

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
2022 – 2023 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	Professional ethics and Teamwork: Explore professional responsibility through projects, internships, field trips/industrial visits and mentorship programmes to transmit communication skills.
PO 4	Critical and Scientific thinking: 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	Social Responsibility with ethical values: 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 Addressed
PSO 1	Acquire knowledge of biological sciences with the implementation of technology on different living systems like plants, animals and microbes.	PO1 PO 2
PSO 2	Explain the fundamental concepts and develop skills in Immunology, Developmental biology, Nanobiotechnology, Genomics, Proteomics, Bioinformatics, Agriculture and Medicine	PO 1 PO 2
PSO 3	Apply the technical aspects related to the improvement of microbes, plants and live-stocks for the welfare of human and environment.	PO 2 PO 4
PSO 4	Impart hands-on techniques in various thrust areas of biotechnology to meet the emerging demands in industry, academia and research.	PO 2 PO 4
PSO 5	Gaining knowledge to transform theoretical concepts to practical products/process to move ahead in entrepreneurship and apply the laws concerning to IPR and bioethics	PO 2 PO 3 PO 5



Cauvery College for Women (Autonomous), Trichy -18

Department of Biotechnology

B.Sc., Biotechnology

(For the Candidates admitted from the Academic year 2022-2023 and onwards)

Semester	Part	Course	Course Title	Course Code	Inst. Hrs. / week	Credits	Exam			Total	
							Hrs.	Marks			
								Int	Ext		
I	I	Language Course-I (LC)	Ikkala Ilakkiyam	22ULT1	6	3	3	25	75	100	
			Hindi Literature & Grammar – I	22ULH1							
			History of Popular Tales, Literature and Sanskrit Story	22ULS1							
			Basic French – I	22ULF1							
	II	English Language Course- I (ELC)	Functional English for Effective Communication – I	22UE1	6	3	3	25	75	100	
	III	Core Course – I (CC)	Cell Biology	Cell Biology	22UBT1CC1	5	5	3	25	75	100
				Cell Biology (P)	22UBT1CC1P	3	3	3	40	60	100
				General Microbiology	22UBT1AC1	4	3	3	25	75	100
				Biochemistry	22UBT1AC2	4	3	3	25	75	100
	IV	Ability Enhancement Compulsory Course-I (AECC)	UGC Jeevan Kaushal- Universal Human Values	22UGVE	2	2	-	100	-	100	
Total					30	22				700	
II	I	Language Course - II (LC)	Idaikkala Ilakkiyamum Pudnamum	22ULT2	5	3	3	25	75	100	
			Hindi Literature & Grammar – II	22ULH2							
			Poetry, Textual Grammar and Alakara	22ULS2							
			Basic French – II	22ULF2							
	II	English Language Course - II (ELC)	Functional English for Effective Communication – II	22UE2	6	3	3	25	75	100	
	III	Core Course – II (CC)	Molecular Biology & Genetics	Molecular Biology & Genetics	22UBT2CC2	5	5	3	25	75	100
				Molecular Biology & Genetics (P)	22UBT2CC2P	3	3	3	40	60	100
				Bioinstrumentation	22UBT2CC3	3	3	3	25	75	100
				Microbiology & Biochemistry (P)	22UBT2AC3P	4	3	3	40	60	100
				Environmental Studies	22UGEVS	2	2	-	100	-	100
Ability Enhancement Compulsory Course-II (AECC)											
IV	Ability Enhancement Compulsory Course-III (AECC)	Innovation and Entrepreneurship	22UGIE	2	1	-	100	-	100		
Extra Credit Course			SWAYAM	As per UGC Recommendation							
Total					30	23				800	

III	I	Language Course-III (LC)	Kappiyamum Nadagamum	22ULT3	5	3	3	25	75	100
			Hindi Literature & Grammar – III	22ULH3						
			Prose, Textual Grammar and Vakyarachana	22ULS3						
			Intermediate French – I	22ULF3						
	II	English Language Course-III(ELC)	Learning Grammar Through Literature - I	22UE3	6	3	3	25	75	100
	III	Core Course– IV(CC)	rDNA Technology	22UBT3CC4	6	6	3	25	75	100
		Core Practical - III(CP)	rDNA Technology(P)	22UBT3CC3P	3	3	3	40	60	100
		Second Allied Course-I (AC)	Bioinformatics	22UBT3AC4	4	3	3	25	75	100
		Second Allied Course- II (AP)	Bioinformatics (P)	22UBT3AC5P	4	3	3	40	60	100
	IV	Generic Elective Course- I (GEC)	Basics of Biotechnology	22UBT3GEC1	2	2	3	25	75	100
Basic Tamil			22ULC3BT1							
Special Tamil			22ULC3ST1							
	Extra Credit Course	SWAYAM	As per UGC Recommendation							
Total					30	23				700

15 Days INTERNSHIP during Semester Holidays*

IV	I	Language Course – IV (LC)	Pandaiya Ilakkiyamum Urainadayum	22ULT4	6	3	3	25	75	100
			Hindi Literature & Functional Hindi	22ULH4						
			Drama, History of Drama Literature	22ULS4						
			Intermediate French – II	22ULF4						
	II	English Language Course – IV (ELC)	Learning Grammar Through Literature – II	22UE4	6	3	3	25	75	100
	III	Core Course – V(CC)	Immunology	22UBT4CC5	6	6	3	25	75	100
		Core Practical - IV(CP)	Immunology (P)	22UBT4CC4P	4	4	3	40	60	100
		Second Allied Course - III (AC)	Basics of Forensic Biology	22UBT4AC6	4	3	3	25	75	100
		Internship*	Internship	22UBT4INT	-	2	-	-	-	100
	IV	Generic Elective Course- II (GEC)	Applied Biotechnology	22UBT4GEC2	2	2	3	25	75	100
Basic Tamil			22ULC4BT2							
Special Tamil			22ULC4ST2							
	Skill Enhancement Course – I (SEC)	Fundamentals of Nanotechnology (P)	22UBT4SEC1P	2	2	3	40	60	100	
	Extra Credit Course	SWAYAM	As per UGC Recommendation							
Total					30	25				800

V	III	Core Course – VI(CC)	Plant Biotechnology	22UBT5CC6	6	6	3	25	75	100
		Core Practical – V(CP)	Plant & Animal Biotechnology (P)	22UBT5CC5P	3	3	3	40	60	100
		Core Course - VII(CC)	Animal Biotechnology	22UBT5CC7	6	6	3	25	75	100
		Core Course – VIII(CC)	Biostatistics	22UBT5CC8	6	6	3	25	75	100
		Discipline Specific Elective – I (DSE)	A. Cancer Biology	22UBT5DSE1A	5	4	3	25	75	100
	B. Human Anatomy, Physiology and Pharmacology		22UBT5DSE1B							
	C. Pharmacognosy		22UBT5DSE1C							
	IV	Ability Enhancement Compulsory Course – IV (AECC)	UGC Jeevan Kaushal - Professional Skills	22UGPS	2	2	-	100	-	100
		Skill Enhancement Course – II (SEC)	Medical Lab Technology (P)	22UBT5SEC2P	2	2	3	40	60	100
	Extra Credit Course		SWAYAM	As per UGC Recommendation						
Total				30	29					700
VI	III	Core Course – IX (CC)	Microbial & Environmental Biotechnology	22UBT6CC9	6	6	3	25	75	100
		Core Practical –VI (CP)	Microbial & Environmental Biotechnology (P)	22UBT6CC6P	3	3	3	40	60	100
		Core Course – X (CC)	IPR, Biosafety and Bioethics	22UBT6CC10	5	5	3	25	75	100
		Core Course – XI (CC)	Cyber Security	22UBT6CC11	5	4	3	25	75	100
		Discipline Specific Elective – II (DSE)	A. Developmental Biology	22UBT6DSE2A	5	4	3	25	75	100
			B. Stem cell Biology	22UBT6DSE2B						
	C. Bioentrepreneurship		22UBT6DSE2C							
	Project	Project Work	22UBT6PW	5	4	-	-	100	100	
	V	Gender Studies	Gender Studies	22UGGS	1	1	-	-	-	100
		Extension activity		22UGEA	0	1	0	-	-	-
Total				30	28					700
Grand Total				180	150					4400

***Internship – 2 Credits (Extra Credit Course)**

Cauvery College for Women (Autonomous), Trichy -18
 Courses & Credits for UG Biotechnology Programme

Part	Course	No. of Courses	Credits	Total Credits
I	Tamil/ Other Language	4	12	12
II	English	4	12	12
III	Core (Theory & Practical)	17	77	109
	Project Work	1	4	
	Internship	1	2	
	First Allied	3	9	
	Second Allied	3	9	
	DSE	2	8	
IV	GEC	2	4	15
	SEC	2	4	
	AECC-I -Universal Human Values	1	2	
	AECC-II-Environmental Studies	1	2	
	AECC-III-Innovation and Entrepreneurship	1	1	
	AECC-IV Professional Skills	1	2	
V	Gender Studies	1	1	02
	Extension Activities	–	1	
		4400	150	150

Semester – I	Internal Marks: 25		External Marks: 75	
COURSE CODE	COURSE TITLE	CATEGORY	HOURS/WEEK	CREDITS
22UBT1CC1	CELL BIOLOGY	CORE	5	5

Course Objectives

- To study about the basic concepts of cells and their cellular organelles and their functions.
- To study the specialized cells.
- To study about cell cycle and its regulations.
- To study cell signaling pathways

Course Outcome and Cognitive Level Mapping

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

CO Number	CO Statement	Cognitive Level
CO1	Relate and explain the basics of cell biology, types, structure, and properties of cells.	K1, K2
CO2	Apply the knowledge of cell biology in diverse research areas.	K3
CO3	Illustrate the Ultra structure and list the functions of cellular organelles in various types of cells	K2, K4
CO4	Explain the significance of cells and specialized cells	K5
CO5	Interpret the concepts of cell, cell division, compartmentalization, transport of nutrients and cell signalling in different types of cells.	K5

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	1	3	1
CO2	3	2	2	2	1	3	1	1	2	2
CO3	3	1	1	3	1	3	3	2	1	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
I	Fundamentals of cell structure: Cell as basic unit of life: Basic properties of cells, cell theory, cell morphology, Ultrastructure - Prokaryotic and Eukaryotic cells. Cell wall: Structural organization; Cytoskeleton: Microtubules and intermediate filaments; Cell Motility – Flagella.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	Cellular membranes and matrices: Cell Membrane: Plasma Membrane – Fluid Mosaic Model and Sandwich Model; Chemical composition and fluidity of membranes; transport of nutrients - diffusion, facilitated diffusion and osmosis.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	Endomembrane System: Ultrastructure and functions: Nucleus; Endoplasmic Reticulum - Rough and Smooth; Golgi Complex, Ribosomes - Types and functions; Mitochondria - Ultrastructure, Chemical Composition and functions; Chloroplast - Ultrastructure, Chemical Composition and functions; Microbodies: Types - Peroxisomes, Glyoxisomes and Lysosomes - Types, structure and function.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	Cell Division and Signaling: Cell division in prokaryotes and eukaryotes: Cell cycle, mitosis, meiosis, crossing over; Apoptosis; Signal transduction - Cell to cell recognition.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	Specialized cells: Motile cells (amoeboid and Sperm cells), nerve cells and nerve impulse conduction, muscle cells and muscle contraction and Egg cells.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	Self Study for Enrichment (Not included for End Semester Examination) Discovery of Cells, Cytoskeleton - Microfilaments, Types of Microbodies, Cell adhesion and Red Blood Cells.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Veer Bala, R. (2021). *Cell Biology*. Latest edition. Med tech.
2. Rastogi, S. C. (2020). *Cell and Molecular Biology*. New Age International Private Ltd.
3. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., Karen, H., Dennis, B., & Walter, P. (2019). *Essential Cell Biology*. 5th International Student Edition. Garland Science.
4. De Robertis, E.D.D. & De Robertis, E.M.F. (2017). *Cell & Molecular Biology*. 8th Edition. Waverly.
5. Verma, P. S. & Agarwal, V. K. (2016). *Cell Biology*. S. Chand Publication.

Reference Books

1. Cooper, G.M. & Hausman, R.E. (2018 Reprint). *The Cell A Molecular Approach*. 6th Edition. Ingram Publication.
2. Griffith, R. (2017). *Cell biology (Meiosis & Mitosis)*. Larsen and Keller Education.
3. Thomas, D. P., William, C. E., Jennifer, L. S. & Graham, J. (2017). *Cell Biology*. 3rd Edition. Elsevier IE (short Disc).
4. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., Karen, H., Dennis, B. & Walter, P. (2017). *Molecular Biology of Cell*. 6th Edition. Garland Science, Taylor & Francis group.
5. Hardin, J., Bertoni, G.P. & Kleinsmith, L.J. (2017). *Becker's World of the Cell*. Pearson Education.

E - Books

1. <https://open.umn.edu/opentextbooks/textbooks/244>
2. http://standing.weebly.com/uploads/2/3/3/5/23356120/8_-_unit_30c.pdf
3. <https://www.infobooks.org/free-pdf-books/biology/cell-biology/>
4. <http://www.freebookcentre.net/Biology/Cell-Biology-Books.html>;
5. https://tripurauniv.ac.in/Page/SubjectWiseOnline_EBooks_Cell_Molecular_Biology

Web Reference

1. <https://ocw.mit.edu/courses/7-06-cell-biology-spring-2007/>
2. <https://sciencewiz.com/portals/cells/tour-inside-the-cell/a-tour-of-the-cell-more-advanced/>
3. <http://naturedocumentaries.org/17217/virtual-tour-cell-xvivo-scientific-animation-2018/>
4. <https://nptel.ac.in/courses/102103012>

Pedagogy

Chalk and Talk, PPT, Videos and Animations

Course Designers

1. Ms. P. ILAMATHY
2. Dr. S. ABINAYA

Semester – I	Internal Marks: 40		External Marks: 60	
COURSE CODE	COURSE TITLE	CATEGORY	HOURS/WEEK	CREDITS
22UBT1CC1P	CELL BIOLOGY (P)	CORE	3	3

Course Objectives

- 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 perform experiments on cell counting and viability.

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 cell organelles.	K3
CO 4	Categorize the different types and stages of cell division.	K4
CO 5	Illustrate and conclude cell viability and counting.	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. Demonstration of Principles and working mechanism of Light Microscope.
3. Principles and working mechanism of rotary Microtome (Demo).
4. Measurement of Cell Size by Micrometry.
5. Prokaryotic Cell Observation – *E. coli*.
6. Eukaryotic Cell Observation – Yeast and Onion.
7. Morphological Characterization of various types of Plant tissue cells.
8. Separation of cell organelles by centrifugation method.
9. Barr body identification from Buccal Smear.
10. Cell Division - Mitotic stages.
11. Cell Division - Meiotic stages.
12. Cell Division - Binary fission of Yeast Cells.
13. Enumeration of Eukaryotic Cells (Yeast), Red Blood Cells and White Blood Cells.
14. Assessment of Cell Viability by trypan blue staining.
15. Experiment on Osmosis.

Reference Books

1. Gupta, R., Seema, M. & Ravi, T. (2018). *Cell Biology: Practical Manual*. Prestige Publishers.
2. William, H. H. (2017). *Cell Biology: Laboratory Manual*, Pearson Education.
3. Amit, G. & Bipin Kumar, S. (2019). *Practical Laboratory Manual – Cell Biology*. Lambert Academic Publishing.
4. Thompson, D. A. (2011). *Cell and Molecular Biology Lab. Manual*. Create Space Independent Publishing Platform.
5. Mary, L. L. (1993). *Cell Biology: Laboratory Manual*. Ron Jon Publishing Incorporated.

E - Books

1. https://www.bjcancer.org/Sites_OldFiles/_Library/UserFiles/pdf/Cell_Biology_Laboratory_Manual.pdf
2. http://www.ihcworld.com/_protocols/lab_protocols/cell-biology-lab-manual-heidcamp.htm
3. https://www.deanza.edu/faculty/heyerbruce/b6b_pdf/Bio6B-Manual_W19.pdf
4. https://www.researchgate.net/publication/330654692_Cell_Biology_Practical_Manual
5. <https://www.pdfdrive.com/cell-biology-protocols-d13735633.html>

Pedagogy

Practical Observation and Demo

Course Designers

1. **Dr. R. UMA MAHESWARI**
2. **Dr. G. GOMATHI**

Semester – I	Internal Marks: 25		External Marks: 75	
COURSE CODE	COURSE TITLE	CATEGORY	HOURS/WEEK	CREDITS
22UBT1AC1	GENERAL MICROBIOLOGY	ALLIED	4	3

Course Objective

- To create basic knowledge on the History and classification of Microorganisms.
- To study the structure and characteristics of microorganisms like bacteria, algae, fungi, protozoa and virus.
- To study the media composition and their types.
- To study the microbial diseases, pathogenesis, diagnosis and preventive measures.

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	Recall and infer the factual and conceptual information required for understanding microbiology.	K1, K2
CO 2	Illustrate the different structural organization of bacteria, Algae, Fungi, protozoa and virus.	K2
CO 3	Develop the different microbial culture media for isolation of microbes and Compare the lifecycle of bacteria, algae, fungi, protozoa and virus.	K3, K4
CO 4	Classify the different kind of microbes (Classification) and explain the general characteristic features of the Algae, Fungi, protozoa and virus.	K4, K5
CO 5	Elaborate the diagnostic methods and controlling measures of various pathogenic microbial diseases for the human welfare.	K6

Mapping of CO with PO and PSO

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

“1”-Slight (Low) Correlation, “2”- Moderate (Medium) Correlation,
“3”-Substantial (High) Correlation “-” - indicates no Correlation

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
I	Historical development of Microbiology – Theories of Spontaneous generation – Biogenesis. General principles and nomenclature – Bergey’s Manual of Determinative Bacteriology, Whittaker’s five kingdom concept- Carl Woese’s three domain classification. Cavalier – Smith’s Eight kingdom classification.	12	CO1, CO2, CO3, CO4, CO5	K1, K2 K3, K4, K5, K6
II	Media Composition and their types based on physical state & ingredients. Microbial Growth-Factors influencing the growth of Microorganisms – Growth Curve.	10	CO1, CO2, CO3, CO4, CO5	K1, K2 K3, K4, K5, K6
III	Structural organization of bacteria – Size, shape and arrangement of bacterial cells – Ultrastructure of a bacterial cell. Size & Morphology of Virus; Viroids. Lifecycle – Lytic & Lysogenic. Morphology & Anatomy of Protozoa - Amoeba & Paramecium.	12	CO1, CO2, CO3, CO4, CO5	K1, K2 K3, K4, K5, K6
IV	General characteristics of Algae (<i>Chlamydomonas sp.</i>) including occurrence, thallus organization, Ultra structure, pigments, eyespot, food reserves. Reproduction – Sexual and Asexual reproduction. Fungi (<i>Aspergillus sp.</i>) – General characteristics of fungi including habitat, distribution, nutritional requirements, Ultrastructure, thallus organization and aggregation.	13	CO1, CO2, CO3, CO4, CO5	K1, K2 K3, K4, K5, K6
V	General account on Microbial diseases - Causative Organism, Pathogenesis, Epidemiology, Diagnosis, Prevention & Control. Bacterial Diseases: Typhoid & Tuberculosis. Fungal diseases: Candidiasis & Aspergillosis. Viral Diseases: Hepatitis, AIDS. Protozoan Diseases: Malaria & Amoebiasis.	13	CO1, CO2, CO3, CO4, CO5	K1, K2 K3, K4, K5, K6
VI	Self - Study for Enrichment (Not included for End Semester Examination) Scope of Microbiology, Types of Sterilization, Size and morphology of Virus – Prions, Ultrastructure of Flagella and Corona Virus	-	CO1, CO2, CO3, CO4, CO5	K1, K2 K3, K4, K5, K6

Text Books

1. Barry, C. (2020). *Talaro's Foundations in Microbiology*. 11th Edition. Mc Graw Hill.
2. Rajan, S. & Selvi Christy, R. (2020). *Essentials of Microbiology*. CBS Publishers Pvt. Ltd.
3. Ananthanarayan, R. & Paniker, C.K.J. (2020). *Textbook of Microbiology*. 11th Edition. Orient Blackswan Pvt. Ltd.
4. Gerard, J.T., Berdell, R.F. & Christine, L.C. (2018). *Microbiology - An Introduction*. 11th Edition. Pearson.
5. Robert, W. B. (2017). *Microbiology with Diseases by taxonomy*. 4th Edition. Pearson.
6. Dr. Baveja, C. P. (2017). *Text Book of Microbiology*. Anja Publications.

Reference Books

1. Apurba, S. S. & Sandhya, B. (2021). *Essentials of Medical Microbiology*. 3rd Edition. Jaypee Brothers.
2. Willey, J.M., Kathleen, M.S. & Dorothy, H.W. (2019). *Prescott's Microbiology*. Mc GrawHill.
3. Gerard, J.T., Berdell, R.F. & Christine, L.C. (2018). *Microbiology: An Introduction*. 13th Edition. Pearson.
4. Madigam, M.T., Bender, K.S., Buckley, D.H., Sattley, W.M. & Stahl, D.A. (2017). *Brock Biology of Microorganism*. 15th Edition. Pearson Education.
5. Rathoure, A.K. (2017). *Essentials of Microbiology*. Brillion Publishing.

E – Books

1. <https://www.pdfdrive.com/essentials-of-medical-microbiology-e33538815.html>
2. <https://www.pdfdrive.com/medical-microbiology-e18737002.html>
3. <https://www.pdfdrive.com/textbook-of-microbiology-and-immunology-e175896260.html>
4. <https://www.pdfdrive.com/sherris-medical-microbiology-d193153850.html>
5. <https://www.pdfdrive.com/oxford-handbook-of-infectious-diseases-and-microbiology-d158084200.html>
6. <https://www.pdfdrive.com/microbiology-with-diseases-by-body-system-d185840565.html>

Web References

1. <https://nptel.ac.in/courses/102103015>
2. <http://ecoursesonline.iasri.res.in/course/view.php?id=108>
3. <https://www.digimat.in/nptel/courses/medical/microbiology/MB11.html>
4. <https://www.iaritoppers.com/2019/06/fundamentals-of-microbiology-icar-ecourse-pdf-book-download.html>
5. <https://microbiologysociety.org/why-microbiology-matters/what-is-microbiology/microbes-and-the-human-body/microbes-and-disease.html>

Pedagogy

Chalk and talk, PPT, Group Discussion, Assignment, Demo, Quiz, Seminar

Course Designers

1. Ms. P. JENIFER
2. Dr. M. KEERTHIGA

Semester – I	Internal Marks: 25		External Marks: 75	
COURSE CODE	COURSE TITLE	CATEGORY	HOURS/WEEK	CREDITS
22UBT1AC2	BIOCHEMISTRY	ALLIED	4	3

Course Objectives

- To study the basics of biomolecules.
- To study classification, structure and functional properties of carbohydrates, proteins, lipids, vitamins and minerals.
- To study the impact of proteins and enzymes.
- To study vitamin deficiency diseases.

Course Outcome and Cognitive Level Mapping

Upon the Successful completion of the course the student would be able to

CO Number	CO Statement	Cognitive Level
CO1	Understand and remember the chemistry and salient features of macromolecules	K1, K2
CO2	In depth knowledge about the properties and significance of the biomolecules	K2
CO3	Explain and differentiate the relationship between different kinds of biomolecules such as carbohydrates, lipids, nucleic acid and proteins.	K2, K4
CO4	Classify and demonstrate the various sources and functions of the nutrients. Calorific value of food.	K3, K4
CO5	Evaluate and analyze the concept of nutrition in health and disease, with metabolism and functions of a living system	K4, K5

Mapping of CO with PO and PSO

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

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

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
I	Carbohydrates: Definition, structure, classification and functions of carbohydrates - Monosaccharides: Glucose and Fructose. Disaccharides: Sucrose and Maltose, Oligosaccharides: Raffin. Polysaccharides: Starch and Glycogen. Physical and chemical properties of carbohydrates.	12	CO1, CO2, CO3, CO4, CO5	KI, K2, K3, K4, K5
II	Lipids: Definition, classification and importance of lipids - Simple lipids: Triglycerides, Compound lipids: Phosphatides and Derived lipids: Cholesterol. Structure and functions of glycerol, phospholipids, glycolipids and lipoproteins. Physical and chemical properties of lipids.	12	CO1, CO2, CO3, CO4, CO5	KI, K2, K3, K4, K5
III	Amino acids: Introduction, structure and classification of amino acids - Essential amino acids, Semi - essential amino acids, Non-essential amino acids and carboxyl groups of amino acids. Physico-chemical properties of amino acids. Functions of amino acids.	12	CO1, CO2, CO3, CO4, CO5	KI, K2, K3, K4, K5
IV	Proteins: Definition and classification based on shape, composition, solubility and functions of proteins. Structure of proteins - Primary, secondary, tertiary and quaternary structure - protein folding. Structure, classification and properties of enzymes. Mechanism of enzyme activity. Enzyme inhibition - Competitive, non-competitive and uncompetitive inhibition.	12	CO1, CO2, CO3, CO4, CO5	KI, K2, K3, K4, K5
V	Vitamins and Minerals: Vitamins: Definition and Classification. Fat soluble vitamins - sources, structure and physiological functions; Water soluble vitamins - sources, structure and physiological functions. Vitamin deficiency diseases (Scurvy and Rickets). Minerals: Macro minerals and micro minerals - sources and functions.	12	CO1, CO2, CO3, CO4, CO5	KI, K2, K3, K4, K5
VI	Self-Study for Enrichment: (Not Included for External Examination) Oligosaccharides – Stachyose, Structure and functions of – sphingolipids, importance of amino acids, Protein – denaturation and Vitamin deficiency diseases - Anemia.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

Text Books

1. Singh, S. P., & Singh, A. N. (2021). *Textbook of Biochemistry*. CBS Publications.
2. Gupta, S. N. (2020). *Concepts of Biochemistry*. Rastogi Publications.
3. Sathyanarayana, U., and Chakrapani, U. (2020). *Biochemistry*. 5th Edition. Elsevier India.
4. Seema, P. U. (2020). *Textbook of Biochemistry*. 1st Edition. Dreamtech Press.
5. Padmaja H. A., Dr.Yogesh, K. & Dr. Rammohan R. (2019). *Biochemistry*. Nirali Prakashan Publications.
6. Denise, R.F. (2017). *South Asian Edition of Lippincott Illustrated Reviews Biochemistry*. 7th Edition. Wolters Kluwer Publications.

Reference Books

1. Manzoor, M. M. (2021). *Fundamentals of Biochemistry*. Lambert Academic Publishing (LAP).
2. Voet, D. & Voet, J.G.(2021). *Voet's Biochemistry*. Adapted Edition 2021. Wiley India.
3. Brailsford, R. T. (2020). *Principles of Biochemistry*. MJP Publisher.
4. Jeremy M., Berg, Lubert, S., John, T., Gregory, G. (2019). *Biochemistry*. Freeman and Company publications.
5. Appling D.R., Anthony-Cahill, S. J., Mathews, C. K. (2017). *Biochemistry: Concepts and Connections*. Pearson Education.
6. Vikrant, V. (2021). *Biochemistry*. Discovery Publishing House Pvt Ltd.

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. <https://www.pdfdrive.com/biochemistry-biochemistry-e19576202.html>
5. <https://www.pdfdrive.com/marks-basic-medical-biochemistry-a-clinical-approach-5th-edition-e158491166.html>

Web References

1. <http://ecoursesonline.iasri.res.in/course/view.php?id=422>
2. <https://nptel.ac.in/courses/102105034/>
3. <https://youtu.be/DhwAp6yQHQI>
4. <https://sites.google.com/a/uasd.in/ecourse/biochemistry> <https://youtu.be/f7jRpniCsaw>
5. <https://agrimoon.com/fundamentals-of-biochemistry-pdf-book/>

Pedagogy

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

Course Designer

Ms. M. AZEERA

Semester – II	Internal Marks: 25		External Marks: 75	
COURSE CODE	COURSE TITLE	CATEGORY	HOURS/WEEK	CREDITS
22UBT2CC2	MOLECULAR BIOLOGY & GENETICS	CORE	5	5

Course Objectives

- To study the basics of Genetics and molecular biology.
- To study about laws and concepts of Mendelian inheritance.
- To study the process of DNA replication, transcription, and translation process.
- To study Gene expression, post-transcriptional and post-translational modifications

Course Outcome and Cognitive Level Mapping

Upon the Successful completion of the course the student would be able to

CO Number	CO Statement	Cognitive Level
CO1	Understand and remember chemistry and salient features of DNA and the concepts of inheritance.	K1, K2
CO2	In-depth knowledge of the mendelian laws, sex determination, replication, transcription and translation.	K2
CO3	Explain and differentiate the process of DNA replication, transcription and translation between prokaryotes and Eukaryotes.	K2, K4
CO4	Compare and distinguish the laws of segregation, law of independent assortment, linkage, multiple alleles, and Eukaryotic and prokaryotic gene expression.	K3, K4
CO5	Evaluate and analyze the basic concepts of classical and molecular genetics	K4, K5

Mapping of CO with PO and PSO

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

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

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	Historical developments of molecular biology and Genetics; DNA and RNA as genetic material - Griffith's, Hershey - chase Experiments and Fraenkel-Conrat 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.	13	CO1, CO2, CO3, CO4, CO5	KI, K2, K3, K4, K5
II	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 <i>Drosophila</i> ; Law of Independent Assortment – Dihybrid. Test cross and Back Cross.	14	CO1, CO2, CO3, CO4, CO5	KI, K2, K3, K4, K5
III	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. Somatic cell genetics.	14	CO1, CO2, CO3, CO4, CO5	KI, K2, K3, K4, K5
IV	Chromosome structural organization – Chromatin and chromatids; Special types of Chromosomes: Polytene and Lampbrush chromosomes. DNA Replication- Prokaryotic and Eukaryotic DNA replication, enzymes and proteins involved in DNA replication. Models of replication – Semi-conservative, Unidirectional, Bidirectional, Rolling circle mechanism. Inhibitors of DNA replication. DNA repair mechanisms.	16	CO1, CO2, CO3, CO4, CO5	KI, K2, K3, K4, K5
V	Transcription – Prokaryotic and Eukaryotic transcription, Enzymes involved in transcription. Post transcriptional modifications – 5' – CAP formation, 3' processing and polyadenylation, splicing. Regulation of Transcription - Prokaryotes: lac operon and trp operon. Translation – Prokaryotic and Eukaryotic translation, Mechanisms of initiation, elongation and termination. Post-translational modifications - Importance of Glycosylation and Phosphorylation.	18	CO1, CO2, CO3, CO4, CO5	KI, K2, K3, K4, K5
VI	Self-Study for Enrichment (Not Included for End Semester Examination) Extra Nuclear inheritance, Crossing over, Replisomes and Primosomes, Wobble hypothesis, hormonal control of gene expression, Regulation of transcription.	-	CO1, CO2, CO3, CO4, CO5	KI, K2, K3, K4, K5

Text Books

1. Verma, P.S & Agarwal, V.K. (2022). *Cell Biology, Genetics, Molecular Biology, Evolution and Ecology*. S Chand and Company Ltd.
2. Vishnu Shankar, S. (2021). *Fundamentals of Genetics and Molecular Biology*. Red'shine Publication Pvt. Ltd.
3. Pragma, K. (2020). *Essentials of Genetics*. Dream tech Press.
4. Veer Bala, R. (2019). *Genetics*, 4th edition. Med tech.
5. Andreas, H & Samuel, C. (2018). *Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology 8th Edition*. Cambridge University Press.

Reference Books

1. Poonam, A. (2022). *Lippincott Illustrated Reviews: Cell and Molecular Biology*. Wolters Kluwer India Pvt Ltd.
2. Harvey, L., Arnold B., Chris, A. K & Monty, K. (2021). *Molecular Cell Biology Ninth edition*. W. H. Freeman
3. Nancy, L.C., Rachel, R.G., Carol, C.G., Gisela, G.S & Cynthia, W. (2020). *Molecular Biology: Principles of Genome Function 3rd Edition*. Oxford University Press.
4. Lieberman. (2020). *BRS Biochemistry, Molecular Biology, and Genetics*. 7th edition. Wolters Kluwer India Pvt Ltd.
5. Jocelyn, E.K., Elliott, S.G & Stephen, T.K. (2017). *Lewin's GENES XII 12th edition*. Jones and Bartlett Publishers, Inc

E - books

1. <https://www.pdfdrive.com/lewins-genes-xii-e185848559.html>
2. <https://www.pdfdrive.com/introduction-to-genetics-a-molecular-approach-e187102063.html>
3. <https://www.pdfdrive.com/the-cell-a-molecular-approach-e186369576.html>
4. <https://www.pdfdrive.com/genetics-a-conceptual-approach-e186741220.html>
5. <https://www.pdfdrive.com/cell-biology-genetics-molecular-biology-evolution-and-ecology-e157248372.html>

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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. <http://ndl.iitkgp.ac.in/document/bnZnR2hPaUVqRU9TbFc2Rmp1MVJzN0dyTCs3OGxyRzdaUWpPTzdRV2pBTT0>
5. <http://ndl.iitkgp.ac.in/document/Qkh4R2FGUkRNZjFicFUvWmpzQ2loU1NPaeI6eWpVaXpnNGUwc21iQzZKbUdaczdobHlyeWNpditXM2hpaFNOS1F6dVc4NGltYWZEQ09YbEVIWjJtelE9PQ>

Pedagogy

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

Course Designers

1. **Ms. P. ILAMATHY**
2. **Dr. M. KEERTHIGA**

Semester–II	Internal Marks: 40		External Marks: 60	
COURSE CODE	COURSE TITLE	CATEGORY	HOURS/ WEEK	CREDITS
22UBT2CC2P	MOLECULAR BIOLOGY & GENETICS PRACTICAL	CORE	3	3

Course Objectives

- To develop skills related to DNA Isolation Techniques.
- To study about the Quantification of Nucleic acids.
- To gain knowledge in mutagenesis.
- To perform experiments on *Drosophila* and observe their genetic variations.
- To gain knowledge about simple traits in man.

Course Outcome and Cognitive Level Mapping

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

CO Number	CO Statement	Cognitive Level
CO1	Demonstrate and analyze the DNA isolation methods.	K3, K4
CO2	Infer the separation techniques for DNA and protein and their quantification methods.	K4
CO3	Illustrate and interpret the different mutagenesis techniques.	K3
CO4	Explain the Mendelian traits and distinguish the male and female <i>Drosophila</i> cultures.	K4
CO5	Categorize the different genetic disorders in man using the Pedigree Chart.	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. Isolation and purification of Genomic DNA from Prokaryotes
2. Isolation and purification of Genomic DNA from Eukaryotes
3. Isolation and purification of Plasmid DNA
4. Separation of DNA by using AGE
5. Separation of Protein by using NATIVE - PAGE
6. Separation of Protein by using SDS - PAGE
7. Quantification of Nucleic Acids – DNA by chemical method
8. Quantification of Nucleic Acids – RNA by chemical method
9. Bacterial mutagenesis using Physical Method
10. Transformation
11. Observation of simple Mendelian traits among humans.
12. Drosophila – male and female Identification and Culture.
13. Karyotyping with the help of photographs
14. Pedigree charts of some common characters like blood group and color blindness.
15. Determination the ABO blood groups in a random sample and calculation of the allele frequency using Hardy Weinberg's law.

Reference Books

1. [Taneri](#), B., [Asilmaz](#), E., [Delikurt](#), T., [Savas](#), P., [Targen](#), S., & [Esemen](#), Y. (2020). *Human Genetics and Genomics: A Practical Guide*, John Wiley & Sons.
2. Hofmann, A.C., Willson, S & Walker's. (2017). *Principles and Techniques of Biochemistry and Molecular Biology*, Cambridge University Press.
3. Joshi, S., & Dhamij, N., (2015). *Rediscovering Genetics: A Laboratory Manual*, Wiley India.
4. Malacinski, G.M., & Freifeder's. (2013). *Essentials of Molecular Biology*, Norosa Publishing House.
5. Thompson, D. (2011). *Cell and Molecular Biology Lab Manual*, Norosa Publishing House.

E-Books

1. <https://jru.edu.in/studentcorner/lab-manual/agriculture/Fundamentals%20of%20Genetics.pdf>
2. https://academicworks.cuny.edu/cgi/viewcontent.cgi?article=1008&context=ny_oers
3. <https://sjce.ac.in/wp-content/uploads/2018/04/Cell-Biology-Genetics-Laboratory-Manual-17-18.pdf>

4. https://www.academia.edu/27721547/LABORATORY_MANUAL_BTY108_BASIC_GENETICS_LABORATORY
5. <https://www2.umbc.edu/summerstem/documents/biology/BIOL302L-SU14-Caruso.pdf>

Web References

1. <https://www.jove.com/v/5058/separating-protein-with-sds-page>
2. http://www.uwyo.edu/molb2021/virtual-edge/lab13/exp_13a.html
3. <https://www.youtube.com/watch?v=oBwtxdI1zvk>
4. <https://www.jove.com/v/5082/an-introduction-to-drosophila-melanogaster>

Pedagogy

Practical Observation and Demo

Course Designers

1. **Ms. R. NEVETHA**
2. **Dr. G. GOMATHI**

Semester – II	Internal Marks: 25		External Marks: 75	
COURSE CODE	COURSE TITLE	CATEGORY	HOURS/ WEEK	CREDITS
22UBT2CC3	BIOINSTRUMENTATION	CORE	3	3

Course Objectives

- To understand the working principles of different instruments used in the biological field
- To provide a better understanding of various analytical techniques
- To apply the instruments in different fields.

Course Outcome and Cognitive Level Mapping

Upon 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 develop the working mechanism of various analytical techniques	K2, K3
CO3	List the types and applications of microscopy, Electrophoresis, Chromatography, Colorimeter and Centrifugation techniques	K4
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 Biomedical applications.	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	1	3	1
CO2	3	2	2	2	1	3	1	1	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
I	Microscope – Light Microscopy, Bright and Dark field Microscopy, Fluorescence Microscopy, Confocal Microscope, Electron microscopy: HR-TEM, FE- SEM.	10	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	Principle and Applications of Electrophoresis – Types of electrophoresis- Pulsed Field Gel Electrophoresis, SDS-PAGE and 2 D gel; Immunoelectrophoresis; Blotting Techniques; Gel documentation.	10	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	Fundamentals of Chromatography - Principle and its applications, Types –TLC, Column, Affinity, Ion –exchange, HPLC, GC-MS and LC-MS.	7	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	Colorimeter – Principle and its applications, Beer Lambert’s Law, Spectrophotometer- Principle and its applications, Types of Spectrophotometer-UV – Visible	7	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	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.	11	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	Self-Study for Enrichment (Not Included for End Semester Examination) Introduction to Instrumentation, AGE, FTIR, Centrifugation. Autoradiography	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Reilly (2019). *Bioinstrumentation*. CDS Publishers
2. Bhawana Pandey M.H. Fulekar. (2019). *Bioinstrumentation*. Dream tech Publishers.
3. Ankita, J., Haresh K., Varsha, T & Nikunj, B. P. (2020) *Bioinstrumentation techniques - Basics and applications*. Notion Press
4. Agarwal, P.K., Baqri, S.R & Gau, K. (2022). *Molecular Biology, Bioinstrumentation and Biotechniques*. Pragati Prakashan Publishers.
5. [Veerakumari, L.](#) (2021). *Bioinstrumentation*. MJM Publisher

Reference Books

1. [Andreas, H & Clokie, S](#) .(2018). *Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology*. Cambridge University Press.
2. Mesut, S. (2020). *Instrumentation Handbook for Biomedical Engineers*. CRC Press
3. Vasudevan, R. (2019). *Biomolecular and Bioanalytical Techniques, Theory, Methodology and Applications*. [Wiley](#)
4. [Bogusław, B & Irena B.](#)(2022). *Handbook of Bioanalytics*. [Springer International Publishing](#).
5. Jeanette, M.V.E. (2019). *Immunoassay and Other Bioanalytical Techniques*. [Taylor & Francis Limited](#).

Web References

1. <https://www.technologynetworks.com/analysis/articles/an-introduction-to-the-light-microscope-light-microscopy-techniques-and-applications-351924>
2. <https://www.nature.com/scitable/definition/gel-electrophoresis-286/>
3. <https://www.khanacademy.org/science/class-11-chemistry-india/xbbb6cb8fc2bd00c8:in-in-organic-chemistry-some-basic-principles-and-techniques/xbbb6cb8fc2bd00c8:in-in-methods-of-purification-of-organic-compounds/a/principles-of-chromatography>
4. <https://study.com/academy/lesson/what-is-centrifugation-definition-process-uses.html>
5. <https://microbenotes.com/electron-microscope-principle-types-components-applications-advantages-limitations/>

E - Books

1. <https://www.pdfdrive.com/bioinstrumentation-tools-for-understanding-life-e14086185.html>

2. https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SMB2103.pdf
3. <https://www.kau.edu.sa/Files/0017514/Subjects/principals%20and%20techniques%20of%20biochemistry%20and%20molecular%20biology%207th%20ed%20wilson%20walker.pdf>
4. <https://www.pdfdrive.com/bioanalytical-chemistry-e180345635.html>
5. <https://www.pdfdrive.com/bioanalytical-chemistry-e185517690.html>

Pedagogy

Chalk and Talk, PPT, Videos and Animations

Course Designers

1. **DR. R. UMA MAHESHWARI**
2. **DR. S. ABINAYA**

Semester – II	Internal Marks: 40		External Marks: 60	
COURSE CODE	COURSE TITLE	CATEGORY	HOURS/ WEEK	CREDITS
22UBT2AC3P	MICROBIOLOGY AND BIOCHEMISTRY PRACTICAL	ALLIED	4	3

Course Objectives

- To impart the students with hands on skills related to biochemical techniques.
- To enable the students to perform qualitative analysis of biomolecules.
- To make the students to maintain aseptic and pure culture techniques of microorganisms.
- To enhance the students with knowledge about biochemical characterization of microorganisms.

Course Outcome and Cognitive Level Mapping

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

CO Number	CO Statement	Knowledge Level
CO 1	Define and Demonstrate aseptic and pure culture techniques in isolation and culture of microorganisms	K1, K2
CO 2	Identify and Classify the type of microorganism using staining techniques & biochemical tests.	K2, K3
CO 3	Make use of various tests for examination of urine & enzymes.	K3
CO 4	Apply various qualitative tests to identify the biomolecules.	K3
CO 5	Identify and Examine the biomolecules present in the given sample.	K3, K4

Mapping of CO with PO and PSO

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

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

Syllabus

1. Preparation of Molarity, Normality solutions and Buffers.
2. Qualitative analysis of Carbohydrates
3. Qualitative analysis of proteins
4. Qualitative analysis of Lipids.
5. Estimation of Glucose by DNS method.
6. Qualitative chemical examination of Urine.
7. Determination of salivary amylase activity.
8. Separation of plant pigments using Paper chromatography.
9. Media Preparation & Sterilization.
10. Isolation and Enumeration of Microorganisms from Water and Soil.
11. Pure Culture Techniques – Spread plate, Streak plate, Pour plate and Slant preparation.
12. Measurement of Bacterial Growth – Turbidometric method
13. Staining Techniques – Simple staining, Gram's staining & Capsule Staining.
14. Cell Motility – Hanging drop technique.
15. Biochemical Characterization of microorganisms – IMViC tests.

Reference Books

1. Arora, B., & Arora, D. R. (2020). *Practical Microbiology (2nd Edition)*. CBS Publishers & Distributors.
2. Chawla, R. (2020). *Practical Clinical Biochemistry: Methods and Interpretations*. JP Medical Ltd.
3. Aneja, K.R. (2018). *Laboratory Manual of Microbiology and Biotechnology (2nd Edition)*. ED-TECH.
4. Gupta, R.C., Bhargava, S. (2018). *Practical Biochemistry (5th Edition)*. CBS Publishers.
5. Cappucino, J. G. (2017). *Microbiology - Laboratory Manual*. Pearson.
6. Plummer, D. T. (2017). *An Introduction to Practical Biochemistry (3rd Edition)*. Tata McGraw-Hill Education.

E- Books

1. <https://www.pdfdrive.com/bensons-microbiological-applications-laboratory-manual-in-general-microbiology-short-version-d185416575.html>
2. <https://www.pdfdrive.com/laboratory-manual-for-general-microbiology-e33507828.html>

3. <https://www.pdfdrive.com/microbiology-laboratory-exercises-justmedeu-d15396585.html>
4. <https://www.pdfdrive.com/laboratory-manual-of-biochemistry-d44169898.html>
5. <https://www.pdfdrive.com/biochemistry-laboratory-manual-e33724502.html>

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1. <https://vlab.amrita.edu/?sub=3&brch=63>
2. <https://vlab.amrita.edu/?sub=3&brch=73>
3. https://profiles.uonbi.ac.ke/jamesmuthomi/files/acp101_microbiology_practical_exercises.pdf
4. <https://nptel.ac.in/courses/102103015>
5. <https://jru.edu.in/studentcorner/lab-manual/bpharm/Lab%20Manual%20-%20Biochemistry.pdf>

Pedagogy

Practical Observation and Demo

Course Designers

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