PSGR
Krishnammal College for Women

PSGR KRISHNAMMAL COLLEGE FOR WOMEN
COIMBATORE-641004
(College of Excellence)
Autonomous and Affiliated to Bharathiar University
(Accredited with 'A++' Grade by NAAC with CGPA 3.71 (IV Cycle)
(Ranked 4th in NIRF 2023)

DEPARTMENT OF BIOTECHNOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS) & LEARNING OUTCOMES- BASED

CURRICULAR FRAMEWORK (LOCF)

B.Sc. BIOTECHNOLOGY

SEMESTER I

2024 – 2027 BATCH

B.Sc BIOTECHNOLOGY

PROGRAMME LEARNING OUTCOME (PLO):

After completion of this programme, the student will be able to

PLO1: Achieve successful technical and professional career which will turn the student into an effective researcher or as an entrepreneur.

PLO2: Acquire sound knowledge in basic sciences and applied sciences and thereby applying the principles in dealing problems in a scientific way.

PLO3: Acquire knowledge in the fields of molecular biology, genome biology, gene engineering, protein engineering, immuno technology, tissue engineering and bioinformatics.

PLO4: Have a life-long learning to follow novel developments in the field which will inspire high ethical values and technical standards.

PLO5: Be equipped to transfer this knowledge to the consumer by applying biotechnological principles in producing a research-oriented product.

PROGRAMME SPECIFIC OUTCOME:

At the end of the programme the student will

PSO1: Ability to understand the structure and function of cells.

PSO2: Skill to make biosafe cloning host cells, design new proteins, develops new diagnostic tools, drug discovery through virtual analysis.

PSO3: Acquire skills to higher levels of learning and/or for the development of new products.

PSO4: Initiate new start-ups in areas of biotechnology.

PSO5: Comprehend current trends to meet the future challenges in biotech industry.

PSGR Krishnammal College for Women

DEPARTMENT OF BIOTECHNOLOGY
CHOICE BASED CREDIT SYSTEM (CBCS) & LEARNING OUTCOME BASED CURRICULAR FRAMEWORK (LOCF)
BACHELOR OF SCIENCE (B.Sc.) BIOTECHNOLOGY – 2024-2027 BATCH
SYLLABUS & SCHEME OF EXAMINATION
Applicable to students admitted during the academic year 2024-2025 and onwards

SEMESTER	Part	Course Code	Title of the Course	Course Type	Instruction hours/week	Contact hours	Tutorial hours	Duration of Examination	Examination Marks			Credits
									CA	ESE	TOTAL	
I	I	TAM2301/ HIN2301/ FRE2301	Language I – T / H / F	L	6	88	2	3	25	75	100	3
	II	ENG2301	English Paper I	E	6	88	2	3	25	75	100	3
	III	BT24C01	Cell and Molecular Developmental Biology	CC	4	58	2	3	25	75	100	4
	III	BT24CP1	**Core Practical I**–Cell and Molecular Developmental Biology and Microbiology Practical	CC	4	60	-	-	-	-	-	-
	III	BT24A01/ CE23A01/ PS23A01	**Allied Paper I** Biochemistry/ IDC-Allied Chemistry For Biologist -I /Allied Physics Paper–I	GE	5	73	2	3	20	55	75€	4
	III	BT24AP1/ CE23AP1/ PS23AP1	**Allied Practical I** Biochemistry and Bioinstrumentation Practical / Allied Chemistry Practical for Biologist / Allied Physics Practical	GE	3	45	-	-	-	-	-	-
	IV	**Non-Tamil Students**										2
		NME23B1/ NME23A1	Basic Tamil I/ Advanced Tamil I	AEC	2	28	2	-	100	-	100	
		Students with Tamil as Language										
		NME23ES	Introduction to Entrepreneurship	AEC	2	30	-	-	100	-	100	
I-V	VI	COM15SER	Community Services	GC	30 hrs outside class hours -					Completed or not		
I-V	VI	24BONL1 24BONL2 24BONL3	Online Course 1 Online Course 2 Online Course 3	ACC	-	-	-	-	-	-	-	-

L : Language **CC : Core Courses**
E : English **ACC : Additional Credit Courses**
GE : Generic Elective **AEC : Ability Enhancement Courses** **GC : General Courses**
CA – Continuous Assessment **ESE - End Semester Examination**
€ : CA conducted for 25 and converted into 20, ESE conducted for 75 and converted into 55

QUESTION PAPER PATTERN

CA Pattern

Section A	:	3 x 2 = 6
Section B	:	3 x 5 = 15 (either or – same CLO Level)
Section C	:	3 x 8 = 24 (either or – same CLO Level)
Total		**45 marks**

ESE Pattern

Section A	:	5 x 2 = 10
Section B	:	5 x 5 = 25 (either or – same CLO Level)
Section C	:	5 x 8 = 40 (either or – same CLO Level)
Total		**75 marks**

Internal Components for theory (for 25 Marks)

CA Test	:	5 Conducted for 45 marks after 50 days
Model Exam	:	7 Conducted for 75 marks after 85 days (Q.P. Pattern (2,5,8) Each Unit 15 Marks)
Seminar/Assignment/Quiz	:	5
Class Participation	:	5
Attendance	:	3

25 marks + ESE 75 Marks

From the academic year 2024-25 and onwards marks allotted for attendance component in CA is modified as

91-100% attendance : 3 Marks
81-90% attendance : 2 Marks
75-80% attendance : 1 Mark

CA Question Paper Pattern:1 x 45=45 Marks (Each unit carries 15 marks)

One question from each unit with each question comprising of

- One questions with a weightage of 2 marks (no choice)
- One questions with a weightage of 5 marks (Internal Choice at the same CLO level)
- One question with weightage of 8marks (Internal Choice at the same CLO level)

Model Question Paper Pattern: 1 x 75 =75 Marks (Each unit carries 15 marks)

- One question with a weightage of 2 marks (no choice)
- One question with a weightage of 5 marks (Internal Choice at the same CLO level)
- One question with weightage of 8 marks (Internal Choice at the same CLO level)

Internal component for Practical's (for 25 Marks)

Lab Performance	-	7 marks
Regularity	-	5 marks
Model Exam	-	10 marks
Attendance	-	3 marks
Total	-	25 marks

ESE Practical's Pattern

The End Semester Examination will be conducted for a maximum of 75 marks with a maximum 15 marks for the record and other submissions if any.

COURSE CODE	TITLE OF THE COURSE	CATEGORY	L	T	P	CREDITS
BT24C01	**CELL AND MOLECULAR DEVELOPMENTAL BIOLOGY**	**THEORY**	**58**	**2**	**-**	**4**

Objectives:

To facilitate the students to

- Familiarize various aspects of cellular organization and their role in DNA replication, transcription and translation.
- Develop comprehensive understanding on the complete cellular and molecular function of cell organelles in terms of cell-to-cell interaction, gene regulation, cellular signaling.
- Impart the skills of molecular biology and their applications in various disciplines
- Understand the principles and molecular mechanisms involved in cellular differentiation, morphogenesis, growth and Potency of the cell.

Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Classify the cells based on their structural and genetic makeup of the organism.	K1
CLO2	Examining the basic concepts of cell cycle and regulators involved in it.	K2
CLO3	Implementing the concepts of cell signaling and communication in research fields.	K3
CLO4	Exploration of the genetic mechanisms involved in studying the cellular activity of an organism.	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO 5
CLO1	S	S	S	S	S
CLO2	S	M	S	M	M
CLO3	S	S	M	S	S
CLO4	S	M	S	S	M

S- Strong; M-Medium

BT24C01-CELL AND MOLECULAR DEVELOPMENTAL BIOLOGY

Unit I: Basics of Cells **(11 hrs)**

Cell as a basic unit: discovery of the cells, classification of cell types, ***development of cell theory**, early chemical investigation in cell biology. ***Prokaryotic and Eukaryotic cell organization**. Cytoplasmic compartments of the cell**.** Structure and Functions of organelles.

Unit II: Mechanisms of Cell Transport **(12 hrs)**

Chemical composition and fluidity of membranes; ***dynamic nature of membranes;transportation across cell membrane**; **membrane potentials**; extracellular matrices– structure and function; cytoskeleton– structure and function, Protein Sorting - Protein degradation.

Unit III: Cell Division, Cell cycle Regulation and Cell Signaling **(12 hrs)**

***Eukaryotic cell cycle**, **Cyclin, CDKs, Check points**, Cell cycle inhibitors, DNA content, FACS, Regulation of cell cycle- factors and genes regulating cell cycle. ***Mitosis and Meiosis**; Cell **signaling – types of cell signaling - *G protein mediated**, Tyrosine kinase mediated signaling. Transposable elements-prokaryotes. Apoptosis-Mitochondrial pathway.

Unit IV: Gene Regulation and Expression **(12 hrs)**

Central Dogma of the cell. DNA-Structure, types**, *DNA replication in prokaryotes** - Transcription in Prokaryotes and Eukaryotes - RNA Processing - Genetic code- Translation - ***Similarities and differences in prokaryotic and eukaryotic translation** - **Post Translational Modifications. *DNA damage-types of DNA damage and factors affecting**, Mutation, types and DNA Repair mechanism-types, Base Excision repair, SOS repair, NHEJ.

Unit V: **Embryology** **(11 hrs)**

Gametogenesis - ***Spermatogenesis** and Oogenesis in mammals. ***Fertilization- Types of cleavage**, **blastula formation**, embryonic fields, gastrulation and formation of germ layers in animals- Organogenesis.

***Link Provided for the Highlighted Content Offered in Blended Mode**

S.No	Topics	Video Link
Unit I: Basics of Cells		
1	Development of cell theory, prokaryotic and Eukaryotic cell organization	https://youtu.be/Pxujitlv8wc?si=VUbhZk0_nCHoq-DJ https://youtu.be/URUJD5NEXC8?si=FQUxOFpsfMkacM9f
Unit II: Mechanisms of Cell Transport		
2	dynamic nature of membranes; transportation across cell membrane; membrane potentials	https://youtu.be/qBCVVszQQNs?si=iK0tnvN8sRpCvtlg https://youtu.be/RPAZvs4hvGA?si=GKW1uLOJJVViJuxo
Unit III: Cell Division, Cell cycle Regulation and Cell Signaling		
3	Eukaryotic cell cycle, Cyclin, CDKs, Check points, Mitosis and Meiosis; Cell signaling – types of cell signaling - G protein mediated	https://youtu.be/0BqJ58ZiWwA?si=8Azil9Zg45Gtyzby https://youtu.be/DwAFZb8juMQ?si=5eyGXuPGaXqCLeRU https://youtu.be/9sF_h-bAnIE?si=rgAtHdwb8XAYJ-gy https://youtu.be/kLOwGKEvZF0?si=mRGStR-lda_2QtvR
Unit IV: Gene Regulation and Expression		
4	DNA replication in prokaryotes, Similarities and differences in prokaryotic and eukaryotic translation - Post Translational Modifications. DNA damage-types of DNA damage and factors affecting	https://youtu.be/IjVLhoyfGAM?si=a4jjdPTy89urWGp4 https://youtu.be/_br9ahJX4Bc?si=-1AFrYmNkrp6u2cl https://youtu.be/gG7uCskUOrA?si=bW5DxQgEc7Q4C83x https://youtu.be/2yI_SoOWFMU?si=81vKbeuUjknZQjkL https://youtu.be/ceFr0xTMV5k?si=6icNHEf_U0RNjd0j https://youtu.be/NXT3cMTTLEI?si=XhSfRr9kOaQGe-9e
Unit V: Embryology		
5	Spermatogenesis, Fertilization- Types of cleavage, blastula formation	https://youtu.be/ZFLb19nC2bs?si=cCc_dhrN83xj2V5f https://youtu.be/HuWCwyRiaUI?si=WfCKnOrc2vu2kWKP https://youtu.be/VQoVOrA6dXo?si=xxa1VVtpfby5RzZK

TEXT BOOKS

S. No.	Authors	Title of the book	Publishers	Year & Edition
1.	S C Rastogi	Cell and Molecular Biology	New Age International Private Limited	2020
2.	Sastry KV, Shukla V	Developmental Biology	Rastogi Publications	2018
3.	Thomas D. Pollard, William C.Earnshaw, Jennifer Lippincott-Schwartz, Graham Johnson	Cell Biology	Saunders	2016
4.	Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter	Molecular Biology of Cell	Garland Science	2014 & 6th Edition

REFERENCE BOOKS

S.No	Authors	Title of the book	Publishers	Year & Edition
1	Bruce Alberts, Karen Hopkin, Alexander D. Johnson, David Morgan; Martin Raff, Keith Roberts; Peter Walter	Essential Cell Biology	W.W. Norton & Company	2018 & 5th Edition
2	D.Freifelder	Freifelders Essentials of Molecular Biology	Jones & Bartlett Publishers	2015
3	Harvey Lodish; Arnold Berk; Chris A. Kaiser; Monty Krieger; Anthony Bretscher; Hidde Ploegh; Kelsey C. Martin; Michael Yaffe; Angelika Amon	Molecular Cell Biology	W H Freeman & Co	2021 & 9th Edition

Course Designer:

Dr. R. Nirmal Kumar

Module No.	Topic	CLO level	No. of periods	Content delivery method	Student engagement	Participatory Learning / Experiential Learning / Problem based Learning
Unit I Basics of Cells						
1.	Cell as a basic unit	CLO1	1	Lecture – Chalk and Talk / Group reading	Word cloud/ Mind map / Think Write and Share	Participatory Learning
2.	Discovery of the cells,	CLO1	1	Displays	Gallery walk, Post it parade	Experiential Learning
3.	Classification of cell types	CLO1	1	OER	Debate, Quescussion, Pro-con grid	Problem-based Learning
4.	Development of cell theory	CLO1, CLO2	1	PPT / OER	Quiz (Quizalize/ Socrative)	Participatory Learning
5.	Early chemical investigation in cell biology	CLO1, CLO2	1	Chalk and talk/ Picture	Debate, Quescussion, Pro-con grid	Problem-based Learning
6.	Prokaryotic and Eukaryotic cell organization	CLO1, CLO2	1	PPT / OER	Gallery walk, Post it parade	Experiential Learning
7.	Cytoplasmic compartments of the cell.	CLO1, CLO2, CLO3	1	Virtual lab	Presentation	Problem-based Learning
8.	Cytoplasmic compartments of the cell.	CLO1, CLO2, CLO3	1	Lecture – Chalk and Talk / Group reading	Word cloud/ Mind map / Think Write and Share	Participatory Learning
9.	Structure and Functions of organelles	CLO1, CLO2, CLO3	1	OER	Debate, Quescussion, Pro-con grid	Problem-based Learning
10.	Structure and Functions of organelles	CLO1, CLO2, CLO3	1	Lecture – Chalk and Talk / Group reading	Word cloud/ Mind map / Think Write and Share	Participatory Learning
11.	Structure and Functions of organelles	CLO1, CLO2, CLO3	1	Lecture – Chalk and Talk / Group reading	Word cloud/ Mind map / Think Write and Share	Participatory Learning

Unit – II Mechanisms of Cell Transport						
12.	Chemical composition and fluidity of membranes;	CLO1, CLO2	1	Lecture / Seminar	Diagrams, Sketchboard	Participatory Learning
13.	dynamic nature of membranes	CLO1, CLO2	1	PPT	Group reading and discussion	Experiential Learning
14.	dynamic nature of membranes	CLO1, CLO2	1	Lecture / Seminar	Diagrams, Sketchboard	Participatory Learning
15.	transportation across cell membrane;	CLO1, CLO2, CLO3	1	PPT	Word cloud/ Mind map / Think Write and Share	Participatory Learning
16.	membrane potentials	CLO1, CLO2, CLO3	1	PPT	Review collection, Case study	Problem-based Learning
17.	membrane potentials	CLO1, CLO2, CLO3	1	Lecture / Seminar	Diagrams, Sketchboard	Participatory Learning
18.	extracellular matrices– structure and function;	CLO1, CLO2, CLO3	1	OER	Flipped classroom, Presentation	Participatory Learning
19.	cytoskeleton– structure and function	CLO1, CLO2, CLO3	1	Lecture / OER	Simulation	Experiential Learning
20.	cytoskeleton– structure and function	CLO1, CLO2, CLO3	1	Lecture / OER	Simulation	Experiential Learning
21.	Protein Sorting -	CLO1, CLO2, CLO3	1	Lecture / OER	Simulation	Experiential Learning
22.	Protein degradation	CLO1, CLO2, CLO3	1	Lecture/ Virtual lab	Simulation	Experiential Learning
23.	Protein degradation	CLO1, CLO2, CLO3	1	Lecture/ Virtual lab	Simulation	Experiential Learning
Unit – III Cell Division, Cell cycle Regulation and Cell Signaling						
24.	Eukaryotic cell cycle,	CLO2, CLO3	1	ORE / PPT	Flipped classroom, Assignment	Participatory Learning
25.	Cyclin, CDKs, Check points,	CLO2, CLO3	1	Lecture PPT	Peer teaching	Participatory Learning

26.	Cell cycle inhibitors, DNA content, FACS,	CLO2, CLO3	1	Video / Observation	Group discussion	Experiential Learning
27.	Regulation of cell cycle-	CLO2, CLO3	1	Video / Observation	Student seminar	Experiential Learning
28.	factors and genes regulating cell cycle.	CLO2, CLO3	1	Lecture PPT	Student seminar	Participatory Learning
29.	Mitosis	CLO2, CLO3	1	Lecture PPT	Student seminar	Participatory Learning
30.	Meiosis	CLO2, CLO3	1	Seminar / PPT	Flipped classroom	Participatory Learning
31.	Cell signaling –	CLO2, CLO3	1	Video / Observation	Discussion	Experiential Learning
32.	types of cell signaling - G protein mediated	CLO2, CLO3	1	Lecture PPT	Quiz	Participatory Learning
33.	Tyrosine kinase mediated signaling	CLO2, CLO3	1	Video / Observation	Discussion	Experiential Learning
34.	Transposable elements- prokaryotes.	CLO2, CLO3	1	Lecture PPT	Pro/con grid	Experiential Learning
35.	Apoptosis- Mitochondrial pathway	CLO2, CLO3	1	Virtual lab, Chalk and talk/ Picture	Group reading and discussion	Problem-based Learning
Unit – IV Gene Regulation and Expression						
36.	Central Dogma of the cell	CLO4	1	Lecture	Design thinking	Problem-based Learning
37.	DNA-Structure, types	CLO4	1	Seminar / PPT	Word cloud/ Mind map / Think Write and Share	Participatory Learning
38.	DNA replication in prokaryotes	CLO4	1	PPT	Word cloud/ Mind map / Think Write and Share	Participatory Learning
39.	Transcription in Prokaryotes and Eukaryotes	CLO4	1	PPT	Review collection	Participatory Learning
40.	RNA Processing - Genetic code	CLO4	1	Demonstratio n	Discuss Ion	Experiential Learning
41.	Translation	CLO4	1	Brainstormin g	Flipped classroom, Discussion	Experiential Learning
42.	Similarities and differences in	CLO4	1	PPT	Word cloud/ Mind map /	Participatory Learning

	prokaryotic and eukaryotic translation				Think Write and Share	
43.	Similarities and differences in prokaryotic and eukaryotic translation	CLO4	1	PPT	Discuss Ion	Experiential Learning
44.	Post Translational Modifications	CLO4	1	PPT	Case study	Problem-based Learning
45.	DNA damage and types of DNA damage and factors affecting	CLO4	1	PPT	Word cloud/ Mind map / Think Write and Share	Participatory Learning
46.	Mutation, types and DNA Repair mechanism-types	CLO4	1	Research article reading	Group reading and discussion	Experiential Learning
47.	Base Excision repair, SOS repair, NHEJ	CLO4	1	PPT	Review collection, Case study	Problem-based Learning
Unit –V Embryology						
48.	Gametogenesis -	CLO3, CLO4	1	Research article reading	Group reading and discussion	Experiential Learning
49.	Spermatogenesis	CLO3, CLO4	1	PPT	Word cloud/ Mind map / Think Write and Share	Participatory Learning
50.	Oogenesis in mammals	CLO3, CLO4	1	Video / Observation	Group discussion	Experiential Learning
51.	Fertilization	CLO3, CLO4	1	Video / Observation	Group discussion	Experiential Learning
52.	Types of cleavage	CLO3, CLO4	1	PPT, Socrative	Group reading and discussion	Experiential Learning
53.	Types of cleavage	CLO3, CLO4	1	PPT, Socrative	Case study	Problem-based Learning
54.	blastula formation	CLO3, CLO4	1	PPT	Word cloud/ Mind map / Think Write and Share	Participatory Learning
55.	embryonic fields	CLO3, CLO4	1	Lecture	Flipped classroom	Problem-based Learning

56.	Gastrulation and formation of germ layers in animals	CLO3, CLO4	1	Lecture	Group reading and discussion	Experiential Learning
57.	Gastrulation and formation of germ layers in animals	CLO3, CLO4	1	Lecture	Group reading and discussion	Experiential Learning
58.	Organogenesis.	CLO3, CLO4	1	Research article reading	Group reading and discussion	Problem-based Learning

Name of the course	**BT24C01-Cell and Molecular Developmental Biology**
Name of the Faculty	**Dr. G. Archana**
Participatory Learning	**40 %**
Experiential Learning	**40 %**
Problem-based Learning	**20 %**

COURSE CODE	TITLE OF THE COURSE	CATEGORY	L	T	P	CREDITS
BT24CP1	**CORE PRACTICAL I - CELL AND MOLECULAR DEVELOPMENTAL BIOLOGY AND MICROBIOLOGY PRACTICAL**	**PRACTICALS**	**-**	**-**	**120**	**4**

Objectives:

To facilitate the students to

- To develop the knowledge on different microbiological techniques and isolate microorganisms from the various sources and to establish pure cultures
- To isolate and differentiate different cell organelles and utilize staining techniques to visualize them
- To understand the molecular techniques in separating the genetic material from the organism
- To identify the components of blood cells and summarizes the concept of gametes.

Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand and identify techniques in isolating different microorganisms.	K1
CLO2	Acquire the skills in interpreting the specimens and inferring the results.	K2
CLO3	Demonstrate basic molecular techniques in isolating the genetic material from both prokaryotic and eukaryotic organisms	K3
CLO4	Will be capable of determining the components of blood cells and determine the concept of gametes	K3

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	M	S
CLO2	S	M	S	S	M
CLO3	S	S	M	M	S
CLO4	S	M	S	S	M

S- Strong; M-Medium

BT24CP1 - CELL AND MOLECULAR DEVELOPMENTAL BIOLOGY AND MICROBIOLOGY PRACTICAL

CELL AND MOLECULAR DEVELOPMENTAL BIOLOGY (60 hrs)

1. Use of simple compound microscope and Micrometry
2. Blood smear preparation and Identification of Blood cells
3. Plant cell sectioning (CS)- Dicot and monocot sections of stem and root
4. Preparations of onion peel and observations of cells
5. Osmosis and tonicity
6. Isolation of Genomic DNA
7. Quantification of DNA using UV Spectroscopy/ Nano Drop
8. Observation of sperm & Egg
9. Mounting of chick Embryo - 24 h, 48 h, 72 h, 96 h.

MICROBIOLOGY (60 hrs)

1. Microbiological techniques–Sterilization techniques, Media preparation
2. Isolation and enumeration of microbes (bacteria & fungi) from soil.
3. Pure culture methods-pour plate, spread plate, streak plate method.
4. Identification of Bacteria: Staining methods–simple and Gram's staining.
5. Motility test: Hanging drop technique.
6. Biochemical Identification–IMViC–test.
7. Hydrolysis test -Starch and Casein.
8. Growth curve of bacteria
9. Anti-microbial sensitivity test–Disc diffusion test.
10. Fungal identification: Lactophenol cotton blue staining and KOH mounting (morphology)

TEXT BOOKS:

S.No	Authors	Title of the book	Publishers	Year & Edition
1.	A K Roy &M.M.Prasad	Laboratory Manual of Microbiology: Practical Manual Series: 05	New India Publishing Agency	2010
2.	Cappuccino	Microbiology: A Laboratory Manual	Pearson Education India	2014
3.	Chaitanya K. V.	Cell and Molecular Biology - A Lab Manual	PHI Learning	2013

REFERENCE BOOKS:

S.No	Authors	Title of the book	Publishers	Year& Edition
1.	Dr. H. Abdul Jaffer Ali	Microbiology Laboratory Manual	Vijay Nicole Imprints	2017
2.	R. Saravanan , D., Dhachinamoorthi , CH. M M. Prasada Rao	A Handbook of Practical Microbiology	LAP LAMBERT Academic Publishing.	2019& 1st Edition
3.	Cappuccino, J. G., & Welsh, C.	Current Protocols in Cell Biology	Wiley Publication.	2019&1st Edition

Course Designer:
Dr. G. Anbarasi
Dr. G. Archana

COURSE CODE	TITLE OF THE COURSE	CATEGORY	L	T	P	CREDITS
BT24A01	**ALLIED PAPER I- BIOCHEMISTRY**	**THEORY**	**73**	**2**	**-**	**4**

Objectives:

To facilitate the students to

- To understand the structure of simple sugars
- To elucidate the role played by different Biomolecules
- To analyze the structure of different sugars, lipids, amino acids and proteins.
- To analyze the various pathways involved in sugar utilization

Course Learning Outcome

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Classify the biomolecules based on structure and function	K1
CLO2	Comprehend the basics of enzymes and their role in different metabolic processes.	K2
CLO3	Acquire knowledge about the Importance of lipids and their biosynthesis	K3
CLO4	Analyze the significance of metabolic pathways and their role in cellular function	K3

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO 5
CLO1	S	S	M	S	S
CLO2	S	M	S	M	M
CLO3	S	S	M	S	S
CLO4	S	M	S	M	S

S- Strong; M-Medium

BT24A01-BIOCHEMISTRY

Unit I: Structure and Function of Carbohydrates (14 hrs)

Carbohydrates: Definition, classification, structure and biological functions of mono, di, oligo and polysaccharides (starch, glycogen, ***cellulose, dextrin**, hyaluronic acid, keratin sulphate, heparin and ***chondroitin sulphate**).

Unit II: Enzymes (15 hrs)

Enzymes – properties, classes of enzymes, enzyme reaction, theories of enzyme reaction, ***MM equation, LB plot**, factors affecting enzyme reaction, enzyme units, enzyme assay, coenzyme, apo- and holo-enzymes. Co-factors, and prosthetic group, Isoenzymes. Enzyme inhibition-Reversible (competitive, uncompetitive, non-competitive) and irreversible inhibition. ***Mechanism based inhibitors.**

Unit III: Lipids (15 hrs)

Biological significance, nomenclature and classification. Simple lipids; Fatty acids and their properties, ***triglycerides**, waxes, steroids and prostaglandins. Compound lipids: Phospholipids, sphingolipids and glycolipids**. *Lipoproteins. β-oxidation of lipids, Biosynthesis of saturated fatty acids.**

Unit IV: Vitamins & Proteins (15 hrs)

Vitamins – water soluble and fat soluble, ***importance of vitamins in life**. Amino acids: structure, classification, physical and chemical properties. Proteins: ***Biological importance, classification, general properties.** Primary structure- Human Insulin, Secondary structure - keratin tertiary structure- myoglobin and quaternary structure- Hemoglobin.

Unit V: Metabolism of Biomolecules (14 hrs)

***Metabolism: Catabolism & Anabolism.** Energy metabolic pathways – Glycolysis, Kreb's cycle, Oxidative phosphorylation. Substrate level phosphorylation, Gluconeogenesis, pentose phosphatepathway.

***Link Provided for the Highlighted Content Offerefd in Blended Mode**

S.No	Topics	Video Link
Unit I: Structure and Function of Carbohydrates		
1	Structure and Function of Carbohydrates-cellulose, dextrin, chondroitin sulphate	https://www.youtube.com/watch?v=8UyHLl0jc-A https://www.youtube.com/watch?v=Yd3-AR_hDgk
Unit II: Enzymes		
2	UNIT II- MM equation, LB plot, Mechanism based inhibitors	https://www.youtube.com/watch?v=y43pIHUtjeM https://www.youtube.com/watch?v=jJUoQMLMV2E
Unit III : Lipids		
3	Unit III- Lipids- triglycerides, Lipoproteins. β-oxidation of lipids, Biosynthesis of saturated fatty acids.	https://www.youtube.com/watch?v=BVxeeiR7JB0 https://www.youtube.com/watch?v=J6z77QGsYQc https://www.youtube.com/watch?v=vxDSl9XKB1A
Unit IV : Vitamins & Proteins		
4	Unit IV- importance of vitamins in life.Biological importance, classification, general properties.	https://www.youtube.com/watch?v=rhwk3-uuUis https://www.youtube.com/watch?v=OOXLylm4XD0
Unit V : Metabolism of Biomolecules		
5	Unit V- Metabolism: Catabolism & Anabolism	https://www.youtube.com/watch?v=HrYRMknYHrk https://www.youtube.com/watch?v=wTrmGhCogRk https://www.youtube.com/watch?v=XwJ-mCp-TZ0 https://www.youtube.com/watch?v=Lf4irlyN1eE

TEXT BOOKS

S.No	Authors	Title of the book	Publishers	Year & Edition
1	Nelson,D.L.andCox,.M. Lehninger	Principles of Biochemistry	Macmillan Higher Education	2021& 8th Edition
2	U. Satyanarayana, U.Chakrapani	Biochemistry,	Elsevier	2021& 6th Edition
3	A.C. Deb	Fundamentals of Biochemistry	New central book agency	2001
4	Donald Voet, Charlotte W. Pratt, Judith G. Voet	Principles of Biochemistry	Wiley; International Student Version	2012 & 4th Edition
5	Jain, J.L, Sunjay Jain and Nitin Jain	Biochemistry	Chand and Company, New Delhi	2010

REFERENCE BOOKS

S.No	Authors	Title of the book	Publishers	Year & Edition
1	Victor Rodwell , David Bender , Kathleen Botham, Peter Kennelly, P.	Harper's Biochemistry	McGraw Hill	2018& 1st edition
2	Jeremy M.Berg, John L.TymoczkoandLubertstryer	Biochemistry	W H Freeman &Co. ,	2002

Course Designer:

Dr. V. Bhuvaneshwari

Module No.	Topic	CLO level	No. of periods	Content delivery method	Student engagement	Participatory Learning / Experiential Learning / Problem based Learning
Unit I - Structure and Function of Carbohydrates						
1.	Carbohydrates: Definition	CLO1	1	Lecture – Chalk and Talk / Group reading	Word cloud/ Mind map / Think Write and Share	Participatory Learning
2.	Carbohydrates: Classifications	CLO1	1	Displays	Gallery walks, Post it parade	Experiential Learning
3.	Structure	CLO1 CLO2	1	OER	Debate, Quescussion, Pro-con grid	Problem-based Learning
4.	biological functions	CLO1 CLO2	1	Lecture – Chalk and Talk / Group reading	Word cloud/ Mind map / Think Write and Share	Participatory Learning
5.	Monosaccharides	CLO1 CLO2	1	Displays	Gallery walks, Post it parade	Experiential Learning
6.	Disaccharides	CLO1 CLO2	1	PPT / OER	Quiz (Quizalize/ Socrative)	Participatory Learning
7.	Oligosaccharides	CLO1 CLO2	1	Chalk and talk/ Picture	Debate, Quescussion, Pro-con grid	Problem-based Learning
8.	Polysaccharides	CLO1 CLO2	1	Lecture – Chalk and Talk / Group reading	Word cloud/ Mind map / Think Write and Share	Participatory Learning
9.	Starch	CLO1 CLO2	1	Spotters/ Chalk and talk	Flipped classroom, Poster	Experiential Learning
10.	Glycogen	CLO1 CLO2	1	PPT / OER	Gallery walks, Post it parade	Experiential Learning
11.	cellulose, dextrin,	CLO1 CLO2	1	Virtual lab	Presentation	Problem-based Learning

12.	hyaluronic acid	CLO1 CLO2	1	Lecture – Chalk and Talk / Group reading	Word cloud/ Mind map / Think Write and Share	Participatory Learning
13.	keratin sulphate,	CLO1 CLO2 CLO3	1	OER	Debate, Quescussion, Pro-con grid	Problem-based Learning
14.	Heparin	CLO1 CLO2 CLO3	1	PPT / OER	Gallery walks, Post it parade	Experiential Learning
15.	chondroitin sulphate).	CLO1 CLO2 CLO3	1	Video / Observation	Group discussion	Experiential Learning
Unit – II: Enzymes						
16.	Enzymes – properties,	CLO1 CLO2	1	PPT / OER	Quiz (Quizalize/ Socrative)	Participatory Learning
17.	classes of enzymes, enzyme reaction,	CLO1 CLO2	1	Lecture / Seminar	Diagrams, Sketchboard	Participatory Learning
18.	theories of enzyme reaction	CLO1 CLO2	1	PPT	Review collection, Case study	Problem-based Learning
19.	MM equation, LB plot,	CLO1 CLO2	1	Video / Observation	Group discussion	Experiential Learning
20.	factors affecting enzyme reaction,	CLO2 CLO3	1	PPT	Review collection, Case study	Problem-based Learning
21.	enzyme units, enzyme assay	CLO2 CLO3	1	Lecture / Seminar	Diagrams, Sketchboard	Participatory Learning
22.	Coenzyme	CLO2 CLO3 CLO4	1	PPT	Review collection, Case study	Problem-based Learning
23.	apo- and holo-enzymes.	CLO2 CLO3 CLO4	1	Lecture / Seminar	Diagrams, Sketchboard	Participatory Learning
24.	Cofactors, and prosthetic group,	CLO2 CLO3 CLO4	1	Spotters / Lecture	Post it parade	Experiential Learning
25.	Isoenzymes	CLO2 CLO3 CLO4	1	OER	Flipped classroom, Presentation	Participatory Learning
26.	Enzyme inhibition-	CLO2 CLO3 CLO4	1	Lecture / OER	Simulation	Experiential Learning
27.	(competitive, uncompetitive, non-competitive)	CLO2 CLO3 CLO4	1	Lecture / OER	Simulation	Experiential Learning
28.	and irreversible inhibition.	CLO2 CLO3	1	Lecture / OER	Simulation	Experiential Learning

		CLO4				
29.	Mechanism based inhibitors	CLO2 CLO3 CLO4	1	Lecture/ Virtual lab	Simulation	Experiential Learning
Unit – III: Lipids						
30.	Biological significance, nomenclature	CLO2 CLO3 CLO4	1	ORE / PPT	Flipped classroom, Assignment	Participatory Learning
31.	and classification. Simple lipids	CLO2 CLO3 CLO4	1	Lecture PPT	Peer teaching	Participatory Learning
32.	Fatty acids and their properties	CLO2 CLO3 CLO4	1	Video / Observation	Group discussion	Experiential Learning
33.	Triglycerides	CLO2 CLO3 CLO4	1	Video / Observation	Student seminar	Experiential Learning
34.	waxes.	CLO2 CLO3 CLO4	1	Lecture PPT	Student seminar	Participatory Learning
35.	steroids	CLO2 CLO3 CLO4	1	Lecture PPT	Student seminar	Participatory Learning
36.	prostaglandins.	CLO2 CLO3 CLO4	1	Seminar / PPT	Flipped classroom	Participatory Learning
37.	Compound lipids:	CLO2 CLO3	1	Demonstration	Discussion	Experiential Learning
38.	Phospholipids,	CLO2 CLO3	1	Lecture PPT	Quiz	Participatory Learning
39.	sphingolipids	CLO4 CLO5	1	Demonstration	Discussion	Experiential Learning
40.	Glycolipids	CLO2 CLO3 CLO4	1	Lecture PPT	Pro/con grid	Participatory Learning
41.	Lipoproteins.	CLO2 CLO3 CLO4	1	Video	Quescussion	Participatory Learning
42.	β-oxidation of lipids,	CLO2 CLO3 CLO4	1	Video / Observation	Group discussion	Experiential Learning
43.	Biosynthesis of saturated fatty acids	CLO2 CLO3 CLO4	1	Video / Observation	Group discussion	Experiential Learning
44.	Biosynthesis of saturated fatty acids	CLO2 CLO3 CLO4	1	Video / Observation	Group discussion	Experiential Learning
Unit – IV: Vitamins & Proteins						
45.	Vitamins –	CLO2 CLO3	1	Lecture	Design thinking	Problem-based Learning

		CLO4				
46.	water soluble	CLO2 CLO3 CLO4	1	Research article reading	Group reading and discussion	Problem-based Learning
47.	fat soluble	CLO2 CLO3 CLO4	1	Research article reading	Group reading and discussion	Problem-based Learning
48.	importance of vitamins in life.	CLO2 CLO3 CLO4	1	Video / Observation	Group discussion	Experiential Learning
49.	Amino acids:	CLO2 CLO3 CLO4	1	Interaction on topics and Assignmen t	Review collection	Participatory Learning
50.	structure, classification,	CLO2 CLO3 CLO4	1	PPT	Review collection	Participatory Learning
51.	physical and chemical properties	CLO2 CLO3 CLO4	1	Demonstrati on	Discussion	Experiential Learning
52.	physical and chemical properties	CLO2 CLO3 CLO4	1	Brainstormi ng	Flipped classroom, Discussion	Participatory Learning
53.	Proteins: Biological importance,	CLO2 CLO3 CLO4	1	PPTFlipped Classroom	Review collection, Case study	Problem-based Learning
54.	classification,	CLO2 CLO3 CLO4	1	PPT	Case study	Problem-based Learning
55.	general properties.	CLO2 CLO3 CLO4	1	Video / Observation	Group discussion	Experiential Learning
56.	Primary structure-Human Insulin,	CLO2 CLO3 CLO4	1	Research article reading	Group reading and discussion	Experiential Learning
57.	Secondary structure - keratin	CLO2 CLO3 CLO4	1	PPT	Review collection	Participatory Learning
58.	tertiary structure-myoglobin	CLO2 CLO3 CLO4	1	Research article reading	Group reading and discussion	Experiential Learning
59.	quaternary structure-Hemoglobin	CLO2 CLO3 CLO4	1	PPT	Review collection, Case study	Problem-based Learning
Unit –V Metabolism of Biomolecules						
60.	Metabolism:	CLO3 CLO4	1	Research article reading	Group reading and discussion	Experiential Learning

61.	Catabolism	CLO3 CLO4	1	PPT	Review collection	Participatory Learning
62.	Anabolism.	CLO3 CLO4	1	Video / Observation	Group discussion	Experiential Learning
63.	Anabolism.	CLO3 CLO4	1	Video / Observation	Group discussion	Experiential Learning
64.	Energy metabolic pathways	CLO3 CLO4	1	Video / Observation	Group discussion	Participatory Learning
65.	Energy metabolic pathways	CLO3 CLO4	1	PPT, Socrative	Case study	Problem-based Learning
66.	Glycolysis	CLO3 CLO4	1	PPT	Review collection	Participatory Learning
67.	Glycolysis	CLO3 CLO4	1	PPT	Case study	Problem-based Learning
68.	Kreb's cycle,	CLO3 CLO4	1	Video / Observation	Group discussion	Experiential Learning
69.	Oxidative phosphorylation	CLO3 CLO4	1	PPT	Review collection	Participatory Learning
70.	Oxidative phosphorylation	CLO3 CLO4	1	Video / Observation	Group discussion	Experiential Learning
71.	Substrate level phosphorylation,	CLO3 CLO4	1	PPT	Review collection	Participatory Learning
72.	Gluconeogenesis	CLO3 CLO4	1	PPT	Review collection	Participatory Learning
73.	pentose phosphate pathway	CLO3 CLO4	1	Research article reading	Group reading and discussion	Participatory Learning

Name of the course	BT24A01-BIOCHEMISTRY
Name of the Faculty	Dr Rachana Sharma
Participatory Learning	40 %
Experiential Learning	40 %
Problem-based Learning	20 %

COURSE CODE	TITLE OF THE COURSE	CATEGORY	L	T	P	CREDITS
BT24AP1	**ALLIED PRACTICAL I- BIOCHEMISTRY AND BIOINSTRUMENTATION PRACTICAL**	**PRACTICALS**	**-**	**-**	**90**	**2**

Objectives:

- To facilitate the students to evaluate the methods of biomolecules estimations, separation techniques and biochemical analysis
- To enable the students to Learn to make standard solutions
- Gain knowledge in usage of separation techniques
- Apply the knowledge of understanding volumetric, colorimetric and spectrophotometric analysis

Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO	CLO Statement	Knowledge Level
CLO1	Remember and differentiate the different techniques employed in estimating biomolecules	K1
CLO2	Categorizing the method to quantify proteins and sugars	K2
CLO3	Examining the enzymatic assays and their calculations	K3
CLO4	Comprehend the basics of chromatography techniques	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	M	M
CLO2	S	S	M	M	S
CLO3	S	S	M	S	S
CLO4	S	M	S	M	M

S- Strong; M-Medium

BT24AP1- BIOCHEMISTRY AND BIOINSTRUMENTATION PRACTICAL

BIOCHEMISTRY **(45 hrs)**

1. Preparation and standardization of solutions
2. Qualitative Analysis of Carbohydrates – Glucose, Fructose, Sucrose, Starch
3. Qualitative Analysis of Amino acid – Glycine, Tyrosine, Cysteine, Tryptophan, Proline, glutamic acid
4. Estimation of proteins-Lowry's method
5. Estimation of total free amino acids – Ninhydrin Method
6. Estimation of Glucose (Dinitrosalicylic acid method)
7. Quantification of Vitamin C
8. Analysis of Oils - Acid Number

BIOINSTRUMENTATION **45 hrs)**

1. Laboratory rules and regulations –Safety principles and Handling
2. pH measurement of samples using pH meter
3. Preparation of buffer-Phosphate Buffer
4. Centrifugation-Separation of organelles using Centrifugation
5. Paper Chromatography- Separation of plant pigments
6. Spectrophotometric method -Estimation of chlorophyll content
7. Thin Layer Chromatography for separation of amino acids
8. Analysis of Phytochemicals using HPLC (demo)

TEXT BOOKS:

S.No	Authors	Title of the book	Publishers	Year & Edition
1.	Geethalakshmi, Sundararama, Anitha Arumugam	Lab in Cell Biology, Microbiology and Bioinstrumentation: Laboratory Manual	Amazon Asia-Pacific Holdings Private Limited	2017
2.	Deepak Shrivastava	Practical Handbook of Biochemistry: Lab Manual	Notion Press	2020
3.	Sadasivam, S. and Manickam, A.	Biochemical methods	New Age International Publishers.	2018 & 3rd Edition
4.	Veerakumari. L	Bioinstrumentation	MJP Publishers, New Delhi, India	2009

REFERENCE BOOKS:

S.No	Authors	Title of the book	Publishers	Year & Edition
1.	N.A. Khan & K.N.Singh	Laboratory Manual of Biochemistry	Daya Publishing House	2014
2.	Abhijit Paintal, Chinmoy Goswami, Rabindra Narain	Handbook of Bioinstrumentation	Dominant Publishers & Distributors	2011
3.	Pingoud, A and Urbanke, C.	Biochemical Methods: A Concise Guide for Students and Researchers	Wiley-VCH.	2010 &1st Edition

Course Designers:

Dr. R. Nirmal Kumar

Dr. V. Bhuvaneshwari