

# BME8135: ENGINEERING PRINCIPLES FOR DRUG DELIVERY

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## Effective Term

Semester B 2024/25

## 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	1 hr/week
3	Group project	Provide opportunities for students to integrate the principles taught in lectures through case studies	2, 3, 4	

### Assessment Tasks / Activities (ATs)

ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)	
1	Midterm Test	1, 2	30	
2	Group Project	2, 3, 4	20	Promote team-work

3	Assignment (including presentation)	1, 2, 3, 4	10	Encourage independence
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**Continuous Assessment (%)**

60

**Examination (%)**

40

**Examination Duration (Hours)**

2.5

**Assessment Rubrics (AR)****Assessment Task**

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

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(D) Basic

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**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

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**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

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(D) Basic

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**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

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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

### Reading List

#### Compulsory Readings

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

#### Additional Readings

	Title
1	W. Mark Saltzman. <i>Drug Delivery: Engineering Principles for Drug Therapy (Topics in Chemical Engineering)</i> . 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