BME6137: MEDICAL DIAGNOSTICS

Effective Term
Semester B 2024/25

Part I Course Overview

Course Title
Medical Diagnostics

Subject Code
BME - Biomedical Engineering
Course Number
6137

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
BME8137 Medical Diagnostics

Exclusive Courses
Nil

Part II Course Details

Abstract
This course will provide students a comprehensive overview of different concepts and tools used in disease prediction, diagnosis, prevention and optimal treatment planning. The first focus area will emphasize the role of diagnostic imaging

in detecting molecules, genes, and cells. Emphasis will be placed on how these techniques can help study molecular mechanisms of disease in vivo. Topics include nuclear imaging techniques: PET, SPECT; molecular MRI and optical imaging methods, targeted probes, molecular imaging in the context of cancer and infectious diseases. The second focus areas will include molecular diagnostics including nucleic acid techniques, OMICS, rapid molecular diagnostics in cancer and infectious disease testing and precision medicine. Introduction to basics of radiomics and AI in diagnosis will also be included. Following the completion of the course, students will have built a strong foundation for future exploration and study in molecular diagnostics.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Understand the principles of medical diagnostics and apply them to diagnosis of cancer and infectious diseases.		x	x	
2	Explain the fundamentals of common tools of molecular diagnostic tests and imaging technologies.		x	x	
3	Discuss the utility of molecular diagnostics in the clinic.		x	x	
4	Critically evaluate current literature and present scientific written and oral reports on relevant topics.		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	Lecture	Explain key concepts in medical diagnostics	1, 2, 3, 4	2 hours/week
2	Tutorial	Solve problems based on concepts discussed during lectures	1, 2, 3, 4	1 hours/week
3	Mini-project	Prepare oral and written proposals on topic of choice through literature review.	2, 3, 4	N.A.

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Assignments	1, 2, 3, 4	20	Assignments based on course modules discussed during the lectures
2	Individual term project (report + presentation)	1, 2, 3, 4	40	Individual term project based on written report and/or oral presentation. The project will focus on review of medical diagnostic test and its clinical application

Continuous Assessment (%)

60

Examination (%)

40

Examination Duration (Hours)

2

Additional Information for ATs

Final exam at the end of semester on questions based on coursework discussed in the lectures

Assessment Rubrics (AR)

Assessment Task

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

Criterion

Ability to describe in detail various concepts learned in different modules; solve problems relevant to in vivo molecular imaging and in vitro molecular diagnostics.

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

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

Criterion

Capacity for self-directed learning; quality of literature review; ability to critically assess the topic; quality of scientific presentation: written and oral.

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

Ability to explain basic concepts and applications of medical diagnostics, apply concepts to solve problems, based on lecture content

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

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

Criterion

Ability to describe in detail various concepts learned in different modules; solve problems relevant to in vivo molecular imaging and in vitro molecular diagnostics.

Excellent

(A+, A, A-) High

Good

(B+, B) Significant

Marginal

(B-, C+, C) Basic

Failure

(F) Not even reaching marginal levels.

Assessment Task

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

Criterion

Capacity for self-directed learning; quality of literature review; ability to critically assess the topic; quality of scientific presentation: written and oral.

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

Ability to explain basic concepts and applications of medical diagnostics, apply concepts to solve problems, based on lecture content

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

Precision Medicine, Molecular imaging, Nuclear Imaging, Biomarkers, Molecular Diagnostics, Rapid Diagnostic Tests, Nucleic Acid Techniques, Cancer Imaging, Infectious Diseases.

Reading List

Compulsory Readings

	Title
1	Molecular Imaging: Principles and Practice. Weissleder R, Ross BD, Rehemtulla A, Gambhir SS (eds). Available online
2	Medical Biotechnology. Edition 1 by Bernard R. Glick, Cheryl L. Patten, Terry L. Delovitch. Available online.
3	Scientific articles

Additional Readings

	Title
1	Janeway's Immunobiology
2	The Cell. 2nd Edition. Geoffrey M. Cooper
3	Tietz Textbook of Clinical Chemistry and Molecular Diagnostics, selected sections