BME8135: ENGINEERING PRINCIPLES FOR DRUG DELIVERY

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Engineering Principles for Drug Delivery

Subject Code
BME - Biomedical Engineering
Course Number
8135

Academic Unit
Biomedical Engineering (BME)

College/School
College of Biomedicine (BD)

Course Duration
One Semester

Credit Units
3

Level
R8 - Research Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
BME6135 Engineering Principles for Drug Delivery

Exclusive Courses
Nil

Part II Course Details

Abstract

Drug delivery aims to modify the exposure of the drugs to people using engineering principles and materials science. It allows the potential of reducing toxicity, increasing efficacy, and improved use. This course is a lecture-based and project-based class. Topics include drug delivery fundamentals and transport mechanisms, materials and formulations for drug delivery, and biomedical applications.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Explain basic concepts and principles of drug delivery (clinical needs)		x	x	
2	Analyse the basic working principles of different drug delivery systems in human body		x	x	x
3	Identify suitable materials, formulations, and devices that can potentially be used to achieve clinically-effective drug delivery			x	x
4	Design formulations and devices that can achieve clinically-effective delivery of drugs			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 concepts of drug delivery and the design of drug delivery system	1, 2, 3, 4	2 hrs/week
2	Tutorial	Recap and expand the materials taught in lectures	1, 2, 3, 4	0.5 hr/week
3	Group project	Provide opportunities for students to integrate the principles taught in lectures through case studies	2, 3, 4	0.5 hr/week

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Group Project	2, 3, 4	20	Promote team-work	No

2	Assignment (including presentation)	1, 2, 3, 4	10	Encourage independence	No

Continuous Assessment (%)

30

Examination (%)

70

Examination Duration (Hours)

2.5

Minimum Continuous Assessment Passing Requirement (%)

30

Minimum Examination Passing Requirement (%)

30

Assessment Rubrics (AR)

Assessment Task

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

Criterion

Ability to identify essential strategies to transport drugs across the biological barriers in therapy, and to explain the engineering principles behind.

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

Criterion

Ability to utilize the materials taught in lectures to analyse and develop customized formulations/devices for specific medical conditions.

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 before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Ability to apply the engineering concepts precisely to solve the existing challenges that can not be addressed in current formulation/devices.

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 analyse the challenges of drug delivery in details, from molecular to cell to system level; and to apply the engineering approach to address these 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
Midterm Test (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to identify essential strategies to transport drugs across the biological barriers in therapy, and to explain the engineering principles behind.

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

Criterion
Ability to utilize the materials taught in lectures to analyse and develop customized formulations/devices for specific medical conditions.

Excellent
(A+, A, A-) High

Good
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Part III Other Information

Keyword Syllabus
Drug delivery barriers
- Pharmacokinetics & Pharmacodynamics
- Drug transport in cells, between cells, and through tissues/organs

Formulations
- Conventional pharmaceutical formulations
- Nanoparticle-based drug delivery systems
- Device-based drug delivery systems

Applications
- Topical/transdermal delivery
- GI delivery
- Systematic delivery
- perspective from industry

Reading List

Compulsory Readings

	Title
1	Allen, Theresa M., and Pieter R. Cullis. Drug delivery systems: entering the mainstream. Science 2004 303: 1818-1822.
2	Tibbitt M W, Dahlman J E, Langer R. Emerging frontiers in drug delivery. Journal of the American Chemical Society, 2016, 138(3): 704-717.
3	Fenton O S, Olafson K N, Pillai P S, et al. Advances in biomaterials for drug delivery. Advanced Materials, 2018, 30(29): 1705328.

Additional Readings

	Title
1	W. Mark Saltzman. Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering). 03/2001, Oxford University Press.
2	Anya M Hillery, Kinam Park. Drug Delivery: Fundamentals and Applications CRC Press 09/2016.
3	Chenjie Xu, Xiaomeng Wang, Manojit Pramanik. Imaging Technologies and Transdermal Delivery in Skin Disorders. 11/2019, Wiley-VCH