Subject Description Form

Subject Code	BME21149
Subject Title	**Biomaterials Science and Engineering**
Credit Value	3
Level	2
Prerequisite	ABCT1741 General Chemistry I
Objectives	This is a general subject on biomaterials. It provides students with the knowledge of commonly used materials (polymer, metal, ceramics and composites) in medicine and some fundamentals (mechanical, degradation and biological properties) in biomaterials science.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Demonstrate a broad knowledge of materials science and engineering in biomedical applications; b. Analyze physical properties including degradation and mechanical properties (e.g., stress-strain relationship, material behaviours under axial/torsional/flexural loading) of different kinds of biomaterials; c. Analyze biocompatibility and tissue–material interaction for different kinds of biomaterials; d. Compare the mainstream biomaterials currently used for medical applications including tissue engineering and drug delivery.
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) ▪ Programme Outcome 2: Demonstrate an ability to design and conduct BME experiments, as well as to analyze and interpret data. (Practice) ▪ Programme Outcome 3: Demonstrate an ability to identify, formulate, and solve BME problems. (Practice) ▪ Programme Outcome 4: Demonstrate an ability to understand the impact of BME solutions in a global and societal context, especially the importance of health, safety, and environmental considerations to both workers and the general public. (Teach)
Subject Synopsis/ Indicative Syllabus	Introduction; biomaterials definition; structures and property of biomaterials; processing of biomaterials; biopolymers including natural polymers and synthetic polymers; properties of materials including mechanical, degradation and biological properties for biomedical applications; cell surface interactions; scaffold fabrication; tissue engineering; drug delivery and nanomaterials.

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<tr><td>Teaching and Learning Methodology</td><td>Students will learn basic knowledge and principles of biomaterial science, methods of biomaterial characterization as well as the comparison of different biomaterial properties (mechanical, degradation and biological) for various biomaterial applications in the lectures; Laboratory sessions will help the students practice and gain experience for scaffold fabrication and characterization.</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="4">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></tr>
<tr><td>1. Continuous assessment – quiz</td><td>30%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>2. Continuous assessment – group presentation</td><td>20%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>3. Final exam</td><td>50%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100%</td><td colspan="4"></td></tr>
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Note: To pass this subject, students must obtain grade D or above in both continuous assessment (including home assignments and class quiz) and final examination.
Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:
Continuous assessment will include quiz and group presentation. In the first stage, the students will learn the basic concepts of biomaterials science. One quiz will be followed to testify the outcomes of the first stage learning (outcomes a, b and c). For the second stage of learning, the biocompatibility and other biomaterial related characteristics and the related applications are explored (outcomes a, b, c and d). Second quiz will be followed to testify the outcomes of the second stage learning (outcomes a, b, c and d). Lab and group presentation will be designed to testify how the students understand what they have learned (outcomes a, b, c (lab) and d (group presentation). Then a final exam will be designed to testify the whole outcomes (a, b, c and d) of this course.
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Student Study Effort Expected	Class contact:	
	▪ Lecture	30 Hrs.
	▪ Laboratory	9 Hrs.
	Other student study effort:	
	▪ Preparation for homework and quiz	40 Hrs.
	▪ Preparation for exam	38 Hrs.
	Total student study effort	117 Hrs.
Reading List and References	▪ Nanoengineered Biomaterials for Regenerative Medicine (9780128133569), Mozafari, M., Rajadas, J., Kaplan, D., Elsevier, 2018 ▪ Biomaterials and their applications, Hamid Reza Rezaie, Andreas Ochsner, Leila Bakhtiari, Springer, ISBN 978-3-319-17845-5, 2015 ▪ Biomaterials for Organ and Tissue Regeneration, Edited by Nihal Vrana Helena Knopf-Marques Julien Barthes, ISBN:9780081029060, Elsevier, 2020 ▪ Tissue Engineering for Artificial Organs: Regenerative Medicine, Smart Diagnostics and Personalized Medicine'. Editor. Hasan A. Wiley-VCH. ISBN: 978-3-527-33863-4, 2017	
Date of Last Major Revision	28 December 2021	
Date of Last Minor Revision	17 June 2022	