

## Subject Description Form

<b>Subject Code</b>	BME42129
<b>Subject Title</b>	<b>Neuroengineering</b>
<b>Credit Value</b>	3
<b>Level</b>	4
<b>Prerequisite</b>	BME31103 Applied Electrophysiology
<b>Objectives</b>	To provide students the principles of computational neuroscience and their applications in current and future technologies of neural rehabilitation and healthcare; and to develop students' ability to trace the advances of technologies in the field.
<b>Intended Learning Outcomes</b>	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Understand the fundamental coding and modeling theories in the nervous systems;</li> <li>b. Understand the basic methods of information processing for neural decoding in the sensorimotor and central nervous systems;</li> <li>c. Learn and apply modeling and data analysis tools to real bio-signals;</li> <li>d. Describe and explain the principles of brain machine interface (BMI), neural prosthetics, functional magnetic resonance imaging, and electromagnetic recording/stimulation;</li> <li>e. Explore and trace the further development of neuroengineering technologies in the future.</li> </ol>
<b>Contribution to Programme Outcomes (Refer to Part I Section 10)</b>	<ul style="list-style-type: none"> <li>▪ Programme Outcome 1: Demonstrate an ability to apply knowledge of mathematics, science, and engineering appropriate to the Biomedical Engineering (BME) discipline. (Teach and Practice)</li> <li>▪ Programme Outcome 2: Demonstrate an ability to design and conduct BME experiments, as well as to analyze and interpret data. (Teach and Practice)</li> <li>▪ 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)</li> <li>▪ Programme Outcome 4: Demonstrate an ability to identify, formulate, and solve BME problems. (Teach and Practice)</li> <li>▪ Programme Outcome 5: Demonstrate an ability to understand the impact of BME solutions in a global and societal context, especially the</li> </ul>

	<p>importance of health, safety, and environmental considerations to both workers and the general public. (Teach)</p> <ul style="list-style-type: none"> <li>▪ Programme Outcome 7: Demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for BME practice. (Teach and Practice)</li> <li>▪ 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)</li> <li>▪ Programme Outcome 9: Demonstrate an ability to function in multi-disciplinary teams. (Practice)</li> <li>▪ Programme Outcome 11: Demonstrate an ability to communicate effectively and advise clients, professional colleagues, and other members of the community. (Practice)</li> <li>▪ Programme Outcome 12: Demonstrate an ability to recognize the need for, and to engage in life-long learning. (Teach and Practice)</li> </ul>										
<b>Subject Synopsis/ Indicative Syllabus</b>	<p>Clinical and diagnostic neuroengineering; circuit elements of the nervous and sensorimotor systems; biological neural networks; neural coding measurements and their processing: functional magnetic resonance imaging (fMRI); magnetoencephalography (MEG), electroencephalography (EEG), Electrocorticography (ECoG), Electromyography (EMG); neural prosthetics; brain machine interface (BMI); electromagnetic recording/stimulation: deep brain stimulation (DBS), and transcranial magnetic stimulation (TMS).</p>										
<b>Teaching and Learning Methodology</b>	<p>There will be lectures and group projects dealing with principles and examples of the application of neuroengineering. Students also will learn and design novel systems/methods under the supervision of the lecturer to explore their potential to invent. Grouped presentation and demonstration of their inventions will be evaluated by the lecturer and invited external professionals.</p>										
<b>Assessment Methods in Alignment with Intended Learning Outcomes</b>	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)								
	Assignments	20%	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Group project	40%	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Final examination	40%	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Total	100%									

	<p>Note: To pass this subject, students must obtain grade D or above in both continuous assessment and final examination.</p> <p><i>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</i></p> <p>Individual learning outcomes will be assessed as part of the integrated outcome demonstrated by the students in the written assignments and the grouped project. A final examination will be used to establish that the student has understood and can integrate knowledge in neuroengineering to analyze the signals and solve problems.</p>	
<b>Student Study Effort Expected</b>	Class contact:	
	▪ Lecture	16 Hrs.
	▪ In class group project	13 Hrs.
	Other student study effort:	
	▪ Self-study	63 Hrs.
	▪ Preparation for the group project	24 Hrs.
	Total student study effort	126 Hrs.
<b>Reading List and References</b>	<ul style="list-style-type: none"> <li>▪ Daniel J. DiLorenzo, Joseph D. Bronzino, Neuroengineering, 2007.</li> <li>▪ Bruce F. Katz, Neuroengineering the Future: Virtual Minds and the Creation of Immortality, 2008.</li> <li>▪ IOP Publishing, Journal of Neural Engineering, (2004- present).</li> <li>▪ BioMed Central, Journal of NeuroEngineering and Rehabilitation, (2004-present).</li> <li>▪ IEEE, IEEE Transactions on Neural Systems and Rehabilitation Engineering, (1994-present)</li> </ul>	
<b>Date of Last Major Revision</b>	14 July 2014	
<b>Date of Last Minor Revision</b>	10 July 2015	