CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS)

Nationally Accredited with 'A' Grade by NAAC

ISO9001:2015Certified

TIRUCHIRAPPALLI

PG AND RESEARCH DEPARTMENT OF MICROBIOLOGY

M.Sc., MICROBIOLOGY

SYLLABUS

2022 -2023 andOnwards

CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS)

PG AND RESEARCH DEPARTMENT OF MICROBIOLOGY

VISION

Our vision is to encourage eminent research work through the conception of an attractive and vibrant environment to achieve goals of our department.

MISSION

- To impart relevant, ultimate, principle-oriented education and practical expertise in the field of Microbiology.
- To strive to provide quality education conjugated with innovative technology so as to be able to gain technical and educational expertise locally, nationally, internationally.
- Our prime focus is to enrich the ambitions of our students, staff and steer with constructive collaboration towards excellence.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEOs	Statements
PEO1	**LEARNINGENVIRONMENT** 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.
PEO2	**ACADEMICEXCELLENCE** To provide a conducive environment to unleash their hidden talents and to nurture the spirit of critical thinking and encourage them to achieve their goal.
PEO3	**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.
PEO4	**PROFESSIONALETHICSANDSOCIALRESPONSIBILITY** 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 to the nation.
PEO5	**GREENSUSTAINABILITY** To understandtheimpactofprofessionalsolutionsinsocietalandenvironmental contexts and demonstrate the knowledge for an overall sustainable development.

PROGRAMME OUTCOMES FOR M.Sc.,Microbiology PROGRAMME

PO NO	On completion of M.Sc., Microbiology, the students will be able to
PO1	**Scientific Management and Career Opportunities:** Master the scientific and applied aspects of the subject for employment opportunities.
PO2	**Explore Creativity and Intelligence:** Employ novel ideas with conceptual thinking to secure self-discipline and independence to foster scientific attitude by exploration of Science.
PO3	**Team Building and Scientific Temperament:** Inculcate training, internships and team spirit with leadership skills through academic projects and transmit complex scientific and technical information and contribute to the scientific community.
PO4	**Innovative Learning and Technological Advancement:** Perceive research in the specialized areas and to engage in life-long learning to keep pace with emerging trends in academics, research and technology.
PO5	**Personality Development with Social Responsibility:** Achieve ethical, social and holistic values with social responsibility to develop a healthy life.

PROGRAMME SPECIFIC OUTCOMES FOR M.Sc., MICROBIOLOGY

PSO NO.	Students of M.Sc., Microbiology will be able to	POs Addressed
PSO 1	Understand the applied sciences to engage them life long learning to foster their successful carrier and educational goals.	**PO1,PO5**
PSO 2	Focus perceptive in the subject of Microbiology to apply its principles and its applications by adding broad range of scientific knowledge.	**PO2, PO3**
PSO 3	Acquire contextual knowledge on basis and modern concepts in current areas with contemporary technologies and multidisciplinary domains	**PO3,PO4**
PSO 4	Instill to work independently identify appropriate resources, enable individual, institutional and national values to understand the impact of innovation and applications	**PO4,PO1**
PSO 5	Ability to imbibe moral and ethical values to formulate effective research grants and experimental designs	**PO5,PO2**

CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS), TRICHY-18

M.Sc., Microbiology Programme Structure under CBCS

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

Sem.	Course	Title	Course Code	Inst./ Hours/ Week	Credit	Exam Hours	Marks		Total
							Int.	Ext.	
I	Core Course – I (CC)	Essentials of Microbiology	22PMB1CC1	6	5	3	25	75	100
	Core Course – II (CC)	Biological Macromolecules	22PMB1CC2	6	5	3	25	75	100
	Core Course – III (CC)	Clinical Virology	22PMB1CC3	5	5	3	25	75	100
	Elective Course – I	A. Biological Techniques	22PMB1EC1A	5	5	3	25	75	100
		B. Organic Farming	22PMB1EC1B						
		C. Microbial Cytology	22PMB1EC1B						
	Core Practical –I (CP)	Essentials of Microbiology, Biological Macromolecules and Clinical Virology practical	22PMB1CC1P	8	4	3	40	60	100
		TOTAL		**30**	**24**	**-**	**-**	**-**	**500**
	15 Days INTERNSHIP during Semester Holidays								
II	Core Course- V (CC)	Microbial Metabolism		6	5	3	25	75	100
	Core Course – VI (CC)	Clinical Immunology		6	5	3	25	75	100
	Core Course – IV (CC)	Microbial Ecology		5	4	3	25	75	100
	Core Practical– II (CP)	Microbial Metabolism, Clinical Microbiology and Microbial Ecology practical		8	4	3	40	60	100
	Elective Course – II	A. Biofertilizer Technology		5	4	3	25	75	100
		B. Public Health Microbiology							
		C. Marine Microbiology							
		Internship			2				100
	Extra Credit Course	Swayam Online Course		As per UGC Recommendation					
		TOTAL		**30**	**24**	**-**	**-**	**-**	**600**

III	Core Course-VII (CC)	Industrial Microbiology		6	5	3	25	75	100
	Core Course-VIII(CC)	Microbiology for Competitive Examinations		6	5	3	-	100	100
	Core Practical–III (CP)	Industrial Microbiology practical		8	4		40	60	100
	Elective Course -III (EC)	A. Clinical Mycology and Parasitology		5	4	3	25	75	100
		B. Food Adulteration							
		C. Biomedical Laboratory Technology							
	Elective Course – IV (EC)	A. Recombinant DNA Technology		5	4	3	25	75	100
		B. Microbes in Solid Waste Management							
		C. Microbial Nanotechnology							
	Extra Credit Course	Swayam Online Course		As per UGC Recommendation					
	TOTAL			**30**	**22**	**-**	**-**	**-**	**500**
IV	Core Course – IX (CC)	Microbial Biotechnology		6	5	3	25	75	100
	Core Course – X (CC)	Molecular Biology and Microbial Genetics		6	4	3	25	75	100
	Elective Course - V (EC)	A. Bioinformatics and Biostatistics		5	4	3	25	75	100
		B. Entrepreneurial Microbiology							
		C. Molecular Taxonomy and Phylogeny							
	Core Practical-IV (CP)	Microbial Biotechnology, Molecular Biology and Microbial Genetics practical		8	4	3	40	60	100
	Project			5	4	-	-	-	100
	TOTAL			**30**	**20**	**-**	**-**	**-**	**500**
	GRAND TOTAL			**120**	**90**	**-**	**-**	**-**	**2100**

Note:

Total No. of Core Papers -10

Total No. of Practicals -4

Total No. of Elective Papers -5

Internship -1

No. of Projects -1

Total -21

The internal and external marks for theory and practical papers are as follows:

Subject	Internal Marks	External Marks
Theory	25	75
Practical	40	60

Separate passing minimum is prescribed for Internal and External

For Theory:

a) The passing minimum for CIA shall be 40% out of 25 marks (i.e. 10 marks)

b) The passing minimum for End Semester Examinations shall be 40% out of 75marks (i.e. 30 marks) c) The passing minimum not less than 50% in the aggregate.

For Practical:

a) The passing minimum for CIA shall be 40% out of 40 marks (i.e. 16 marks)

b) The passing minimum for End Semester Examinations shall be 40% out of 60marks (i.e. 24 marks) c) The passing minimum not less than 50% in the aggregate.

For PROJECT:

Marks for Dissertation: 80 Marks

Marks for Viva Voce: 20 Marks

Total Marks: 100 Marks

Cauvery College for Women (Autonomous),Trichy

M.Sc., Microbiology

(ForthecandidatesadmittedfromtheAcademicyear2022-2023and onwards)

Semester	Course	Title	Course Code	Inst./ Hrs/Week	Credits	Exam			Total
						Hrs	Marks		
							Int.	Ext.	
I	Core Course – I (CC)	Essentials of Microbiology	22PMB1CC1	6	5	3	25	75	100
	Core Course – II (CC)	Biological Macromolecules	22PMB1CC2	6	5	3	25	75	100
	Core Course – III(CC)	Clinical Virology	22PMB1CC3	5	5	3	25	75	100
	Elective Course – I (EC)	A. Biological Techniques B. Organic Farming C. Microbial Cytology	22PMB1EC1A 22PMB1EC1B 22PMB1EC1C	5	5	3	25	75	100
	Core Practical –I (CP)	Essentials of Microbiology, Biological Macromolecules and Clinical Virology Practical	22PMB1CC1P	8	4	3	40	60	100
Total				**30**	**24**	**-**	**-**	**-**	**500**

Semester I	Internal Marks: 25		External Marks : 75	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS./WEEK**	**CREDITS**
22PMB1CC1	**ESSENTIALSOFMICROBIOLOGY**	**CORE**	**6**	**5**

Course Objective

- To enable the students to understand the basic knowledge in Microbiology.

Prerequisites

Basic knowledge and concepts of microbiology

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Determine the scope of Microbiology	K4
CO2	Differentiate the types of Microscopy	K4
CO3	Assess the morphological features of Eukaryotic Cell	K5
CO4	Generalize view of Prokaryotic Cell Structure	K6
CO5	Develop the cultivation methods of microbes	K6

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	2	3	3	2
CO2	2	2	2	2	2	3	2	3	2	2
CO3	2	3	1	2	3	3	2	3	2	2
CO4	3	2	3	2	2	3	2	3	2	1
CO5	3	3	3	3	2	3	2	3	3	2

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

Syllabus

UNITI(18HOURS)

History and Scope of Microbiology, Classification systems– Phenetic, phylogenetic and numerical. Domain and kingdom concept - Haeckel's three kingdom concept, Whittaker's five kingdom concept, Carl Woes three domain system, Cavalier - smith eight kingdom concept. Bacterial classification (outline) according to Bergey's manual of systemic Bacteriology.

UNITII(18 HOURS)

Principles of microscopy. Compound microscope (Monocular and Binocular microscopes) – construction and function of parts, ray diagram of path of light, objectives, oculars, condensers, sources of illumination and uses. Dark field, Phase contrast and Fluorescence microscopes, Confocal microscopes, Atomic Force Microscope - principle, construction, ray diagram and applications - Electron microscopy – TEM and SEM – principle, construction, ray diagram and uses.

UNITIII (18HOURS)

Study of bacteria: Size, shape and arrangement of bacterial cells. Structures external to cell wall – capsule, slime layer, flagella, pili, fimbriae, stalks, prosthecae. Cell wall – gram positive and gram negative. Structures internal to cell wall – cell membrane , cytoplasm , cytoplasmic inclusions , genome, spores and cysts. Reproduction in bacteria: a) Binary fission *E coli* , *Bacillus* and *Streptococcus* b) Other methods – Budding, Fragmentation, Prostheca, Multiple fission**.**

UNITIV (18HOURS)

General characteristics, Classification, Structure and Reproduction of Algae: *Chlorophyta* (Green algae), *Diatoms*, *Rhodophyta* (Red algae), Fungi: Cell wall – chemical composition and functions, membranes and their functions, nutritional strategies of fungi. Structure and life cycle of fungi *Ascomycetes* (*Aspergillus*), *Zygomycetes* (*Mucor*), *Basidiomycetes* (*Agaricus*). Discovery, distinctive properties, morphology and ultra-structure of Virus, Classification of virus **.**

UNITV (18HOURS)

Microbial growth - culture media - isolation of pure culture. Growth curve: Diauxy - continuous culture – chemostat – turbidostat - synchronized growth. Measurement of microbial growth – Total cell count method - viable cell count method and biomass determination - dry weight – wet weight – protein – Kjeldhal nitrogen – chlorophyll. Growth phases – kinetics – asynchronous – synchronous - batch – continuous culture. Factors affecting growth (pH, salinity, temperature, light, etc). Microbial growth control - Physical and chemical methods – sterilization and disinfection. Maintenance and preservation of microorganism**.**

UNITVI - Self Study for Enrichment (Not included for End Semester Examinations)

Nomenclature and modern methods of Bacterial taxonomy, Micrometry, Gaint bacteria, Cultivation of virus and Protozoa, Bacterial nutrition.

TextBooks

1. Dave Wessner , Christine Dupont , Trevor Charles , Josh Neufeld.(2020).*Microbiology*.Wiley.
2. Bhagwan Rekadwad. (2020).*Microbial Systematics: Taxonomy, Microbial Ecology, Diversity*. CRC Press.
3. Joan L. Slonczewski , John W. Foster , Erik R. Zinser.(2020).*Microbiology: An Evolving Science*. W. W. Norton & Company.
4. Michael J. LeBoffe, Burton E. Pierce. (2019).*Microbiology: Laboratory Theory & Application, 1st Edition.* Morton Publishing Company.
5. Gerard Tortora , Berdell Funke , Christine Case. (2018).*Microbiology: An Introduction, 4th Edition*,Pearson.

ReferenceBooks

1. Gerard Tortora , Berdell Funke , Christine Case, Derek Weber, Warner Bair . (2020).*Microbiology: An Introduction, 12th Edition.*Pearson.
2. Barry Chess.(2020).*Talaro's Foundations in Microbiology: Basic Principles, 7th edition*.McGraw Hill.
3. Lourdes Norman-McKay .(2018).*Microbiology: Basic and Clinical Principle, 1st edition* .Pearson**.**
4. Kathleen Park Talaro , Barry Chess. (2017).*Foundations in Microbiology***,** *7th edition*. McGraw Hill.
5. PrescottL.M,Harley,J.P.andHelin,D.A. (2017).*Microbiology, 5th Edition***.** McGraw Hill.

Web References

1. https://microbenotes.com/category/basic-microbiology/
2. https://microbiologyinfo.com/
3. https://bio.libretexts.org/Bookshelves/Microbiology/Book%3A_Microbiology_(Kaiser)/Unit_1%3A_Introduction_to_Microbiology_and_Prokaryotic_Cell_Anatomy/1%3A_Fundamentals_of_Microbiology
4. https://www.biologydiscussion.com/notes/microbiology-notes/notes-microbiology-biology/34235
5. https://www.britannica.com/science/microbiology

Pedagogy

Chalk and talk, Quiz, Assignments, Group Discussion, Demo and PPT

Course Designer

Dr.P.F.Steffi

Semester I	Internal Marks:25		External Marks:75	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS./WEEK**	**CREDITS**
22PMB1CC2	**BIOLOGICAL MACROMOLECULES**	**CORE**	**6**	**5**

Course objective

- To provide knowledge about cell and its function, to understand the metabolicpathways of various macromolecules.

Prerequisite

Basic understanding of cell and its functions, biological macromolecules.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Classification of cell, and its structure in prokaryotes and eukaryotes	K4
CO2	Elaborate the basic concepts of enzyme and its catalysis	K4
CO3	Analyze the chemical nature and function of biological macromolecules	K5
CO4	Discuss the concepts of thermodynamics and biological buffers	K6
CO5	Explain the concepts of metabolism with detailed pathways	K6

Mapping of CO with PO and PSO

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

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

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

Syllabus

UNIT I **(18HOURS)**

Cellular organization :Cell and it's function-Structural organization and functions of bacterial, animal and plant cell-Nucleus, Cytoplasm, Mitochondria, Golgi apparatus, Lysosomes, Ribosomes, Endoplasmic reticulum. Various specialized components of microorganisms-Pili,Fimbriae,Cilia,Flagella,S-layer,Magnetosomes-their structure and function**.** Cell division-Mitosis ,Meiosis

UNIT II **(18HOURS)**

Enzymes:Enzymes-Definition –Classification –specificity-active site-Emil fischer and koshland Model for the mechanism of enzyme action,. Enzyme kinetics:Michaelis–Menton equation for simple enzymes-Factors affecting enzyme activity. Enzyme inhibition- competitive-Non competitive and Uncompetitive. Isozymes-coenzymes- Biological significance of enzymes

UNIT III **(18HOURS)**

Biological macromolecules and their biosynthesis**:**Macromolecules. Nucleic acid - properties,biosynthesis of purines and pyrimidines - Structure of DNA and RNA.Types of RNA. Proteins -classification - primary-secondary-tertiary - quaternary and three dimensional structure of proteins. Synthesis of proteins. Aminoacids-Essential and Non Essential-Carbohydrates-mono,di,oligo and polysaccharides. Lipids and biomolecules: Fatty acids, properties, -oxidation

UNIT IV **(18HOURS)**

Bioenergetics:Bioenergetics –Laws of thermodynamics, strategy of energy production in the cell. Oxidation -reduction reactions, coupled reactions and group transfer. Biological energy transducers-structural features of biomembranes, transport, free energy and spontaneity ofreaction,G,G°,G'and equilibrium.Basic concepts of acids,bases,pH and buffer

UNIT V **(18HOURS)**

Concepts of metabolism**:** Basic concepts of metabolism - catabolic principles and break down of carbohydrates-Glycolysis-EMP and Entner doudroff pathway ,TCA cycle and HMP shunt.Lipids-Types of oxidation-proteins-Deamination, Transamination, Decarboxylation and Transmethylation- Nucleicacids – Purine and pyrimidine catabolism-significance

UNITVI- Self Study for Enrichment (Not included for End Semester Examinations)

Cell cycle, Allosteric enzymes, Biosynthesis of cholesterol, Biological buffer system –Types and functions, ATP production

TextBooks

1.Amit Kumar Nayak, Amal Kumar Dhara, Dilipkumar Pal (2021) *Biological Macromolecules Bioactivity and Biomedical Applications.* 1st Edition.Elsevier Inc.

2.Rene Crester Kratz , (2020) *Molecular & Cell Biology* 2nd edition dummies

3. Jeremy MBerg, JohnL Tymoczko and Lubert stryer.,(2002*) Biochemistry* .5th edition W.H.Freeman and company ,Newyork

4. FreifelderD (2004) *Molecular Biology*, 4thEdition Narosa Publishing House ,NewDelhi

Reference Books

1. David. E.Metzler and Carol.M Metzler(2001) *Biochemistry -Thechemical reactionsofliving cells-Vol1and2.*2ndedition Harcourt/Academic press ,Newyork
2. Lehninger,Albert L, David L Nelson and MichaelMCox.(2021) *Lehninger Principlesof*

Biochemistry.NewYork: 8th Edition Worth Publishers.
3. StryerL BergJM and Tymoczko JL (2002) *Biochemistry* 5thedition.NewYork W.H.Freeman.
4. Thomas M Devlin.A.(2002) *Textbook of Biochemistry with clinical correlations*,5thedition. JohnWileyandsons,Inc., publication,Newyork
5. Rafi MD (2014) *Textbook of Biochemistry for medical students*, 2ndeditionUniversitiesPress,(India) Pvt. Ltd,Hyderabad,India

Web References

1. https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_(Boundless)/03%3A_
2. https://www.youtube.com/watch?v=h-z9-9OOWC4
3. https://www.youtube.com/watch?v=-FQmAnmLZtE
4. https://www.youtube.com/watch?v=ok9esggzN18
5. https://www.youtube.com/watch?v=PYH63o10iTE
6. https://www.youtube.com/watch?v=VigpwmH7E3M
7. https://www.youtube.com/watch?v=_zm_DyD6FJ0
8. https://www.youtube.com/watch?v=VGHD9e3yRIU
9. https://www.youtube.com/watch?v=2Jgb_DpaQhM
10. https://www.youtube.com/watch?v=NNASRkIU5Fw
11. https://www.youtube.com/watch?v=qVAvmieRM1E
12. https://www.youtube.com/watch?v=Gh2P5CmCC0M

Pedagogy

Chalk and talk, Quiz, Assignments, Group Discussion, Demo and PPT

Course Designer

Dr. N.Pushpa

Semester I	Internal Marks: 25		External Marks: 75	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/ WEEK**	**CREDITS**
22PMB1CC3	**CLINICAL VIROLOGY**	**CORE**	**5**	**5**

Course Objective

- To impart and explain the students with the advanced knowledge of the characteristics of Clinically important viruses with the focus on the General characters, Cultivation, Pathogenesis, Lab diagnosis, Prophylaxis, and Treatment of the disease.

Prerequisites

Basic Understanding of Etiology and Diagnostic Management of Animal Viruses.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Describe General Characters and Classification of viruses	K3
CO2	Aware different Diagnostic methods adopted for viruses	K4
CO3	Examine and differentiate the various air borne viral infections	K4
CO4	Analyse some food borne viral diseases	K6
CO5	Examine and Categorize different types of Vector borne Viral diseases and Oncogenic viruses	K6

Mapping of CO with PO and PSO

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

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

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

Syllabus

UNIT I (15HOURS)

General Virology - Introduction and Historical perspective of clinical virology. Nomenclature, General Properties and Ultra structure of viruses. viral replication, classification of Viruses – Baltimore and ICTV methods. Sample collection, Transport and examinations of viral Specimens. Incomplete viruses- Prions, Satellite Viruses, Viroids and Virusoids.

UNIT II **(15HOURS)**

General Methods of Diagnosis and Serology - Cultivation of clinically important viruses in embryonated eggs, experimental animals, cell cultures, cell lines and transgenic systems. Serological methods – Haemagglutination & HAI; complement fixation, Immunofluorescence methods, PCR, ELISA and Radio immunoassays, Immunoblotting- Western Blot. Assay of viruses – physical, chemical and Infective assay. Antiviral agents and viral vaccines.

UNIT III **(15HOURS)**

Air borne Viruses - Clinical Course, Disease burden , risk factor, Epidemiology, Prevention and Treatment of following Air borne viruses- Rhinovirus, Influenza Virus (A,B and H1N1), Varicella virus- Chicken pox, Mumps virus, Measles virus, MERS- CoV and SARS- Cov-2.

UNIT IV **(15HOURS)**

Food borne Viruses - Causative agent, Pathogenesis, Lab Diagnosis, Treatment and Prophylaxis of following Food borne Viruses- Adenovirus,Rotavirus, Hepatitis virus, Enteroviruses- Poliomyelitis, Calcivirus, Polio virus and Coxsackie viruses.

UNIT V **(15HOURS)**

Vector borne Viruses - Morphology of Causative agent, clinical symptoms, pathogenesis, mode of transmission, prevention and treatment of the following Vector borne viral diseases - Chikungunya, Dengue, Yellow fever, Rabies and Ebola Viruses.

Oncogenic Viruses -Pathogenesis, Diagnosis and Prevention of Oncogenic viruses- Human Papiloma virus, HIV, HTLV, Herpes and Epstein Barr Virus.

UNIT VI-Self Study for Enrichment(Not included for End Semester Examinations)

Cultural Characters of Viruses, Qualitative and Quantitative estimation of Viruses, Structure and life cycle of viruses, Etiology and Classification of viruses and Viral Prophylaxis.

Text Books

1. Ananthanarayan and Jayaram Paniker(2020).*Text book of Microbiology*. 11thEdition,London: Oxford University press.
2. Geo Brooks, Karen C Carroll, Janet Butel and Stephen Morse (2020). *Medical Microbiology*.26th Edition, Mc Graw Hill Publication.
3. Jawetz, Melnick and Adelberg's (2019). *Medical Microbiology*. 24th Edition, Hill Medical Publication division.
4. Kenneth J Ryan, Nafees Ahmad and Andrew Alspaugh J (2018). *Sherris Medical Microbiology.* 7th Edition, Mc GrawHill Education.
5. Mishra B (2018). *Text Book of Medica Virology.*1st Edition, CBS Publishers.
6. Greenwood D, Slack R C, Barer M R and Irving W L (2018). *Medical Microbiology: A Guide to Medical Infections*. 19th Edition, Churchill Livingstone Publishers.

Reference book

1. Aejaz Iqbal and Zafar Nowshad (2020). *Medical microbiology: Millennium Edition.*

Notion Press.
2. Alan J. Cann (2015). *Principles of Molecular Virology*. 4th Edition,California: Academic Press.
3. Dimmock NJ and Primerose SB(2016). *Introduction to modern virology*.4th Edition, London: Oxford Blackwell scientific publication.
4. Singh R.P (2015). *Immunology and Medical Microbiology*. 1st Edition,New Delhi: Kalyani Publishers.

Web References

1. **https://www.youtube.com/watch?v=SAbYEYs-_ak**
2. **https://www.youtube.com/watch?v=6RDofkmG1yo**
3. **https://www.youtube.com/watch?v=dGKeq7DH91c**
4. **https://www.youtube.com/watch?v=xEp-Sdgl9AU**
5. **https://www.youtube.com/watch?v=Kweu6hjWV9w**

Pedagogy

Chalk and talk, Quiz, Assignments, Group Discussion, Demo and PPT

Course Designer

Dr. S. Jeyabharathi

Semester I	Internal Marks :25		External Marks: 75	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
22PMB1EC1A	**BIOLOGICAL TECHNIQUES**	**ELECTIVE**	**5**	**5**

Course Objective

- To educate the students with the basic principles of microbial techniques so as to develop their research aptitude and career prospects.

Prerequisite

Basic understanding of experimental protocols on biological research.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO 1	Differentiate the microscopic techniques.	K4
CO 2	Determine the spectroscopic, Spectrophotometric methods & analytical techniques.	K4
CO 3	Critique knowledge about chromatographic techniques.	K5
CO 4	Revise about electrophoresis & its applications.	K6
CO 5	Combine view of molecular techniques.	K6

Mapping of CO with PO and PSO

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

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

Syllabus

UNIT I (15HOURS)

Microscopic Techniques-Basic principles,mechanisms and application of Bright Field, Dark field, Phase contrast, Polarization, Confocal laser scanning microscope, Fluorescence, Scanning Electron microscope & Transmission Electron Microscope (SEM & TEM) and Radio- frequency scanning tunneling microscopy, Atomic force microscopy.Preparation of microbial, animal and plant samples for microscopy.

UNITII (15HOURS)

Spectroscopy & Spectrometry- Basic concepts and applications of Circular Dichroism (CD) and Optical Rotatory Dispersion (ORD), Fluorescence spectroscopy, UV/Visible spectrophotometry, Infrared spectroscopy, Fourier-transform infrared spectroscopy (FTIR), Nuclear Magnetic Resonance spectroscopy (NMR).

UNIT III (15 HOURS)

Chromatographic Techniques- Basic Principles and application of Bioautography, Thin-layer chromatography, Paper chromatography, Gel filtration chromatography, Ion- exchange chromatography, Affinity chromatography, Gas chromatography and High Performance Liquid chromatography.

UNIT IV (15 HOURS)

Centrifugation & Electrophoresis- Basic principles and applications of Centrifuges - Preparative, analytical, high speed, low speed, ultracentrifuge, differential and density gradient. Basic concepts and applications of Gel Electrophoresis- Agarose and acrylamide (native, denaturing and gradient), Isoelectric focusing, 2D Electrophoresis, Immuno-electrophoresis and Pulse field Electrophoresis.

UNIT V (15HOURS)

Radigraphy & Molecular Techniques- Basic principles and application of Autoradiography. Liquid scintillation counting, phosphor imaging, Imatinib Resistance Mutation Analysis. Types of PCR- Real time PCR, Reverse Transcriptase PCR, Multiplex PCR, Nested PCR and In-situ PCR. Blotting (Southern, Western, Northern) Techniques, DNA Finger printing, RFLP, RAPD and AFLP application.

UNIT VI - Self Study for Enrichment(Not included for End Semester Examination)

Differentiate the functions of Microscope, Interpret the results of FTIR, Separation of the compounds using chromatography and centrifugation, Working principles of DNA Amplification.

Text Books

1. Rao, D. M. (2020). *Instrumental Methods of Analysis.* 1st Edition.CBS publishers and distributors pvt ltd.
2. Gurdeep R. Chatwal. (2019).*Instrumental Methods of Chemical Analysis*. 3rd Edition. Himalaya publishing house.
3. Bhawana Pandey M.H. Fulekar. (2019).*Bioinstrumentation.* 5th Edition. Dream tech Press.

4. Gilbert H Mitchell.(2017). *Gel Electrophoresis: Types, Applications & Research*. 1st Edition. Nova Science Publishers .
5. Jessica carol. (2016).*Textbook of Analytical Biochemistry.* 1st Edition. Syrawood Publishing House.

Reference Books

1. Ankita Jain, Haresh Kalasariya, Varsha Tailor,Nikunj Patel. (2020).*Bioinstrumentation techniques-Basics and applications.*1st Edition. Notion Press.
2. Gakhar, Monika Miglani, Ashwani Kumar.(2019).*Molecular Biology: A Laboratory Manual.* 1st Edition .Dreamtech Press.
3. Almroth E.,Wright.(2018). *Principles of Microscopy: Being a Handbook to the Microscope.* 1st Edition .Forgotten Books.
4. Andreas Hofmann and Samuel Clokie. (2018). *Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology.*8th Edition. Cambridge University Press.
5. Sanjay B Bari.(2017). *Theory and Practice of Chromatographic Techniques.* 1st Edition. Pharma Med Press.

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1.http://physics.fe.uni-lj.si/students/predavanja/Microscopy_Kulkarni.pdf
2. https://research.ipmu.jp/seminar/sysimg/seminar/574.pdf
3. http://www-keeler.ch.cam.ac.uk/lectures/Irvine/
4. https://www.ccamp.res.in/sites/default/files/Basics%20of%20Chromatography_KR_C-CAMP.pdf
5. http://www.bdu.ac.in/schools/biotechnology-and-genetic-engineering/biomedical-science/docs/course_materials/Biotechniques/Electrophoresis.pdf
6. https://ehs.psu.edu/sites/ehs/files/lsc_theory_of_operation_part_1.pdf
7.https://www.youtube.com/watch?v=kOCcmJ3nVQ4

Pedagogy

Power point presentations, Group Discussion, Seminar, Quiz, Assignment, Brain Storming Activity.

Course Designer

Dr.N.Sathammai Priya

Semester I	Internal Marks: 25		External Marks: 75	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS./WEEK**	**CREDITS**
22PMB1EC1B	**ORGANIC FARMING**	**ELECTIVE**	**5**	**5**

Course Objective

- This course aims at sensitizing the need and generating knowledge and skills on various organic farming practices, so as to equip the learners carrying out organic agricultural production and management.

Prerequisites

Basic knowledge and concepts of organic farming

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Analyze the origin and importance of organic farming	K4
CO2	Explain the scope of organic farming	K5
CO3	Criticize the methodology practiced in organic farming	K5
CO4	Develop an idea about biocontrol agents in crop protection	K6
CO5	Construct the strategies for the commercialization of organic products	K6

Mapping of CO with PO and PSO

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

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

Syllabus

UNIT I (15 HOURS)

Introduction - Different concepts of organic farming – Natural farming, Biodynamic farming, and Zero Budget Farming. Principles of organic farming- Conventional farming v/s Organic farming. Benefits and Need for organic farming.

UNIT II **(15 HOURS)**

Development and Scope of organic farming; Requirements for organic farming-Soil fertility, Crop Nutrition & Nutrients inputs. Organic Crop Production Systems. Benefits of Integrated organic farming system.

UNIT III **(15 HOURS)**

Green manuring- Composting- principles, stages, types and factors, Composting methods – Vermicomposting- and Preparation of Vermi wash, Organic amendments and sludges. Biofertilizers and their types- methods of application-advantages and disadvantages. Seed Propagation-planting materials and seed treatments, Water management -drip irrigation -rain water harvesting.

UNIT IV **(15 HOURS)**

Plant protection- Integrated Pest Management- bio pesticides and Herbal pesticides- production at household/ farm level, Agniastra, Neemastra-mode of application-advantages. Biocontrol agents. Weed management- preventive practices, biological control of weeds, mechanical control, Standards for organic inputs, crop rotation-intercropping- Mulching-Pruning.

UNIT V **(15 HOURS)**

Seed conservation- techniques- seed bank. Farm inspection and Process of Certification. Quality analysis of organic foods-Standards of organic foods- Organic Trademark-Marketing of Organic products. Economics of Organic Farming and Government schemes related to organic farming.

UNITVI - Self Study for Enrichment (Not included for End Semester Examinations)

Farming components and preparation of organic nutrients. Preparation of Bio fertilizers - Bio pesticides and formulations. Study on crop rotation and mixed cropping techniques.

Text Books

1. Joanne M Willey, Kathleen M Sandman and Dorothy H Wood. (2019). *Prescotts Microbiology*, McGraw-Hill 11th Education.
2. Unni M R and Sabu Thomas. (2018). *Organic Farming Global Perspectives and Methods*. 1st Edition. Woodhead Publishing.
3. Amitava Rakshit and H B Singh. (2018). *ABC of Organic Farming*. 1st Edition. Jain Brothers.
4. Maliwal P.L. (2019). *Principles of Organic Farming.* 1st Edition. Scientific Publishers.
5. Govind Mishra Munish Kumar Verma, Ajeet Singh. (2019). *Organic farming.* 1st Edition. Sankalp Publication.

ReferenceBooks

1. Bansal M. (2020). *Basics of Organic Farming*. 1st Edition. CBS publishers and Distributors Pvt. Ltd.
2. Janet Wilson. (2020). *Composting: Sustainable and Low- Cost Techniques for Beginners.* 1st Edition. Drip Digital Publisher.
3. Debabrata Biswas, Shirley A. Micallef. (2019). *Safety and Practice for Organic Food.* 1st Edition. Academic press Elsevier Science.
4. Vinaya Kumar Sethi. (2018*). Organic farming and bio-fertilizers.* 1st Edition. Discovery publishing House Pvt. Ltd.

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1. **https://www.24mantra.com/blogs/organic-farming-vs-conventional-farming-which-method-is-better/**
2. **https://www.onlinebiologynotes.com/biofertilizer-advantages-types-methods-of-application-and-disadvantages/**
3. **https://www.britannica.com/topic/seed-propagation**
4. **https://content.ces.ncsu.edu/extension-gardener-handbook/8-integrated-pest-management-ipm**
5. **https://www.agric.wa.gov.au/small-landholders-western-australia/marketing-organic-produce**
6. **https://youmatter.world/en/definition/organic-farming-definition-standards-benefits/**
7. **https://vikaspedia.in/agriculture/national-schemes-for-farmers/schemes-for-organic-farming**

Pedagogy

Chalk and Talk, Assignment, Seminar& Group Discussion.

Course Designer

Dr. S. Jenny

Semester I	Internal Marks:25		External Marks:75	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
22PMB1EC1C	**MICROBIAL CYTOLOGY**	**ELECTIVE**	**5**	**5**

Course Objective

- To introduce basics in prokaryotic and eukaryotic cell structure

Prerequisites

Microscopic and submicroscopic details of microorganisms.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Assess the main principles of cell theory	K5
CO2	Determine the Prokaryotic cell	K4
CO3	Evaluate the Structure and functions of eukaryotic cell	K5
CO4	Generalize view of cell division	K6
CO5	Examine Microbial cell communication	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**	**3**	**2**	**2**	**1**
CO2	**3**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**2**
CO3	**2**	**3**	**2**	**3**	**2**	**2**	**3**	**2**	**3**	**2**
CO4	**3**	**2**	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**2**
CO5	**2**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**2**

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

Syllabus

UNIT I(15 HOURS)

History of microbial cytology, Cell- definition and general concepts, Main principles of the cell theory, cell as basic unit of life, broad classification of cell types- Prokaryotic and eukaryotic cells and their similarities and differences.

UNIT II(15 HOURS)

Structure and function of prokaryotic cell- outer flagella, surface layers, cell wall, cytosol and other organelles, chromosome and extra chromosomal DNA.

UNIT III(15 HOURS)

Structure and function of eukaryotic cell- cytosol,nucleus,chloroplast,organelles of Vesicular trafficking system, endoplasmic reticulum(rough and smooth), golgibodies, lysosomes and microbodies.

UNIT IV(15 HOURS)

Role of cell cycle and control of cell cycle, cell division- Mitosis and Meiosis.

UNITV (15 HOURS)

Overview- types of cell signaling- signal molecules – signal amplification – receptor types-quorum sensing.

UNIT VI - Self study for Enrichment(Not included for End Semester Examination)

State the cell theory of organisms, Difference between prokaryotic and eukaryotic cell, Cell cycle control mechanism, Role of signal transduction.

Text Books

1. Verma P.S. and Agarwal V.K. (2016) *Cell Biology (Cytology, Biomolecules, Molecular Biology)*, Paperback.S.Chand and Company Ltd.
2. Kumar P. and Mina U. (2018) *Life Sciences: Fundamentals and Practice, Part-I, 6th Edition.*Pathfinder Publication.
3. Hardin J. and Bertoni G. (2017) *Becker's World of the Cell. 9th Edition (Global Edition).* Pearson Education Ltd.
4. Karp G., Iwasa J. and Masall W. (2015) *Karp's Cell and Molecular Biology – Concepts and Experiments. 8th Edition*. John Wiley and Sons.
5. Urry L.A. Cain M.L., Wasserman S.A., Minorsky P.V., Jackson R.B. and Reece J.B. (2014) *Campbell Biology in Focus*. Pearson Education.

Reference Books

1. Albert B., Hopkin K., Johnson A.D., Morgan D., Raff M., Roberts K. and Walter P. (2018) *Essential Cell Biology 5th Edition* (paper back) W.W. Norton & Company.
2. Cooper G.M. and Hausman R.E. (2016) The Cell – *A Molecular Approach, 7th Edition*.Sinauer Associates Inc.
3. Mason K.A., Losos J.B. and Singer S.R. (2011) *Raven and Johnson's Biology. 9th Edition*. Mc Graw Hill publications.
4. Alberts B., Johnson B., Lewis J., Morgan D., Raff M., Roberts K. and Walter P. (2015) *Molecular biology of cell, 6th Edition.*Garland Science, Taylor and Francis.
5. Challoner J. (2015) *The Cell: A visual tour of the building block of* life.The University of Chicago Press and Ivy Press Ltd.

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1. https://repository.embuni.ac.ke/bitstream/handle/123456789/1246/CYTOLOGY%20CHAPTER%201.pdf?sequence=1&isAllowed=y

2. https://biologydictionary.net/prokaryotic-cell/
3. https://opentextbc.ca/biology2eopenstax/chapter/eukaryotic-cells/#:~:text=Like%20a%20prokaryotic%20cell%2C%20a,that%20allow%20for%20compartmentalizing%20functions.
4. https://ncert.nic.in/textbook/pdf/kebo110.pdf
5. https://www.mdpi.com/2079-6382/9/11/779/pdf

Pedagogy

Chalk and talk, Quiz, Assignments, Group Discussions, Demo and PPT

Course Designer

Dr.E.Priya

Semester I	Internal Marks: 40		External Marks : 60	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS./WEEK**	**CREDITS**
22PMB1CC1P	**ESSENTIALS OF MICROBIOLOGY, BIOLOGICAL MACROMOLECULES AND CLINICAL VIROLOGY PRACTICAL**	**CORE PRACTICAL**	**8**	**4**

Course objective

- To impart knowledge about bacterial morphology, phage identification and estimation of nucleic acids

Prerequisites

Imparting practical skills of microbiology

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Determine the sterilization methods	K4
CO2	Examine the bacterial morphology	K4
CO3	Evaluate bacteriophage	K5
CO4	Critique knowledge about buffer preparation	K5
CO5	Measure the Use of chromatography	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	3	3	2	2
CO2	3	2	1	3	3	3	2	2	3	2
CO3	3	3	3	3	3	3	2	2	2	2
CO4	3	2	3	2	3	3	1	3	3	1
CO5	3	3	3	2	2	3	2	3	3	2

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

Syllabus

I. Essentials of Microbiology

1. Safety measures to be followed in the laboratory
2. Study of compound microscope: use of monocular, binocular microscopes, use of oil immersion lens
3. Micrometry – measurement of cell dimensions
4. Study of instruments – autoclave, hot air oven, inoculation chamber (LAFU), Incubator, pH meter
5. Cleaning and sterilization of glassware and preparation of cleaning solutions
6. Enumeration of bacteria from environmental sample – Spread and Pour plate
7. Purification of bacteria by different streaking methods
8. Study of microbial behavior – motility of bacteria by hanging drop technique
9. Staining of bacteria - Monochrome staining, Preparation of Gram staining solutions, Gram staining, Negative staining, Structural staining – endospore, cell wall, capsule staining
10. Fungal slide culture.

II. Biological macromolecules

1. Preparation of buffer (Tris, phosphate, acetate buffer)
2. Determination of (H+) ion concentration
3. Verification of Beer-Lambert's law using coloured solution
4. Preparation of standard graph for the following and estimating the concentration in a microbial sample

i) Glucose-Anthrone method,
ii) Bovine serum albumin (Lowry's method) and
iii) Nucleic acid -DNA(diphenyl amine method),RNA(Orcinol method).

5. Separation of amino acids by paper chromatography and identification of amino acid.
6. Separation of proteins by PAGE, SDS-PAGE-Demonstration.

III. Clinical Virology

1. Animal tissue culture - Demo
2. Embryonated egg inoculation
3. Cell lines studies - Demo

Reference Books

1. Saha R. (2022). *Microbiology Practical Manual,2nd edition***.** CBS Publishers & Distributors.

2. Apurba S Sastry , Sandhya Bhat.(2021).*Essentials of Practical Microbiology, 1st edition.* Jaypee Brothers Medical Publishers.
3. Baveja C. P, BavejaV. (2021).*Text and Practical Microbiology for MLT, 3rd edition.* Arya Publications.
4. Das S.(2020).*Microbiology Practical Manual,1st edition* CBS Publishers.
5. Bharti Arora, AroraD.R. (2020).*Practical Microbiology, 2nd edition*. CBS Publishers & Distributors.
6. Sinha K P.(2020).*Manual of Practical Biochemistry,1st edition.* Scientific Book Company.
7. Rafi Mohammed.(2020).*Manual of Practical Biochemistry,3rd edition.* Orient Blackswan Pvt Ltd.
8. Soundravally Rajendiran , Pooja Dhiman.(2019).*Biochemistry Practical Manual, 1st edition.* Elsevier.
9. Amita Jain , Jyotsna Agarwal , Vimala Venkatesh.(2018).*Microbiology Practical Manual, 1st edition* Elsevier.
10. GunasekaranP.(2018). *Laboratory Manual In Microbiology, 2nd edition* NewAgeInternationalPvt. Ltd. Publisher.

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1. https://microbiologyonline.org/file/7926d7789d8a2f7b2075109f68c3175e.pdf
2. https://ttk.elte.hu/dstore/document/893/book.pdf
3. https://webstor.srmist.edu.in/web_assets/downloads/2021/18BTC103J-lab-manual.pdf
4. https://profiles.uonbi.ac.ke/jamesmuthomi/files/acp101_microbiology_practical_exercises.pdf
5. https://www.slideshare.net/PatriciaCosta17/practical-handbook-of-microbiology

Pedagogy

Chalk and talk, Quiz, Assignments, Group Discussions, Demo and PPT

Course Designer

Dr.P.F.Steffi