Engineering Tripos Part IIB, 4G9: Biomedical Engineering, 2024-25

Module Leader

Dr T Bashford [1]

Lecturers

Prof M Sutcliffe (MPFS), Dr T Bashford (TB), Prof T Makin (TM), Prof A Flewitt (AJF)

Timing and Structure

11 lectures; four discussion meetings. Assessment: 100% coursework. Lectures will be recorded.

Aims

The aims of the course are to:

- Provide a comprehensive overview of biomedical engineering
- Outline the key principles of good engineering design in a biomedical context
- Introduce the concept of system design approach for sustainable improvement
- Describe the technology adoption pathway in healthcare

Objectives

As specific objectives, by the end of the course students should be able to:

- Conduct research and define the issues with existing medical devices or clinical procedures
- Understand how to apply engineering knowledge to solve biomedical challenges
- Communicate and work with healthcare professionals to validate the engineering designs
- Use a broader systems design toolkit to address larger and more complex issues in healthcare

Content

The course has four case studies. Students will 'major' on one case study, but will need to attend (either in person or via recorded lectures) the lectures pertaining to the other case studies to cover all the required elements of the course.

General introduction (3L total) [TB (2L); MPFS (0.33L); GMB (0.33L); AJF (0.33L)]

Introduction of biomedical engineering and systems approach to systems improvement; introduction of four case studies

Monitoring after brain injury case study (2L) [TB]

Monitoring after brain injury; novel technology; stakeholder acceptance regulatory pathway.

Biomechanics case study (2L) [MPFS]

Knee biomechanics/kinematics; design for the knee replacement; clinical/patient acceptance

Wearable motor augmentation case study (2L) [TM]

Neurological, neuroanatomical and user considerations in the design of augmentation technology, Basics of anatomy, user needs, patient and public engagement, and rapid iterative design cycling.

Biosensor case study (2L) [AJF]

Concept of point-of-care; microfluidic platform-assisted biosensors; manufacturing

Discussion meetings (5L) [Guest mentors (2L); all lecturers (3L)]

Short presentation sessions from guest mentors (University, NHS, industry) and panel discussions; open discussion meetings with lecturers

Further notes

Please note that the number of places is limited and if the module looks likely to be oversubscribed preference will be given to those who initially selected this module in their preliminary selections on COMET.

Coursework

Coursework	Format	Due date & marks
Initial coursework mapping 'canvas' One-page document focusing on the big picture of the chosen case study Learning objective: • demonstrate the framework of systematic engineering design • encourage the student to plan the case study by raising questions • adapt a genetic system design framework to a specific project at a high level • make an initial list of foci under each key topic on the canvas template	Individual Report anonymously marked	End of week [10%]
Expanded courswork mapping ' canvas' A much expanded version of the first coursework element Learning objective: • provide further guidance on the canvas on the activities that need to be considered by providing example questions • reflect on an accurate problem identification, risk management, the interdependency between technical and social components in the project	Individual Report anonymously marked	End of week [30%]
Final report Final report - 20 page upper limit, 5,000 word upper limit	Individual Report anonymously marked	End of week [60%]

Coursework	Format	Due date & marks
Learning objective: • provide information on the problem formulation, requirement specification, design, risk assessment, stakeholder acceptance, marketing/policy strategy, design solution, etc.		

Booklists

Please refer to the Booklist for Part IIB Courses for references to this module, this can be found on the associated Moodle course.

Examination Guidelines

Please refer to Form & conduct of the examinations [2].

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Links
[1] mailto:tb508@cam.ac.uk
[2] https://teaching25-26.eng.cam.ac.uk/content/form-conduct-examinations