# CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS) NATIONALLY ACCREDITED (III CYCLE) WITH "A" GRADE BY NAAC ISO 9001:2015 CERTIFIED TIRUCHIRAPPALLI – 620 018

# **DEPARTMENT OF BIOTECHNOLOGY**



# B.Sc., BIOTECHNOLOGY SYLLABUS 2023 – 2024 and Onwards

# CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS) DEPARTMENT OF BIOTECHNOLOGY

# **VISION**

- To educate a broad range of basic lab skills applicable to biology and biotechnology.
- Make the students know and understand broad range of basic biological concepts and can apply and analyse these in at least one specialty area.
- Make the students generate a hypothesis, design approaches to test them and interpret the data from those tests to reach valid conclusions.
- To develop the ability to place their own works in a broader scientific context.

# **MISSION**

- To produce ambitious, creative graduates who are interested in continuing their education in biosciences.
- Make the students to read and critically evaluate the original scientific literature.
- To produce responsible biotechnology professionals to fulfill the employment and research needs in the biotechnology industry.
- Enhance the student's ability to integrate their acquired computer and biosciences knowledge and skills to investigate and solve the biological problems.
- To create opportunities for placement in leading industries through Internships.

# PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEOs	Statements
PEO 1	LEARNING ENVIRONMENT
	To facilitate value-based holistic and comprehensive learning by
	integrating innovative learning practices to match the highest quality
	standards and train the students to be effective leaders in their chosen
	fields.
PEO 2	ACADEMIC EXCELLENCE
	To provide a conducive environment to unleash students hidden talents
	and to nurture the spirit of critical thinking and encourage them to
	achieve their goal.
PEO 3	EMPLOYABILITY
	To equip students with the required skills in order to adapt to the
	changing global scenario and gain access to versatile career opportunities
	in multidisciplinary domains.
PEO 4	PROFESSIONAL ETHICS AND SOCIAL RESPONSIBILITY
	To develop a sense of social responsibility by formulating ethics and
	equity to transform students into committed professionals with a strong
	attitude towards the development of the nation.
PEO 5	GREEN SUSTAINABILITY
	To understand the impact of professional solutions in societal and
	environmental contexts and demonstrate the knowledge for overall
	sustainable development.

# PROGRAMME OUTCOMES FOR B.Sc., BIOTECHNOLOGY PROGRAMMES

PO NO	On completion of B.Sc., Biotechnology Programme, the students will be able to								
PO 1	Academic Excellence and Competence: Elicit firm fundamental knowledge in theory as well as practical for coherent understanding of academic field to pursue multi and interdisciplinary science careers in the future.								
PO 2	Holistic and Social approach: Create novel ideas related to the scientific research concepts through advanced technology and sensitivity towards sustainable environmental practices as well as social issues.								
PO 3	<b>Professional ethics and Teamwork:</b> Explore professional responsibility through projects, internships, field trips/industrial visits and mentorship programmes to transmit communication skills.								
PO 4	<b>Critical and Scientific thinking:</b> Equip training skills in Internships, Research Projects to do higher studies in multidisciplinary paths with a higher level of specialization to become professionals of high - quality standards.								
PO 5	<b>Social Responsibility with ethical values:</b> Ensure ethical, social and holistic values in the minds of learners and attain gender parity for building a healthy nation.								

# PROGRAMME SPECIFIC OUTCOMES FOR B.Sc., BIOTECHNOLOGY

PSO NO	The students of B.Sc., Biotechnology will be able to	POs
100110		Addressed
	Acquire knowledge of biological sciences with the implementation of	PO1
PSO 1	technology on different living systems like plants, animals and	PO 2
	microbes.	
	Explain the fundamental concepts and develop skills in Immunology,	<b>PO 1</b>
PSO 2	Developmental biology, Nanobiotechnology, Genomics, Proteomics,	<b>PO 2</b>
	Bioinformatics, Agriculture and Medicine	
PSO 3	Apply the technical aspects related to the improvement of microbes,	PO 2
1505	plants and live-stocks for the welfare of human and environment.	<b>PO 4</b>
PSO 4	Impart hands-on techniques in various thrust areas of biotechnology to	PO 2
1504	meet the emerging demands in industry, academia and research.	<b>PO 4</b>
	Gaining knowledge to transform theoretical concepts to practical	PO 2
PSO 5	products/process to move ahead in entrepreneurship and apply the	<b>PO 3</b>
	laws concerning to IPR and bioethics	<b>PO 5</b>

Cauvery College for Women (Autonomous), Trichy -18 Department of Biotechnology



B.Sc., Biotechnology Learning Outcome Based Curriculum Framework (CBCS - LOCF) (For the Candidates admitted from the Academic year 2023-2024 and onwards)

ter	Ļ					lits		Exar	n	al
nes	Par	Course Course Title Course Code		Inst Hrs	red	rs.	Ma	rks	<b>Fot:</b>	
Ser						C	Η	Int	Ext	
			Pothu Tamil –I	23ULT1						
			Hindi ka Samanya Gyan aur Nibandh	23ULH1						
	Ι	Language Course-I (LC)	Poetry, Grammar and History of Sanskrit Literature	23ULS1	6	3	3	25	75	100
			Foundation Course: Paper I - French I	23ULF1						
Ι	II	English Language Course -I (ELC)	Paper I - French I 23ULF1   nguage Course General English -I 23UE1   Cell and Molecular 22UPT1CC1					25	75	100
		Core Course – I (CC)	-I (ELC)Cell and Molecular Biology23UBT1CC1		5	5	3	25	75	100
		Core Practical - I (CP)	Cell and Molecular Biology (P)	23UBT1CC1P	3	3	3	40	60	100
	III	First Allied Course- I (AC)	Biological Chemistry	23UBT1AC1	4	3	3	25	75	100
		First Allied Course- II(AP)	Biological Chemistry (P)	23UBT1AC2P	4	3	3	40	60	100
	IV	Ability Enhancement Compulsory Course-I (AECC)	Value Education	2	2	-	100	_	100	
			Total	30	22				700	
			Pothu Tamil -II	23ULT2						
			Hindi Literature &Grammar – II	22ULH2						
	Ι	Language Course - II (LC)	Prose, Grammar and History of Sanskrit literature	23ULS2	6	3	3	25	75	100
		<b>F</b> 1' 1 T	Basic French – II	22ULF2						
	II	Course -II (ELC)	General English -II	23UE2	6	3	3	25	75	100
II		Core Course – II (CC)	Genetics	23UBT2CC2	5	5	3	25	75	100
		Core Practical - II (CP)	Genetics (P)	23UBT2CC2P	3	3	3	40	60	100
	III	Core Course - III (CC)	Biomolecular Techniques	23UBT2CC3	2	2	3	25	75	100
		First Allied Course – III (AP)	General Microbiology	23UBT2AC3	4	3	3	25	75	100
		Ability Enhancement Compulsory Course-II(AECC)	Environmental Studies	22UGEVS	2	2	-	100	-	100
	IV	Ability Enhancement Compulsory Course-III(AECC)	Course-II(AECC)Innovation and Entrepreneurship22UGIE				-	100	-	100
		Extra Credit Course	SWAYAM	As pe	er UC	C Re	comm	endatic	n	· .
				Total	30	22				800

Semester – I	Internal Marks: 25	External Marks: 75				
COURSE CODE	COURSE TITLE	CATEGORY	HOURS/WEEK	CREDITS		
23UBT1CC1	CELL AND MOLECULAR BIOLOGY	CORE	5	5		

- > To learn about the fundamentals of cell and its structure.
- > To study the cellular organelles and membrane
- > To understand the molecular structure and functions of DNA and RNA
- > To evaluate the mechanism of transcription and translational process

# **Course Outcome and Cognitive Level Mapping**

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

CO Number	CO Statement	Cognitive Level
CO1	Understand the basic knowledge about cell and to compare the structure of prokaryotic cell with eukaryotic cell	K1, K2
CO2	Illustrate the fundamentals about the structural and functional aspects of cell organelles and cell membrane	К2
CO3	Categorize the importance of cells to the intra and extracellular environment by discussing about the intracellular signaling pathways	K3
CO4	Analyze the structure and functions of nucleic acid and acquire knowledge about the molecular mechanism of DNA and RNA	K4
CO5	Analyze the molecular mechanism of transcription, translation and post translational modifications of proteins	K4

# Mapping of CO with PO and PSOs

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	2	1	3	2	2	2	1
CO2	3	3	3	2	1	3	3	2	2	1
CO3	3	3	3	3	2	3	3	3	3	2
CO4	3	3	3	3	2	3	3	3	2	1
CO5	3	3	3	2	2	3	3	3	2	1

"1" - Slight (Low) Correlation, "2" - Moderate (Medium) Correlation,

"3" – Substantial (High) Correlation, "-" indicates there is no Correlation.

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
Ι	<b>Cell Structure:</b> Discovery and diversity of cells - Cell theory - Structure of prokaryotic (bacteria) and eukaryotic cells (plant and animal cells).	10	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4
п	IntroductiontoCellularOrganelles:BiomacromoleculesandBiomicromolecules(Primary functions inthe cell).Structure andFunctions of Cell Organelles:Cell wall - Cellmembrane - Cytoplasm - Nucleus - Endoplasmicreticulum - Ribosomes - Golgi bodies - Plastids -Vacuoles - Lysosomes - Mitochondria - Flagella -Cilia - Centrosome and Centrioles - Cytoskeleton.	17	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4
III	<b>Cell Division and Cell Signalling:</b> Cell cycle - Cell cycle check points - Cell division - Mitosis and Meiosis - Cellular differentiation - Cell junctions - Cell Adhesion - Extra Cellular Matrix - Cell to cell communications - Signal transduction - G - Protein Coupled Receptors Signal transduction pathways.	16	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4
IV	<b>Structure and Functions of DNA and RNA:</b> Structure and functions of DNA- Types of RNA - Central Dogma of the cell: DNA - Replication in prokaryotes and eukaryotes - Enzymes and Proteins involved in Replication - Inhibitors of DNA Replication.	16	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4
V	<b>Introduction to Transcription and Translation:</b> Transcription - Transcription in prokaryotes and eukaryotes - initiation, elongation, termination and Post Transcriptional Modifications. Translation in prokaryotes and eukaryotes - Similarities and differences in prokaryotic and eukaryotic translation - Post Translational Modifications - Protein Sorting - Protein degradation	16	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4
VI	Self-Study for Enrichment (Not Included for End Semester Examination) Eukaryotic rRNA genes, formation of eukaryotic tRNA molecules.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4

#### Text books

- 1. Harvey, L., Arnold, B., Lawrence, Z., Paul, M., David, B., James, D. (2020). *Molecular Cell biology*. 5th Edition.W. H. Freeman Publishers.
- 2. Bruce, A. (2014). *Molecular Biology of the cell*. 6th Edition. W. W. Norton Publishing Company.
- 3. Devasena, T. (2012). Cell Biology, Oxford University Press.
- 4. Robert, W. (2012). Molecular Biology. 5th Edition. McGraw Hill.
- 5. James Watson, D. (2011). *The Double Helix: A personal account of the Discovery of the Structure of DNA*. Touchstone Publishers.

# **Reference books**

- 1. Brown, T. A. (2021). *Gene Cloning and DNA Analysis: An Introduction*. 8th Edition. Wiley and Sons.
- 2. Cooper, G. (2018). The Cell: A Molecular Approach, 8th Edition. Oxford University Press.
- 3. Thomas Pollard, D., William Earnshaw, C., Jennifer Lippincott, S., Graham Johnson, T. (2017). *Cell Biology*. 3rd Edition. Elsevier publishers.
- 4. James Watson, D., Baker Tania, A., Bell Stephen, P., Alexander, G., Michael, L., Losick, R. (2016). *Molecular Biology of the gene*. 7th Edition. Pearson Publishers.
- 5. Walker John, M. & Ralph, R. (2015). *Molecular Biology and Biotechnology*. 6th Edition. RSC Publishing.

# E – Books

- 1. https://www.pdfdrive.com/molecular-cell-biology-molecular-cell-biology-e7302545.html
- 2. <u>https://www.pdfdrive.com/cell-division-genetics-and-molecular-biology-cell-division-genetics</u> <u>and-molecular-biology-e22406140.html</u>
- 3. <u>https://www.pdfdrive.com/molecular-cell-biology-e187264624.html</u>
- 4. <u>https://www.pdfdrive.com/dna-replication-recombination-and-repair-molecular-mechanisms-and</u> pathology-e187695166.html
- 5. <u>https://www.pdfdrive.com/a-characterization-of-the-role-of-post-translational-modifications-in-transcriptional-regulation-by-e74315851.html</u>

# Web References

- 1. https://www.lehigh.edu/~inbios21/PDF/Fall2008/Lopresti\_11142008.pdf
- 2. https://www.genome.gov/geneticsglossary/Organelle.pdf
- 3. http://kea.kar.nic.in/vikasana/bridge/biology/chap\_14.pdf
- 4. http://ncbr.muni.cz/~martinp/C3210/StructBioinf3.pdf
- 5. https://sites.engineering.ucsb.edu/~shell/che170/DNA-notes.pdf

# Pedagogy

Chalk and Talk, PPT, Animation and Videos

# **Course Designer**

Dr. R. RAMESHWARI

Semester – I	Internal Marks: 25 External N					
COURSE CODE	COURSE TITLE	CATEGORY	HOURS/WEEK	CREDITS		
	CELL AND					
23UBT1CC1P	MOLECULAR	CORE	3	3		
	<b>BIOLOGY (P)</b>					

- > To perform experiments using microscopes and micrometry.
- > To study about cells and their morphology by appropriate techniques.
- > To gain knowledge in cell division and their stages.
- > To develop skills related to the Isolation and Separation Techniques of Nucleic acids.

# **Course Outcome and Cognitive Level Mapping**

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

CO Number	CO Statement	Cognitive Level
CO 1	Define and describe the basic instruments involved in Biology.	K1, K2
CO 2	Discuss and differentiate the morphology of various types of cells.	K2
CO 3	Classify and illustrate the different cellular organelles.	K3
CO 4	Categorize the different types and stages of cell division.	K4
CO 5	Illustrate the techniques involved in size analysis of macromolecules.	K4

# Mapping of CO with PO and PSO

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2	3	2	3	3	1
CO2	3	3	3	3	2	3	2	3	3	1
CO3	3	2	3	3	2	3	2	3	3	1
CO4	3	2	3	3	1	3	2	2	3	1
CO5	3	3	3	3	1	3	2	2	3	2

"1" – Slight (Low) Correlation, "2" – Moderate (Medium) Correlation, "3" – Substantial (High) Correlation, "-" indicates there is no correlation.

#### Syllabus

- 1. Laboratory rules, regulations and safety measures.
- 2. Components of a Compound / Light Microscope.
- 3. Blood smear preparation and Identification of Blood cells.
- 4. Measurement of Cell Size by Micrometry.
- 5. Morphological Characterization of various types of Plant tissue cells.
- 6. Cell fractionation and Identification of cell organelles (Demo)
- 7. Barr body identification from Buccal Smear.
- 8. Observation of Mitosis in Onion root tip cells.
- 9. Observation of Binary fission in Yeast Cells.
- 10. Cell Counting and viability in Yeast Cells
- 11. Enumeration of Eukaryotic Cells Red Blood Cells
- 12. Enumeration of Eukaryotic Cells White Blood Cells
- 13. Isolation and purification of Genomic DNA from Human Cheek Cells.
- 14. Separation of DNA by using AGE
- 15. Separation of Protein by using SDS PAGE

#### **Reference Books**

- Trigunayat, M. M., Trigunayat, K. (2019). A Manual of Practical Zoology: Biodiversity, Cell Biology, Genetics & Developmental Biology Part-1. Scientific Publishers.
- 2. Amit, G., Bipin Kumar, S. (2019). *Practical Laboratory Manual Cell Biology*. Lambert Academic Publishing.
- 3. Hubel, A. (2018). Preservation of cells: a practical manual. John Wiley & Sons.
- 4. Das, D. (2017). ESSENTIAL PRACTICAL HANDBOOK OF CELL BIOLOGY & GENETICS, BIOMETRY & MICROBIOLOGY: A LABORATORY MANUAL. Academic Publishers.
- 5. Rybicki, E. (2014). A Manual of Online Molecular Biology Techniques. University of Cape Town.

# E - Books

- 1. <u>https://www.google.co.in/books/edition/CELL\_AND\_MOLECULAR\_BIOLOGY/Qy7Ioup</u> <u>YJacC?hl=en&gbpv=1&printsec=frontcover</u>
- 2. https://www.academia.edu/71052580/Techniques in Molecular\_Biology\_Lab\_Manual\_2
- 3. <u>https://www.deanza.edu/faculty/heyerbruce/b6b\_pdf/Bio6B-Manual\_W19.pdf</u>
- 4. https://www.researchgate.net/publication/330654692\_Cell\_Biology\_Practical\_Manual
- 5. https://onlinelibrary.wiley.com/doi/book/10.1002/0470033487
- 6. <u>https://www.bioscience.com.pk/topics/zoology/item/614-chick-embryo-at-24-hours</u>

#### Pedagogy

Practical Observation, Video and Demo

#### **Course Designer**

Ms. P. ILAMATHY

Semester – I	Internal Marks: 25		External	Marks: 75
COURSE CODE	COURSE TITLE	CATEGORY	HOURS/WEEK	CREDITS
23UBT1AC1	BIOLOGICAL CHEMISTRY	ALLIED	4	3

- > To learn about the fundamentals of atoms and periodic table classification.
- $\blacktriangleright$  To study the concepts of acids and bases.
- > To understand the fundamentals of carbohydrates, lipids, fatty acids and nucleic acids.
- > To evaluate the structural properties of proteins, amino acids, vitamins and hormones.

# **Course Outcome and Cognitive Level Mapping**

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

CO Number	CO Statement	Cognitive Level
CO1	Understand the basic knowledge about structure of atoms, periodic properties of elements and differentiate the properties of chemical substances	K1, K2
CO2	Illustrate the types of chemical reactions and to calculate the stoichiometry and rate	К2
CO3	Categorize the importance of classification, properties, structure of carbohydrates and various biochemical cycles involved in carbohydrate metabolism	К3
CO4	Analyze the classification and structural properties of lipids, fatty acids and nucleic acids	K4
CO5	Determine the chemistry, classification, structural properties of proteins, amino acids, vitamins and hormones	K4

#### Mapping of CO with PO and PSOs

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	2	1	3	3	2	2	1
CO2	3	3	3	2	2	3	3	3	2	2
CO3	3	3	3	2	1	3	3	3	2	1
CO4	3	3	3	3	2	3	3	3	3	3
CO5	3	3	3	3	2	3	3	3	3	3

"1" – Slight (Low) Correlation, "2" – Moderate (Medium) Correlation,

"3" – Substantial (High) Correlation, "-" indicates there is no Correlation.

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
Ι	<b>Basics of Biological Chemistry:</b> Acids & Bases properties and differences, Concepts of acids and bases. pH of solution, pH scale, measurement of pH. Buffer solutions, properties of buffers, Henderson - Hasselbalch equation. The chemical foundation of life. Water: its unique properties, ionization of water, buffering action in biological system, properties and characteristics of water.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4
п	<b>Fundamentals of Carbohydrates and Biochemical Cycles:</b> Classification of carbohydrates. Properties of carbohydrates. Ring structure of sugars and conformation of sugars. Metabolism of Carbohydrates – Glycogenesis, Glycolysis, Glycogenolysis, TCA cycle.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4
III	<b>Classification of Lipids and Nucleic acids</b> : Classification of Lipids. Properties and Biological importance of lipids. Metabolism of Fatty acids, triglycerides, phospholipids, cholesterol. β -oxidation of fatty acids. Classification of nucleic acids. Classification of DNA & RNA.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4
IV	Introduction to Proteins and Amino acids: Classification and structure of amino acids. Structural conformation of proteins. Classification of proteins. Properties and biological importance of amino acids and proteins. Degradation of Amino acids and Urea Cycle. ATP production. Oxidative phosphorylation, Electron transport chain and Photophosphorylation.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4
V	Vitamins and Minerals: Vitamins: Definition, Classification. Fat soluble vitamins- sources, structure and physiological functions; Water soluble vitamins-sources, structure and physiological functions. Vitamin deficiency diseases. Minerals: Macro minerals and micro minerals - sources and functions	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4
VI	Self-Study for Enrichment (Not Included for End Semester Examination) Weak interactions in aqueous systems, water as a reactant and fitness of the aqueous environment. Lipids as signals, cofactors and pigments.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4

# Text books

- 1. Singh, S. P., Singh, A. N. (2021). Textbook of Biochemistry. CBS Publishers.
- 2. Gupta, S. N. (2020). Concepts of Biochemistry. Rastogi Publications.
- 3. Sathyanarayana, U., Chakrapani, U. (2020). Biochemistry, 5th Edition. Elsevier Publishers.
- 4. Seema Pavgi, U. (2020). Textbook of Biochemistry.1st Edition. Dreamtech Press.
- 5. Padmaja Agarkar, H., Yogesh, K. & Rammohan, R. (2020). *Biochemistry*. Nirali Prakashan Publishers.

#### **Reference** books

- 1. Manzoor Malik, M. (2021). Fundamentals of Biochemistry. LAP Lambert Academic Publishing.
- 2. Vikrant, V. (2021). Biochemistry. Discovery Publishing House Pvt Ltd.
- 3. Brailsford Robertson, T. (2020). Principles of Biochemistry. MJP Publishers.
- 4. Jeremy Berg, M., Stryer, L., Tymoczko, J., Gatto, G. (2019). *Biochemistry*. Freeman and Company.
- 5. Dean Appling, R., Spencer Anthony, J., Cohill, C., Christopher Mathews, K. (2017). *Biochemistry Concepts and Connections*. Pearson Education.

# E – Books

- 1. https://www.pdfdrive.com/lehninger-principles-of-biochemistry-d158404366.html
- 2. https://www.pdfdrive.com/biochemistry-d196362531.html
- 3. https://www.pdfdrive.com/biochemistry-genetics-molecular-biology-d18198970.html
- 4. <u>https://www.pdfdrive.com/marks-basic-medical-biochemistry-a-clinical-approach-5th-edition-e158491166.html</u>
- 5. https://www.pdfdrive.com/biochemistrystrayer-e25312085.html

# Web References

- 1. <u>http://ecoursesonline.iasri.res.in/course/view.php?id=422</u>
- 2. https://nptel.ac.in/courses/102105034/
- 3. https://youtu.be/DhwAp6yQHQI
- 4. https://agrimoon.com/fundamentals-of-biochemistry-pdf-book/
- 5. http://courseware.cutm.ac.in/courses/fundamentals-of-biochemistry/

#### Pedagogy

Chalk and Talk, PPT, Animation and Videos

#### **Course Designer**

Ms.P. ILAMATHY

Semester-III	Internal Marks: 25		External	Marks: 75
COURSE CODE	COURSE TITLE	CATEGORY	HOURS/ WEEK	CREDITS
23UBT1AC2P	<b>BIOLOGICAL CHEMISTRY (P)</b>	ALLIED	4	3

- > To acquire skills about the various techniques in Biochemical Analysis
- > To understand the basic concepts of Chemical preparations.
- > To study about the qualitative and quantitative analysis of various chemical compounds.
- > To perform experiments on detection of chemicals present in unknown solutions.

#### **Course Outcome and Cognitive Level Mapping**

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

CO Number	CO Statement	Cognitive Level
CO 1	Demonstrate and discuss the genomic DNA and protein isolation method from different sources	K1, K2
CO 2	Describe and outline the method of qualitative and quantitative analysis of organic compounds.	K2, K3
CO 3	Classify and categorize the organic compound according to the experimental analysis	K3, K4
CO 4	Analyse and estimate the quantity of compounds in unknown given sample	K4, K5
CO 5	Analyze, compare and distinguish the nature of various organic classes of compounds qualitatively.	K4, K5

## Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2	3	2	3	3	1
CO2	3	3	3	3	2	3	3	3	3	1
CO3	3	2	3	3	2	3	2	3	3	1
CO4	3	2	3	3	2	3	2	2	3	3
CO5	3	3	3	3	2	3	3	2	3	2

"1" – Slight (Low) Correlation, "2" – Moderate (Medium) Correlation,

"3"-Substantial (High) Correlation, "-" indicates there is no Correlation.

# Syllabus

- 1. Units and Measurements.
- 2. Preparation of Molarity, Normality solutions and Buffers.
- 3. Determination of pH and use of pH meter.

Qualitative Analysis

- 4. Qualitative analysis of carbohydrates Glucose, sucrose and starch.
- 5. Qualitative analysis of amino acids Tyrosine, Tryptophan, Arginine, Proline and Cysteine.

Quantitative Analysis

6. Analyse Blood Glucose Level

Volumetric Analysis

- 7. Estimation of Glycine- Formal Titration.
- 8. Determination of Ascorbic acid DCPIP method.
- 9. Estimation of Ferrous sulphate using standard Mohr's salt.

Colorimetric Analysis

10. Estimation of glucose - DNS method.

11. Estimation of Cholesterol- Zak's method

12. Estimation of proteins – Bradford's method

Chromatographic Analysis

13.Separation of plant pigments using Paper chromatography

#### **Reference Books**

- 1. Evangeline, J. (2022). *Manual of Practical Medical Biochemistry*. 3rd edition. Jaypee Brothers Medical Publishers.
- 2. Chawla, R. (2020). Practical Clinical Biochemistry: Methods and Interpretations. JP Medical Ltd.
- 3. Kaushik, G.G., Neha, S., Sabira, D., Ruchi, J. (2020). *Practical Manual of Biochemistry*. CBS Publishers and Distributors
- 4. Gupta, R.C., Bhargava, S. (2018). Practical Biochemistry. 5th Edition. CBS Publishers.
- 5. Plummer, D. T. (2017). *An Introduction to Practical Biochemistry*. 3rd Edition. Tata McGraw-Hill Education.
- 6. Jayaraman, J. (2011). *Laboratory Manual in Biochemistry*, New Age International Pvt Ltd Publishers.

# E-Books

1.https://skyfox.co/wp-content/uploads/2020/12/Practical-Manual-of-Biochemistry.pdf

- 2. https://www.pdfdrive.com/practical-biochemistry-e187196416.html
- 3. https://www.pdfdrive.com/practical-clinical-biochemistry-e187182591.html

4.<u>https://www.pdfdrive.com/marks-basic-medical-biochemistry-a-clinical-approach-5th-edition-e158491166.html</u>

5.https://www.researchgate.net/publication/313745155\_Practical\_Biochemistry\_A\_Student\_Companion

# Web References

- 1. https://biotech01.vlabs.ac.in/List%20of%20experiments.html
- 2. https://vlab.amrita.edu/?sub=3&brch=63&sim=156&cnt=1
- 3. https://www.vrlabacademy.com/Experiments/501/Medical-Biochemistry-Laboratory.html
- 4. https://www.asbmb.org/education/online-teaching/online-lab-work

# Pedagogy

Practical Observation and Demo

# **Course Designer**

Dr. M. KEERTHIGA

Semester II	Internal Marks	:: 25	Exte	rnal Marks: 75
COURSE CODE	COURSE TITLE	CATEGORY	HOURS/WEEK	CREDITS
23UBT2CC2	GENETICS	CORE COURSE-II	5	5

- > To predict and analyze the inheritance of traits in various genetic scenarios.
- To apply the concepts of genetics, inheritance patterns and genetic disorders in various organisms including humans.
- > To conduct pedigree analysis to determine the inheritance patterns of genetic traits within families.
- To apply the knowledge of chromosomal disorders and chromosomal aberrations into genetic research, genetic counselling and the diagnosis of chromosomal disorders.
- > To identify scenarios and conditions where genetic drift and genetic shift are most likely to occur.

#### **Course outcome and Cognitive Level Mapping**

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

CO	CO Statement	Cognitive
Number		Level
CO1	Understand the historical milestones in molecular biology and genetics, the structure and functions of nucleic acids and their significance in the field of biology and genetics.	K1, K2
CO2	Illustrate about the structural organization of chromosome, chromosomal aberrations, chromosomal disorders.	K2
CO3	Understand the fundamental principles of inheritance as elucidated by Mendel, as well as subsequent developments in genetics related to gene linkage and independent assortment.	K3
CO4	Analyse pedigrees to determine the inheritance patterns of sex-linked traits and predict the probabilities of inheritance.	K4
CO5	Apply the knowledge of gene frequency, genetic drift and shift, pedigree analysis into study of evolution, genetic disorders.	K4

#### Mapping of CO with PO and PSO

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	1	2	2	1	3	1	2	3	1
CO2	3	2	2	2	1	3	1	2	2	1
CO3	3	3	2	2	1	3	3	2	2	1
CO4	3	3	2	2	1	3	3	2	3	1
CO5	3	3	3	3	1	3	3	3	3	2

"1" – Slight (Low) correlation "3" – Substantial (High) correlation "2" - Moderate (Medium) correlation

"\_" indicates there is no correlation

UNIT	CONTENT	HOURS	COs	COGNITI VE LEVEL
I	Historical developments of molecular biology and Genetics; DNA as genetic material - Griffith's, Hershey - chase Experiments; Avery Macleod Mccarty Experiment. Structure and functions of Nucleic acids: Nucleosides and Nucleotides, Purines and Pyrimidines. Watson and Crick model of DNA. A, B & Z forms of DNA. Structure of RNA and its Types.	15	CO1, CO2, CO3	KI, K2, K3, K4
П	Chromosome's structural organization – Chromatin and chromatids; Special types of Chromosomes: Polytene and Lampbrush chromosomes. Chromosomal variation in number, Changes in Chromosomal structure, Chromosomal disorders - Transposable elements in prokaryotes and eukaryotes.	15	CO1, CO2, CO4	KI, K2, K3, K4
III	Early concepts of inheritance; Discussion on Mendel's Laws of inheritance - Law of Dominance and Uniformity – Incomplete dominance and codominance; Law of Segregation of genes - Morgan's work on Drosophila; Law of Independent Assortment – Dihybrid cross. Test cross and Back Cross	15	CO2, CO3, CO4	KI, K2, K3, K4
IV	Sex determination, differentiation and sex-linkage, Sex – linked inheritance, Sex-influenced and sex-limited traits; Linkage Analysis – Fruit Fly. Recombination and genetic mapping in eukaryotes, Multiple Alleles – ABO Blood Grouping.	16	CO3, CO4, CO5	KI, K2, K3, K4
V	Genetic control of Development in Drosophila and Arabidopsis. Population genetics, calculating gene frequency, factors affecting gene frequency. Genetic drift, Shift, Pedigree analysis and genetic counselling.	14	CO3, CO4, CO5	KI, K2, K3, K4
VI	Self-Study for Enrichment RNA as genetic material – Fraenkel - Conrat Experiment- Chromosomal aberrations, Somatic cell genetics. (Not Included for End Semester Examination)	-	CO1, CO2, CO4	KI, K2, K3, K4

#### **Text Books**

- 1. Vishnu Shankar, S. (2021). Fundamentals of Genetics and Molecular Biology. Red'shine Publication Pvt. Ltd.
- 2. Pierce, B. A. (2018). Genetics essentials: concepts and connections (p. 488). WH Freeman.
- 3. Brown, T. A. (2012). Introduction to genetics: a molecular approach. Garland Science.
- 4. Vega, L. (2019). Fundamentals of genetics. Scientific e-Resources.
- 5. Panchal, S. (2022). Fundamentals of Genetics. In *Genetics Fundamentals Notes* (pp. 3-51). Singapore: Springer Nature Singapore.

#### **Reference Books**

1. Pierce, B. A. (2012). Genetics: a conceptual approach. Macmillan.

2. Brooker, R. J. (2015). Genetics: analysis and principles. (No Title).

3. Goldberg, M. L., Fischer, J. A., Hood, L., & Hartwell, L. (2021). Genetics: from genes to genomes. (*No Title*).

4. Russell, P. J., & Gordey, K. (2002). IGenetics (No. QH430 R87). San Francisco: Benjamin Cummings.

5. Watson, J. D. (2004). *Molecular biology of the gene*. Pearson Education India.

# E - books

1. https://www.pdfdrive.com/lewins-genes-xii-e185848559.html

2.<u>https://www.pdfdrive.com/introduction-to-genetics-a-molecular-approach-e187102063.html</u>

- 3. https://www.pdfdrive.com/the-cell-a-molecular-approach-e186369576.html
- 4. https://www.pdfdrive.com/genetics-a-conceptual-approach-e186741220.html

#### Web References

1. https://microbenotes.com/category/molecular-biology/

2. https://www.easybiologyclass.com/topic-genetics/

3. https://ocw.mit.edu/courses/7-03-genetics-fall-2004/pages/lecture-notes/

4.<u>http://ndl.iitkgp.ac.in/document/bnZnR2hPaUVqRU9TbFc2Rmp1MVJzN0dyTCs3OGxyRz</u> <u>daUWpPTzdRV2pBTT0</u>

#### Pedagogy

Blackboard, PPT, Videos, Animations, Group Discussion and Quiz.

#### **Course Designer**

#### Dr. R. RAMESHWARI

Semester-II	Internal Marks: 40	External Marks: 60			
COURSE CODE	COURSE TITLE	CATEGORY	HOURS/ WEEK	CREDITS	
23UBT2CC2P	GENETICS (P)	CORE PRACTICAL-II	3	3	

- > To learn and execute various techniques in genome analysis.
- > To study the basic concepts of mendelian laws and its deviations using simple problems.
- > To study effects of mutations and molecular markers.
- > To learn Cultural handling technique of *Drosophila melanogaster*.
- > To prepare permanent slides of polytene chromosome.

#### **Course outcome and Cognitive Level Mapping**

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

СО	CO Statement	Knowledge
Number		Level
CO 1	Demonstrate the basic principles of important techniques in Genetics.	K1
CO 2	Analyze the Polytene chromosome of the organisms. Identify Barr bodies from Buccal smear	K2
CO 3	Perform basic genetics problem based on Mendel's laws	K2
CO 4	Apply the effects of mutation and appraise the applications of molecular markers.	K3
CO 5	Identify and analyze chromosomal aberrations using karyotyping methods	К3

#### Mapping with Programme Outcomes

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	2	1	3	3	2	3	1
CO2	3	3	3	2	1	3	2	2	3	1
CO3	3	3	2	2	1	3	2	2	2	2
CO4	3	3	3	3	1	3	2	2	3	1
CO5	3	3	2	3	1	3	2	2	2	1

"1" – Slight (Low) Correlation,

"2" - Moderate (Medium) Correlation,

"3"-Substantial (High) Correlation,

"-"indicates there is no Correlation.

#### Syllabus

- 1. Mendel's law of genetics Mono and Dihybrid crosses.
- 2. Rearing morphology of Drosophila (mutant eye identification)
- 3. Observation of Genetic model organisms (*Arabidopsis thaliana* and *Coenorrabditis elegans*)- Permanent slides
- 4. Isolation of spontaneous mutant cells.
- 5. Isolation of petite mutant yeast cell.
- 6. Study the effect of physical mutagens on bacterial characteristics.
- 7. Karyotype analysis- Human (Normal and Abnormal) and onion.
- 8. Identification of Barr body (Buccal epithelium smear)
- 9. Preparation of polytene chromosomes (Chironomous larvae salivary gland)- squash preparation.
- 10. Pedigree charts of some common characters like blood group and color blindness.
- 11. Determination the ABO blood groups in a random sample and calculation of the allele frequency using Hardy Weinberg's law.

#### **Reference books**

- 1. Kaushik Kumar Panigrahi. (2019), *Practical Manual on "Fundamentals of Genetics"* (*PBG-121*). First Publisher: Odisha University of Agriculture & Technology.
- 2. Amita J, Jyotsna A and Vimala V (2018). *Microbiology Practical Manual*. (1st Edition). Elsevier India.
- 3. Talib VH (2019). Handbook Medical Laboratory Technology. (2nd Edition). CBS.
- 4. Snustad, D.P., Simmons, M.J. (2009). *Principles of Genetics*. V Edition. John Wiley and Sons Inc.
- 5. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). *Concepts of Genetics. IX* Edition. Benjamin Cummings.

# **E-Books:**

- 1. <u>https://www.pdfdrive.com/a-manual-of-laboratory-and-diagnostic-tests-e157742334.html</u>
- 2. <u>https://www.pdfdrive.com/lippincott-manual-of-nursing-practice-e189815788.html</u>
- 3. <u>https://www.pdfdrive.com/introduction-to-genetic-analysis-solutions-megamanual-e158762003.html</u>

#### Web links:

- 1. https://egyankosh.ac.in/bitstream/123456789/16314/1/Experiment-8.pdf
- 2. <u>https://uou.ac.in/sites/default/files/slm/MSCBOT-510(L).pdf</u>
- 3. <u>https://vlab.amrita.edu/?sub=3&brch=76&sim=1089&cnt=1</u>
- 4. <u>https://webstor.srmist.edu.in/web\_assets/srm\_mainsite/files/files/BT0213%20-</u>%20CELL%20BIOLOGY%20PRACTICAL%20MANUAL.pdf
- 5. https://www.iitg.ac.in/cseweb/vlab/anthropology/procedure\_mendels.html

#### Pedagogy

Practical Observation and Demo

#### **Course Designer**

# Dr. M. KEERTHIGA

Semester – II	Semester – II Internal Marks: 25				
COURSE CODE	COURSE TITLE	CATEGORY	HOURS/ WEEK	CREDITS	
23UBT2CC3	BIOMOLECULAR TECHNIQUES	CORE COURSE	2	2	

- ➤ To understand the working principles of different instruments used in the biological field
- ➤ To provide a better understanding of various analytical techniques
- ➤ To operate and maintain common bio instruments effectively and safely.
- > To understanding of biomedical instrumentation principles in aspects of device design and applications.
- An ability to analyze contemporary bioinstrumentation studies to make connections and decisions based on their scientific merit.

#### **Course Outcome and Cognitive Level Mapping**

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

CO Number	CO Statement	Knowledge Level
CO1	Define and Express the principle of Microscopy, Electrophoresis, Chromatography, Colorimeter and tracing Techniques	K1, K2
CO2	Demonstrate and analyze of the economic and environmental aspects of bioinstrumentation, including cost-effective instrument selection, maintenance, and sustainable practices	K2, K4
CO3	Interpret the types and applications of microscopy, Electrophoresis, Chromatography, Colorimeter and Centrifugation techniques	K3
CO4	Appraise the advantages of advanced techniques like HR_TEM,2D-GEL, LC-MS, FTIR and NMR	K5
CO5	Elaborate the role of Bioinstrumentation techniques in advancing healthcare, scientific discovery, and the understanding of biological systems	K6

#### Mapping of CO with PO and PSO

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	1	2	2	1	3	1	2	3	1
CO2	3	2	2	2	1	3	1	2	2	1
CO3	3	3	2	2	1	3	3	2	2	1
CO4	3	3	2	2	1	3	3	2	3	1
CO5	3	3	3	3	1	3	3	3	3	2

"1" – Slight (Low) Correlation, "2" – Moderate (Medium) Correlation,

**"3"** – Substantial (High) Correlation, "-" indicates there is no correlation.

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
Ι	<b>Microscopy:</b> Light Microscopy, Bright and Dark field Microscopy, Fluorescence Microscopy, Confocal Microscope, Electron microscopy	5	CO1, CO2, CO3	K1, K2, K3, K4
II	<b>pH Meter &amp; Spectrophotometer:</b> pH Meter: Principle and Operation of pH meter, Calomel Electrode, Glass Electrode, Combined Electrode, Methods of determining pH. Colorimeter – Principle and its applications, Beer Lambert's Law, Spectrophotometer- Principle and its applications, Types of Spectrophotometer- UV – Visible	4	CO1, CO2, CO3	K1, K2, K3, K4
III	<b>Centrifugation and Imagining Techniques:</b> Centrifugation – Principle, Types – Zonal, Differential, Density gradient centrifugation and ultracentrifugation its applications. Imaging Techniques- X-ray and NMR. Tracer Techniques - Radioactive isotope –Half life, GM Counter, Liquid Scintillation Counter.	5	CO2, CO3, CO4	K1, K2, K3, K4
IV	<b>Electrophoresis:</b> Principle and Applicationsof Electrophoresis – Types of electrophoresis- Pulsed Field Gel Electrophoresis, SDS-PAGE and 2 D gel; Immunoelectrophoresis; Blotting Techniques; Gel documentation	8	CO3, CO4, CO5	K1, K2, K3, K4
V	<b>Chromatography:</b> Fundamentals of Chromatography - Principle and its applications, Types –TLC, Column, Affinity, Ion –exchange, HPLC.	8	CO3, CO4, CO5	K1, K2, K3, K4
VI	Self-Study for Enrichment Introduction to Instrumentation, AGE (Not Included for End Semester Examination)	-	CO1, CO2	K1, K2, K3, K4

#### **Text Books**

- 1. Agarwal, P.K., Baqri, S.R & Gau, K. (2022). Molecular Biology, Bioinstrumentation and Biotechniques. Pragati Prakashan Publishers.
- 2. Vitha, M. F. (2018). Spectroscopy: Principles and instrumentation. John Wiley & Sons.
- 3. Ohlendieck, K., & Harding, S. E. (2018). Centrifugation and ultracentrifugation. *Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology*, 1(2), 424-453.
- 4. Skoog, D. A., Holler, F. J., & Crouch, S. R. (2017). *Principles of instrumental analysis*. Cengage learning.

- 5. Ismail, B., & Nielsen, S. S. (2010). Basic principles of chromatography. *Food analysis*, 27, 473-498.
- 6. Enderle, J., & Bronzino, J. (Eds.). (2012). *Introduction to biomedical engineering*. Academic press.

#### **Reference Books**

- 1. Bogusław, B & Irena B (2022). Handbook of Bioanalytics. Springer InternationalPublishing.
- 2. Webster, J. G. (Ed.). (2003). Bioinstrumentation. John Wiley & Sons.
- 3. Khandpur, R. S. (2005). *Biomedical instrumentation: Technology and applications* (Vol. 1). New York: Mcgraw-hill.
- 4. Upadhyay, A., Upadhyay, K., & Nath, N. (1993). Biophysical chemistry principles and techniques.
- 5. Chatterjee, S., & Miller, A. (2012). *Biomedical instrumentation systems*. Cengage Learning.

# E books

- 1. https://www.academia.edu/30824186/6846793\_Bioinstrumentation\_pdf
- 2. <u>https://files.eric.ed.gov/fulltext/ED407284.pdf</u>
- 3. <u>https://sist.sathyabama.ac.in/sist\_coursematerial/uploads/SMB2103.pdf</u>
- 4. <u>https://www.pdfdrive.com/bioanalytical-chemistry-e185517690.html</u>
- 5. https://www.pdfdrive.com/bioanalytical-chemistry-e180345635.html

# Web links

- 1. https://nptel.ac.in/courses/102103044
- 2. <u>https://kamarajcollege.ac.in/wp-content/uploads/Allied-I-Bioinstrumentation.pdf</u>
- 3. <u>https://www.youtube.com/watch?v=MvkFWmzFqNM</u>
- 4. <u>https://www.nature.com/scitable/definition/gel-electrophoresis-286/</u>
- 5. <u>https://www.khanacademy.org/science/class-11-chemistry-india/xfbb6cb8fc2bd00c8:in-inorganic-chemistry-some-basic-principles-and-techniques/xfbb6cb8fc2bd00c8:in-in-methodsof-purification-of-organic-compounds/a/principles-of-chromatography</u>

# Pedagogy

Power point presentation, Group Discussion, Seminar, Assignment, Animations.

# Course Designer

Ms. R. NEVETHA

Semester – II	Internal Marks: 25	External Marks: 75				
COURSE CODE	COURSE TITLE	CATEGORY	HOURS/ WEEK	CREDITS		
23UBT2AC3	GENERAL MICROBIOLOGY	FIRST ALLIED COURSE-III	4	3		

- > To study about the classification of microorganisms.
- > To study about the media composition and their types
- > To study about the structure and characteristics of bacteria, algae, fungi, protozoa and virus.
- > To study the characteristics, properties and biological significance of the different organism.
- To obtain the knowledge in health care for prevention of diseases, diagnosis, sterilization methods and drug production.

#### **Course Outcome and Cognitive Level Mapping**

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

CO Number	CO Statement	Knowledge Level
CO1	Recall the history of Microbiology and list out the scopes.	K1
CO2	Outline the methods involved in media preparation and sterilization.	K2
CO3	Summarize the structural organization of Bacteria.	K2
CO4	Explain the general characteristic features of Algae and Fungi.	K2
CO5	Describe the Diversity, Ecology and Characteristics of different Protozoa and Viruses.	K3

# Mapping of CO with PO and PSO

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	1	2	2	1	3	1	2	3	1
CO2	3	2	2	2	1	3	1	2	2	1
CO3	3	3	2	2	1	3	3	2	2	1
CO4	3	3	2	2	1	3	3	2	3	1
CO5	3	3	3	3	1	3	3	3	3	2

"1" – Slight (Low) Correlation, "2" – Moderate (Medium) Correlation,

"3" – Substantial (High) Correlation, "-" indicates there is no correlation.

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
Ι	History and Classification: Historical development of Microbiology - Theories of Spontaneous generation – Biogenesis The scope of Microbiology; General principles and nomenclature – Haeckel's three kingdom concept, Whittaker's five kingdom concept- Carl Woese's three domain classification. Cavalier – Smith's Eight kingdom classification.	13	CO1, CO2, CO3	K1, K2, K3, K4
П	Media Preparation and Sterilization: Media Composition and their types based on physical state & ingredients. Microbial Growth- Factors influencing the growth of Microorganisms – Growth Curve.	11	CO1, CO2, CO3	K1, K2, K3, K4
III	<b>Bacteria:</b> Structural organization of bacteria – Size, shape and arrangement of bacterial cells – Ultrastructure of a bacterial cell – cell wall, cell membrane, ribosomes, nucleoid, slime, capsule, flagella, fimbriae, spores, cysts, plasmid, mesosomes and cytoplasmic inclusions.	11	CO1, CO2, CO3	K1, K2, K3, K4
IV	<b>Diversity of Microbial world</b> : General characteristics of Algae (Chlamydomonas sp) including occurrence, thallus organization, Ultra structure, pigments, flagella, eyespot, food reserves. Reproduction – Sexual and Asexual reproduction. Fungi ( <i>Aspergillus</i> sp) – General characteristics of fungi including habitat, distribution, nutritional requirements, Ultrastructure, thallus organization and aggregation.	13	CO1, CO2, CO3,	K1, K2, K3, K4
V	<b>Protozoa &amp; Viruses:</b> Protozoa: General characteristics with special reference to Amoeba, <i>Paramecium</i> and <i>Giardia</i> . Viruses: Viruses, viroids and prions - A general introduction with special reference to the structure of the following: TMV, poliovirus. Lytic and lysogenic cycle.	12	CO3, CO4, CO5	K1, K2, K3, K4
VI	Self-Study for Enrichment Types of Sterilization and Disinfection. (Not Included for End Semester Examination)	-	CO1, CO2	K1, K2, K3, K4

#### **Text Books**

- 1. Tortora, G. J., Case, C. L., Bair III, W. B., Weber, D., & Funke, B. R. (2008). Microbiology:an introduction. (11<sup>th</sup> Edition).
- 2. Baveja, D. C. (2005). Textbook of Microbiology, (2017). *Published by Arya Publication*, *Page*, (592).
- 3. Rathoure, A. K. (2017). Brillion Publishing, Essentials of Microbiology.
- 4. Tortora, G. J., Funke, B. R., & Case, C. L. (2015). *Microbiology: An Introduction, Books a la Carte Edition*. Benjamin-Cummings.
- 5. Madigan, M. T., Martinko, J. M., & Parker, J. (1997). *Brock biology of microorganisms* (Vol.11). Upper Saddle River, NJ: Prentice hall.

# **Reference Books**

- 1. Madigan, M. T., Bender, K. S., Buckley, D. H., Sattley, W. M., & Stahl, D. A. (2018). Brock Biology of Microorganisms. 15th Global Edition. *Boston, US: Benjamin Cummins*, *1*, 1391-1407.
- 2. Prescott, Harley andKlein (2016). McGraw Hill. *Microbiology*. 10<sup>th</sup>Edition.
- 3. Pelczar, Chan and Kreig (2016). McGraw-Hill. Microbiology 9thEdition.
- Madigan, M. T., Martinko, J. M., Bender, K. S., Buckley, D. H., & Stahl, D. A. (2016). *Microbiologia de Brock-14<sup>a</sup> Edição*. Artmed Editora.
- 5. Cowan, M. K., & Talaro, K. P. (2009). *Microbiology: a systems approach*. McGraw-Hill Higher Education.

# E books

- 1. https://rlmc.edu.pk/themes/images/gallery/library/books/Microbiology/Text\_Book\_of\_Microbiology.pdf
- 2. https://www.academia.edu/40368024/Textbook\_of\_MICROBIOLOGY
- 3. <u>http://www.grsmu.by/files/file/university/cafedry/microbiologii-virysologii-immynologii/files/essential\_microbiology.pdf</u>
- 4. https://worldofmedicalsaviours.com/microbiology-books-pdf/

# Web links

- 1. https://archive.nptel.ac.in/courses/102/103/102103015/
- 2. <u>https://www.youtube.com/watch?v=Bhe6Tj2Ebys</u>
- 3. https://microbiologynotes.com/category/basic-microbiology/
- 4. https://byjus.com/biology/microbiology/

#### Pedagogy

Power point presentation, Group Discussion, Seminar, Assignment, Animations.

#### Course Designer DR R. RAMESHWARI