# Programme Specification

**Programme title:** MEng (Hons) Engineering (Electronic & Electrical)

**Final award (BSc, MA etc):** MEng (Hons), if students do not successfully complete sufficient modules then they may be awarded a BEng (Hons) or a BEng (Ord). The details of this are given at the end of this document.

**UCAS code:** H601 (UCL internal code UMNEENSEEE14)

**Cohort(s) to which this programme specification is applicable:** 2016 intake onwards

**Awarding institution/body:** University College London

**Teaching institution:** University College London

**Faculty:** Engineering Sciences

**Parent Department:** Electronic & Electrical Engineering

**Departmental web page address:** http://www.ee.ucl.ac.uk/

**Method of study:** Full-time

**Criteria for admission to the programme:** As stated on the UCAS website, e.g., currently A-level offers AAA although this is subject to change

**Length of the programme:** Four years. All students have the option to spend the third year in an approved overseas university on an approved course of study or in a relevant industry

**Level on Framework for Higher Education Qualifications (FHEQ)** 7
Engineering is concerned with developing, providing and maintaining infrastructure, products, processes and services for society. Engineering addresses the complete life-cycle of a product, process or service, from conception, through design and manufacture, to decommissioning and disposal, within the constraints imposed by economic, legal, social, cultural and environmental considerations. Engineering relies on three core elements, namely scientific principles, mathematics and 'realisation'. Scientific principles clearly underpin all engineering, while mathematics is the language used to communicate parameters, model and optimise solutions. Realisation encapsulates the whole range of creative abilities which distinguish the engineer from the scientist; to conceive, make and actually bring to fruition something which has never existed before. This creativity and innovation to develop economically viable and ethically sound sustainable solutions is an essential and distinguishing characteristic of engineering, shared by the many diverse, established and emerging disciplines within engineering.

The UK Standard for Professional Engineering Competence (2014) sets out five main areas of competence expected for Chartered Engineers, each covering a number of different aspects:

A. Use a combination of general and specialist engineering knowledge and understanding to optimise the application of existing and emerging technology.

B. Apply appropriate theoretical and practical methods to the analysis and solution of engineering problems.

C. Provide technical and commercial leadership.

D. Demonstrate effective interpersonal skills.

E. Demonstrate a personal commitment to professional standards, recognising obligations to society, the profession and the environment.
Brief outline of the structure of the programme and its assessment methods:
(see guidance notes)

The first and second year cover the fundamentals of the subject, including key professional skills, and are mandatory and common to all programmes. The programmes are therefore interchangeable until the end of the second year. A tutorial system is operated in Years 1 and 2, with personal tutors offering academic and pastoral support. In the third year there is a major individual project and a wide choice of six further modules in subjects ranging from Entrepreneurship to Electronic Devices and Nanotechnology. In the fourth year there is a major group-based project and a wide choice of five further modules, including access to MSc modules from a range of MSc programs. There is also access to minors and electives in Years 2 to 4, across a range of courses within the Engineering Faculty.

Assessment is based on a combination of end-of-year written exams, project work, programming assignments, laboratory work and coursework.

<table>
<thead>
<tr>
<th>Board of Examiners:</th>
<th>i) Name of Board of Examiners:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Electronic &amp; Electrical Engineering</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Professional body accreditation (if applicable):</th>
<th>Institution of Engineering and Technology (IET)</th>
<th>Date of next scheduled accreditation visit:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2018</td>
</tr>
</tbody>
</table>
EDUCATIONAL AIMS OF THE PROGRAMME:

Electronic and electrical engineering permeates most aspects of modern life, from electricity power generation and transmission industries, the computer revolution, global telecommunications, and the modern entertainment industries. It is also key to the technologies and solutions needed for future energy requirements. Electronic and electrical engineers are critical to systems that sense, transmit and process information, and to the generation, control and application of power. The specific aims of our programme include:

1. To provide students with a knowledge and understanding of core principles of electronic and electrical engineering and of the underlying scientific principles and the context within which electronic engineers have to function.
2. To promote and develop thinking and problem-solving skills.
3. To provide an awareness of the context in which engineering operates in terms of safety, environmental and economic aspects.
4. To provide a wide range of intellectual, practical and transferable skills that will allow students to develop careers in research, industry and other professional areas of the economy.
5. To provide technical awareness in appropriate specialist applications of technology in the electronic and electrical engineering field.
6. To develop the student's mathematical rigour, accuracy and numeracy skills appropriate for professional engineering.
7. To present and develop advanced professional, ethical, economic and management skills relevant to the electronics industry.
8. To provide an advanced knowledge of topics in electronic and electrical engineering, and in associated engineering and scientific disciplines over a broad range of subjects.
9. To offer an integrated, deep and broad, multidisciplinary programme of study that will provide the student with knowledge and understanding of electronic and electrical engineering.
10. To provide an enhanced preparation for professional practice by means of specialist skills and industrially-relevant group-working opportunities that will allow students to develop careers in industries related to electronic and electrical engineering.
11. To enable the degree programme to be seen as a desirable and important route to careers other than electronic & electrical engineering as well as for those who wish to follow careers in this field.
## INTENDED LEARNING OUTCOMES:

The MEng programme is designed to give an enhanced preparation for professional practice. It includes increased breadth and depth of study beyond that of a corresponding BEng (Hons), and an increased emphasis on industrial relevance. Project work within the MEng programme includes both an individual research/design project and a more wide-ranging group project with strong industrial involvement. The programme provides opportunities for students to develop and demonstrate knowledge and understanding, skills, qualities and other attributes in the following areas.

### Knowledge and understanding - Graduates will be able to

- Use knowledge of underlying principles, physics and mathematics on which modern electronics is based, including complex numbers, matrix algebra, differential equations, transform theory, semiconductor physics and optics, to tackle a wide range of tasks, including analysis and design of devices, circuits and systems.
- Understand and apply the fundamental principles that underpin electronic circuits, including Ohm’s Law, Kirchhoff’s Laws, Fourier and Laplace Equations, Maxwell’s Equations, control theory (e.g. using z-transforms for digital control).
- Analyse and design complex electronic systems e.g. device and integrated circuit fabrication, advanced analogue and digital electronics, programming of embedded devices such as FPGAs using Verilog/VHDL, hybrid digital/anologue systems, such as PLL frequency synthesizers and the principles of power systems.
- Draw on materials from a range of courses in electronic and electrical engineering and related disciplines in order to solve problems in electronic and electrical engineering including demonstrating depth and breadth to their learning.
- Apply business and management techniques that are relevant to electronic and electrical engineering.
- Explain the role of electronics in society and the constraints within which their engineering judgement will be exercised.
- Understand the professional and ethical responsibilities of electronic and electrical engineers.
- Appreciate the national and international role of the electronic and electrical engineer and the impact of engineering solutions in a global context.
- Demonstrate a systematic understanding of knowledge, and a critical awareness of current problems and/or new insights, much of which is at, or informed by, the forefront of their academic discipline, field of study or area of professional practice.

### Skills and other attributes – Graduates will be able to

- Deal with complex issues both systematically and creatively, make sound judgments in the absence of complete data, and communicate their conclusions clearly to specialist and non-specialist audiences.
- Demonstrate self-direction and originality in tackling and solving problems and act autonomously in planning and implementing tasks at a professional or equivalent level.
- Continue to advance their knowledge and understanding, and to develop new skills to a high level.
- Have the qualities and transferrable skills necessary for employment in circumstances requiring the independent learning ability required for continuing professional development, the exercise of initiative and personal responsibility, and decision-making and sound judgment in complex and unpredictable situations.
- Use a combination of general and specialist engineering knowledge and understanding to optimise the application of existing and emerging technology.
- Apply appropriate theoretical and practical methods to the analysis and solution of engineering problems
- Use software necessary for engineering analysis and design, including Matlab, Spice and ADS and specific software, such as PCB layout software, if required in projects or labs.
- Demonstrate practical transferrable engineering skills such as programming, system design and development, through the range of labs, scenarios and projects that permeate the programme.
- Apply advanced knowledge in certain areas as appropriate to the third and fourth year options chosen,
- Undertake a large-scale supervised research project in academia or industry and present the results of this work in a written report and oral presentation to peers and staff.
- Work effectively in both individual and group projects.
- Explain in depth the managerial and economic factors facing a professional engineer.
- Interpret specifications and document their solutions to Electronics and Electrical Engineering problems so that others can follow and validate their work.
- Apply professional engineering practice and judgement in project work.
- Appreciate and practice professional skills, including appreciation of sustainability, commercial risk and ethics and understanding of electronic and electrical engineering in the wider context of engineering in general, in accordance with the ethos of the Integrated Engineering Program.
**Intellectual skills – Graduates will be able to**

- Demonstrate a comprehensive understanding of techniques applicable to their own research or advanced scholarship.
- Demonstrate originality in the application of knowledge, together with a practical understanding of how established techniques of research and enquiry are used to create and interpret knowledge in the discipline.
- Show originality in tackling and solving problems.
- Understand how the boundaries of knowledge are advanced through research.
- Demonstrate a conceptual understanding that enables the student to evaluate critically current research and advanced scholarship in the discipline.
- Demonstrate a conceptual understanding that enables the student to evaluate methodologies and develop critiques of them and, where appropriate, to propose new hypotheses.
- Apply appropriate quantitative mathematical, scientific and engineering tools to the analysis of problems.
- Analyse and solve engineering problems, applying rigour in any related mathematics.
- Design an Electronic and Electrical Engineering system, component or process to meet a need.
- Be creative in the solution of problems and in the development of designs.
- Integrate knowledge and understanding of other scientific, mathematical, computational or engineering disciplines in order to support their engineering specialisation.
- Formulate and test hypotheses modifying the hypotheses depending on the data obtained.
- Evaluate designs, processes and products and make improvements.
- Take a holistic approach in solving problems and designing systems, applying professional judgements to balance risks, costs, benefits, safety, reliability, aesthetics and environmental impact.

**Characteristics – Engineering Graduates will**

- Be rational and pragmatic, interested in the practical steps necessary for a concept to become reality.
- Strive to achieve sustainable solutions to problems and have strategies for being creative, innovative and overcoming difficulties by employing their knowledge in a flexible manner.
- Be numerate and highly computer literate, and capable of attention to detail.
- Be cost and value-conscious, and aware of the social, cultural, environmental, health and safety, and wider professional responsibilities they should display.
- Appreciate the international dimension to engineering, commerce and communication.
- When faced with an ethical issue be able to formulate and operate within appropriate codes of conduct.
- Adopt a professional outlook, capable of team working, effective communicators, and able to exercise responsibility.

The detailed differences between the various specialised degree programs can be found in the Program Structure section at the end of this document.
### A: Knowledge and understanding

<table>
<thead>
<tr>
<th>Knowledge and understanding of:</th>
<th>Teaching/learning methods and strategies:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fundamental principles of electronics including field theory, semiconductor materials</td>
<td>Taught courses, including tailor-made mathematics courses</td>
</tr>
<tr>
<td>Circuit theory, both analogue and digital</td>
<td>Laboratory experiments</td>
</tr>
<tr>
<td>Analytic and modelling techniques relevant to electronic devices, circuits and systems</td>
<td>“Scenario” weeks (group project based learning)</td>
</tr>
<tr>
<td>The design process, including practical examples of design</td>
<td>Computer program assignments</td>
</tr>
<tr>
<td>Mathematical techniques relevant to the discipline</td>
<td>Coursework</td>
</tr>
<tr>
<td>Application of theory to address real-world problems, needs and requirements</td>
<td>Exercise sheets</td>
</tr>
<tr>
<td></td>
<td>Tutorial system for pastoral and technical support</td>
</tr>
</tbody>
</table>

### Assessment:
- Written exams
- Mid-sessional exams
- Laboratory reports
- Scenario reports and presentations
- Project reports
- Project vivas and presentations

### B: Skills and other attributes

<table>
<thead>
<tr>
<th>Intellectual (thinking) skills:</th>
<th>Teaching/learning methods and strategies:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability to identify and solve problems, to analyse and interpret and use critical thinking to approach an engineering problem</td>
<td>Taught lectures</td>
</tr>
<tr>
<td>Ability to use design tools, e.g. Matlab, relevant to the discipline and understand their limitations</td>
<td>Laboratory work</td>
</tr>
<tr>
<td></td>
<td>Project work including Grand Challenges</td>
</tr>
</tbody>
</table>
### C: Skills and other attributes

**Practical skills (able to):**
- Develop circuits and systems, e.g. involving soldering and/or breadboarding
- Program effectively, e.g. using Java/C, VHDL
- Manage and execute projects, including a major Fourth Year group project

**Teaching/learning methods and strategies:**
- Laboratories
- Key skills lectures
- Computer programming exercises
- Project work, particularly the major individual third year project and group fourth year project

**Assessment:**
- Laboratory reports, project reports
- Computer programming assignments
- Project reports, project vivas and project presentations
# D: Skills and other attributes

<table>
<thead>
<tr>
<th>Transferable skills (able to):</th>
<th>Teaching/learning methods and strategies:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effectively deliver public presentations</td>
<td>Transferable skills are developed throughout the teaching and learning programme outlined above and thus distributed throughout the programme. Where appropriate, certain courses will aim particularly to develop specific areas, for example the Good Professional Practice and Engineering Toolbox lectures that address areas of professional practice that are separate from the technical aspects of the programme.</td>
</tr>
<tr>
<td>Managing learning and development, including time management and organisational skills, including within group projects</td>
<td></td>
</tr>
<tr>
<td>To understand and communicate intellectually challenging ideas in writing</td>
<td></td>
</tr>
<tr>
<td>To communicate effectively and clearly in discussions and oral presentations</td>
<td></td>
</tr>
<tr>
<td>To assess the relevance and importance of initially unfamiliar ideas and to exercise critical judgment</td>
<td></td>
</tr>
<tr>
<td>To work independently; and also as a member of a team, recognising the different roles within a team and its organisation</td>
<td></td>
</tr>
<tr>
<td>To have a good appreciation of professional practice including commercial, moral and ethical issues involved in the exploitation of technology</td>
<td></td>
</tr>
<tr>
<td>Appreciation of the need for continuing professional development, adaptability and the ability to learn</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessment:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The various assessment methods employed (see above) cover most of the transferable skills which this programme intends to develop</td>
</tr>
</tbody>
</table>

The following reference points were used in designing the programme:

- the Framework for Higher Education Qualifications: [link](http://www.qaa.ac.uk/en/Publications/Documents/Framework-Higher-Education-Qualifications-08.pdf);
- the relevant Subject Benchmark Statements: [link](http://www.qaa.ac.uk/assuring-standards-and-quality/the-quality-code/subject-benchmark-statements);
- the programme specifications for UCL degree programmes in relevant subjects (where applicable);
- UCL teaching and learning policies;
- staff research.

**Please note:** This specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. More detailed information on the learning outcomes, content and teaching, learning and assessment methods of each course unit/module can be found in the departmental course handbook. The accuracy of the information contained in this document is reviewed annually by UCL and may be checked by the Quality Assurance Agency.

**Programme Organiser(s) Name(s):**
Prof. Paul Brennan

**Date of Production:**
July 2016
<table>
<thead>
<tr>
<th>Date of Review:</th>
<th>July 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date approved by Head of Department:</td>
<td></td>
</tr>
<tr>
<td>Date approved by Chair of Departmental Teaching Committee:</td>
<td></td>
</tr>
<tr>
<td>Date approved by Faculty Teaching Committee:</td>
<td></td>
</tr>
</tbody>
</table>