BME4106: NEURAL INTERFACING TECHNOLOGIES

Effective Term
Semester A 2026/27

Part I Course Overview

Course Title
Neural Interfacing Technologies

Subject Code
BME - Biomedical Engineering
Course Number
4106

Academic Unit
Biomedical Engineering (BME)

College/School
College of Biomedicine (BD)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

Neural interfaces are an emerging class of devices which electrically, chemically, or optically interact with the nervous system. Neural interfaces find uses in both research and clinic, aiding in our understanding of how the nervous system functions and in the treatment of conditions such as Parkinson’ s disease and spinal cord injury. This course will teach students about neural interfaces, covering concepts such as material choices, fabrication techniques, implant-tissue interactions, and neuronal recording and modulation as well as how these are implemented in interfacing devices.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Explain the fundamental concepts behind neural interface design		x	x	
2	Describe the characteristics and purpose of existing neural interface devices		x	x	
3	Analyse the design principles underlying existing neural interface devices			x	x
4	Apply neural interface design concepts to design devices for new applications in existing healthcare 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	Students will develop fundamental concepts and some understanding of practical implementations of neural interfaces. In some sessions, students will expand and consolidate their understanding of neural interfaces through discussion with the instructor and their peers.	1, 2, 3, 4	3 hrs/week

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	In-class quiz	1, 2	10	-	No
2	Assignment	1, 2, 3, 4	30	-	Yes

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

2

Minimum Continuous Assessment Passing Requirement (%)

30

Minimum Examination Passing Requirement (%)

30

Assessment Rubrics (AR)

Assessment Task

1. In-class quiz

Criterion

Capability to explain, describe and apply the concepts introduced in lectures about the principles underlying neural interfacing.

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

2. Assignment

Criterion

Capability to analyse problems and apply knowledge to develop solutions in neural interfacing using concepts introduced in lectures.

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
3. Examination

Criterion
Capability to analyse problems and apply knowledge to develop solutions in neural interfacing using concepts introduced in lectures.

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

Part III Other Information

Keyword Syllabus

- Design concepts: Feature size, Fabrication material (polymer, metal), Fabrication technique (photolithography, 3D printing, laser cutting), Inflammation, Foreign body reaction.
- Device classes and targets: Electrode array, Neural recording, Neural stimulation, Brain, Spinal cord, Nerve.
- Applications: Fundamental neuroscience research, Neuromodulation, Diagnostics, Closed-loop.

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	Introduction to Bioelectronics: Materials, Devices, and Applications. Eleni Stavrinidou, Christopher M. Proctor, 2022. AIP Publishing LLC. https://doi.org/10.1063/9780735424470
2	Brain–Computer Interfaces: Principles and Practice. Jonathan Wolpaw, Elizabeth W. Wolpaw, 2012. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780195388855.001.0001
3	The Immune Response to Implanted Materials and Devices. Bruna Corradetti, 2017. Springer International Publishing, Cham. https://doi.org/10.1007/978-3-319-45433-7
4	Electrophysiology: Basics, Methods, Modern Approaches and Applications. Second edition, Jürgen Rettinger, Silvia Schwarz, Wolfgang Schwarz, 2022. Springer International Publishing, Cham. https://doi.org/10.1007/978-3-030-86482-8