

Subject Description Form

Subject Code	ABCT5101
Subject Title	Modern Approaches in Biopharmaceutical Development
Credit Value	3
Level	5
Pre-requisite	Nil
Co-requisite	Nil
Exclusion	Nil
Objectives	<ol style="list-style-type: none">1. To provide a comprehensive review on the nature and principle of therapeutics currently available in the market.2. Foster understanding on target identification to clinical drug development process with specific examples, on how clinical therapeutics are developed, from target identification to product development.3. To provide a comprehensive understanding on different approaches used in early drug discovery process.4. Provide understanding on the principles of different omics technology and discuss how drug discovery process can be fostered by the use of omics.5. To introduce the concept of druggability and lead optimization. Understanding the role of medicinal chemistry in the process.6. To introduce the concept, uses and developments of biologics for the treatment of diseases.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none">a) demonstrate a thorough understanding on the use and development of biopharmaceuticals in the treatment of diseases.b) familiarize with different approaches used in drug discovery.c) appreciate the different factors that determine the potential of drug lead at the pre-clinical stage.d) have a clear knowledge of the drug discovery process, from the identification of drug targets to lead discovery to lead evaluation to optimization.e) gain a basic understanding of the field of biologics and biosimilars.

**Subject Synopsis/
Indicative Syllabus**

- 1. Introduction to Biopharmaceuticals**
 - Pharmaceuticals vs biologics.
 - Currently available therapeutics: small molecules, peptides, cytokines enzymes, and antibodies.
 - Nature, working principles, applications, manufacturing process, limitations of pharmaceuticals vs biologics
 - Combined pharmaceuticals and biologics as a new class of therapeutics.
 - Emerging therapeutics (mRNA vaccine, cell-based therapies)

- 2. Biopharmaceutical development: from drug target identification to therapeutics.**
 - Introduction to drug development process – from target identification to clinical trial.
 - Case studies of biopharmaceutical development in different therapeutic area (cancer, diabetes, hypertension, hypercholesterolemia, infectious diseases).

- 3. Different approaches in drug lead discoveries**
 - Compound libraries- nature and diversities
 - Phenotypic Screening
 - Target-Based Discovery
 - High-Throughput Screening
 - Computer-Aided Drug Design
 - Fragment-Based Drug Discovery
 - Genome-based discovery
 - Drug Repurposing/Repositioning
 - AI-based drug discovery

- 4. Small molecules: target identification**
 - Different approaches for drug target discovery

- 5. Use of omics in drug discovery process**
 - Principles and applications of Transcriptomic
 - Principles and applications of Proteomics
 - Principles and applications of Metabolomics
 - Use of omics in drug development: target identification; prediction on side effect and efficacy, and understanding drug metabolism.

- 6. Small molecules: medicinal chemistry, druggability and formulation study**
 - Medicinal chemistry - lead optimization through chemical synthesis.
 - Druggability: binding affinity, predicting druggability, physiochemical properties, safety profile, drug likeness.
 - Formulation: oral, injectable, or topical formulations.
 - Ways of formulations: encapsulation, emulsion creation, slow-release mechanisms

- 7. Biologics: enzymes, antibodies, peptides**
 - Overview of biologics.
 - Nature of protein structure and function (primary, secondary, tertiary, and quaternary protein structure, protein folding and

	<p>denaturation)</p> <ul style="list-style-type: none"> • Development and manufacturing of biologics. • Biotherapeutics. Examples of therapeutic proteins and antibodies, and their role in treating diseases. • Biosimilars: The concept of biosimilars, comparison to generic drugs, and relevance in the market. • Case Studies <p>8. Tutorial Introduction to AlphaFold and Discovery Studio</p>							
<p>Teaching/Learning Methodology</p>	<p>Lectures, mini-project (presentation + written assignment), examination</p> <p>Students have to obtain a pass in attendance, mini-project and final examination component in order to pass the subject.</p> <ol style="list-style-type: none"> 1. Mini-project – Students are required to conduct a mini-project related to drug discovery. Students will conduct a presentation, followed by the submission of an essay, on a selected topic. They will be assessed on their understanding of the topic's content. Students have to demonstrate their insights into the topic in concern, in both presentation and essay. 2. Attendance – Students who attended less than 80% of both the lecture and tutorial classes will result in fail of this component. 3. Final Examination – To assess how much students have learned the concepts of the principle of biopharmaceutical development 							
<p>Assessment Methods in Alignment with Intended Learning Outcomes</p>	<p>Specific assessment methods/tasks</p>	<p>% (weighting)</p>	<p>Intended subject learning outcomes to be assessed (Please tick as appropriate)</p>					
			<p>a</p>	<p>b</p>	<p>c</p>	<p>d</p>	<p>e</p>	
<p>1. Attendance</p>			<p>10</p>		<p>√</p>			<p>√</p>
<p>2. Mini-project</p>			<p>45</p>	<p>√</p>	<p>√</p>	<p>√</p>	<p>√</p>	<p>√</p>
<p>3. Final examination</p>			<p>45</p>	<p>√</p>	<p>√</p>	<p>√</p>		<p>√</p>
<p>Total</p>			<p>100 %</p>					
<p>Students are allowed to use GenAI tools to support their writing of and essays. If GenAI tools are used to support their essay writings, students must declare the use of such tools and how they have been used in the assessments. It should be noted that submitting a work generated by GenAI, in part or in whole, as your own (even in paraphrased form) constitutes an act of academic dishonesty; it is no different from asking another person to write your assignment or claiming others' ideas as yours.</p>								
<p>Student Study</p>	<p>Class contact:</p>							

Effort Expected	▪ Lecture	33 Hrs.
	▪ Tutorial	6 Hrs.
	Other student study effort:	
	▪ Mini-project	15 Hrs.
	▪ Self study	60 Hrs.
	Total student study effort	114 Hrs
Reading List and References	<ol style="list-style-type: none"> 1. Drug discovery and development technology in transition. Hill, R. G. (Raymond G.) ; Rang, H. P. ; ebrary, Inc. Edinburgh : Churchill Livingstone Elsevier; c2013; 2nd ed 2. Biologics, biosimilars, and biobetters : an introduction for pharmacists, physicians and other health practitioners. Ramzan, Iqbal, 1951- editor. Hoboken, New Jersey : Wiley; 2021 	