MNE6115: BIO-INSPIRED ROBOTS

Effective Term
Summer Term 2026

Part I Course Overview

Course Title
Bio-Inspired Robots

Subject Code
MNE - Mechanical Engineering
Course Number
6115

Academic Unit
Mechanical Engineering (MNE)

College/School
College of Engineering (EG)

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
BME6115 Biorobotics

Exclusive Courses
Nil

Part II Course Details

Abstract
This course provides a comprehensive introduction to bio-inspired robotics, with a focus on biorobots, biohybrid robots, medical robots, and soft medical micro/nanorobots for biomedical applications. Students will explore how principles

from nature inspire advanced robotic designs, how the integration of living materials in biohybrid systems brings new paradigms, how biorobots advance precision medicine, and how soft micro/nanorobots are applied for biomedical applications. The course covers key principles of the design, fabrication, and applications of bio-inspired robots. By completion of the course, students will be equipped with skills to merge engineering innovation with biomedical insight for next-generation bio-inspired robots and their healthcare applications.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	To compare and evaluate bio-inspired robots, biohybrid robotic systems, medical robots and microrobots.		x	x	
2	To analyze the design, fabrication, and actuation strategies of bio-inspired robots.			x	
3	To master the working principles of biorobotic systems.			x	
4	To analyze, identify novel underlying principles of bio-inspired robotic systems of interest and illustrate how to critically apply them to address healthcare related challenges.			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	The main teaching activity.	1, 2, 3	2 hrs/week
2	Discussion	Seminar-style interactive discussion between students themselves and the instructor based on given topics and readings.	4	1 hr/week

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Mid-term exam	1, 2, 3	20	-	No
2	Group presentation	4	30	Maximum group size of four students.	Yes

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Assessment Rubrics (AR)

Assessment Task

Mid-term exam

Criterion

1. ABILITY to compare and evaluate bio-inspired robots, biohybrid robotic systems, medical robots and microrobots.
2. ABILITY to analyze the design, fabrication, and actuation strategies of bio-inspired robots.
3. ABILITY to master the working principles of biorobotic systems.

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 presentation

Criterion

1. CAPACITY for SELF-DIRECTED LEARNING to study bio-inspired robotic systems.
2. ABILITY to COMMUNICATE and PRESENT the finding bio-inspired robots.
3. ABILITY to critically APPLY principles of bio-inspired robotic systems to address healthcare related challenges.

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

Criterion

1. ABILITY to compare and evaluate bio-inspired robots, biohybrid robotic systems, medical robots and microrobots.
2. ABILITY to analyze the design, fabrication, and actuation strategies of bio-inspired robots.
3. ABILITY to master the working principles of biorobotic systems.

Excellent

(A+, A, A-) High

Good

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Fair

(C+, C, C-) Moderate

Marginal

(D) Basic

Failure

(F) Not even reaching marginal levels

Part III Other Information

Keyword Syllabus

Bio-inspired robotics, Biohybrid robotics, Medical robots, Soft medical micro/nano-robotics, Biomaterials, Precision medicine, Healthcare applications.

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	Sitti, M. Mobile Microrobotics. MIT Press, 2017.
2	Zhang, L., Chiu, P., Chan, K., Recent Progress in Medical Miniature Robots: from Bench to Bedside, Academic Press, 2024.

3	Zhang, L., Zhang, J., Xia, N., Dong, Y., Untethered Miniature Soft Robots: Materials, Fabrications, and Applications, Wiley-VCH Verlag GmbH, 2023.
4	Schweikard, A., & Ernst, F. Medical Robotics. Springer, 2015.
5	Fukuda T, Arai F, Nakajima M. Micro-nanorobotic manipulation systems and their applications. Springer Science & Business Media, 2013.
6	Yi G, Selected topics in micro/nano-robotics for biomedical applications. Springer, 2013.
7	Microrobotics: Methods and Applications, Yves Bellouard, CRC Press, 2009.