Medical Electronics and Neural Engineering (MPHY0037)

### Description

**Purpose**
This course brings together material from engineering, physics and physiology which is relevant to situations in which electronic devices are in direct contact with the body. Body contact is common in clinical practice with medical devices being used for biosensing and recording biopotentials, such as ECG, as well as for stimulation. The course focuses on interaction with the nervous system. This is relevant to rehabilitation, intensive care, clinical neurophysiology, neuroprosthetics, etc. It should be useful:

- To medical students who will encounter these applications in clinical practice.
- To students who intend to go on to biomedical research.
- To engineering students who go on to specify, design, test or use clinical electrical equipment.

**Aims**
Our aim is to prepare students to work with the kind of electronic devices that interact with people, and in particular patients. As the most common types of interactions are with the neural system, the field is generally known as neural engineering.

We do not provide an introduction to electronics, this is expected known (see prerequisite). Rather, we focus on the knowledge, and practical experiences, required to successfully monitor and process biosignals, whether bio-potentials such as ECG and ENG, or bio-chemical signals. We also consider electrical stimulation and its many applications.

The four topics covered are: electronics (amplifiers and filters), bio-sensors (electrodes and chemical sensors), nerves (anatomy, biophysics, physiology), and applications (biopotential recording and electrical stimulation).

**Learning Objectives**
- To acquire knowledge and/or understanding of:

### Key information

<table>
<thead>
<tr>
<th><strong>Key information</strong></th>
<th><strong>Value</strong></th>
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<tbody>
<tr>
<td><strong>Year</strong></td>
<td>2020/21</td>
</tr>
<tr>
<td><strong>Credit value</strong></td>
<td>15 (150 study hours)</td>
</tr>
<tr>
<td><strong>Delivery</strong></td>
<td>UG L6, Campus-based</td>
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<tr>
<td><strong>Reading List</strong></td>
<td>View on UCL website</td>
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<tr>
<td><strong>Tutor</strong></td>
<td>Dr Henry Lancashire</td>
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<tr>
<td><strong>Term</strong></td>
<td>Term 2</td>
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<td><strong>Timetable</strong></td>
<td>View on UCL website</td>
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### Assessment
- **Written examination (main exam period):** 80.0%
- **Coursework:** 20.0%

### Find out more
For more information about the department, programmes, relevant open days and to browse other modules, visit ucl.ac.uk
The origins of electrophysiological signals and their characteristics.

Essential requirements for electrodes.

Basic principles of bio-chemical sensors

Basic principles of electrical stimulation.

The characteristics and limitations of biomedical amplifiers for acquisition of electrophysiological signals, and to demonstrate how these characteristics are derived from an understanding of electrophysiology, electrode properties and electrical hazards.

To apply this knowledge during laboratory practicals and develop laboratory skills.

To develop problem solving and analysis skills using the knowledge accumulated from this course.

To improve, or develop, communication skills.

To take responsibility for your own learning experience.

Teaching and exams

The teaching methods include lectures, practical sessions, tutorials and students’ own self-directed work, with a strong emphasis on the practical sessions and self-directed work. Students at this level are expected to take responsibility for their learning, and work throughout the term to truly understand the material, wrote learning is insufficient.

A module represents about 150 hours of work from a student. Of these, we aim to provide about 40 contact hours, shared between lectures, practical sessions and tutorials. The rest of the time is dedicated to self-directed, independent, work, such as reading the notes, preparing for a lecture, completing coursework, revising for an assessment, writing up lab reports, researching on the applications as instructed...

The course is assessed by coursework (including Moodle quizzes and lab reports) throughout the term, and a 3 hour unseen written exam.

If you are taking this course at level 6 (typically if you are in the third year of your degree, except for the Biomedical Engineering students), the coursework is worth 20 % and the exam 80 %. For students taking this course at level 7, there is an additional element to the lab reports, making this part of the assessment worth 30 %, while the exam is worth 70 %. Note that every student takes the same exam, only the lab reports contain an additional element.

A video description can be found at the UCL Media Central.
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