BME2123: MATHEMATICS FOR BIOMEDICAL ENGINEERING

Effective Term
Semester A 2024/25

Part I Course Overview

Course Title
Mathematics for Biomedical Engineering

Subject Code
BME - Biomedical Engineering
Course Number
2123

Academic Unit
Biomedical Engineering (BME)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

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

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
MA1201 Calculus and Basic Linear Algebra II /
MA1301 Enhanced Calculus and Linear Algebra II; or equivalent#

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Additional Information
#Prerequisites which are not part of the Major Requirement are waived for students admitted with Advanced Standing.

Part II Course Details

Abstract

This course aims to develop a basic understanding of various mathematics tools, with an emphasis on engineering applications to support subsequent courses in BME. Students will learn how to solve ordinary differential equations using analytical methods. Additionally, Fourier series and Laplace transforms will be introduced. The course also covers basic probability and statistical techniques for data analysis and hypothesis testing. Students will be equipped with the quantitative tools necessary for the design and analysis of various engineering systems. Furthermore, there will be a brief introduction to how these tools can be applied in biomedical contexts.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Explain high-level concepts in differential equations, probability, and statistics.		x		
2	Apply basic operations involving Fourier series, Laplace transforms, and probability theory.			x	
3	Demonstrate the capability of solving various differential equations, either explicitly or through series and transforms.			x	
4	Apply statistical computations.			x	
5	Design statistical or mathematical models using differential equations and probability theory, and apply computations for specific applications.		x	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	Lectures	Students will develop an understanding of fundamental concepts, theories and skills.	1, 2, 3, 4, 5	3 hrs/week
2	Tutorials	Students will apply problem-solving skills in a more interactive setting.	2	1 hr/week for 2 weeks

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	In-class Quizzes	1, 2, 3, 4	20	5 in-class quizzes
2	Assignments	1, 2, 3, 4, 5	15	3 assignments
3	Midterm exam	1, 2, 3	25	

Continuous Assessment (%)

60

Examination (%)

40

Examination Duration (Hours)

2

Additional Information for ATs

For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained.

Assessment Rubrics (AR)

Assessment Task

In-class Quizzes

Criterion

Ability to apply the methodology and procedure for solving some ordinary differential equations and statistical 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

Assignments

Criterion

Ability to apply the methodology and procedure for solving some ordinary differential equations and statistical problems.

Excellent (A+, A, A-)

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Assessment Task
Examination

Criterion
Ability to apply the methodology and procedure for solving some ordinary differential equations and statistical problems.

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Part III Other Information

Keyword Syllabus
- Ordinary differential equations.
- Fourier series.
- Laplace transforms.
- Random variables.
- Probability.
- Distributions.
- Data and sample description.
- Estimation of parameters.
- Hypothesis testing.
- Simple linear regression.

Reading List

Compulsory Readings

	Title
1	Advanced Engineering Mathematics (10th Ed.) by Erwin Kreyszig, Wiley, 2011

Additional Readings

	Title
1	Elementary Statistics (11th Ed.) by R. Johnson & P. Kuby, Duxbury, Thomson Learning, 2012