Subject Description Form

Subject Code	BME31103
Subject Title	**Applied Electrophysiology**
Credit Value	3
Level	3
Prerequisite	Nil
Objectives	To provide students with fundamental concepts and practical experiences of electrophysiological measurements; to develop students' ability to analyze the bioelectrical signals and solve problems; and to prepare the students in the applications of bioelectrical measurement in modern health care and bioinstrumentation design.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the origination of bioelectricity in neurons and muscles, as well as the related applications in electrophysiological measurement and bioinstrumentation; b. Design and conduct experiments on key electrophysiological measurements; c. Comprehend the routine clinical electrodiagnosis and device-assisted rehabilitation in modern health care; d. Understand electrical hazards and safety procedures to be followed in electrophysiological measurements and instrumentation design.
Contribution to Programme Outcomes (Refer to Part I Section 10)	▪ Programme Outcome 1: Demonstrate an ability to apply knowledge of mathematics, science, and engineering appropriate to the Biomedical Engineering (BME) discipline. (Teach, Practice and Measure) ▪ Programme Outcome 2: Demonstrate an ability to design and conduct BME experiments, as well as to analyze and interpret data. (Teach and Practice) ▪ Programme Outcome 3: Demonstrate an ability to design a system, component, or process relevant to BME to meet desired needs within realistic constraints, such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability. (Teach and Practice) ▪ Programme Outcome 4: Demonstrate an ability to identify, formulate, and solve BME problems. (Teach, Practice and Measure) ▪ Programme Outcome 5: Demonstrate an ability to understand the impact of BME solutions in a global and societal context, especially the

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<tr><td></td><td>importance of health, safety, and environmental considerations to both workers and the general public. (Teach and Measure)
▪ Programme Outcome 7: Demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for BME practice. (Teach and Practice)
▪ Programme Outcome 8: Demonstrate an ability to use the computer/IT tools relevant to the BME discipline along with an understanding of their processes and limitations. (Practice)
▪ Programme Outcome 9: Demonstrate an ability to function in multi-disciplinary teams. (Practice)
▪ Programme Outcome 11: Demonstrate an ability to communicate effectively and advise clients, professional colleagues, and other members of the community. (Practice)
▪ Programme Outcome 12: Demonstrate an ability to recognize the need for, and to engage in life-long learning. (Teach and Practice)</td></tr>
<tr><td>Subject Synopsis/ Indicative Syllabus</td><td>The origins of bioelectricity and their measurements: Action Potentials (AP), Nerve Conduction Studies (NCS), Electromyogram (EMG), Electrocardiogram (ECG), Electroencephalogram (EEG), and Evoked Potentials (EP) by Neuromuscular Electrical Stimulation (NMES) and Transcranial Magnetic Stimulation (TMS).

Interpretation and analysis of bioelectrical signals for their physiological/clinical meanings; identification and solving noise interference during measurements; electrical hazards and safety during electrophysiological measurements.

Working principles of electrophysiological measurement in bioinstrumentation design for diagnosis and treatment.</td></tr>
<tr><td>Teaching and Learning Methodology</td><td>There will be 27 hours lecture and 12 hours laboratory sessions.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="8">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Assignments, student papers, and labs</td><td>60%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Final Examination</td><td>40%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td>100%</td><td colspan="8"></td></tr>
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<tr><td></td><td colspan="2">Note: To pass this subject, students must obtain grade D or above in both continuous assessment and final examination.

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Different assignments will be used to guide the students toward the learning objectives of the subject contents. Grouped student paper presentation will help the students explore the knowledge/information related to but beyond the lectures through team work. Laboratory sessions are included to facilitate students in applying learned knowledge to conduct experimental investigation in applied electrophysiology to analyze bioelectrical signals and solve problems. Students are expected to demonstrate their knowledge through a student paper presentation and a final examination.</td></tr>
<tr><td rowspan="8">Student Study Effort Expected</td><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture</td><td>27 Hrs.</td></tr>
<tr><td>▪ Laboratories</td><td>12 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Lab preparation and report writing</td><td>30 Hrs.</td></tr>
<tr><td>▪ Self-study</td><td>48 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>117 Hrs.</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Reading List and References</td><td colspan="2"><u>Textbook</u>
▪ Webster JG (Editor). Medical Instrumentation Application and Design, John Wiley & Sons, New York, 2020.

<u>Reference Books</u>
▪ Bin He (Editor), Neural Engineering, Springer, 2020.
▪ Webster JG (Editor), Bioinstrumentation, John Wiley & Sons, 2004.
▪ Hu Xiaoling, Intelligent Biomechatronics in Neurorehabilitation, Elsevier, 2019.</td></tr>
<tr><td>Date of Last Major Revision</td><td colspan="2">14 July 2023</td></tr>
<tr><td>Date of Last Minor Revision</td><td colspan="2">14 July 2023</td></tr>
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