Programme Specification[1]

1. Programme Title(s) and Code(s):

Programme Title	*UCAS Code*	*GU Code*
MEng Biomedical Engineering	J700	J700-2204

2. Academic Session:

2018-19

3. SCQF Level (see Scottish Credit and Qualifications Framework Levels):

11

4. Credits:

600

5. Entrance Requirements:

Please refer to the current undergraduate prospectus at: http://www.gla.ac.uk/undergraduate/prospectus/

6. ATAS Certificate Requirement (see Academic Technology Approval Scheme):

ATAS Certificate not required

7. Attendance Type:

Full Time

8. Programme Aims:

Biomedical Engineering is the application of engineering concepts to the field of medicine and biomedicine. The Biomedical Engineering degree at the University of Glasgow combines the strong academic engineering education provided within the School of Engineering with the excellent research and teaching activity in the School of Life Sciences and with the international level research activity throughout the University and its allied hospitals in Biomedical Engineering. The blending of these multidisciplinary activities provides the basis for the development of engineers with a good knowledge of the application of engineering skills to the biomedical field.

[1] 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 full advantage is taken of the learning opportunities that are provided. More detailed information on the learning outcomes, content and teaching, learning and assessment methods of each course can be found in course handbooks and other programme documentation and online at www.gla.ac.uk/

The accuracy of the information in this document is reviewed periodically by the University and may be checked by the Quality Assurance Agency for Higher Education.

The professional Biomedical Engineer requires a sound knowledge of the engineering principles and other skills of engineering science in parallel with their application in the biomedical field. These engineering skills include modelling of systems, mechanical analysis, electrical and electronic circuits, medical imaging, biomaterials and biomechanics. These skills will be brought together in the design projects through the degree and in the penultimate year group project and final year MEng project, which is normally to be undertaken furth of the University of Glasgow in either industry or a research laboratory. The Biomedical Engineering degree will allow the graduate to progress into a career in biomedical engineering or engineering or into the research field based on the knowledge developed throughout the degree. Furthermore the graduate will be equipped to develop their skills through continued personal development.

The MEng programme is an integrated Masters programme in Biomedical Engineering designed as a preparation for professional practice. It provides an extended and enhanced programme of study beyond the BEng and is not simply a one year extension to the BEng. It is designed for the more able student. The programme of study is both broader and deeper than the corresponding BEng (Hons). The Faster Route MEng allows very able students with very good Advanced Highers or A Levels or equivalent to enter the second year of the MEng degree programme.

The MEng degree sets out to:

- To present an integrated in depth multidisciplinary programme of study which will provide the student with knowledge and understanding of Biomedical Engineering as applied throughout the body;
- To provide opportunities for the student to study in depth a choice of specialist subjects within the field of Biomedical Engineering;
- To provide an opportunity for students to develop transferable problem solving skills in Biomedical Engineering in group and large scale individual project work;
- To provide technical awareness in appropriate specialist applications of technology in the Biomedical Engineering field;
- To develop the student's mathematical skills, accuracy and numerate skills as required by a professional engineer at the MEng level;
- To develop the student's communication skills via written reports and oral presentations of both group and individual projects;
- To present professional, economic and management issues relevant to the Biomedical Engineering industry;
- To provide depth and breadth at an awareness level for later expansion;
- To provide the opportunity for high level project work in universities or industry worldwide;
- To develop the student's awareness of the ethical problems within the Biomedical Engineering field.

9. Intended Learning Outcomes of Programme:

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:

An MEng graduate will be able to:

- Use their knowledge and understanding of the appropriate mathematical, scientific and computational tools that underpin Biomedical Engineering, to solve, in depth, analytical, design or theoretical problems in the field of Biomedical Engineering;
- Apply their knowledge and understanding of physical and biological laws, mathematics and numerical analysis in order to model Biomedical Engineering and similar systems;
- Draw on materials from a range of courses and wider reading in Biomedical Engineering principles and in Structural, Mechanical, Electrical and Biomedical Engineering and the Biological Sciences in order to solve problems in Biomedical Engineering including demonstrating depth and breadth to their learning;
- Apply business and management techniques that are relevant to Biomedical Engineering and Biomedical Engineers;
- Explain the role of Biomedical Engineers in society and the constraints within which their engineering judgement will be exercised;
- Explain the professional and ethical responsibilities of Biomedical Engineers including those additional to working within the medical and patient environment;
- Consider the national and international role of the Biomedical Engineer and the impact of engineering solutions in a global context.

Skills and Other Attributes:

By the end of this programme MEng graduates will be able to:

Subject-specific/practical skills

- Plan and execute safely a series of experiments in both the engineering and biomedical context;
- Design, from requirement, market need or specification, a biomedical engineering device implant or system, up to the preliminary design stage, and present this design via a series of poster, written and oral presentationsfrom both group and individual work;
- Use laboratory and workshop equipment to generate data, including both engineering and physiological measurements, with appropriate rigour;
- Analyse experimental results in depth and determine their strength and validity;
- Assess the safety and potential efficacy of a medical device or implant;
- Prepare technical drawings and technical reports;
- Give in depth technical presentations in oral form, as posters or in written form;
- Write up experimental methods, results and conclusions, and carefully and clearly plot experimental or computational results and interpret experimental data by the use of regression, curve fitting and filtering, applying appropriate statistical analysis;
- Use scientific literature effectively and by drawing on their knowledge from lectures and wider reading around the subject be able to solve Biomedical Engineering problems;
- Develop and update a research plan and adjust a work programme in order to conduct a major research project in academia or industry;
- 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;
- Document their solutions to Biomedical Engineering problems so that others can follow and validate their work;
- Apply professional engineering practice and judgement in project work;
- Write computer programs and use computational tools and packages, selecting the appropriate “state of the art” tools to solve Biomedical Engineering problems.

Intellectual skills

An MEng graduate will be able to:

- Apply appropriate quantitative mathematical, scientific and engineering tools to the analysis of problems;
- Apply rigour in mathematics;
- Plan, conduct and report a programme of original research;
- Analyse and solve engineering problems;
- Design a Biomedical 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 modifiying the hypotheses depending on the data obtained;
- Evaluate designs, processes and products and make improvements;
- Integrate and evaluate information and data from a variety of sources;
- Take a holistic approach in solving problems and designing systems, applying professional judgements to balance risks, costs, benefits, safety, reliability, aesthetics and environmental impact.

Transferable/key skills

Graduates will be assessed as being able to:

- Work in a group project environment and contribute effectively to the group project, including working as a member of an interdisciplinary team;
- Work on an individual project involving self-directed research;
- Communicate effectively (in writing, verbally and through drawings);
- Apply mathematic skills (algebra, geometry, modelling, analysis);
- Transfer techniques and solutions from one field of engineering to another and to the biomedical field;
- Use information and communications technology
- Manage resources and time effectively;
- Exercise team leadership;
- Learn independently in familiar and unfamiliar surroundings with open-mindedness and in the spirit of critical enquiry;

- Learn effectively for the purpose of continuing professional development and in a wider context throughout their career.

10. Typical Learning and Teaching Approaches:

Staff involved in the degree programme utilise a wide range of teaching methods that they deem the most appropriate for a particular course. These include:

- Lectures;
- Lecture material placed on web-pages or other e-learning environment;
- External lectures from industry or clinicians;
- Feedback given to students during tutorials;
- Small group and large group tutorial sessions;
- Question and answer sessions during lectures or staff Office Hours;
- Guided reading of texts, journal articles etc., for individual and group projects;
- Completion of web-based exercises or computer based laboratory sessions;
- Laboratory sessions.

11. Typical Assessment Methods:

The degree programme will consist of both taught courses and a major research project. The taught courses will be assessed by various combinations of examinations and coursework. The examinations will assess the theoretical knowledge gained in the individual course units while the experimental and practical skills will be assessed in the laboratory sessions and associated coursework. The group project and final year research project will be assessed both with presentations of the work undertaken and a project report.

Assessment Methods to be used are:

- Written examinations (Summative assessment);
- Oral presentations of individual and group work;
- Individual written project report(s) of both individual and group projects;
- Group written project report(s) of group projects;
- Interview of group project manager and assessment of group project minutes;
- Poster presentation of group project work;
- Practical skills will be assessed through laboratory experiments, write-ups, coursework reports, project reports and presentations;
- Experimental, research and design skills will be assessed through laboratory experiments write-ups, coursework reports, project reports and presentations;
- Presentation skills through group presentations and poster presentations.

12. Programme Structure and Features:

MEng(FR) J700-2204 — last entry in 2012

MEng Year 3

Compulsory Courses

Course Code	Course	Credits	Semester
BIOL2005	Drugs and Disease 2 (7b)	10	2
BIOL2015	Immunology 2 (13a)	10	1
ENG2015	Design and Manufacture 2	10	2
ENG2016	Mechanical Design 2	10	2
ENG3011	Biological Fluid Mechanics 3	10	1
ENG3015	Control EE3	10	2
ENG3034	Instrumentation and Data Systems 3	10	2
ENG3036	Mathematical Modelling and Simulation M3	10	1
ENG3038	Microscopy and Optics 3	10	1

ENG3045	Signal Processing of Biosignatures 3	10	2
PHYS4013	Medical Imaging	10	1
STATS3002	Statistics for Biomedical Engineering 3	10	1
		120	

MEng Year 4

Compulsory Courses

Course Code	Course	Credits	Semester
ENG4036	Biosensors and Diagnostics 4	10	2
ENG4085	Integrated System Design Project 4	20	1 & 2
ENG4113	Rehabilitation Engineering 4	10	2
ENG4178	Biomechanics 4	10	2
ENG4189	Bioethics for Biomedical Engineering 4	10	1
		60	

Optional Courses (choose 60 credits)

Course Code	Course	Credits	Semester
BIOL4124	Tissue and Cell Engineering option	20	1
ENG4004	Advanced Materials Technology P4	10	2
ENG4025	Applied Engineering Mechanics 4	10	1
ENG4042	Control 4	20	1
ENG4053	Digital Signal Processing 4	20	1
ENG4098	Microelectronics in Consumer Products P4	10	1
ENG4118	Robotics 4	20	2
ENG4122	Structural Analysis 4	10	2
ENG5008	Aerospace Control I	10	1

MEng Year 5

Compulsory Courses

Course Code	Course	Credits	Semester
ENG5041P	Individual Project 5	60	1
MGT5068	Professional Practice 5	20	2
		80	

Optional Courses (choose 40 credits)

Course Code	Course	Credits	Semester
ENG5102	Applications of Biomedical Engineering 5	10	2
ENG5106	Bioinformatics and Systems Biology 5	10	2
ENG5281	Energy in Biological Systems M	10	2
ENG5282	Scaffold and Tissues M	10	2
ENG5285	Advanced Imaging and Therapy M	10	2

Course Code	Course	Credits	Semester
BIOL2013	Human Form & Function 2 (7a)	10	Semester 1
BIOL2035	Physiology & Neurosci 2 (4C)	20	Semesters 1 and 2 (Thru)
ENG2004	Analogue Electronics 2	10	Semester 2
ENG2011	Biomaterials 2	10	Semester 1
ENG2012	Biomed Engineering Skills 2	10	Semesters 1 and 2 (Thru)
ENG2015	Design and Manufacture 2	10	Semester 2
ENG2081	Mechanics of Structures 2A	10	Semester 1
ENG2084	Dynamics 2	10	Semester 2
ENG2085	Fluid Mechanics 2	10	Semester 1
ENG2086	Engineering Mathematics 2	20	Semester 1
		120	

Regulations

This programme will be governed by the relevant regulations published in the University Calendar. These regulations include the requirements in relation to:

(a) Award of the degree
(b) Progress
(c) Early exit awards

http://www.gla.ac.uk/services/senateoffice/calendar/

13. Programme Accredited By:

14. Location(s):

Glasgow

15. College:

College of Science and Engineering

16. Lead School/Institute:

Engineering [REG30300000]

17. Is this programme collaborative with another institution:

No

18. Awarding Institution(s):

University of Glasgow

19. Teaching Institution(s):

University of Glasgow

20. Language of Instruction:

English

21. Language of Assessment:

English

22. Relevant QAA Subject Benchmark Statements (see Quality Assurance Agency for Higher Education) and Other External or Internal Reference Points:

This Programme Specification is informed by the QAA Benchmark Statement for Engineering

http://www.qaa.ac.uk/en/Publications/Documents/Subject-benchmark-statement-Engineering-.pdf

It is also informed by the Engineering Council Publication “UK Standard for Professional Engineering Competence (UK-SPEC)”

http://www.engc.org.uk/engcdocuments/internet/Website/UK-SPEC third edition (1).pdf

In addition the programme has been developed with regard to the reports on the development of Biomedical Engineering degrees of the Whitaker Foundation in the USA and the Royal Academy of Engineering report “First Degrees in Medical Engineering – A Positive Step for Engineering?”, Report for the UK Focus on Biomedical Engineering, http://www.raeng.org.uk/policy/ukfocus/publications.htm. Also the Special Issue on Biomedical Engineering Education in Proceedings of the Institution of Mechanical Engineers Part H: Journal of Engineering in Medicine Vol 223(H4) 2009.

23. Additional Relevant Information (if applicable):

Support for students is provided by the Postgraduate/Undergraduate Adviser(s) of Studies supported by University resources such LEADS (www.gla.ac.uk/myglasgow/leads/), Counselling & Psychological Services (www.gla.ac.uk/services/counselling/), the Disability Service (www.gla.ac.uk/services/studentdisability/) and the Careers Service (www.gla.ac.uk/services/careers/).

24. Online Learning:

No

25. Date of approval:	