|------------------|-----------------|-------------|---------------|---------------|-------------|------------|-----------|------|
| BE3-HMIB | Modelling in Biology                       | CORE          | 3    | 30        | 120              | 0               | 150         | 50%           | 50%           | 0%          | 6          | 6.00     |
| BE3-HIPR | Image Processing                           | CORE          | 3    | 38        | 112              | 0               | 150         | 100%          | 0%            | 0%          | 6          | 6.00     |
| BE3-HBINST | Biomedical Instrumentation                 | CORE          | 3    | 30        | 120              | 0               | 150         | 50%           | 50%           | 0%          | 6          | 6.00     |
| E3.07    | Digital Signal Processing                  | CORE          | 3    | 20        | 130              | 0               | 150         | 100%          | 0%            | 0%          | 6          | 6.00     |
| BE3-MMGP | MEng Group Project                         | CORE          | 3    | 21        | 279              | 0               | 300         | 0%            | 80%           | 20%         | 6          | 12.00    |
| BE3-HSYNB | Synthetic Biology                          | ELECTIVE (F)  | 3    | 35        | 115              | 0               | 150         | 60%           | 30%           | 10%         | 6          | 6.00     |
| BE3-HPIM | Physiological Imaging and Monitoring       | ELECTIVE (F)  | 3    | 26        | 124              | 0               | 150         | 70%           | 30%           | 0%          | 6          | 6.00     |
| BE3-HBACSA | Biomedical Advanced and Computational Stress Analysis | ELECTIVE (F) | 3    | 30        | 120              | 0               | 150         | 70%           | 30%           | 0%          | 6          | 6.00     |
| BE3-HHCARD | Human Centred Design of Assistive and Rehabilitation Devices | ELECTIVE (F) | 3    | 28        | 122              | 0               | 150         | 0%            | 30%           | 70%         | 6          | 6.00     |
| BE3-HTERM | Tissue Engineering and Regenerative Medicine | ELECTIVE (F/H) | 3/4  | 26        | 124              | 0               | 150         | 100%          | 0%            | 0%          | 6          | 6.00     |
| BE3-MHASP | Hearing and Speech Processing              | ELECTIVE (F/H)| 3/4  | 28        | 122              | 0               | 150         | 100%          | 0%            | 0%          | 6          | 6.00     |
| BE3-MBMIME | Biomimetics                                | ELECTIVE (F/H)| 3/4  | 26        | 124              | 0               | 150         | 100%          | 0%            | 0%          | 6          | 6.00     |
| E3.08    | Advanced Signal Processing                 | ELECTIVE (F)  | 3    | 20        | 130              | 0               | 150         | 100%          | 0%            | 0%          | 6          | 6.00     |</p>
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