BME6121: BIOMECHANICS

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Biomechanics

Subject Code
BME - Biomedical Engineering
Course Number
6121

Academic Unit
Biomedical Engineering (BME)

College/School
College of Biomedicine (BD)

Course Duration
One Semester

Credit Units
3

Level
P5, P6 - Postgraduate Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
MBE6121/BME8132 Biomechanics

Exclusive Courses
Nil

Part II Course Details

Abstract
This course aims to introduce students to the concepts that are required for the development of biomedical prosthetic devices in the human body; to provide a supportive, directed experiential and cooperative learning environment for

students to acquire and develop technique knowledge to enable them solve related engineering problems in various biomedical products.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the essential concepts of biomechanics and their impacts on the behavior of physical bodies subject to forces or displacements		x		
2	Identify the mechanical engineering problems in biomaterials and biomedical devices, explain the problems with critical thinking generated from mechanics concepts, and solve the problems with mechanics theory			x	
3	Apply the biomechanics knowledge to explain structural and functional behavior of biomedical applications by conducting a group project				x
4	Present the background, literature information, methodology and results or conclusion of the group project with both scientific written reports and oral presentation			x	x

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	In classroom lectures are focused to develop the conceptual understanding of biomechanics and practical applications in various biomedical products that are in day-today use.	1, 2	2 hrs/week

2	Tutorial/Demo sessions	Tutorial/Demo sessions in classroom or in laboratory are to show students a clearer image of the real world biomedical applications. Students are expected to be actively involved in the process of learning by diagnosing and solving a strategically important real-life problem by applying the engineering concepts and associated methodologies.	3, 4	1 hr/week

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	In-class Test	1, 2	20	The in-class test is to assess students' understanding on the basic concepts of mechanics and the working methodology in various bio-applications.	No
2	Oral presentation and project report	3, 4	40	The oral presentation and project report are to assess students' capability on identifying and solving strategic biomechanics problems.	Yes

Continuous Assessment (%)

60

Examination (%)

40

Examination Duration (Hours)

2

Minimum Continuous Assessment Passing Requirement (%)

30

Minimum Examination Passing Requirement (%)

30

Assessment Rubrics (AR)

Assessment Task
In-class test (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Describe the principles of biomechanics and mechanical design concepts to provide solutions to related problems.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
Group-project report and presentation (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Ability to identify problems and propose methods in analysing/solving biomechanics related problems in real life.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Explain the fundamental concepts and working principles of biomechanics and design, select proper machine elements and solve problems.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
In-class test (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Describe the principles of biomechanics and mechanical design concepts to provide solutions to related problems.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
Group-project report and presentation (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to identify problems and propose methods in analysing/solving biomechanics related problems in real life.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task

Examination (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Explain the fundamental concepts and working principles of biomechanics and design, select proper machine elements and solve problems.

Excellent

(A+, A, A-) High

Good

(B+, B) Significant

Marginal

(B-, C+, C) Basic

Failure

(F) Not even reaching marginal levels

Part III Other Information

Keyword Syllabus

- Biomechanics, biomaterials, cells, tissues, organs, implants, human musculoskeletal system, biomedical devices, cell/surface interactions, endovascular system, drug delivery, dental implants, hip/knee implants, doctor and patients, ethical

- Solid mechanics, fluid mechanics, physical bodies, vector, force, displacement, moment, mechanical properties, Hooke's law, stress, strain, elasticity, plasticity, viscoelasticity, fracture, fatigue, wear, corrosion, toughening of materials, composites

- Problem identification and solving techniques, reporting and presentation

In addition to the examination and in-class test, students are required to learn through a group project in order to improve their understanding on strategic thinking, problem solving, team working processes, the relationships and interactions between the fields of knowledge that they have learnt in this and other courses.

Reading List

Compulsory Readings

	Title
1	Lecture notes and other teaching materials posted in on-line learning system.
2	Biomechanics: Concepts and Computation (Cambridge Texts in Biomedical Engineering), Cees Oomens, Marcel Brekelmans and Frank Baaijens, Cambridge University Press, 2009

Additional Readings

	Title
1	Biomechanics: Mechanical Properties of Living Tissues Y.C. Fung Springer, 1993 (Second Edition)
2	Fundamentals of Biomechanics, Duane Knudson, Springer, 2007 (Second Edition)
3	Introductory Biomechanics: from Cells to Organisms, C. Ross Ethier and Craig A. Simmons, Cambridge University Press, 2007
4	Biomechanics: Circulation Y.C. Fung, Springer, 2010
5	Biomechanics: Principles and Applications, D.R. Peterson and J.D. Bronzino, Editors, CRC Press, 2008
6	Biomaterials Science: An Introduction to Materials in Medicine, B.D. Ratner, A.S. Hoffman, F.J. Schoen and J.E. Lemons, Editors, Academic Press, 2004 (Second Edition)

7	Biomechanics in the Muskuloskeletal System, M. Panjabi & A.A. White II, Philadelphia, PA, 2001
8	Basic Orthopedic Biomechanics, V.C. Mow and W.C. Hayes, Lippincott-Willimas & Wilkins Press, 1997
9	An Introduction to Tissue-Biomaterials Interactions, K.C. Dee, D.A. Puleo and R. Bizios, Wiley-Liss, John Wiley & Sons, 2002