

ERA UNIVERSITY, LUCKNOW
STUDY & EVALUATION SCHEME (Effective from Session 2025-26)
M.Sc. BIOTECHNOLOGY
YEAR II, SEMESTER – IV

S. No.	Course category	Course code	Course title	Hours/week			EVALUATION SCHEME				CT	C	Attributes						
													Employability	Entrepreneurship	Skill Development	Gender	Environment Sustainability	Human values	Professional Ethics
				L	T	P	Mid Sem Exam	TA	Total	End Sem Exam									
THEORY																			
1.	Major Other Faculty	MBT0401T	Research Methodology	3	1	0	20	20	40	60	100	4	√	√	√	√			
2.	Major Other Faculty	MBT0402T	Bio-Informatics	3	1	0	20	20	40	60	100	4	√		√	√			
3.	Elective	MBT0403E	Drug Design & Discovery									4	√	√	√	√			
4.	Elective	MBT0404E	Developmental Biology	3	1	0	20	20	40	60	100	4	√	√	√	√			
5.	Elective	MBT0405E	Fundamentals of Computers									4	√	√	√	√			
PRACTICALS/PROJECT																			
6.	Major Other Faculty	MBT0406P	Bio-Informatics Lab	0	0	2	20	20	40	60	100	1							
7.	Major Own Faculty	MBT0407R	Dissertation	0	0	36	-	-	-	300	300	18	√		√		√		
Total											700	31							

L- Lecture

T- Tutorial

P- Practical

C- Credit

TA- Teacher Assesme

Electives: Any one out of three

CT- Course Total

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Era University
Department of Biotechnology
Course Outline
Academic Year: 2025-2026

Course Name: Research Methodology		Course Code: MBT0401T		Year: II	Semester: IV
Core Course					
Credits: 4	Total No. of Lectures: 60		Lecture-Tutorial-Practical (In hours/week) L-T-P: 3-1-0		
Evaluation Spread	Internal Continuous	40	End Term Exam	60	
Course Objective	To develop independence in experimental design and interpretation and to develop research skills for immediate productivity in industrial, governmental, or clinical settings for an ultimate benefit of society.				
Course Outcome	CO1: Understand basics of Research. CO2: Define the problem and develop synopsis of a defined research problem. CO3: Perform collection and interpretation of research data CO4: Write grants, scientific report and perform data analysis.				
Pedagogy	Interactive, Discussion Based Sessions, Presentations, Seminars				
Internal Evaluation Mode	Sessional Test: 20 Quiz: 5 Assignments: 5 Attendance: 5 Presentations: 5				
Unit	Topic				No. of Lectures Total =60
I	Research Methodology: An Introduction Meaning of Research, Objectives of Research, and Motivation in Research, Types of Research, Research Approaches, Significance of Research, and Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India.				12
II	Defining the Research Problem What is a Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem.				12
III	Research Design Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, and Basic Principles of Experimental Designs.				12
IV	Methods of Data Collection Collection of Primary Data, Observation Method, Interview Method, Collection of Data through Questionnaires, Collection of Data through Schedules, Difference between Questionnaires and Schedules, Other Methods of Data Collection, Collection of Secondary Data Selection of Appropriate Method for Data Collection, Case Study Method. Sample and Sampling Techniques.				12
V	Interpretation and Report Writing Meaning of Interpretation, Why Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research				12

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Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report Precautions for Writing Research Reports, Writing for Grants.

Suggested Readings

1. Research Methodology, Methods & Techniques by C. R. Kothari. New Age International Publishers.
2. Research Methodology a Step-by-Step Guide for beginners by Ranjit Kumar. SAGE Publications Limited.
3. Handbook of Research Methodology. A compendium for Scholars and Researchers by Dr. Shanti Bhushan Mishra & Dr. Shashi Alok. Educreation Publishing.

UNIT	MAPPED CO
I	CO1
II	CO2
III	CO1, CO2
IV	CO3
V	CO3, CO4

MAPPED CO's WITH PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
CO1	√	√	√	√			√	√	√
CO2	√	√	√	√			√	√	√
CO3	√	√	√	√			√	√	√
CO4	√	√	√	√			√	√	√

Course Created by:
Dr. Ghazal Fatima

Approved by:

Sangeeta

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Era University
Department of Biotechnology
Course Outline
Academic Year: 2025-2026

Course Name: Bio-Informatics		Course Code: MBT0402T		Year: II	Semester: IV
Core Course					
Credits: 4	Total No. of Lectures: 60 Lecture-Tutorial-Practical (In hours/week) L-T-P: 3-1-0				
Evaluation Spread	Internal Continuous	40	End Term Exam	60	
Course Objective	To introduce the bioinformatics discipline; To make students familiar with the major biological questions which can be addressed by bioinformatics.; To introduce the major tool used for sequence and structure analysis and explain in general how they work.				
Course Outcome	CO1 Get an idea about basic computing; CO2: Explain the scope of bioinformatics CO3: Use freely available bioinformatics tools. CO4: Provide basic outline of the process used for global and local alignment. CO5: Learn basics of Drug designing tools such as Molecular Docking and Molecular dynamics simulation.				
Pedagogy	Interactive, Discussion Based Sessions, Presentations, Seminars				
Internal Evaluation Mode	Sessional Test: 20 Quiz: 5 Assignments: 5 Attendance: 5 Presentations: 5				
Unit	Topic				No. of Lectures Total =60
I	Computer basics; Operating systems; Hardware, Software, DOS; Programming in Visual Basic: Introduction to application development using Visual Basic; Working with Code and Forms; Variables, Procedures and Controlling Program Executor; Standard Controls; Data Access Using Data Control; Internet; LAN; WAN; Web servers.				12
II	Introduction to Nucleic acid and Protein Sequence Data Banks: Gene bank; EMBL nucleotide sequence data bank, NBRF-PIR, SWISSPROT; Signal peptide data bank. Database Similarity Searches: BLAST, FASTA, PSI-BLAST algorithms; Pair wise sequence alignment-NEEDLEMAN and Wunsch; Smith Waterman algorithms; Multiple sequence alignments - CLUSTAL, PRAS.				12
III	Patterns, motifs and Profiles in sequences: Derivation and searching; Derived Databases of patterns; Motifs and profiles: Parasite , Blocks, Prints-S, Pam, etc. PROSITE				12
IV	Primer Designing; Homology Modeling; Promoter scanning; Splice site Prediction; Phylogenetic analysis; Determination of Secondary & Tertiary structure of proteins.				12
V	Acquisition and visualization of molecular structures and energy optimization methods. Use of bioinformatics in drug designing; Basics of Molecular Dynamics Simulation and Molecular docking methods.				12

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Era University
Department of Biotechnology
Course Outline
Academic Year: 2025-2026

Course Name: Drug Design & Discovery		Course Code: MBT0403E		Year: II	Semester: IV
Elective Course					
Credits: 4	Total No. of Lectures: 60	Lecture-Tutorial-Practical (In hours/week) L-T-P: 3-1-0			
Evaluation Spread	Internal Continuous	40	End Term Exam	60	
Course Objective	The course aims to introduce the students to understand the basic principles of drug discovery, molecular sight of development identification of drug targets, understanding of bioinformatics-based drug designing and, analysis of physiochemical properties of drug molecules and computer aided drug designing.				
Course Outcome	CO1: Students will learn the various aspects of drug discovery, in-silico methods of drug designing, docking analysis, CO2: Students will also learn understanding of bioinformatics, chemo-informatics, physiochemical and, various drug screening techniques.				
Pedagogy	Interactive, Discussion Based Sessions, Presentations, Seminars				
Internal Evaluation Mode	Sessional Test: 20 Quiz: 5 Assignments: 5 Attendance: 5 Presentations: 5				
Unit	Topic				No. of Lectures Total =60
I	Introduction to Drug Discovery and Development: Stages of drug discovery and development: Rational approaches to lead discovery based on traditional medicine, Random screening, Non-random screening, serendipitous drug discovery, lead discovery based on drug metabolism and clinical observation.				12
II	Drug Targets: Types of Drug targets: Proteins/Enzymes, Receptor Proteins, Nucleic Acids & other drug targets, Active sites, Allosteric sites, Intermolecular binding force of drugs with targets: electrostatic or ionic bonds, Hydrogen bonds, Vander Waals forces, Dipole- dipole and ion dipole interaction, Repulsive interaction and Pi-Pi interaction.				12
III	Informatics & Methods in drug design: Introduction to Bioinformatics, chemo-informatics and ADME databases. Pub Chem, Drug Bank, Chem spider, Representation of Drugs: Smile notation, IUPAC name, Chemical formula, molecular descriptors, 2D representation, Formats: SDF, MOL, MOL2. Softwares: Building chemical structures with Chem sketch. Chemical descriptors, predicting biological activities of drug molecules using QSAR.				12
IV	Physico-chemical properties of drug molecules in relation to biological activity – Solubility, Lipophilicity, partition-coefficient, Ionization, hydrogen bonding, Chelation, redox potential and surface activity. Bioisosterism and steric features of drugs, drug distribution and protein binding, Introduction to Pro and soft drug approaches.				12
V	Computer Aided Drug Design (CADD): Structure-based Drug Design: Molecular docking- principle and concept,				12

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Rigid docking, flexible docking, manual docking. Common Docking Programs: AutoDock4, AutoDock Vina, etc. Ligand-based Drug Design: Concept of pharmacophore mapping and pharmacophore-based Screening, Quantitative Structure-Activity Relationship (QSAR). Homology Modeling: steps and tools; Concept of Molecular Dynamics; Overview of in-vitro & in vivo clinical trials

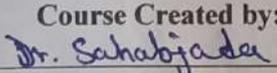
Suggested Readings

1. Quick Guideline for Computational Drug Design; Sheikh Arslan Sehgal, Rana Adnan Tahir, A. Hammad Mirza and Asif Mir
2. Computer Aided Drug Design; Anees Ahmad Siddiqui, Haris Kumar, Subuhi Khisal
3. K. Anand Solomon. (2019), Molecular Modelling and Drug Design. MJP Publishers
4. Computation in Bioinformatics: Multidisciplinary Applications. Wiley-Scrivener publishers.
5. Advances in Bioinformatics, Springer publishers.
6. Bioinformatics, Wiley publishers, 4th edition.

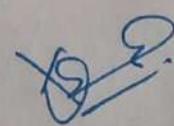
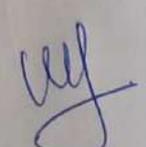
UNIT	MAPPED CO
I	CO1, CO2
II	CO1, CO2
III	CO1, CO2
IV	CO1, CO2
V	CO1, CO2

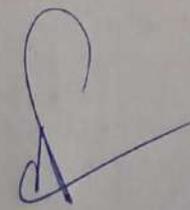
MAPPED CO's WITH PO's & PSO's

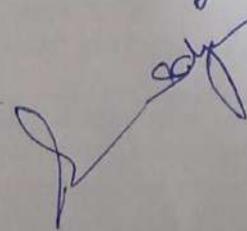
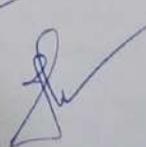
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
CO1	√	√	√			√	√	√	
CO2	√	√	√			√	√	√	√

Course Created by:


Approved by:

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Era University
Department of Biotechnology
Course Outline
Academic Year: 2025-2026

Course Name: Developmental Biology		Course Code: MBT0404E		Year: II	Semester: IV
Elective Course					
Credits: 4	Total No. of Lectures: 60	Lecture-Tutorial-Practical (In hours/week) L-T-P: 3-1-0			
Evaluation Spread	Internal Continuous	40	End Term Exam	60	
Course Objective	Developmental biology aims to understand how an organism develops-how a single cell becomes an organized grouping of cells that is then programmed at specific times to become specialized for certain tasks. Developmental biology includes production of gametes, fertilization, and development of the embryo, emergence of the adult organism, senescence, and death.				
Course Outcome	<p>CO1: Attempt to understand the molecular, genetic, cellular, and integrative aspects of building an organism.</p> <p>CO2: To understand the intimate relation between structures in different organ systems, such as the nervous system and muscle, and is primordial for understanding disorders of development that in the human may present as one of the congenital myopathies.</p> <p>CO3: To provide the detail knowledge about basic of embryonic development.</p> <p>CO4: Evaluate the applications of cell and development biology to understand the basic of life.</p>				
Pedagogy	Interactive, Discussion Based Sessions, Presentations, Seminars				
Internal Evaluation Mode	Sessional Test: 20 Quiz: 5 Assignments: 5 Attendance: 5 Presentations: 5				
Unit	Topic				No. of Lectures Total =60
I	General introduction to Developmental Biology, Spermatogenesis, Physiological of sperm, Sperm structure and physiology, Oogenesis, Egg-size, shape and Egg membranes, classification of eggs.				12
II	Fertilization: type's mechanism, monospermy and polyspermy. Activation of egg and Egg metabolism, Types of cleavage, factors affecting cleavage, definition, types, patterns & mechanism of gastrulation; Process, types and mechanism of Gastrulation.				12
III	Formation & differentiation of primary germ layers, Fate Maps in early embryos. Organization of shoot and root apical meristem and developmental. Leaf development and phyllotaxy.				12
IV	Organogenesis in Animal: Neurulation, ontogenesis, development of vertebrate eye. Fate of different primary germ layers, development of behavior: constancy & plasticity, extra embryonic membranes, placenta in mammals.				12
V	Embryogenesis in plant: Developmental of Microsporangium and Megasporangium in Angiosperm. Pollination, types, Embryo-Embryo sac development and double fertilization in plants, seed formation and germination.				12

Suggested Readings

1. Gilbert, Scott's. 10th edition (2014)
2. Chattopadhyay. S. 2016
3. Kolkata. First edition.
4. Balinsky, B.I., 5th Edition.

UNIT	MAPPED CO
I	CO1, CO3, CO4
II	CO1, CO2, CO3, CO4
III	CO3, CO4
IV	CO1, CO2, CO3, CO4
V	CO1, CO2, CO3, CO4

MAPPED CO's WITH PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
CO1	√	√	√				√	√	
CO2	√	√	√				√	√	
CO3	√	√	√				√	√	
CO4	√	√	√				√	√	

Course Created by:

Dr. Ghizal Fatima

Approved by:

Akhyat

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S.P.

Key Singh

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Era University
Department of Biotechnology
Course Outline
Academic Year: 2025-2026

Course Name: Fundamental of Computers		Course Code: MBT0405E		Year: II	Semester: IV
Elective Course					
Credits: 4	Total No. of Lectures: 60		Lecture-Tutorial-Practical (In hours/week) L-T-P: 3-1-0		
Evaluation Spread	Internal Continuous	40	End Term Exam	60	
Course Objective	The main objective of this course is to introduce the fundamentals of computing devices and reinforce computer vocabulary, particularly with respect to personal use of computer hardware and software, the Internet, networking and mobile computing. It focuses on such computer literacy that prepares students for life-long learning of computer concepts and skills. Students discover why computers are essential components in education, business and society in this course.				
Course Outcome	<i>After the successful course completion, learners will develop following attributes:</i> CO1: Explain the needs of hardware and software required for a computation task. CO2: Explain the working of important application software and their use to perform any computational activity. CO3: Demonstrate the use of Operating system commands. CO4: Understanding the concept of input and output devices of Computers and how it works and recognize the basic terminology used in computer system. CO5: Explain principal differences in various operating systems. Identify computer systems technical specifications.				
Pedagogy	Interactive, discussion-based, student-centered, Presentation				
Internal Evaluation Mode	Sessional Test; Quiz; Assignments; Attendance; Presentations				
UNIT	Topic				No. of Lectures Total=60
I	Introduction to computer: Introduction, important characteristics of computer, Block diagram of computer, advantages and limitations of Computer, generations of computer, classification of Computer, computer hardware & software, computer languages, Translators, types of Translators.				12 Hrs
II	Introduction to Input/Output devices: Input devices: (keyboard, mouse, scanner devices, bar card reader, Microphone, light pen, touch screen etc.). Output Devices: Monitors, pointers, plotters, projector, Speaker etc.), Storage/Memory: Primary memories, secondary memory, RAM ROM, Unit of Memory, Generation of Computers, and Applications of Computer.				12 Hrs
III	Introduction to Operating System (OS): Introduction, Components of OS, Objectives of OS, Services of OS, Types of OS, Name of some popular OS. Windows: History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.). Disk Operating System (DOS): Components of DOS, Types of Files in DOS, Directories and their Structure, Internal and External DOS Command.				12 Hrs

IV	<p>Introduction to Computer Networks: Introduction, types of networks, LAN, MAN, WAN, Network Topologies, star, ring, bus, mesh, tree, Components of Network. Data communication, types of data communication.</p> <p>Introduction to Internet: definition, basic services, Email: Advantage of email, how to create email, File Transfer Protocol, Hyper Text Transfer protocol, Tenet, the World Wide Web (WWW)), www browsers, use of the internet, Computer Virus and Anti-Viruses Software. Cyber Network Security.</p>	12 Hrs
V	<p>Introduction to MS-Word: Introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spell checking, printing the document file.</p> <p>Introduction to Excel: Introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs.</p> <p>Introduction to Power Point: Introduction, creating and manipulating presentation, views, formatting and enhancing text slide with graphs.</p>	12 Hrs

Suggested Readings

1. V. Rajaraman, & quot; Fundamentals of Computers & quot; PHI.
2. Peter Norton & quot; Introduction to Computers & quot; TMH.
3. Hahn, & quot; The Internet complete reference & quot; TMH.
4. D.S. Yadav & quot; Foundation of Information Technology & quot; New Age International.
5. P.K. Sinha, Computer Fundamentals, BPB Publications New Delhi 6th Edition, 2004.
6. Anita Goel, Computer Fundamentals, Pearson Education, 2010.

UNIT	MAPPED CO
I	CO1
II	CO1 & CO2
III	CO2, CO4 & CO5
IV	CO3, CO4 & CO5

MAPPED CO's WITH PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	√	√	√	√	√	√	√		√		√	√	√	√	√	
CO2	√	√	√	√	√	√	√		√		√	√	√	√	√	
CO3	√	√	√	√	√	√	√		√		√	√	√	√	√	
CO4	√	√	√	√	√	√	√		√		√	√	√	√	√	
CO5	√	√	√	√	√	√	√		√		√	√	√	√	√	

Dr. Mohd Islam

Course created by:

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Approved by:

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Era University
Department of Biotechnology
Course Outline
Academic Year: 2025-2026

Course Name: Bioinformatics Lab	Course Code: MBT0406P	Year: II	Semester: IV
Core Course			
Credits: 1	Total No. of Lectures: NIL Lecture-Tutorial-Practical (in hours/week) L-T-P: 0-0-2		
	Internal Continuous	40	End Term Exam 60
Course Objective	The objective of this course is to develop the understanding of basics of sequence database, pair wise sequence alignment, protein structure and gene finding tools.		
Course Outcome	<i>After the successful course completion, learners will develop following attributes:</i> CO1: Students find concepts of Data Mining CO2: To utilize data mining techniques and enhance its application in acquiring Biological Data CO3: To learn large scale biological data analysis using Bioinformatics Software.		
Pedagogy	Interactive, discussion-based, Practical's		
Internal Evaluation Mode	Sessional Test; Viva; Attendance; Lab Record		
Lab Course	List of Experiments		No. of Practicals Total =30Hrs
Bioinformatics	<ol style="list-style-type: none"> 1. Introduction to types of sequence databases (Nucleotide & Protein) 2. Retrieving sequences from the databases 3. Simple sequence comparison using DOTPLOT 4. Pair wise Sequence Alignment (NW and SW approach) 5. FASTA & BLAST search 6. Multiple Sequence Alignment (ClustalX & Treeview) 7. Use of various primer designing and restriction site prediction tools. 8. Protein Structure Visualization (PDB, SCOP, RASMOL, Swiss-PDB Viewer) 9. Gene Finding tools (Grail or Genscan, Glimmer) 		30Hrs
Suggested Readings			
<ol style="list-style-type: none"> 1. Lodish, H F. Berk, A. Kaiser, CA, Krieger, M. Bretscher, A. Ploegh, H. Aman, A. Martin, K. (2016). Molecular Cell Biology (8th Ed.). New York: W.H. Freeman. 2. Gupta P.K. Cell and Molecular Biology 2018. 5th edition Rastogi Publication India. 3. Barker K (2004). At the Bench: A laboratory Navigator. Cold Spring Harbor Laboratory Press. USA. 4. Iwasa J., Marshal W. Karp's Cell and Molecular Biology. Concepts and experiments. (2015) (8th edition) Wiley & sons, New York 5. Watson, J. D. Baker TA, Bell, SP Gann, A. Levine, M. Losick R. (2008). Molecular Biology of the Gene (5th ed.). Pearson. 			

Dr. Zainab Siddiqui

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MAPPED CO's WITH PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	√	√	√	√	√	√	√		√		√	√	√	√	√	
CO2	√	√	√	√	√	√	√		√		√	√	√	√	√	
CO3	√	√	√	√	√	√	√		√		√	√	√	√	√	

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Era University
Department of Biotechnology
Course Outline
Academic Year: 2025-2026

Course Name: Dissertation	Course Code: MBT0407R	Year: II	Semester: IV
Core Course			
Credits: 18	Tutorial-Practical (In hours/week) L-T-P: 0-0-36		
Evaluation Spread	Internal Continuous	-	End Term Exam 300
Course Objective	<p>The main objective of this course is to develop independence in experimental design and interpretation and to develop research skills.</p> <p>To promote education and research in biotechnology and provide academic and professional excellence for immediate productivity in industrial, governmental, or clinical settings for an ultimate benefit of society and environment.</p>		
Course Outcome	<p>After completion of this course students will be able to:</p> <p>CO1: Perform literature review.</p> <p>CO2: Define the problem and develop synopsis of a defined research problem.</p> <p>CO3: Establish a methodology using advanced tools / techniques.</p> <p>CO4: write scientific report and perform data analysis.</p>		
Pedagogy	Interactive, Discussion Based Sessions, Presentations, Seminars, Practical's		
Internal Evaluation Mode	Nil		

MAPPED CO's WITH PO's & PSO's

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
CO1	√	√	√	√		√	√		√
CO2	√	√	√	√		√	√	√	√
CO3	√	√	√			√	√	√	√
CO4	√	√	√	√	√	√	√	√	√

Course Created by:
Dr. Tabrez Tafar

Approved by:

Tabrez Tafar

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