

**M.Sc., MICROBIOLOGY**  
**COURSE STRUCTURE WITH SYLLABUS UNDER CBCS**  
*(For the candidates admitted in the academic year 2020-2021)*

**SYLLABUS**



**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE**  
**(AUTONOMOUS)**

*(Affiliated to Bharathidasan University, Tiruchirappalli)*

*(Accredited with "A" Grade with NAAC; An ISO 9001:2015 Certified Institution)*

**SUNDARAKKOTTAI, MANNARGUDI – 614 016**  
**TAMIL NADU, INDIA.**

**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE  
(AUTONOMOUS)**



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**SUNDARAKKOTTAI, MANNARGUDI-614016.**  
**TAMILNADU, INDIA.**

**M.Sc., MICROBIOLOGY COURSE STRUCTURE UNDER CBCS**

*(For the candidates admitted in the academic year 2020-2021)*

**ELIGIBILITY:** A Pass in B.Sc., with Bio Technology/ Bio Chemistry/ Botany/ Zoology/ Microbiology/ Bioinformatics/ Biology/ Life sciences/ B.S., with Biological Sciences as one of the subjects (B.E/ B.Tech in Biotechnology) / B.Pharm/ B.Sc., Agriculture/ B.Sc., Horticulture

Sem	Course	Subject Code	Title of the Paper	Ins. Hours/ Week	Credit	Exam Hours	Marks		Total
							CIA	ESE	
I	Core Course – I (CC)	20PMB101	General Microbiology	5	5	3	25	75	100
	Core Course – II (CC)	20PMB102	Microbial Physiology and Metabolism	5	5	3	25	75	100
	Core Course – III (CC)	20PMB103	Pharmaceutical Microbiology	5	5	3	25	75	100
	Core Course – IV (CC)	20PMB104	Essentials of Biochemistry	5	5	3	25	75	100
	Core Practical – I (CP)	20PMB105P	General Microbiology, Microbial Physiology and Metabolism and Pharmaceutical Microbiology and Essentials of Biochemistry	6	5	3	40	60	100
	Elective Course-I (EC)	20PMBE1/ 20PMBE1B	Quality Control and IPR/ Microbial Biotechnology	4	3	3	25	75	100
				<b>TOTAL</b>	<b>30</b>		-	-	-
					<b>28</b>				
I	Core Course – V (CC)	20PMB206	Environmental and Agricultural Microbiology	4	4	3	25	75	100
	Core Course – VI (CC)	20PMB207	Medical Bacteriology	5	4	3	25	75	100
	Core Course – VII (CC)	20PMB208	Virology	4	4	3	25	75	100
	Core Course – VIII (CC)	20PMB209	Immunology and Immunotechnology	4	4	3	25	75	100
	Core Practical – II (CP)	20PMB210P	Environmental and Agricultural Microbiology, Medical bacteriology, Virology, Immunology and Immunotechnology	6	5	3	40	60	100
	Elective Course – II (EC)	20PMBE2/ 20PMBE2B	Marine Microbiology/Food and Dairy Microbiology	4	3	3	25	75	100
	Extra Disciplinary Course-I(EDC)	20PMBED1A/ 20PMBED1B	Bioentrepreneurship/ Horticulture	3	2	3	25	75	100
			<b>TOTAL</b>	<b>30</b>		-	-	-	<b>700</b>
					<b>26</b>				
I	Core Course – IX (CC)	20PMB311	Microbial Genomics and Proteomics	4	4	3	25	75	100

Sem	Course	Subject Code	Title of the Paper	Ins. Hours/Week	Credit	Exam Hours	Marks		Total	
							CIA	ESE		
I	Core Course – X (CC)	20PMB312	Clinical Mycology and Parasitology	4	4	3	25	75	100	
	Core Course – XI (CC)	20PMB313	Research Methodology , Biostatistics and Bioinformatics	5	4	3	25	75	100	
	Core Course – XII (CC)	20PMB314	Bioprocess Technology	4	4	3	25	75	100	
	Core Practical – III (CP)	20PMB315P	Microbial Genomics and Proteomics Clinical mycology and virology, Research Methodology , Biostatistics and Bioinformatics and Bioprocess Technology	6	5	3	40	60	100	
	Elective Course – III (EC)	20PMBE3A/ 20PMBE3B	BioInstrumentation/Genetic Engineering	4	3	3	25	75	100	
	Extra Disciplinary Course-II (EDC)	20PMBED2A/ 20PMBED2B	Solid waste Management/ Basic science for competitive examinations	3	2	3	25	75	100	
				<b>TOTAL</b>	<b>30</b>	<b>26</b>	-	-	-	<b>700</b>
I V	Core Course- XIII	20PMBPW	Project	30	10	-	25	75	100	
				<b>TOTAL</b>	<b>30</b>	<b>10</b>	-	-	-	<b>100</b>
				<b>G. TOTAL</b>	<b>120</b>	<b>90</b>	-	-	-	<b>2100</b>

## CURRICULAM DESIGN

Subject	No. of Courses	Total Credits
Core course	12	52
Core Practical	3	15
Elective Course	3	09
Extra Disciplinary Course	2	04
Project	1	10
<b>Total</b>	<b>21</b>	<b>90</b>

<b>Note:</b>				
1. Theory	Internal	25 marks	External	75 marks
2. Practical		40 marks		60 marks
3. Separate passing minimum is prescribed for Internal and External				

- a) The passing minimum for CIA shall be 40% out of 25 marks (i.e. 10marks)
- b) The passing minimum for University Examinations shall be 40% out of 75marks (i.e. 30marks)
- c) The passing minimum not less than 50% in the aggregate.

### ELECTIVE COURSE

S.No.	Semester	Subject Code	Elective Courses (EC) (Any one from the list)
1.	I	20PMBE1A	Quality Control and IPR
2.	I	20PMBE1B	Microbial Biotechnology
3.	II	20PMBE2A	Marine Microbiology
4.	II	20PMBE2B	Food and Dairy Microbiology
5.	III	20PMBE3A	BioInstrumentation
6.	III	20PMBE3B	Genetic Engineering

### EXTRA DISCIPLINARY COURSES (EDC) OFFERED BY THE DEPARTMENT

S.No.	Semester	Subject Code	Extra Disciplinary Courses (EDC) (Any one from the list)
1.	II	20PMBED1A	Bioentrepreneurship
2.	II	20PMBED1B	Horticulture
3.	III	20PMBED2A	Solid waste Management
4.	III	20PMBED2B	Basic science for competitive examinations

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**DEPARTMENT OF MICROBIOLOGY**

**M.Sc., MICROBIOLOGY**

(For the candidates admitted in the academic year 2020–2021)

**Question Paper Pattern- (Theory)**

**Max time: 3 Hours**

**Max Marks: 75**

**Section – A (10 x 2 = 20)**

**Answer all the questions**

**Answer in One or Two sentences each**

1. }  
2. } Unit I
3. }  
4. } Unit II
5. }  
6. } Unit III
7. }  
8. } Unit IV
9. }  
10. } Unit V

**Section – B (5 x 5 = 25)**

**Answer all the questions**

**Each answer should not exceed 500 words**

- 11.a (or) }  
b } Unit I
- 12.a (or) }  
b } Unit II
- 13.a (or) }  
b } Unit III
- 14.a (or) }  
b } Unit IV
- 15.a (or) }  
b } Unit V

**Section – C (3 x10 = 30)**

**Answer any THREE questions in 1200 words**

16. Unit I  
17. Unit II  
18. Unit III  
19. Unit IV  
20. Unit V

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**DEPARTMENT OF MICROBIOLOGY**

M.Sc., MICROBIOLOGY

**Semester: I- CC-I: General Microbiology**

**Ins. Hrs / Week: 5**

**Course Credit: 5**

**Course Code:**

**OBJECTIVES**

- To enable the students to understand the basic knowledge in Microbiology
- Provide Insights on Microbial Classification and Cultivation techniques
- Explain about Eukaryotic and Prokaryotic cell structure and staining techniques

**UNIT-I: Ultra structure and function Bacteria (20 Hours)**

Morphological types; Cell wall – Gram negative, Gram positive, Cell wall synthesis, halophiles. L-forms and Archaeobacteria, S- Layer, cell membrane, capsule type's composition and function. Structure and function of flagella, fimbriae and pili, Movement of Bacteria- Chemotaxis, Phototaxis, Magnetotaxis, gas vesicles, chlorosomes, carboxysomes, magnetosomes and phycobilisomes. Reserve food materials - polyhydroxybutyrate, polyphosphates, cyanophycin and sulphur inclusions. Nuclear material - bacterial chromosomes and bacterial plasmids. Reproduction- Sporulation. Nutritional types of bacteria. Autotrophs and Chemolithotrophs, Bacterial growth curve: growth kinetics. Batch, continuous and synchronous culture. Measurement of Growth and influence of environmental factor affecting growth. Quorum sensing and its importance.

**UNIT- II: Microbial Classification (10 Hours)**

Definition and systematic, Nomenclature and identification. Haeckel's three kingdom classification, Whittaker's five kingdom approach. Three domain concept of Carl Woese; Taxon, species, strain, type culture; Classification and Salient features of bacteria according to Bergey's Manual of Determinative Bacteriology (9th edition). Introduction to taxonomy : phenotypic classification, phylogenetic classification, genotypic classification, taxonomic ranks – Techniques for determining Microbial taxonomy & Phylogeny: Classical & molecular characteristics - Genetic relationship - DNA homology - 16S r RNA sequencing - Phylogenetic tree

**UNIT- III: Fungi and Viruses (15 Hours)**

Fungi: Classification of fungi based on Alexopoulos system. - characteristics of Fungi – Filamentous, non-filamentous and dimorphic fungi -Morphology, structure and life cycle of *Aspergillus niger* and *Saccharomyces cerevisiae*. Parasitism, mutualism and symbiosis with plants and animals. Industrial uses of yeast and moulds. Lichens: General characters and economic importance. Viruses: ICTV system of classification, General properties, Morphology and ultra-structure of virus - capsid and their arrangements, types of envelopes and their composition, viral genome (RNA, DNA); Viroids, Prions - structure and importance.

**UNIT- IV: Algae and Protozoans (15 Hours)**

Classification of Algae based on Fritsch system – General characters of Bluegreen Algae (Cyanobacteria) Macroalgae - Biological and Economic importance of algae. Protozoa –structural characteristics, classification and reproduction.

## **UNIT-V: Cultivation methods of microbes**

**(15 Hours)**

Isolation of different types of bacteria - Fungi – Actinomycetes - Cyanobacteria - Protozoa. Physical and Chemical requirements for growth; Pure culture methods. Anaerobic culture techniques. Preservation methods of microbes. Type Culture collections. Method of sterilization: Physical (heat, moist and dry), filtration and radiation) and chemical methods of controlling microorganisms (Halogens, phenol and other phenolic compounds, heavy metals, alcohols, ethylene oxide and aldehydes) Staining methods: fixation, types of dyes, simple staining, differential staining (Gram and Acid-fast staining), staining of specific structures (capsule, flagella, LPCB, KOH, Silver staining and spore staining)

**Total Lecture Hours -75**

### **COURSE OUTCOME**

The students will be able to,

1. Students able to understand the basic principles of Microbiology.
2. Gain knowledge about microbial classification
3. Learn about the structure and characteristic of fungi and viruses
4. Understand the structure and significance of algae and protozoa
5. Become skilled with cultivation and identification of microbes

### **TEXT BOOKS**

1. Ananthanarayan R. and Paniker's. 2013. Text book of Microbiology. University Press (9<sup>th</sup> edition), Hyderabad.
2. Dube HC. 2009. Introduction to Fungi. Vikas publishing pvt. Ltd. New Delhi.
3. Dubey RC and Maheswari DK. 2010. A Text Book of Microbiology. S Chand, New Delhi.
4. Johri RM, Snehlatha, Sandhya Shrama. 2010. A Textbook of Algae. Wisdom Press, New Delhi.
5. Kanika Sharma. 2011. Textbook of Microbiology – Tools and Techniques. 1st edition, Ane Books Pvt. Ltd., New Delhi.
6. Rajan S and Selvi Christy R. 2015. Essentials of Microbiology, Anjanaa Book House, Chennai.
7. Salle AJ. 2001. Fundamental principles of Bacteriology. 7th edition, Tata McGrawHill publishing company Ltd, New Delhi.

### **REFERENCE BOOK(S)**

1. Albert G. Moat, John W. Foster and Michael P. Spector (2002) - Microbial Physiology, (4<sup>th</sup> edition), John Wiley & Sons, INC., Publication.
2. Alexopoulos CJ, Mims CW and Blackwell M. Introductory Mycology. Fifth edition John Wiley and Sons. Chichester. 2000.
3. Gerard J. Tortora Berdell R. Funke, Christine L. Case. (2016) - Microbiology an Introduction, Pearson International edition (12<sup>th</sup> edition).
4. Hans G. Schlegel (2003). General Microbiology. (7<sup>th</sup> Edition), Cambridge University, Press.
5. Holt, J S., Kreig N R., Sneath P. H. A and Williams S.T. (1994) Bergey's Manual of Determinative Bacteriology (9<sup>th</sup> edition) Williams and WilkIns., Baltimore.
6. Jeffrey C Pommerville (2004) Alcamo's Fundamentals of Microbiology (7<sup>th</sup> edition) - Jones and Bartlett Publishers
7. Michael Madigan, John Martinko, David Stahl and David Clark (2014) Brock Biology of Microorganisms (13<sup>th</sup> Edition) Pearson Education .
8. Pelczar Jr, M.J. Chan, E.C.S and Kreig N.R (2016) Microbiology (10<sup>th</sup> edition) Pearson Education
9. Prescott LM, Harley JP and Klein DA (2016) Microbiology (10<sup>th</sup> edition) McGraw Hill, New

York.

10. Schlegel HG. General Microbiology, Cambridge University Press, UK. 2008
11. Tortora, Funke and Case. (2018). Microbiology – An Introduction, (13<sup>th</sup> Edition). Pearson Education.

#### **E- RESOURCES**

1. <https://www.cliffsnotes.com/study-guides/biology/microbiology/introduction-to-microbiology/a-brief-history-of-microbiology>
2. <https://www.slideshare.net/UmeshMaskare/bacteria-bacteria-structure>
3. <https://courses.lumenlearning.com/boundless-biology/chapter/structure-of-prokaryotes/>
4. <https://www.slideshare.net/AshfaqAhmad52/cultivation-of-bacteria-and-culture-methods>
5. <https://bitesizebio.com/853/5-laboratory-sterilisation-methods/>
6. <https://www.slideshare.net/jakkaas/cultivation-of-microorganism-21-0411>

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**DEPARTMENT OF MICROBIOLOGY**

**M.Sc., MICROBIOLOGY**

**Semester: I- CC-II: Microbial Physiology and Metabolism**

**Ins. Hours / Week: 5**

**Course Credit: 5**

**Course Code:**

**OBJECTIVES**

- To understand the growth, enzymology and physiological processes of microbes
- To inculcate knowledge on physiology of microbes in extreme environments
- To enable student to understand processes in microbial metabolism and spore formation

**UNIT- I: Bacterial Cell Structure (15 Hours)**

Cell structure and function Bacterial cell wall - Biosynthesis of peptidoglycan - outer appendages – flagella (structure and types of flagella motility), pili and capsule. Chemotaxis in bacteria. Transport mechanisms – active, passive, facilitated diffusions – uni, sym, antiports, Siderophores.

**UNIT- II: Bacterial Growth (15 Hours)**

Microbial growth Bacterial growth - Phases of growth curve – measurement of growth – calculations of growth rate – generation time – synchronous growth – factors affecting growth – pH, temperature, substrate and osmotic condition. Survival at extreme environments – starvation – adaptative mechanisms in thermophilic, alkalophilic, osmophilic and psychrophilic.

**UNIT- III: Microbial Pigments (15 Hours)**

Microbial pigments and photosynthesis Autotrophs - cyanobacteria - photosynthetic bacteria and green algae – heterotrophs – bacteria, fungi, myxotrophs. Brief account of photosynthetic and accessory pigments – chlorophyll – bacterial chlorophyll structure and function, Rhodopsin – carotenoids – phycobiliproteins. Bioluminescence- fluorescence, phosphorescence.

**UNIT- IV: Carbohydrate Metabolism (20 Hours)**

Bioenergetics: Carbon assimilation Carbohydrates – anabolism – autotrophy – oxygenic – anoxygenic photosynthesis – autotrophic generation of ATP; fixation of CO<sub>2</sub> – Calvin cycle (C<sub>3</sub>) – C<sub>4</sub> pathways. Respiratory metabolism – Embden Mayer Hoff pathway – Entner Doudroff pathway – glyoxalate pathway – Krebs cycle – Electron carriers – artificial electron donors – inhibitors – uncouplers - oxidative and substrate level phosphorylation – reverse TCA cycle – gluconeogenesis – Fermentation of carbohydrates – homo and heterolactic fermentations.

**UNIT- V: Microbes and their spores (10 Hours)**

Spore structure and function Cell division – endospore structure – formation – properties – germination. Microbial sporulation and morphogenesis – Bacteria including cyanobacteria and actinobacteria, fungi and algae.

**Total Lecture Hours - 75**

**COURSE OUTCOME**

Students will able to learn

1. Gain knowledge in basic microbial cell components and its significance in cellular respiration
2. Understand the concepts of microbial growth
3. Learn basic knowledge about microbial pigment and photosynthesis
4. Acquire skills on microbial oxidation reactions
5. Explain the spore formation and cell division in microbes

### **TEXT BOOKS**

1. Meena Kumari S, Microbial Physiology, MJP Publishers, Chennai.2006
2. Salle AJ (1996). Fundamental principles of Bacteriology, 7<sup>th</sup> edition, Tata McGrawHill publishing company limited, New Delhi.
3. Dubey CL. Parson WW and Vance DE (1994). Principles of Biochemistry – Wm. C. Brown Publishers, Oxford, England.
4. Prescott. L.M., Harley. J.P., Klein. D.A. (1993). Microbiology. 2nd edn. Wm. C. Brown publishers, Dubugue.

### **REFERENCE BOOK(S)**

1. Caldwell DR. Microbial Physiology and metabolism, Wm. C. Brown Publishers, USA 1995.
2. Lansing M. Prescott, John P. Harley and Donald A. Klein. Microbiology.5th edition. McGraw-Hill Company, New York. 2003
3. Lim,Daniel V. Microbiology, New York, Wadsworth Publishing Company, 1989.
4. Moat AG, Foster JW and Spector MP. Microbial Physiology 4th edition. John Wiley and Sons, New York. 2002.
5. Pelczar Jr MJ, Chan ECS and Kreig NR. Microbiology, 5th edition. Mc. Graw Hill. Inc, New York. 2013.
6. Robert Poole K. Advances in Microbial Physiology, Volume 53, Elsevier Science and Technology. 2007.
7. Salle AJ. Fundamental principles of Bacteriology, 7th edition. Tata McGrawHill publishing company limited, New Delhi. 1996.
8. Tortora, Gerald J, Berdell R, Funke andChirstine L Case, Microbiology: An introduction, California: Benjamin/ Cummings Publishing Co. Inc., 1994.
9. White D. The physiology and biochemistry of Prokaryotes, Oxford University Press, Oxford, New York. 1995.

### **E-RESOURCES**

1. <https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-nutrition/>
2. <https://www.lamission.edu/lifesciences/lecturenote/mic20/Chap06Growth.pdf>
3. <https://www.tandfonline.com/doi/abs/10.3109/07388558409082583?journalCode=ibty20>
4. <https://www.sciencedirect.com/topics/neuroscience/microbial-respiration>
5. <https://www.britannica>

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**DEPARTMENT OF MICROBIOLOGY**

**M.Sc., MICROBIOLOGY**

**Semester: I- CC-III: Pharmaceutical Microbiology**

**Ins. Hours / Week: 5**

**Course Credit: 5**

**Course Code:**

**OBJECTIVES**

- To Understand the basics of pharmaceutical microbiology and important microorganism playing role pharmaceutically
- To understand different products of microbial origin playing key role in pharmaceutical applications.
- To understand good practices and regulation involved in utilizing microbial product for pharmaceutical application

**UNIT- I :Antibiotics and Synthetic antimicrobial agents (10 Hours)**

Mechanism of action; microbial resistance; therapeutic, prophylactic usage and adverse reactions; Antibiotic and Synthetic antimicrobial agents:  $\beta$ -lactam, aminoglycosides, tetracyclines, macrolides. Antifungal antibiotics: Griseofulvin; Antiviral drugs: Amantidines; Nucleoside analogues, Interferons, Peptide antibiotics. Synthetic antibiotics: Sulphonamides; Chloramphenicol; Quinolone.

**UNIT- II: Mechanism of action of antibiotics (20 Hours)**

Inhibition of cell wall synthesis; nucleic acid and protein synthesis. Bacterial resistance to antibiotics; Penetration of antimicrobial agents (cellular permeability barrier, cellular transport system and drug diffusion). Mode of action of non-antibiotic antimicrobial agents; Mode of action of bacterial killing by quinolones; Bacterial resistance to quinolones; Molecular principles of drug targeting; Drug delivery system in gene therapy.

**UNIT -III: Drug Discovery and Development (15 Hours)**

Microbial, Recombinant, Biochemical and Molecular level screening systems and their construction/design strategies. Delivery systems- formulations, targeted drug delivery, sustained release drugs. Drug distribution in body, bioavailability and pharmacokinetic studies. Routes of drug administration- volume of distribution- biotransformation –Phase I and Phase – II reactions. Drug physical and chemical actions – drug interactions – therapeutic applications of beneficial interactions. Adverse drug reactions.

**UNIT -IV: Spoilage and Preservation of Pharmaceutical products (20 Hours)**

Types of spoilage- factors affecting the microbial spoilage of pharmaceutical products, Sources- type of microbial contaminants, assessment of microbial contamination and spoilage. Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations. Growth Promotion test (GPT), Disinfectant efficacy study for different types of Disinfectants, Container Closure Integrity Test (CCIT), Preservative efficacy study (PET). Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures. Application of cell cultures in pharmaceutical industry and research.

## **UNIT -V: Regulatory aspects in pharmaceuticals**

**(10 Hours)**

Introduction to pharmacopoeia; FDA regulation and IP, BP, USP; Reimbursement of drugs and biological; legislative perspectives; GMP in pharmaceuticals; Quality control through WHO; ICH process. Testing of pharmaceutical Products.

**Total Lecture Hours- 75**

### **COURSE OUTCOMES**

The students will be able to,

1. Identify different antimicrobial agents and its mode of action.
2. Process involved in Drug discovery and development
3. Regulatory guidelines in pharmaceuticals product.

### **TEXT BOOKS**

1. Denyer S.P., Hodges N.A. and Gorman S.P. (2004) Hugo and Russell's Pharmaceutical Microbiology, 7<sup>th</sup> Edn. Blackwell Publishers.
2. Vyas S.P& V. K. Dixit. Pharmaceutical Biotechnology. (2003) CBS Publishers & Distributors, New Delhi.
3. Mehra P.S. (2011) A text book of Pharmaceutical Microbiology, IK International Publishing House

### **REFERENCE BOOK(S)**

1. Pharmaceutical Microbiology – Edt. by W.B.Hugo & A.D.Russell Sixth edition. Blackwell scientific Publications
2. Prescott's Microbiology 8th Edition by Willey, Joanne, Sherwood, Linda, Woolverton, Chris
3. Tortora / Funke / Care / Microbiology an introduction.
4. Stephen. P, Denyer, N.A. Hodger- Hugo & Russel's Pharmaceutical Microbiology
5. Geoff Hanlon & Norman A (2013). HodgesEssential Microbiology for Pharmacy and Pharmaceutical Science, Wiley-Blackwell
6. Madhu Raju Saghee , Tim Sandle , Edward C. Tidswell (2011). Microbiology and Sterility Assurance in Pharmaceuticals and Medical Devices,Business Horizons.
7. Geoff Hanlon, Norman A. Hodges (2013). Essential Microbiology for Pharmacy and Pharmaceutical Science,Wiley-Blackwell.
8. Stephen P. Denyer , Norman A. Hodges, Sean P. Gorman , Brendan F. Gilmore (2011).
9. Prahlad Singh Mehra (2011). A Textbook of Pharmaceutical Microbiology,I K International Publishing House.
10. Hugo, WB and Russell, AD. Pharmaceutical Microbiology, (2003). Blackwell Science, Oxford, UK.
11. Krogsgaard L, Lilijefors T. and Madsen, U. Textbook of Drug Design and Discovery, (2004). Taylor and Francis, London.
12. Geoffrey Hanlon and Norman Hodges. Essential Microbiology for pharmacy and pharmaceutical science. (2013).Wiley Blackwell.
13. Gregory Gregoriadis. Drug Carriers in biology & Medicine. (2001). Academic Press New York.

### **E –RESOURCES**

1. <http://www.biologydiscussion.com/microbiology-2/microorganisms-microbiology-2/roleof-microorganisms-in-industrial-processes-microbiology/84754>.
2. <https://www.rheosense.com/applications/viscosity/newtonian-non-newtonian>.
3. <http://technologyIns.cience.blogspot.com/2012/08/different-types-offermentors.html#.XWj58y4zBIU>
4. <http://www.biologydiscussion.com/biotechnology/downstream-processing/stages->

indownstream-processing-5-stages/10160

5. <https://www.upcounsel.com/intellectual-property-examples>
6. <http://www.ulectz.com>
7. <https://amrls.umn.edu/antimicrobial-resistance-learning-site>

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**DEPARTMENT OF MICROBIOLOGY**  
M.Sc., MICROBIOLOGY

**Semester: I- CC-IV: Essentials of Biochemistry**

**Ins. Hours / Week: 5**

**Course Credit: 5**

**Course Code:**

**OBJECTIVES**

- To provide basic understanding of Cell and its function, chemical nature of biological macromolecules, metabolism and mechanism of molecular recognition including control.
- To understand the chemical basis which allows biological molecules
- To give rise to the processes that occur within living cells and between cells, in turn relating greatly

**UNIT- I:**

**(15 Hours)**

An Overview of cells: Origin and evolution of cells. Cell theory, Classification of cells – Prokaryotic and Eukaryotic cells. Comparison of prokaryotic and eukaryotic cells. Cell Membrane – Fluid mosaic model of membrane structure and its composition. Cell cycle. Composition of living matter. Biochemistry of bacterial, animal and plant cell. Specialized components of microorganisms and their structure and function, Cell cycle: mitosis and meiosis and their regulation, programmed cell death and apoptosis.

**UNIT –II:**

**(15 Hours)**

Enzymes as biocatalysts, enzyme classification, specificity, active site, unit activity, isozymes. Enzyme kinetics: Michaelis – Menton equation for simple enzymes. Enzyme inhibition. Non protein enzymes - Abzymes and Ribozymes. Enzyme Engineering. Various methods of enzyme immobilization. Applications of enzymes in Industry.

**UNIT –III:**

**(15 Hours)**

Structural features and chemistry of macromolecules. Nucleic acid – properties, biosynthesis of purines and pyrimidines - Structure of DNA and RNA. Proteins. – classification – amino acids - primary-secondary-tertiary – quaternary and three dimensional structure of proteins. Carbohydrates - mono, di, oligo and polysaccharides. Lipids and biomolecules: Fatty acids, properties, -oxidation - biosynthesis of cholesterol, vitamins -A,B complex, C,D,E and K structure and functions- biosynthesis of vitamins and their regulation.

**UNIT –IV:**

**(15 Hours)**

Bioenergetics and strategy of metabolism - flow of energy through biosphere, strategy of energy production in the cell. Oxidation – reduction reactions, coupled reactions and group transfer. ATP production.

**UNIT- V:**

**(15 Hours)**

Cell metabolism - catabolic principles and break down of carbohydrates, lipids, proteins and nucleic acids - vitamins and their role as coenzymes. Metabolic integration and hormonal regulation: Key junctions in metabolism– glucose-6-phosphate, pyruvate and acetyl CoA. Metabolic profiles of brain, muscle, liver, kidney and adipose tissue. Metabolic interrelationships in various nutritional and hormonal states– obesity, aerobic, anaerobic endurance, exercise, pregnancy, lactation, IDDM, NIDDM and starvation, Cell signalling: cell surface receptors, G- protein, signal transduction pathways.

### **COURSE OUTCOME**

The students will be able to,

1. Demonstrate an experiential learning and critical thinking of the structure and function of both prokaryotic and eukaryotic cells (including the molecular basis and role of sub-cellular compartmentalization)
2. Understand composition and structure of biomembranes, transport mechanisms across biological membranes
3. Acquire fundamental knowledge on enzymes and their importance in biological reactions.
4. Demonstrate an understanding of fundamental biochemical principles, such as the structure and function of Biomolecules, metabolic pathways and the regulation of biological processes.
5. Understand the chemical principles in life processes. Classification, disorders related to metabolic functions are also emphasized in this paper

### **TEXT BOOKS**

1. Freifelder D. Molecular Biology, II Edition, Narosa Publishing House, New Delhi.1996.
2. Stryer L Berg JM and Tymoczko JL. Biochemistry. 5th edition. New York: W. H. Freeman. 2002.
3. Thomas M Devlin. Textbook of Biochemistry with clinical correlations. 5th edition. A John Wiley and sons, Inc., publication, Newyork.2002.
4. Lehninger, Albert L, David L Nelson and Michael M Cox. Lehninger Principles of Biochemistry. New York: Worth Publishers. 2000.

### **REFERENCE BOOK(S)**

1. Christopher K Mathews and Van Holde KE. Biochemistry. 2ndedition. The Benjamin/Cummings publishing company, Inc.1996.
2. David E Metzler and Carol M Metzler. Biochemistry -The chemical reactions of living cells-Vol1and2.2nd edition. Harcourt/Academic press, Newyork. 2001.
3. Donald Voet and Judith G. Voet. Biochemistry – Second Edition. John Willey and Sons, Inc.1995.
4. Geofferey L and Zubay. Biochemsity. Fourth Edition.Wm. C. Brown Publishers.1998.
5. Jeremy M Berg, John L Tymoczko and Lubert stryer. Biochemistry.5th edition.W.H.Freeman and company, Newyork.2002.
6. Reginald H Garret and Charles M Grishm. Biochemistry (Second Edition) Saundars College Publishing.1998.
7. Trudy McKee and James R McKee. Biochemistry-An Introduction.2nd edition.WCB McGraw- Hill,U.S.A. 1999.
8. Rafi MD. Textbook of Biochemistry for medical students, 2nd edition, Universities Press, (India) Pvt. Ltd, Hyderabad, India. 2014.

### **E-RESOURCES**

1. <https://www.pdfdrive.com/biochemistry-books.html>

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**SENGAMALA THAYAR EDUCATIONAL TRUST WOMEN'S COLLEGE  
(AUTONOMOUS)**



**SUNDARAKKOTTAI, MANNARGUDI-614016.**  
(For the Candidates admitted in the academic year 2020-2021)

**DEPARTMENT OF MICROBIOLOGY**  
M.Sc., MICROBIOLOGY

**Semester: I- CP-I: General Microbiology, Microbial Physiology and Metabolism  
and Pharmaceutical Microbiology and Essentials of Biochemistry (P)**

**Ins. Hours / Week: 6**

**Course Credit: 5**

**Course Code:**

**General Microbiology**

- Principles and methods of sterilization
- Direct microscopic observations of bacterial shape- cocci, rods and chains.; fungal spore-mycelium, yeast budding
- Preparation of Media, Differential media: Nutrient broth, Nutrient agar, plates, slants and soft agar
- Micrometry - counting and measurements.
- Pure techniques - serial dilution - pour plate, spread plate, streak plate methods and stab culture techniques
- Bacterial Staining methods - simple, Gram's, acid fast, flagella, capsule and spore.
- Fungal Staining methods - Lacto-phenol cotton blue
- Motility of bacteria Enumeration of bacteria/ yeast cell; viable count (plate count) , total count (Haemocytometer)
- Isolation and purification of cyanobacteria, actinomycetes and fungi
- Soil heavy metal analysis by Atomic Absorption Spectroscopy.
- Demonstration on GC and HPLC.

**Microbial Physiology and Metabolism**

- Bacterial growth curve – Turbidity method
- Effect of temperature, pH and salinity on bacterial growth
- Starch, casein, gelatin and lipid hydrolysis tests
- Biochemical tests: IMViC, TSI, Urease, Catalase, Oxidase, Hydrogen sulphide, coagulase, nitrate reduction tests, Carbohydrate fermentation test

**Pharmaceutical Microbiology**

- Microbial Examination of Non-sterile products
- Bacterial endotoxin testing by Gel Clot Method
- Antibiotic susceptibility test – Disc diffusion method (Kirby –Bauer)
- Determination of MIC of any one antibiotic against any one bacterial species
- Isolation of antibiotic resistant bacteria by Gradient plate method
- Sampling of pharmaceutical products (syrups, cream and ointments) for microbial contamination and load.

**Essentials of Biochemistry**

- Weighing of reagents, Preparations of Normal and Molar solutions.
- Preparation of buffer (Tris, phosphate, acetate buffer)
- Determination of (H<sup>+</sup>)ion concentration

- Verification of Beer-Lambert's law using colored solution
- 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 (diphenylamine method), RNA (Orcinol method).
- Separation of aminoacids by paper chromatography and identification of aminoacid
- Separation of proteIns. by PAGE, SDS – PAGE – Demonstration

### TEXT BOOKS

1. Gunasekaran P (2008). Laboratory Manual in Microbiology, New Age International Pvt. Ltd. Publishers, New Delhi.
2. Kanika Sharma (2009). Manual of Microbiology – Tools and Techniques. 2nd Edition, Ane Books Pvt. Ltd., New Delhi.
3. Rajan S and Selvi Christy R (2015). Experiments in Microbiology. Anjana Books House, Chennai.
4. Bhatia R and Ichhpujani RL. Quality Assurance in Microbiology (1995). CBS Publishers, New Delhi.
5. Praful Bharadia. LabManual in Pharmaceutical MicrobiologyandBiotehnology –I- 2011. 1<sup>st</sup> Edition; Publisher; Nirav and Roopal Prakashan, Ahmedbad.

### REFERENCE BOOK(S)

1. James G Cappuccino and Natalie Sherman (1996). Microbiology. 10th edition, The Benjamin/Cummings pub.co. California.
2. David R Brooke (2007). Bergey's Manual of systematic bacteriology (Vol 1), Eastern Halz, Springer publication, US.
3. Keith Wilson and John Walker (1995). Principles and Techniques of Practical Biochemistry. 4th edition. Cambridge University press, Britain.
4. Nizhny Novgorod (2008). Laboratory manual on Biochemistry: Publishing House of Nizhny Novgorod State medical academy.
5. Shawn O' Farrell and Ryan T Ranallo (2000). Experiments in Biochemistry: A Hands on Approach-A manual for the undergraduate laboratory, Thomson Learning, Inc., Australia.
6. Wilson K and Walker J. (2000). Practical biochemistry, 5th edition, Cambridge University Press, London. 10. Mahatma Gandhi-Doerenkamp Centre (MGDC) for Alternatives to Use of Animals in Life Science Education. <http://www.mgdcaua.org>

### E-RESOURCES

1. <https://www.slideshare.net/ReenaKulshrestha/culture-media-amp-culture-methods-1>
2. <https://www.slideshare.net/HanuPratap/micrometry-162646151>
3. <https://www.slideshare.net/RaviKantAgrawal/biochemical-tests-for-identification-of-bacteria>
4. <https://www.slideshare.net/AshfaqAhmad52/bacterial-growth-68254865>
5. <https://www.slideshare.net/doctorrao/kirbybauer-disc-diffusion-method-antibiotic-susceptibility-testing-skill-based-learning>
6. <https://www.slideshare.net/drkalpeshnakrani/preparation-of-standard-normal-and-molar-solutions>
7. <https://www.slideshare.net/biochemistryden/estimation-of-carbohydrate-by-anthrone-method>
8. <https://www.slideshare.net/jeevithaseyan/estimation-of-dna-by-diphenylamine-method>

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**SENGAMALA THAYAR EDUCATIONAL TRUST WOMEN'S COLLEGE  
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**SUNDARAKKOTTAI, MANNARGUDI-614016.**  
(For the Candidates admitted in the academic year 2020-2021)

**DEPARTMENT OF MICROBIOLOGY**  
M.Sc., MICROBIOLOGY

**Semester: II- CC-V: Environmental and Agricultural Microbiology**

**Ins. Hours / Week: 4**

**Course Credit: 4**

**Course Code:**

**OBJECTIVES**

- Describe the distribution fundamental knowledge about aeromicrobiology, aquatic microbiology, disposal of waste and various aspects of soil microbiology
- Understand the concept of microbial ecology and Illustrate the process of sewage water treatment
- Gain knowledge about sustainable agriculture

**UNIT -I: Aerobiology and aquatic microbiology (15 Hours)**

Droplet nuclei, aerosol, assessment of air quality- air sanitation. Brief account of air borne transmission of microbes - viruses - bacteria and fungi, their diseases and preventive measures. Water ecosystems - upwelling - eutrophication - food chain. Microbial assessment of water quality - water purification, ISI and BSI Regulation for packaged drinking water and water borne diseases. Marine environment – benthic & littoral zone, salt pan, mangroves and estuarine microbes, microbial loop – marine microbial community. Survival at extreme environments – starvation – adaptive mechanisms in thermophilic, alkalophilic, osmophilic and barophilic, psychrophilic microorganisms – hyperthermophiles and halophiles.

**UNIT – II: Soil Microbiology and Ecological Role of Microbes (15 Hours)**

Classification of soils - physical and chemical characteristics, microflora of various soil types (bacteria and nematodes in relevance to soil types) - Biogeochemical cycles, Carbon cycle, organic matter decomposition, humus formation, Nitrogen cycle - nitrogen fixation, ammonification, nitrification, denitrification, and reactions – organisms involved. Nitrogen fixation – symbiotic - root nodulation, non symbiotic, associative organisms, nitrogenase, hydrogenase, nif gene, nod gene. Microbial transformation of phosphorus, solubilization by phosphobacteria and P- mobilization by mycorrhizal fungi, Microbial transformation of sulphur - sulphur toxicity and sulphur bacteria. Iron Cycle, Siderophore production.

**UNIT - III: Waste treatment and microbial processes (10 Hours)**

Wastes - types - solid and liquid wastes characterization - solid - liquid; treatments - physical, chemical, biological- aerobic - anaerobic – primary – Microbial Biofilm - Physiology, morphology, biochemistry of microbial films, mechanisms of adherence, beneficial and harmful role of biofilm, secondary – tertiary- DO, BOD and COD; solid waste treatment - saccharification - gasification - composting, Utilization of solid wastes - food (SCP, mushroom, yeast): fuel (ethanol, methane) fertilizer (composting), liquid waste treatment - trickling - activated sludge - oxidation pond - oxidation ditch. Bioleaching, Bioremediation, Microbial degradation of xenobiotic.

**UNIT IV- Plant microbe interaction and its Role in Agriculture (10 Hours)**

Types of interaction (Symbiosis, parasitism, mutualism, commensalism, saprophytism, necrotrophism etc), Plant and microbial surface organization, concept of rhizosphere, non rhizosphere, mycorrhizosphere - ectomycorrhiza, endomycorrhiza, vesicular arbuscular mycorrhiza - application- rhizoplane and phyllosphere. Microbial plant diseases: disease development, plant defense mechanisms DIMBO and DIMBOA, cultivar dependent and independent resistance, plant protection (phenolic, phytoalexin) disease forecasting, disease control (disease escaping), cultural, chemical

and biocontrol.

**UNIT- V: Concepts of sustainable agriculture (10 Hours)**

Traditional agricultural practice and organic farming principles, Vermicompost, Panchgavya, Dasakavya, Effective microorganisms. Biofertilizers: symbiotic and nonsymbiotic microorganisms – Mass production and maintenance of biofertilizers - *Rhizobium*, *Azospirillum*, and *Azotobacter*, *Phosphobacteria*, *Frankia*, AMF and BGA. Outline of biopesticide, bioinsecticides, bioherbicides and its application to the agriculture. Plant resistance R genes, Induction of R-genes by bacteria – BT cotton and its global impact - Implications for biotechnology

**Total Lecture Hours - 60**

**COURSE OUTCOME**

The students will be able to,

1. Infer the activities and role of air and aquatic microbiology
2. Impart knowledge about soil microbiology and ecological role of microbes
3. Analyse and categorize the crucial role of microbes in sewage water treatment
4. Know the effect on plant microbial interaction and its impact on agriculture
5. Develop skills about sustainable agriculture

**TEXT BOOKS**

1. Dubey RC and Maheswari DK. A Text Book of Microbiology. S Chand, New Delhi. 2010.
2. Subba Rao N.S. (2005), Soil Microbiology (4<sup>th</sup> Edition), Oxford and IBH publishing Company Pvt, Limited.
3. S.R.Reddy (2017), Principles of organic farming, Kalyani Publishers
4. Atlas R. M and Bartha R. (1992). Microbial Ecology Fundamentals and Applications. 3rd edn Benjamin & Cummings Redwood City .CA
5. Bhakuni, D.S. and Rawat, D.S. (2005). Bioactive marine natural products. Anamaya Publishers, New Delhi.
6. Pelczar M.J, Jr. Chan E.C.S and Krieg N.R. (2004). Microbiology, Tata McGraw Hill Publishing Company, New Delhi.
7. Agrios AG. Plant Pathology, Elsevier Academic Press, New Delhi, 2006.
8. Sambamurty A. Textbook of Plant Pathology, I.K. International Publishing House, New Delhi, 2009.

**REFERENCE BOOK(S)**

1. Atlas Ronald, M., Bartha, and Richard (1987). Microbial Ecology (2<sup>nd</sup> Edition). Benjamin Cummings Publishing Company, California.
2. Daniel, C.J. (1996). Environmental Aspects of Microbiology, 1st edn. Bright Sun Publications
3. Dirk, J. Elsas, V., Trevors, J.T., Wellington, E.M.H. (1997). Modern Soil Microbiology, Marcel Dekker INC, New York, HongKong.13.
4. Eldowney S, Hardman DJ, Waite DJ, Waite S. (1993) Pollution: Ecology and Biotreatment. Longman Scientific Technical.
5. Glick B.R. (2015) Beneficial Plant Bacterial Interactions, Springer
6. James W. Nybakker (2001). Marine Biology, Benjamin Cummings Publishing Company, California.
7. Madsen E.L. (2008) Environmental Microbiology: From Genomes to Biogeochemistry, Blackwell publishers.
8. Mukerji K.G, C. Manoharachary & J. Singh (2006). Microbial Activity in the Rhizosphere (Soil Biology Series), Published by Springer-Verlag, Germany.
9. Pepper I., Gerba C. and Gentry T. (Ed.) (2014) Environmental Microbiology, Academic Press.

10. Rai.M.K (2005) Handbook of Microbial biofertilizers. Food Products Press, New York.
11. Raina M. Maier, Ian L. Pepper, Charles, P. Gerba (2006). Environmental Microbiology, Academic press.
12. Scheper, T. (2005). Advances in Biochemical Engineering/Biotechnology-Marine Biotechnology I. Springer.
13. Shimshon Belkin and Rita R. Colwell (2005). Ocean and Health: Pathogens in the marine environment. Springer.
14. Stanier, P.R., Ingraham., Wheelis, M.L and Painter, P.R. (1990) The microbial world. Prentice. Hall of India Private Limited, New Delhi.
15. Varma A and Hock B., (2001) Mycorrhiza: Structure, Function, Molecular Biology and Biotechnology. Publisher: Springer-Verlag, Germany.

#### **E- RESOURCES**

1. <https://www.academia.edu/37403579>
2. <http://ecoursesonline.iasri.res.in/mod/page/view.php?id=5231>
3. <http://www.fao.org/3/t0551e/t0551e05.htm>
4. [www.environmentshumail.blogspot.in/](http://www.environmentshumail.blogspot.in/)
5. <https://serc.carleton.edu/microbelife/index.html>
6. <https://www.slideshare.net/GhassanHadi/waste-water-treatment-120127225>
7. <https://www.slideshare.net/MauraMcDW/steps-to-a-sustainable-agriculture-overview>

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**SENGAMALA THAYAR EDUCATIONAL TRUST WOMEN'S COLLEGE  
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**SUNDARAKKOTTAI, MANNARGUDI-614016.**  
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**DEPARTMENT OF MICROBIOLOGY**  
M.Sc., MICROBIOLOGY

**Semester: II- CC-VI: Medical Bacteriology**

**Ins. Hours / Week: 5**

**Course Credit: 4**

**Course Code:**

**OBJECTIVES**

- The students will gain knowledge about the different types of bacteria
- To gain knowledge about Collection and processing of specimens for microbiological analysis
- To study about the mechanism of Pathogenesis, laboratory diagnosis and treatment of bacterial infections

**UNIT -I: Introduction to Medical Bacteriology (15 Hours)**

Bacteriology: Indigenous normal microbial flora of human body (skin, respiratory, gastrointestinal and genital tract). General attributes and virulence factors of bacteria causing infections. Role of Resistant Flora. Concept of Probiotic. Host Parasite relationships – Nonspecific host immune mechanisms. Mode of spread of infection: Respiratory, skin, wound and burn infection, venereal infections, alimentary tract infection, blood borne infection. Medical Biofilms. Ground rules for collection and dispatch of clinical specimens for microbiological diagnosis and discarding of clinical Specimens.

**UNIT- II: Medically Important Gram Positive bacterial pathogens (15 Hours)**

Morphology, classification, cultural characteristics, pathogenesis, laboratory diagnosis, prevention, Control and treatment of diseases caused by the following organisms: *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Corynebacterium diphtheriae*, *Mycobacterium tuberculosis*, *M. leprae*, *Clostridium tetani*, *C. botulinum*, *Bacillus anthracis* and *Nocardia brasiliensis*.

**UNIT- III: Medically Important Gram Negative bacterial pathogens (15 Hours)**

Morphology, classification, cultural characteristics, pathogenesis, Laboratory diagnosis, prevention, control and treatment of *Salmonella typhi*, *Shigella dysenteriae*, *Vibrio cholerae*, *Escherichia coli*, *Brucella abortus*, *Neisseria meningitidis*, *Rickettsiae rickettsi*, *Chlamydiae trachomatis*, *Mycoplasmas genitalium*, *Treponema pallidum*, *Leptospira interrogans*, *Helicobacter pylori*. Zoonotic diseases, sexually transmitted diseases – Hospital acquired infections – Hospital Infection control committee – functions – Hospital waste disposal – Ethical committee – functions.

**UNIT-IV: Isolation and identification of clinical pathogens (15 Hours)**

Microscopic appearance and Colony characteristics of different bacteria. Various Synthetic and Non – synthetic media for bacterial cultivation. Applications of basal, Differential, Enriched and Selective media for bacterial growth. Isolation and identification of anaerobic bacterial pathogens. Maintenance and preservation of medically important bacterial pathogens.

**UNIT- V: Collection and transport of clinical specimen (15 Hours)**

Collection and transport of various clinical specimen for diagnosis of bacterial pathogens. General methods of isolation and identification of bacterial pathogens from – Skin, Urine, Sputum, CSF, Blood, Pus and Stool.

**Total Lecture Hours-75**

## COURSE OUTCOME

The students will be able to,

1. Analyse the structure and factors contributing to pathogenicity of bacteria and acquire the skills of sample collection and processing for precise bacterial identification
2. Comprehend the diagnosis of bacteria infections and prevention methods
3. Gain knowledge on nosocomial infections and ethical committee
4. Know the morphological, biochemical, cultural properties of medically important bacteria and protozoan
5. Learn the methods of collection, transport and processing of clinical specimens.

## TEXT BOOKS

1. Ananthanarayan and Paniker's Text book of Microbiology 1978. Universities Press (9<sup>th</sup> edition), Hyderabad
2. Cedric Mims, Dockrell H.M. 2006. Medical Microbiology, updated 3<sup>rd</sup> Edition. Elsevier Mosby. U.S.A.
3. Chakraborty, P., 2003. A Text Book of Microbiology. 2<sup>nd</sup> edition, Published by New Central Agency (P) Ltd., Kolkatta.
4. Clinical Microbiology Made Ridiculously Simple 6<sup>th</sup> ed. 2014, by Mark Gladwin, William Trattler and C. Scott Mahan
5. Dey, N.C., Dey, T.K. and Sinha, D., 1999. Medical Bacteriology including Medical Mycology and AIDS. 17<sup>th</sup> edition, New Central Book agency. Kolkatta.

## REFERENCE BOOK (S)

1. Atlas RM. 1997. Principles of Microbiology. 2<sup>nd</sup> edition. W.M.T. Brown Publishers
2. Finegold, S.M. 2000. Diagnostic Microbiology, 10<sup>th</sup> Edition. C.V. Mosby Company, St. Louis.
3. Gerhardt, P., Murray, R.G., Wood, W.A. and Krieg, N.R. (Eds) 1994 Methods for General and Molecular Bacteriology, ASM Press, Washington, DC.
4. Greenwood, D., Slack, R.B. and Peutherer, J.F. 2002. Medical Microbiology, 16<sup>th</sup> Edn. Churchill Livingstone, London.
5. Jawetz, Melnick and Adelberg's. 2013. Medical Microbiology. 26<sup>th</sup> Edition. McGraw-Hill.
6. Madigan MT, and Martinko JM. 2006. *Brock Biology of Micro-organisms*. 8<sup>th</sup> edition. Parker J. Prentice Hall International, Inc.
7. Pelczar Jr MJ, Chan ECS, and Krieg NR. 2004. *Microbiology*. 5<sup>th</sup> edition Tata McGraw Hill.
8. Topley and Wilson 1995. Principles of Bacteriology Virology and Immunity. 9<sup>th</sup> Edn. Vol I, Edward Arnold, London
9. Tortora GJ, Funke BR, and Case CL. 2008. *Microbiology: An Introduction*. 9<sup>th</sup> edition. Pearson Education
10. Willey JM, Sherwood LM, and Woolverton CJ. 2008. Prescott, Harley and Klein's Microbiology. 7<sup>th</sup> edition. McGraw Hill Higher Education

## E- RESOURCES

1. [https://www.icmr.nic.in/sites/default/files/guidelines/Standard\\_Operating\\_Procedures.pdf](https://www.icmr.nic.in/sites/default/files/guidelines/Standard_Operating_Procedures.pdf)
2. [http://www.scielo.org.za/scielo.php?script=sci\\_arttext&pid=S0256-95742015000500034](http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S0256-95742015000500034)
3. <http://www.textbookofbacteriology.net/>
4. <https://academic.oup.com/cid/article/33/6/834/329873>
5. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3470069/>
6. <https://www.dovepress.com/antibiotic-resistance-a-rundown-of-a-global-crisis-peerreviewed-fulltext-article-IDR#>
7. <https://www.sciencedirect.com/topics/immunology-and-microbiology/virulence-factors>

**SENGAMALA THAYAR EDUCATIONAL TRUST WOMEN'S COLLEGE  
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**SUNDARAKKOTTAI, MANNARGUDI-614016.**  
(For the Candidates admitted in the academic year 2020-2021)

**DEPARTMENT OF MICROBIOLOGY**  
M.Sc., MICROBIOLOGY

**Semester: II- CC-VII: Virology**

**Ins. Hours / Week: 4**

**Course Credit: 4**

**Course Code:**

**OBJECTIVES**

- The course is designed to develop the student with enough knowledge about general account of viruses, bacteriophages, plant, animal and human viral diseases
- To train up the student in gaining knowledge about Instrumentation relevant to virology
- To inculcate knowledge on emerging viruses and its pathogenicity

**UNIT- I: Nature and Properties of Viruses**

**(12 Hours)**

Discovery, nomenclature, classification and properties of viruses, Morphology and ultra structure – capsid and their arrangement, envelope - types and their composition, viral genome – types and structure

**UNIT- II: General Methods of Diagnosis and Serology**

**(12 Hours)**

Characterization and Cultivation of viruses- Embryonated eggs, Primary and secondary cell cultures. Purification of Viruses: Gradient Centrifuge, Electrophoresis, and Chromatography. - haemagglutination, haemagglutination inhibition, complement fixation, immunofluorescence, ELISA, RIA. Assay of viruses - physical and chemical methods **Electron microscopy**-SEM and TEM).

**UNIT -III: Microbial Viruses ,Animal viruses Plant Viruses and Human Viruses (12 Hours)**

Bacteriophages- one step growth curve, Life cycle- Lytic and Lysogenic, One step growth curve, (Latent period, Eclipse Period, and burst size) Classification, Morphological groups - virulent dsDNA phage, ssDNA phage, phage lambda, Temperate and Transposable phage, Phage Mu, M13, T4, P1, Bacteriophage typing, Phage therapy (bacteriophage therapy), Cyanophages, Mycoviruses (Mycophages), Rhizobiophages. vector control. Use of viral vectors in cloning and expression.,

**UNIT -IV: Animal and Human Viruses**

**(12 Hours)**

Classification, Multiplication, Epidemiology, Pathogenesis, Diagnosis, Prevention and Treatment of animal viruses- DNA containing viruses, Papovavirus, Simian Virus – 40 (SV-40), Adenoviruses, Herpes viruses, Pox viruses. RNA containing viruses- Picornavirus, Togaviruses (Arboviruses), Rhabdoviruses, Orthomyxoviruses, Reoviridae, Retroviridae, Human Immuno Deficiency virus (HIV), SARS, Influenza viruses and H1N1 virus, Newly Emerging Viruses: COVID-19 virus, Chikungunia virus, Ebola Virus Immune responses to viruses, Viral Vaccines, Interferon and other cytokines, Antiviral therapy and Antiviral drugs.

**UNIT V -Plant Viruses**

**(12 Hours)**

History, Classification and nomenclature of plant viruses, Transmission, Multiplication, symptoms and control of plant viral diseases- Tobacco virus group, Tomato spotted wilt, Bunchy Top of Banana, Potato leaf roll virus, Rice tungro virus, Mosaic disease of sugarcane. Diagnostics in seeds and diseased plants, prevention of crop loss due to virus infection, virus-free planting material.

**Total Lecture Hours -60**

## **COURSE OUTCOME**

The students will be able to,

1. Understand the basic concept of characterization of viruses and viral components
2. Learn about cultivation and serological diagnosis of viruses
3. Describe and review the elements of the viral life cycle
4. Explain vaccine strategies and mechanism of antiviral drug
5. Acquire skills about basic plant diseases and its control

## **TEXT BOOKS**

1. Morag C. and Timbury M.C. (1994). Medical Virology, 10th Edition. Churchill Livingstone London.
2. Dimmock N.J., Primrose S.B. (1994). Introduction to Modern Virology 4th Edition. Blackwell Scientific Publications. Oxford.
3. Conrat, HF, Kimball, PC and Levy JA, (1994). Virology. 12th Edition. Prentice Hall, Englewood Cliff. New Jersey.
4. Parija, S.C. (1996). Textbook of Medical Parasitology. Orient Longman. 5. Jagdish Chandra (1996) Textbook of Medical mycology. Orient Longman
5. Text book of Microbiology ,RC.Dubey and DK.Maheshwari, S.Chand and Company, New Delhi.,2015.
6. Understanding Viruses, Third Edition, Teri Shors, Jones and Bartlett Publication,2013

## **REFERENCE BOOK(S)**

1. Alan J. Cann. Principles of Molecular Virology. 6<sup>th</sup> edition, Academic press, California. 2015.
2. Ann Giudici Fettner. The science of viruses. 2<sup>nd</sup> edition, Quill, William Marrow, New York. 1990.
3. Baishali C, Sumanta K Dutta, PatraLekha RC and Ranjita S. Topley and Wilson's: Principles of bacteriology, Virology and immUNITY. 11<sup>th</sup> edition, vol 4, Edward Arnold, London. 2005.
4. Dimmock NJ and Primrose SB. Introduction to modern virology. 6<sup>th</sup> edition. Blackwell scientific publication, Oxford, London. 2007.
5. Dimmock NJ, Easton AJ and Leppard K. Introduction to Modern Virology, Oxford: Blackwell Publishers, London. 2007.
6. James G Cappuccino and Natalie Sherman. Microbiology. 10th edition, The Benjamin/Cummings pub.co. California. 1996.
7. John Carter and Venetia Saunders. Virology: Principles and applications, 2<sup>nd</sup> Edition, John wiley and son's publishers, USA. 2013.
8. Kenneth M Smith. A text book of plant viral diseases, 3<sup>rd</sup> edition, Elsevier Inc, New York. 1972. Ps and Haffman etal, Covid 19 References,Web book
9. Morag C Timbury. Medical virology. 11<sup>th</sup> edition. Churchill Livingstone, London. 1997.
10. Maureen A Harrison and Ian F Rae. General techniques of cell cultures, Cambridge University Press, England. 2010.
11. Nayudu MV. Plant viruses, Tata Mc Graw Hill education, US. 2008.
12. Nicklin J, Greame Cook and Killington, R. Ins.tant notes in Microbiology, 2<sup>nd</sup> Edition, Viva Books private Limited, New Delhi. 2003.
13. Robert I Krasner. The Microbial challenge: Human Microbe Interaction, American Society for Microbiology, 2<sup>nd</sup> edition, Washington. 2002.
14. Roger Hull. Mathews' Plant Virology, 4<sup>th</sup> edition, Academic press- A Harcourt Science and technology company, New York. 2002.
15. Villarreal LP. Viruses and the Evolution of Life. ASM Press, Washington DC. 2005.
16. Virus taxonomy, Seventh report of the international committee on Taxonomy Viruses, edited by M.H.V. van Regan Mortal and 10 others. (2000)Academic Press, ISBN 0-12-370200-3

17. Guidelines issued by World Health Organization

**E- RESOURCES**

1. <https://viralzone.expasy.org/656>
2. <https://www.sciencedirect.com/topics/neuroscience/dna-viruses>
3. <https://www.sciencedirect.com/topics/immunology-and-microbiology/rna-viruses>
4. <https://gmch.gov.in/e-study/e%20Lecture/microbiology/10%20arboviruses.pdf>
5. <https://www.britannica.com/science/antiviral-drug/anti-hiv-drugs>

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**SUNDARAKKOTTAI, MANNARGUDI-614016.**  
(For the Candidates admitted in the academic year 2020-2021)

**DEPARTMENT OF MICROBIOLOGY**  
M.Sc., MICROBIOLOGY

**Semester: II- CC-VIII: Immunology and Immunotechnology**

**Ins. Hours / Week: 4**

**Course Credit: 4**

**Course Code:**

**OBJECTIVES**

- Illustrate and investigate the different types of immune response to infections and tumors
- Develop new diagnostic and therapeutic Immunological techniques for clinical and research applications
- Compare and contrast the functions of the various immune components with respect to their role in the two major types of immune responses

**UNIT -I: Immune system**

**(12 Hours)**

History of Immunology, Types of immunity- innate and acquired. Humoral and cell mediated immunity. Central and peripheral lymphoid organs- Thymus, bone marrow, spleen, lymph nodes and other peripheral lymphoid tissues GALT. Stem Cell - Haematopoiesis, Cells of the immune system- lymphocytes, mononuclear phagocytes- dendritic cells, granulocytes, NK cells and mast cells.

**UNIT -II: T and B cell, Antigen –antibody reactions**

**(12 Hours)**

T and B-cell receptors, Antigen recognition- processing and presentation to T cells. Interaction of T and B cells. Antigen and antibody – properties, types and functions, Antibody engineering principles - Chimeric antibodies. Antigen –antibody reactions - Precipitation, agglutination, complement fixation, RIA, ELISA, Western blotting and immunofluorescence.

**UNIT- III: T and B cell activation**

**(12 Hours)**

B cell receptor complex, B cell maturation, antibody diversity, understanding self – non self-discrimination, TH cell subpopulation, organization of T cell receptor, cell mediated effectors responses. Complement system: Basics of complement protein - different pathways of complement activation – classical and alternative.

**UNIT- IV: MHC, Cytokines and Lymphokines**

**(12 Hours)**

Structure of MHC molecules- Human Leucocyte Antigen- Functions of MHC. Cytokine and lymphokines structure and their receptors. Hypersensitivity reaction and their types. Auto immune disorders. Immunosuppression - Organ transplantation – Types of Graft, Transplantation antigen, allograft rejection (pathology, mechanism and immune suppression) graft versus host reaction. Tumour Immunology – Tumour antigens, immune response to tumour, immune surveillance, immunodiagnosis, immunotherapy for the treatment of cancer.

**UNIT- V: Immunotechnology and its applications**

**(12 Hours)**

Hybridoma Technology - Production of polyclonal and monoclonal antibodies - techniques and applications. Stem Cell Therapy and Application. Immunization practices- active and passive immunization. Vaccines- killed and attenuated; Modern Vaccine- recombinant vaccines, DNA vaccine, anti idiotypic vaccine and peptide vaccines. Applications of immunotechniques – Flow cytometry, Immunoelectron microscopy (ISEM) and Immunohistochemistry.

**Total Lecture Hours - 60**

## **COURSE OUTCOME**

The students will be able to,

1. Understand the role of immune system in the human body
2. Understand the mechanisms of antigen and antibody reaction
3. Outline and classify the types and major components involved in immune response at the cellular and molecular levels
4. Discuss in detail the concept of immune surveillance and the pattern of response to tumours, their immunodiagnostic and therapy.
5. Trained about immunological techniques

## **TEXT BOOKS**

1. Kuby J. Immunology, 7th edition, W.H. Freeman and company, New York. 2008.
2. Sudha Gangal and Shubhangi Sontakke. Textbook of Basic and clinical Immunology, Universities Press, (India) Pvt. Ltd, Hyderabad, India. 2013.
3. Janeway C, Travers P, Walport M, Sholmchik M.(2004). Immunobiology 6 th edn Gerald Science
4. Ajoy Paul. Text book of Immunology, Books and Allied (P) Ltd., Kolkata, 2016
5. Shyamasree Ghosh, Immunology and Immunotechnology, Books and Allied (P) Ltd., Kolkata, 2017

## **REFERENCE BOOK(S)**

1. Charlene Sand. A reference guide to immune disorder including hypersensitivity and auto immune disease, Webster's digital service, ebook. 2013.
2. Charles A Janeway, Paul Travers Jr. Mark Walport and Donald Capra J. Immunobiology – The immune system in health and disease. 4th edition, Current Biology Publications, London.1999.
3. Goldsby RA, Kindt TK, Osborne BA and Kuby J. Immunology, 5th Edition, W.H. Freeman and Company, New York. 2007.
4. Ivan Roitt, Jonathan Brostoff and David Male. Immunology, 8th edition, Elsevier science Ltd., New York. 2012.
5. Leslie Brent. A history of transplantation immunology, Academic press, London. 1996.
6. Nicole M. Valanzuela and Elaine F Reed. Antibodies in transplantation: the effects of HLA and non-HLA antibody binding and mechanism of injury. In: Transplantation immunology: Methods and protocols. (Eds: Andrea A. Zachary, Mary S. Leffell), Humana Press, New York. 2013.
7. Patricks S and Larkin MJ. Immunological and molecular aspects of bacterial virulence. John wiley and sons, England. 1995.
8. Playfair JHL. Immunology at a glance, 6th edition, Blackwell Science, London. 1996.
9. Samuel Baron .Medical Microbiology, 4th edition, University of Texas medical branch at Galveston, Texas.1996.
10. Richard Hunt, Becker, Holger, Hlawatsch, Nadine, Julich, Sandra and Miethe Peter. Microbiology and Immunology Online. University of South Carolina. 2004.
11. Tak W Mak and Mary Saunders. The immune response basic and clinical practices. Elsevier Academic press, New York. 2012.
12. Tak W Mak and Mary Saunders. Primer to the Immune Response. 2<sup>nd</sup> edition from *Tak Mak, Mary Saunders*, Bradley Jett. New York. 2014.
13. Thomas J Kindt, Barbara A Osborne, and Richard A Golds. Immunology online, University of South Carolina. 2006.
14. William E Paul. Fundamental Immunology. 7th revised edition, Raven press, New York.

2012.

## **E -RESOURCES**

1. <https://www.mechanobio.info> › Development
2. <https://www.cell.com> › trends › immunology
3. <https://microbiologybook.org/mayer/ab-ag-rx.htm>
4. [https://www.ebi.ac.uk/interpro/potm/2005\\_2/Page2.htm](https://www.ebi.ac.uk/interpro/potm/2005_2/Page2.htm)
5. <http://www.immunopaedia.org.za/immunology/archive/type-i-iv-hypersensitivityreactions/immune-complex-formation/hypersensitivity-reactions/?print=print>

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**SENGAMALA THAYAR EDUCATIONAL TRUST WOMEN'S COLLEGE  
(AUTONOMOUS)**



**SUNDARAKKOTTAI, MANNARGUDI-614016.**  
(For the Candidates admitted in the academic year 2020-2021)

**DEPARTMENT OF MICROBIOLOGY**  
M.Sc., MICROBIOLOGY

**Semester : II- CP-II: Environmental and Agricultural Microbiology, Medical Bacteriology,  
Virology, Immunology and Immunotechnology (P)**

**Ins. Hours / Week: 6**

**Course Credit: 5**

**Course Code:**

**Environmental and Agricultural Microbiology**

- Enumeration of Microbial population from rhizosphere and Non-rhizosphere soil
- Localization of Arbuscular Mycorrhizae (AM)
- Isolation of *Azospirillum*, *Azotobacter* and phosphate solubilizing from soil
- Isolation of *Rhizobium* sp. from root nodules of legumes
- Isolation of Cyanobacteria from agricultural soil and water
- Isolation of bacterial and fungal pathogens from plants
- Isolation and identification of air-borne microbes using Andersen sampler.
- Determination of BOD and COD of polluted and pond water.
- Assessment of water quality by MPN technique
- Demonstration of the plant diseases: a) Tobacco mosaic; b) Bacterial blight of paddy; c) Downy mildew of bajra; d) Powdery mildew of cucurbits; e) Head smut of sorghum; f) Red rot of sugar cane.

**Medical Bacteriology**

- Collection, coding and transport of clinical specimens for microbiological examinations
- Isolation and identification of upper respiratory tract bacterial pathogen – *Streptococcus pyogenes*
- Isolation and identification of *Staphylococcus aureus* from clinical specimen
- Isolation and identification of lower respiratory tract bacterial pathogen – *Pseudomonas aeruginosa*
- Isolation and identification of gastrointestinal bacterial pathogens – *Salmonella*, *Shigella* and *Vibrio*
- Isolation and identification of urinary tract pathogens – *E. coli* and *Klebsiella pneumoniae*
- Isolation and identification of bacterial pathogen causing enteric fever – *Salmonella typhi*, *S. paratyphi* A and B.

**Virology**

- Isolation and characterization of bacteriophage from natural resources
- Phage titration – T4 phage
- Study of virus infected plant samples- animal tissue culture- chick embryo fibroblast culture preparation Transmission methods – mechanical

**Immunology and Immunotechnology**

- Collection of venous blood from human and separation, preservation and storage of serum/plasma
- Hemagglutination - Blood grouping ABO and Rh – typing- Slide method.
- Total count of RBC
- Total count of WBC

- Total Cell count
- Agglutination- ASO
- Agglutination – RA
- Agglutination-CRP
- Flocculation – RPR
- WIDAL - Slide method
- WIDAL - Tube method.
- Precipitation Reaction – Immunodiffusion - Ouchterlony patterns
- ELISA – Demonstration.
- Internship/ Industrial Visit- Submit a Detailed report with photograph

### **TEXT BOOKS**

1. Aneja KR (1993). Experiments in Microbiology: Plant Pathology and Tissue Culture, Wishwa Prakashan, New Delhi.
2. Cappuccino JG and Sherman N (2012). Microbiology – A Laboratory Manual. 7th Edition, Dorling Kindersley (India) Pvt. Ltd., New Delhi.
3. Rajan S and Selvi Christy R. Experimental Procedures in Life Sciences. Anajanaa Book House, Chennai. 2011
4. Thangaraj M and Santhana Krishnan P (1998). Practical Manual on Microbial inoculants, Centre of advanced studies in agricultural University, TNAU, Coimbatore.
5. Rajan S. Manual for Medical Laboratory Technology. Anajanaa Book House, Chennai. 2012.

### **REFERENCE BOOKS**

1. Gunasekaran P (2008). Laboratory Manual in Microbiology, New Age International (P) Ltd. Publishers, New Delhi.
2. Harry W. Seeley JR, Paul J Van Demark and John J Lee (1997). Microbes in Action – A Laboratory Manual of Microbiology. W.H. Freeman and Company, New York.
3. Kanika Sharma (2009). Manual of Microbiology – Tools and Techniques. 2nd Edition, Ane Books Pvt. Ltd., New Delhi.
4. Roitt IM. Essentials of Immunology. ELBS, Blackwell Scientific Publishers, London.1998.
5. Kubly J. Immunology 2nd Ed. W.H. Freeman and Co. New York. 1994.
6. Elgert CD. Immunology - Understanding of Immune System by Wiley - Liss, New York. 1996.
7. Monica Cheesbrough. District Laboratory Practice in Tropical Countries - Part I and II 2nd edition. Cambridge University Press, New Delhi. 2006.
8. Betty A Forbes, Daniel F Sahm and Alice S Weissfeld. Bailey and Scott's Diagnostic Microbiology, Mosby Elsevier. 12th edition. 2007.
9. Mackie and McCartney. Practical Medical Microbiology, South Asia Edition. 14th edition. 2006.

### **E-RESOURCES**

1. <https://www.slideshare.net/NawabKhatoon/mycorrhyzae-association>
2. <https://www.slideshare.net/HamaNabaz/lab8-isolation-of-nitrogen-fixer-bacteria>
3. <https://www.slideshare.net/jensonSamraj/docodbod>
4. <https://www.slideshare.net/dpadevkota/streptococcus-pyogens>
5. <https://www.slideshare.net/AliaNajihah1/chapter-4-isolation-identificationandcultivation>
6. <https://www.slideshare.net/ruchivss/rbc-count>
7. <https://www.slideshare.net/ParveenKumarChadha/white-blood-cells-39083994>
8. <https://www.slideshare.net/medicomicro/widal-test-for-enteric-fever>

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(For the Candidates admitted in the academic year 2020-2021)

**DEPARTMENT OF MICROBIOLOGY**  
M.Sc., MICROBIOLOGY

**Semester : III- CC-IX: Microbial Genomics and Proteomics**

**Ins. Hours / Week: 4**

**Course Credit: 4**

**Course Code:**

**OBJECTIVES**

- To provide knowledge on fundamental principles and concepts of prokaryotic and eukaryotic genes and genomes, DNA replication, regulation, etc.
- To impart the current updated knowledge on molecular genetics of prokaryotes and eukaryotes with
- To afford the required fundamental details on eukaryotic molecular genetics

**UNIT-I: Genetic material, DNA replication and repair (10 Hours)**

Identification of genetic material (Griffith, Avery and Hershey and Chase experiments). Organization of genetic material: Bacteria – Eukaryotes: nucleus and nucleosomes, lamp brush and giant chromosomes. DNA replication - Meselson – Stahl experiment, Molecular mechanisms of DNA Replication – bidirectional and rolling circle replication. Plasmids – types, structure and replication. Inhibitors of DNA replication - DNA repair – mechanism of excision repair, SOS repair and mismatch repair.

**UNIT -II: Transcription and translation (12 Hours)**

Process of transcription – initiation, elongation – termination. Synthesis of mRNA in prokaryotes and eukaryotes. RNA splicing. Synthesis of rRNA and tRNA. RNA processing – capping and polyadenylation. Inhibitors of transcription. Genetic code, process of translation – initiation, elongation and termination. Signal sequences and protein transport. Inhibitors of translation.

**UNIT- III: Regulation of gene expression (12 Hours)**

Introduction - Operon concept, *lac*, *trp*, arabinose operons, promoters and repressors. Regulation of gene expression – Transcriptional control – promoters, terminators, attenuators and anti terminators; Induction and repression; Translational control – ribosome binding, codon usage, antisense RNA; post-transcriptional gene silencing – RNAi.

**UNIT -IV :Gene transfer and genetic recombination mechanisms (12 Hours)**

Transformation – competence cells, regulation, general process; Transduction – general and specialized; Conjugation – Discovery, mechanism of F<sup>+</sup> v/s F<sup>-</sup>, Hfr+v/s F<sup>-</sup>, F' v/s F<sup>-</sup>, triparental mating, selftransmissible and mobilizable plasmids, pili. Linkage and genetic maps – genetic mapping of T4 phage. C-value paradox. Hardy Weinberg Equilibrium.

**UNIT -V Mutation and transposable elements (14 Hours)**

Types and molecular basis of mutation– Agents of mutation - Importance of mutations in evolution of species. Discovery of Insertion sequences, complex and compound transposons – T10, T5, and Retroposon – Nomenclature- Insertion sequences – Mechanism – Transposons of *E. coli*, Bacteriophage and Yeast. Importance of transposable elements in horizontal transfer of genes and evolution.

**Total Lecture Hours -60**

## **COURSE OUTCOME**

The students will be able to,

1. Students acquire detailed knowledge of genetic materials, with reference to nucleic acid sequences replication and transcription.
2. They study about the gene sequences, vectors, gene splicing and the art of production of recombinant DNA.
3. Students are capable of understanding the gene regulation mechanisms.
4. Use common methods in microbial genetics.
5. Explain the processes behind mutations and other genetic changes.

## **TEXT BOOKS**

1. Ajoy Paul. 2007. Text Book of Cell and Molecular Biology, Books and Allied (P) Ltd. Kolkata.
2. Channarayappa A. 2010. Molecular Biology, Universities Press, (India) Pvt. Ltd, Hyderabad, India.
3. Channarayappa, A. 2010. Cell Biology, Universities Press, (India) Pvt. Ltd, Hyderabad, India.
4. David Freifelder. 2008. Molecular Biology, 2nd edition. Narosa publishing house, New Delhi.
5. George M MalacIns.ki, Freifelder's, 2008. Essentials of Molecular Biology. 4<sup>th</sup> edition. Narosa Publishing House, New Delhi.
6. Stanly,R.Maloy, John, E. Cronan Jr. and David Freifelder. 2006. Microbial Genetics, 2<sup>nd</sup> edition, Narosa publishing house, New Delhi.

## **REFERENCE BOOK(S)**

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K. and Walter, P. 2008. Molecular Biology of the Cell (5<sup>th</sup> Ed.). New York: Garland Science.
2. Antony, J.F., Griffiths, Gilbert, W.M., Lewontin, R.C. and Miller, J.H. 2002. Modern Genetic Analysis, Integrating Genes and Genomes, 2<sup>nd</sup> edition, WH.
3. Blackburn, G.M. and Gait, M.J. 1996. Nucleic acids in chemistry and biology. Oxford University press.
4. Cooper, G. M., and Hausman, R. E. 2013. The Cell: a Molecular Approach (6<sup>th</sup> Ed.). Washington: ASM ; Sunderland.
5. Friedberg, E.C., Walker, G.C. and Siede, W. 2005. DNA repair and mutagenesis. ASM press.
6. Gardner, E.J., Simmons, M.J. and Snustad, D.P. 2008. Principles of Genetics. 8<sup>th</sup> edition. John Wiley and sons.
7. Hardin, J., Bertoni, G., Kleinsmith, L. J., and Becker, W. M. 2012. Becker's World of the Cell. Boston (8<sup>th</sup> Ed.). Benjamin Cummings.
8. James D Watson, Tania A Baker, Stephen P Bell and Alexander Gann. 2008. Molecular Biology of the Gene, 5<sup>th</sup> edition.
9. Krebs, J. E., Lewin, B., Kilpatrick, S. T. and Goldstein, E. S. 2014. Lewin's Genes XI. Burlington, MA: Jones & Bartlett Learning.
10. Lewin, B. 2000. Genes VII. Oxford University press. London.
11. Lodish, H. F. 2016. Molecular Cell Biology (8<sup>th</sup> Ed.). New York: W.H. Freeman.
12. MalacIns.ki, G.M. and Freifelder, D. 1998. Essentials of Molecular Biology, 3<sup>rd</sup> edition, John and Bartlett Publishers.
13. Maloy, S.R., Cronan, Jr. J.E., and Freifelder, D. 1994. Microbial genetics. Jones and Bartlett publishers.
14. Singer MandBerg, P. 1991. Genes and Genomes. University Science Books.

15. Watson, J. D. 2008. Molecular Biology of the Gene (5<sup>th</sup>ed.). Menlo Park, CA: Benjamin/Cummings.

#### **E- RESOURCES**

1. <https://www.khanacademy.org/science/biology>
2. <https://www.imedpub.com/genetics-molecular-biology-research/>
3. <https://www.mdpi.com/journal/genes/sections/MGG>
4. <https://www.ncbi.nlm.nih.gov>
5. <https://library.au.dk/en/subjectareas/molecularbiologyandgenetics>
6. <https://www.libguides.gvsu.edu.in>

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**SENGAMALA THAYAR EDUCATIONAL TRUST WOMEN'S COLLEGE  
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**SUNDARAKKOTTAI, MANNARGUDI-614016.**  
(For the Candidates admitted in the academic year 2020-2021)

**DEPARTMENT OF MICROBIOLOGY**  
M.Sc., MICROBIOLOGY

**Semester: III- CC-X: Clinical Mycology and Parasitology**

**Ins. Hours / Week: 4**

**Course Credit: 4**

**Course Code:**

**OBJECTIVES**

- To learn about the different types of medically important fungal and parasitic infections
- To gain knowledge about diagnosis and treatment of fungal infections
- To study about the mechanism of Pathogenesis, laboratory diagnosis and treatment of parasitic infections

**UNIT – I: Introduction to clinical mycology (12 Hours)**

Medical Mycology- Introduction-Historical Perspectives and Milestones in Mycology, Classification of medically important fungi .Collection and Transport of fungal specimens.Isolation and identification of fungal pathogens.

**UNIT – II: Mycological infections (12 Hours)**

Morphological and cultural characteristics, epidemiology, pathogenesis, laboratory diagnosis, prevention ,control and treatment of a) Superficial mycosis - *Tinea, Piedra, Tinea versicolor* b)Cutaneous mycosis – Dermatophytosis c) Subcutaneous mycosis - Sporotrichosis, Mycetoma, d) Systemic mycosis - Blastomycosis and Histoplasmosis e) Opportunistic mycosis - Candidiasis, Aspergillosis and Mucoromycosis.

**UNIT –III: Antifungal therapy (12 Hours)**

Historical Perspectives and Current scenario, Classification of Antifungals-Polyene, Synthetic and Miscellaneous antifungals, Antifungal Susceptibility testing-CLSI guidelines, Conventional and non-conventional methods.

**UNIT– IV: Protozoa and Nematode infections (14 Hours)**

Morphological and cultural characteristics, life cycle, epidemiology, pathogenesis, laboratory diagnosis and prevention of Protozoan Intestinal Parasites – *Entamoeba histolytica, Giardia lamblia, Leishmania, Plasmodium* and *Cryptosporidium*.Nematodes – *Ascaris lumbricoides, Taenia solium, Trichonella, Trichuris, Ancylostoma* and *Wucheria bancrofti*.

**UNIT – V: Cestode and Trematode infections (10 Hours)**

Morphology, life cycle, pathogenesis, lab diagnosis, and prevention of a) Cestodes – *Taenia, Diphyllobotrium, Cysticercus* and *Echinococcus*. Etiology following Trematodes – *Schistosoma*, Medical entomology. Methods of testing drug sensitivity.

**Total Lecture Hours - 60**

**COURSE OUTCOME**

The students will be able to,

1. Students learn about medically important fungi including their classification, morphology, and laboratory diagnosis and prevention measures
2. Gain knowledge about the fungi as the causal organisms of infection in human beings, certain

mycoses, diagnosis and treatments

3. Discuss various types of antifungal agents
4. They also acquire knowledge about the diseases caused by protozoan and nematode, their diagnoses, prevention and control
5. Prevention and control of cestode and trematode infections

#### **TEXT BOOKS**

1. Ananthanarayanan R and Jeyaram Panicker CK. 2004. Textbook of Medical Parasitology. 5<sup>th</sup> Ed. Jay Pee brothers Medical publisher Pvt Ltd., New Delhi.
2. Chakroborty P. 2003. A Text book of Microbiology. 2<sup>nd</sup> Ed. New Central Book Agency (P) Ltd., Calcutta..
3. Jegadish Chander, 2018. A Text Book of Medical Mycology. 4<sup>th</sup> Edition, Jaypee Brothers Medical Publishers, Interprint, New Delhi.
4. Mehrotra, R.S. and Aneja, K.R. 2015. An introduction to Mycology. 2<sup>nd</sup> Edition, New Age International (P) Ltd, New Delhi.
5. Rajan S. 2007. Medical Microbiology, MJP Publishers , Chennai.

#### **REFERENCE BOOK(S)**

1. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. 2014. Introductory Mycology. 4<sup>th</sup> Edition, John Wiley & sons, New Delhi.
2. David Greenwood. Mike Barer, Richard Slack and Will Irving. 2012. Medical Microbiology- A Guide to Microbial Infections: Pathogenesis, immunity, Laboratory investigation and Control, 18<sup>th</sup> edition, Churchill Livingstone. United Kingdom.
3. Dimmock, N.J., Easton, A.J. and Lppard , K.N. 2009. Introduction to Modern Virology. Wiley Blackwell. United States.
4. Errol Reiss, Jean Shadomy, H. and Marshall Lyon, G. 2011. Fundamental Medical Mycology. 1<sup>st</sup> Edition, Wiley Blackwell, United States.
5. Flint, S.J., Enquist L.W., Racaniello, V.R. and Skalka, A.M. 2009. Principles of Virology-1- Molecular Biology, 3<sup>rd</sup> Edition. ASM Press, Washington.
6. Jawetz, Melnick and Adelberg's 2001. Medical Microbiology, 22<sup>nd</sup> edition, McGraw Hill Medical Publication division.
7. Morag, C. and Timbury, M.C. 1994. Medical Virology, 10<sup>th</sup> Edition. Churchill Livingston, London. 9. Conrat, H.F., Kimball, P.C. and Levy, J.A. 1994. Virology, 3<sup>rd</sup> Edition. Prentice Hall, New Jersey.
8. Topley and Wilson 1995. Principles of Bacteriology, Virology and Immunity, 9<sup>th</sup> Edition. Edward Arnold, London.

#### **E-RESOURCES**

1. <http://www.mednotes.net/notes/microbiology/>
2. <http://www.virology.net/garryfavwebaids.html>
3. <http://www.bact.wise.edu/microtextbook/>
4. <http://dmoz.org/Science/Biology/Microbiology/>
5. <http://microbiology.mtsinai.on.ca/manual/default.asp>
6. <http://www.biosci.ohio-state.edu/-zoology/parasite/home>.

**SENGAMALA THAYAR EDUCATIONAL TRUST WOMEN'S COLLEGE  
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(For the Candidates admitted in the academic year 2020-2021)

**DEPARTMENT OF MICROBIOLOGY**  
M.Sc., MICROBIOLOGY

**Semester: III- CC-XI: Research Methodology, Biostatistics and Bioinformatics**

**Ins. Hours / Week: 5**

**Course Credit: 4**

**Course Code:**

**OBJECTIVES**

- To orient and motivate the student to learn about research, research planning designing, hypothesis setting and execution of the research work.
- To make them capable of analyzing and interpreting the data, and to write the report and to publish the research findings
- To make the students exposed to bioinformatics and application in microbiological research

**UNIT- I: Research Methodology (15 Hours)**

Meaning and importance. Statement, Constraints, Types of research, Research tools, Qualities of a good researcher. Research process, Preparation of research report. Computers in biological research. Designing a research work – Need of research design – Features of a good design – Concepts and different research design – Basic principles of experimental design.

**UNIT – II: Research Concepts and Report Writing (15 Hours)**

Problem identification and formulation, Approaches, design exploratory descriptive and experimental, steps and Criteria of good research. Writing the research Report-Title, Authors, Address, Abstract, Keywords, Introduction, Review of literature, Materials and Methods, Results, Discussions, Summary, Acknowledgement and Bibliography, Research report- Tables, Figures and Formatting. Writing of project, Funding agencies.

**UNIT- III: Publication of Research and Plagiarism (12 Hours)**

Scientific documents – research paper, review paper, book reviews, theses, conference, books, book chapters and project reports. Guidelines for preparing an article - ISSN, ISBN, impact factor, citation index, downloading index, h-index, i-index, Google scholar, Scopus, Thomson & Reuters, Web of Science and Science Citation Index (SCI) of Web of Science (WOS). Plagiarism and its softwares.

**UNIT- IV: Biostatistics (18 Hours)**

Data collection, source of data, types of classification of data, Tabulation of data – Diagrammatic and Graphical representation of data. Measures of central tendency. Measures of dispersion and variability- Standard deviation. Coefficient of variation, Correlation and Regression. Probability Distributions- Binomial, Poisson and Normal. Sampling Distribution. ANOVA (one way and two way), Chi square test – Student's 't' test – testing of hypothesis-null hypothesis- level of significance- standard error. F Test. Analysis of data by statistical methods- SPSS

**UNIT –V: Bioinformatics (15 Hours)**

Introduction and skills for a bioinformatician. Biological databases. Database searching, Web Resources for Microbiology – Use of Digital Library. Sequence analysis, Pairwise, Multiple Sequence and Phylogenetic alignment. Visualizing protein structures, Predicting structure and function of protein using sequences, Tools for genomics and proteomics. Finding scientific articles – Pubmed.

## **COURSE OUTCOMES**

The students will be able to,

1. Students get motivated as to how one can pursue research, and make them capable of selecting the research problem, designing and execution of research work
2. Students are made capable of writing the research report and publication of research findings
3. Get information regarding the bioinformatics and the tools in relation to microbiological research
4. Communicate the research findings and to support or reject the research hypothesis.
5. Apply the knowledge to analyse the data using Bioinformatics tools.

## **TEXT BOOKS**

1. Anderson J.B. and Poole M. 2011. Assignment and Thesis Writing. 4<sup>th</sup>edn. Wiley India Private Limited, Karnataka
2. Gupta, S.P. 2014. Statistical Methods -S. Chand publication, New Delhi.
3. Gurumani, N. 2006. Research methodology for biological sciences. 1<sup>st</sup>edition, MJP Publishers. A unit of Tamil nadu Book House, Chennai.
4. Kothari C.R. and Garg , G. 2004. Research Methodology: Methods and Techniques. 2<sup>nd</sup>edn. New Age International Publishers, New Delhi.
5. Ramadass, P. and Wilson Aruni, A. 2009. Research and Writing - Across the Disciplines. MJP Publishers, Chennai.
6. Wayne W. Daniel, 2006. Biostatistics- A foundation for analysis in the Health Sciences. 7<sup>th</sup> edition. Wiley India publication, New Delhi.

## **REFERENCE BOOK(S)**

1. Attwood, T.K. and Parry-Smith, D.J. 2001. Introduction to Bioinformatics, Pearson Education Asia. Malaysia.
2. Baxevanis, A.D. and Francis Ouellette, B.F. (Eds.) 2001. Bioinformatics - A Practical Guide to the Analysis of Genes and ProteIns.. Wiley-Interscience, United States.
3. Bernard Rosner, 1999. Fundamentals of Biostatistics, Duxbury Press.USA.
4. Beth Dawson Robert, G. and Trapp Beth Dawson Robert Trapp. 2004. Basic and Clinical Biostatistics (LANGE Basic Science), McGraw-Hill, New York.
5. Claverie, J.M. and Notredame, C. 2003. Bioinformatics for Dummies, Wiley Publishing, Inc. New Delhi.
6. David, W. Mount, Cold Bioinformatics. 2001. Sequence and Genome Analysis, Spring Harbor Laboratory Press, New York.
7. Harvey Motulsky, 1995, Intuitive Biostatistics, Oxford University Press, London.
8. Higgins. D and W. Taylor (Eds.) 2000. Bioinformatics. Sequence, Structure and databanks- A Practical Approach. Oxford University Press. London.
9. Jeffrey A. Witmer and Myra L. Samuels, 2002. Statistics for the Life Sciences (3<sup>rd</sup> Edition). Prentice Hall, United States.
10. Kothari C.R. and Garg G .2004. Research Methodology: Methods and Techniques. 2<sup>nd</sup> edn. New Age International Publishers, New Delhi.
11. Kothari, C.R., 2013. Research methodology Methods and Techniques, New Age International Pvt Ltd Publishers., New Delhi
12. Stanton A. Glantz., 2001. Primer of Biostatistics. McGraw-Hill, New York.
13. Zar, J.H. 1996. Biostatistical analysis. Prentice Hall, Upper saddle River, New Jersey, USA

## **E -RESOURCES**

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2. [http://en.m.wikipedia.org/wiki/Multiple sequence alignment](http://en.m.wikipedia.org/wiki/Multiple_sequence_alignment)
3. [http://en.m.wikipedia.org/wiki/Swiss PDB viewer](http://en.m.wikipedia.org/wiki/Swiss_PDB_viewer)
4. <http://en.m.wikipedia.org/wiki/Rasmol>
5. <http://www.biostat.harvard.edu/links/>
6. <http://www.ped.mod.utah.edu/genpedscrr/Epibio.html/>

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**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE  
(AUTONOMOUS)**



**SUNDARAKKOTTAI, MANNARGUDI-614016.**  
(For the Candidates admitted in the academic year 2020-2021)

**DEPARTMENT OF MICROBIOLOGY**  
M.Sc., MICROBIOLOGY

**Semester: III- CC-XII: Bioprocess Technology**

**Ins. Hours / Week: 4**

**Course Credit: 4**

**Course Code:**

**OBJECTIVES**

- To make the students to learn the process involved in the industrial production of microbial products.
- To make them understand the strategies of strain selection and improvement, process of fermentation, types of fermenters and downstream processing.
- To make awareness about the role of microbes in food preparation, preservation and spoilage and the quality of food and products

**UNIT- I: Introduction to fermentation technology (12 Hours)**

Fermentation processes-Microbial culture; industrially important microbes and their improvement. Screening methods for industrial microbes – detection and assay of fermentation products. Types of Fermentation: Solid Substrate fermentation and submerged fermentation. Strain selection and improvement. Mutation and recombinant DNA techniques for strain improvement. Preservation of industrially important microorganisms.

**UNIT- II: Fermenter – types and functions (14 Hours)**

Fermenters – Basic functions, design and components – asepsis and containment requirements – body construction and temperature control – aeration and agitation systems – sterilization of fermenter, air supply, and medium; aseptic inoculation methods – sampling methods, valve systems – a brief idea on monitoring and control devices and types of fermenters.

**UNIT-III: Raw material and media formulation for fermentation process (14 Hours)**

Fermentation media; Natural media; synthetic media. Sources of Carbon; Nitrogen and vitamins; antifoams. Kinetics of growth in batch and continuous culture, specific growth rate, steady state in a chemostat, fed-batch fermentation, yield of biomass, product, calculation for productivity, substrate utilization kinetics. Fermentation process: Inoculum development. Storage of cultures for repeated fermentations, scaling up of process from shake flask to industrial fermentation.

**UNIT- IV: Downstream Processing (10 Hours)**

Biomass separation by centrifugation; filtration; flocculation and other methods. Cell disintegration: Physical, chemical and enzymatic methods. Product Recovery: Separation of solid and liquid phases; isolation and purification techniques for proteins and other products based on different physico-chemical properties.

**UNIT- V: Food microbiology (10 Hours)**

Microbiology of fermented milk – starter cultures, butter milk, cream, yoghurt, kaffir, kumiss, acidophilus milk and cheese. Industrial Production - Antibiotics- Penicillin and Streptomycin, Amino acids - Glutamic acid and Lysine, Vitamins B12. Enzymes – Amylase -Alcoholic Beverages - Wine and Beer, Vinegar production, SCP - Baker's yeast. Industrial effluent treatment. Food sanitation in food manufacture and in the retail trade; Food control agencies and their regulations.

## **COURSE OUTCOMES**

The students will be able to,

1. Students learn about the fermentation process and the industrial production of microbial products
2. They learn the art of manipulation of fermentation process for optimum production of the products
3. Apply knowledge of optimize media for microbial metabolites and control mechanism
4. The course has become a capacity building for the students who can work in the industries without any inhibition
5. Expand knowledge on downstream processing

## **TEXT BOOKS**

1. Adams MR and Moss MO, 2005. Food Microbiology. 1st edition. Reprinted, Published by New Age International (P) Limited. Publishers, New Delhi.
2. Agarwal AK and Pradeep Parihar, 2006. Industrial Microbiology. Published by Student Edition, Behind Nasrani Cinema, Chopasani Road, Jodhpur.
3. Banwart GJ, 2004. Basic Food Microbiology. 2nd edition, CBS Publishers and Distributors, New Delhi.
4. Casida LE Jr, 1993. Industrial Microbiology, 5th edition, Wiley Eastern Ltd., New Delhi.
5. Crueger W and Crueger A, 2000. Biotechnology: A Test Book of Industrial Microbiology, 2nd edition, Panima Publishing corporation, New Delhi.
6. Frazier WC and Westhoff DC, 1997. Food Microbiology 4th edition, Tata McGraw – Hill Publishing Company Limited – New Delhi.

## **REFERENCE BOOK(S)**

1. Celeste M. Todaro, Henry C. Vogel, 2014. Fermentation and Biochemical Engineering Handbook. William Andrew Press. Norwich, NY
2. Cruger, W., Anneliese, C and Aneja, K.R, 2017. Biotechnology-A textbook of Industrial
3. Hongzhang Chen, 2013. Modern Solid State Fermentation: Theory and Practice. Springer Press, Germany
4. Lancini, G. R. Lorenzetti, 2014. Biotechnology of Antibiotics and other Bioactive Microbial Metabolites. Springer publications, Germany.
5. Microbiology, 3rd edition, Medtech publisher.
6. Patel A.H, 2012. Industrial Microbiology. 2nd edn Mac Millan India Pvt Ltd.
7. Pepler HJ and Perlman D, 2004. Microbial Technology – Fermentation Technology. 2nd edition, Published by Academic Press (An imprint of Elsevier). Volume I and II.
8. Pepler, H.J., D, 2014. Perlman. *Microbial Technology: Fermentation Technology*. Academic Press.
9. Reed, G, 2004. Prescott and Dunn's Industrial Microbiology, 4th edn, CBS publication and distributors, New Delhi.
10. Willey JM, Sherwood LM, and Woolverton CJ. 2013. Prescott's Microbiology. 9<sup>th</sup> edition. McGraw Hill Higher Education, USA.

## **E -RESOURCES**

1. [http://www.biologydiscussion.com/microbiology-2/microorganisms-microbiology-2/roleof-](http://www.biologydiscussion.com/microbiology-2/microorganisms-microbiology-2/roleof-microorganisms-in-industrial-processes-microbiology/84754)
2. [microorganisms-in-industrial-processes-microbiology/84754](http://www.biologydiscussion.com/microbiology-2/microorganisms-microbiology-2/roleof-microorganisms-in-industrial-processes-microbiology/84754)
3. [https://www.rheosense.com/applications/viscosity/newtonian-non-newtonian.](https://www.rheosense.com/applications/viscosity/newtonian-non-newtonian)
4. [http://technologyins.cience.blogspot.com/2012/08/different-types-offermentors.](http://technologyins.cience.blogspot.com/2012/08/different-types-offermentors.html#.XWj58y4zbiU)
5. [html#.XWj58y4zbiU](http://technologyins.cience.blogspot.com/2012/08/different-types-offermentors.html#.XWj58y4zbiU)
6. <http://www.biologydiscussion.com/biotechnology/downstream-processing/stages->

indownstream-

7. [processing-5-stages/10160](#)
8. <https://www.upcounsel.com/intellectual-property-examples>

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**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE  
(AUTONOMOUS)**



**SUNDARAKKOTTAI, MANNARGUDI-614016.**  
(For the Candidates admitted in the academic year 2020-2021)

**DEPARTMENT OF MICROBIOLOGY**  
M.Sc., MICROBIOLOGY

**Semester III- CP-III– Microbial Genomics and Proteomics, Clinical mycology and Parasitology, Research Methodology, Biostatistics and Bioinformatics and Bioprocess Technology**

**Ins. Hours / Week: 6**

**Course Credit: 5**

**Course Code:**

**Molecular Biology and Microbial Genetics**

- Isolation of antibiotic resistant microbes
- Isolation of mutants by spontaneous mutation – Gradient plate technique
- Isolation of auxotrophic and antibiotic resistant mutants by physical and chemical mutagens
- Isolation of microbial genomic DNA
- Isolation of plasmids from *E.coli* (mini preparation).
- Restriction digestion
- Polymerase Chain Reaction
- Blotting techniques (Southern, Northern, Western and Dot blottings)

**Clinical Mycology and Parasitology**

- KOH Preparation for skin scrapings for fungi
- Lactophenol preparation for fungi – *Aspergillus*, *Rhizopus* and *Fusarium*
- Germ tube test for *Candida albicans*
- Sugar fermentation and sugar assimilation test for yeasts
- Cultivation of fungi and yeast on SDA
- Saline wet mount examination of stool for parasites
- Iodine mount examinations of stool for parasites
- LPCB Mount examinations of stools for parasites
- Staining of peripheral blood smear for malarial parasite

**Research Methodology, Biostatistics and Bioinformatics**

- Collection of data, sampling designs, tabulation and graphic representation using biological materials.
- Representation of statistical data by Histograms, Ogive curve and Pie diagrams
- SPSS (Statistical Package for the Social Sciences)
  - a) Determination of statistical averages / central tendencies - Arithmetic mean, Median and Mode
  - b) Determination of measures of dispersion – Mean deviation and Standard deviation
  - c) Tests of significance ‘t’ test, ‘chi’ square, standard error and standard deviation.
- Study of Nucleic acid sequence databanks – GenBank, EMBL nucleotide sequence databank, DDBJ.
- Study of Protein Structure and Classification databases – PDB, SCOP and CATH.

**Bioprocess Technology**

Production, quantification, extraction and characterization of the following

- Alcohol - Wine

- Organic acid – Citric acid – Solid state and submerged fermentation.
- Amino acid– Glutamic acid.
- Lactic acid production by *Lactobacillus*
- Extra cellular enzymes – Protease by submerged fermentation and Cellulase by solid state fermentation.

### TEXT BOOKS

1. Ananthanarayan R. and Kapil A. 2013. Ananthanarayan and Panicker's Text book of Microbiology, 9<sup>th</sup> Edn. Paperback, Orient BlackSwan, Hyderabad.
2. Chander J, 2009. Text Book of Medical Mycology, 3<sup>rd</sup> Edn. Mehta Publishers, Pune.
3. Chatterjee K.D, 2009. Parasitology: Protozoology and Helminthology, 13<sup>th</sup> Edn. CBS Publishers and Distributors Pvt. Limited, Chennai.
4. John P. 2007. Harley Microbiology Lab manual, 7th edition McGraw Hill Medical Publication division.
5. Maicello Pagano, Kimberlee Gauvreau, 2000. Principles of Biostatistics, 2nd edition, Duxbury Press.
6. Monica Cheesbrough, 2006. District Laboratory Practice in Tropical Countries - Part I and II 2nd edition. Cambridge University Press, New Delhi.
7. Parija S.C, 2013. Text Book of Medical Parasitology – Protozoology and Helminthology, 4<sup>th</sup> Edn. All India Publishers and Distributors, New Delhi.
8. Rajan S and Selvi Christy R, 2011. Experimental Procedures in Life Sciences. Anajanaa Book House, Chennai.
9. Rajan S, 2012. Manual for Medical Laboratory Technology. Anajanaa Book House, Chennai.
10. Roland Ennos, 2011. Statistical and Data Handling Skills in Biology, 3rd edition. Pearson.

### REFERENCE BOOK(S)

1. Betty A Forbes, Daniel F Sahn and Alice S Weissfeld, 2007. Bailey and Scott's Diagnostic Microbiology, Mosby Elsevier. 12th edition.
2. Brooks G., Carrol K.C., Butel J. and Morse S, 2012. Jawetz Melnick and Adelberg Medical Microbiology, 26<sup>th</sup> Edn. Lange Medical Publications
3. Mackie and McCartney, 2006. Practical Medical Microbiology, South Asia Edition. 14th edition.
4. Reiss E. Shadomy H.J. and Lyon G.M, 2011. Fundamentals Medical Mycology, Wiley-Blackwell, USA.
5. Roitt IM, 1998. Essentials of Immunology. ELBS, Blackwell Scientific Publishers, London.
6. Sambrook J and Russell DW, 2001. Molecular cloning- A laboratory manual. Cold spring harbor Laboratory Press, New York.

### E-RESOURCES

1. <https://youtu.be/WZbAfQ58eCw>
2. <https://youtu.be/EfTJqNZ1E0w>
3. <https://youtu.be/WTelVO4ywUc>
4. [http://en.m.wikipedia.org/wiki/Nucleotide sequence database](http://en.m.wikipedia.org/wiki/Nucleotide_sequence_database)
5. [http://en.m.wikipedia.org/wiki/Multiple sequence alignment](http://en.m.wikipedia.org/wiki/Multiple_sequence_alignment)
6. [http://en.m.wikipedia.org/wiki/Swiss PDB viewer](http://en.m.wikipedia.org/wiki/Swiss_PDB_viewer)

### ELECTIVE COURSE

**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE  
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**SUNDARAKKOTTAI, MANNARGUDI-614016.**  
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**DEPARTMENT OF MICROBIOLOGY**

**M.Sc., MICROBIOLOGY**

**Semester: I- EC-I: Quality Control and IPR**

**Ins. Hours / Week: 4**

**Course Credit:3**

**Course Code:**

**OBJECTIVES**

- To gain knowledge about intellectual property rights, copyrights, trademarks and geographical limitation
- Explain various concepts of biotechnological inventions and their commercialization
- Ethics of biological Goods manufacturing practice, usage of animals, plants and their biosafety assessment

**UNIT- I: Introduction to Bioethics (12 Hours)**

Introduction to Bioethics; Legality, Morality and Ethics, Ethics of GMOs, the principles of bioethics, autonomy, beneficence, privacy, justice and equality. Ethics of animal testing.

**UNIT- II: Biosafety Concept and Issues (12 Hours)**

Biosafety Concept and issues, rational vs subjective, perceptions of risk and benefits of Biosafety. Biosafety Guidelines and implementations. Biosafety concern levels – Individual, Institution, society, region, country and world- Lab associated Infections.

**UNIT-III: Biosafety Assessment (10 Hours)**

Biosafety Assessment (BSA), BSA of biotechnology and pharmaceutical products such as drugs, vaccines and biomolecules.

**UNIT –IV: Quality Control (14 Hours)**

Quality control in food process technology- Indian and International standards, WHO Standards- Quality Control in Food and Dairy product technology- Quality control in potable water, APHA. Quality control in microbial products, Quality assurance and BIS.

**UNIT- V: IPR (12 Hours)**

GATT and IPR, IPR in India, Indian patent Law. WTO Act, Convention on Biodiversity (CBD), patent cooperation treaty (PCT), TRIPS and Budapest treaty, forms of patents and patentability, process of patenting, Indian and international agencies involved in IPR and patenting, Global scenario of patents and India's position, patenting of biological material, GLP and GMP.

**Total Lecture Hours- 60**

**COURSE OUTCOME**

The students will be able to,

1. Gain knowledge about the IPR, Patent regulations and its importance.
2. Improve their knowledge in quality assessment of industrial products
3. Learn the principles of Biosafety Guidelines and risk assessment
4. Gain knowledge about quality control in food process technology
5. Learn about Patents law and Process of patenting

### **TEXT BOOKS**

1. Sateesh MK. 2010. Bioethics and Biosafety, I. K. International Publishing House PVT. Ltd., Karnataka
2. Dubey. R.C. 2008. A Textbook of Biotechnology, S. Chand and company Ltd., New Delhi.

### **REFERENCE BOOK(S)**

1. Frederic H Erbisich and Karim M Maredia, 2004. Intellectual Property Rights in Agricultural Biotechnology, CABI publisher.
2. Mittal D P. 1999. Indian patents law. Taxmann Allied Services (p) Ltd.
3. Christian lenk, Nils Hoppe and Roberto Andorno. 2007. Ethics and law of intellectual property: Current problems in politics, Science and technology, Ashgate publisher (p) ltd. UK.
4. Felix Thiele, Richard E Ashcroft. 2005. Bioethics in a small World springer.
5. John Bryant. Bioethics for scientist. John Wiley and son's publisher, UK.

### **E- RESOURCES**

1. [https://en.wikipedia.org/wiki/Intellectual\\_property](https://en.wikipedia.org/wiki/Intellectual_property)
2. [https://en.wikipedia.org/wiki/Intellectual\\_property](https://en.wikipedia.org/wiki/Intellectual_property)
3. <http://www.ipr.res.in/>
4. <https://www.wipo.int/about-ip/en/>

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**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE  
(AUTONOMOUS)**



**SUNDARAKKOTTAI, MANNARGUDI-614016.**  
(For the Candidates admitted in the academic year 2020-2021)

**DEPARTMENT OF MICROBIOLOGY**

M.Sc., MICROBIOLOGY

**Semester: II- EC-I: Microbial Biotechnology**

**Ins. Hours / Week: 4**

**Course Credit:3**

**Course Code:**

**OBJECTIVES**

- To impart the potential applications of microbial and molecular biotechnology in medicine
- To develop new products for sustainable agriculture
- To know about various other current industrial processes

**UNIT- I: Microbial production of therapeutic agents and vaccines (12 Hours)**

History – Definition, concept and scope of biotechnology. Microbial vs molecular biotechnology and Commercialization – concerns and consequences - Pharmaceuticals - interferons and growth hormones, enzymes: DNase I and alginate lyase, Monoclonal antibodies – HIV therapeutic agents. Subunit vaccines: Herpes simplex virus, Foot and mouth disease virus, TB, Peptide vaccines – genetic immunization – vector vaccines.

**UNIT- II: Microbial production of commercial products (12 Hours)**

Microbial production of restriction endonucleases: *Pst*I, Dye: Indigo, Antibiotics: Synthesis of Novel antibiotics. Biopolymers: Xanthan gum and PHA. Microbial production of alcohol, lactic acid, streptomycin, L- glutamic acid, lipase and riboflavin.

**UNIT- III: Production of PGPR, biofertilizers and biocontrol agents (14 Hours)**

Plant growth promoting bacteria (PGPR) – genetic engineering of nitrogenase gene cluster, hydrogenase and Nodulation. Mass cultivation of microbial biofertilizers: Cyanobacteria (*Spirulina*), *Azolla* and other nitrogen fixers (*Rhizobia*, *Azospirillum*, *Azotobacter* and VAM) Biocontrol of pathogens: Siderophores, antibiotics and enzymes. Release of genetically engineered organisms - Ice nucleation and anti-freeze proteins. Microbial herbicides. Microbial Insecticides (*Pseudomonas* and *Bacillus thuringiensis*): - genetic engineering of Bt strains.– Bt cotton – viral Insecticides – entomopathogenic fungi.

**UNIT- IV: Plant and algal biotechnology and bioremediation (10 Hours)**

Ti plasmid derived vector systems - Development of Insect, virus and herbicide resistant plants, stress and senescence tolerant plants, modification of flower nutritional content, sweetening by genetic engineering. Plant as bioreactors. Production of food, colourant and fuel from microalgae.

**UNIT -V: Transgenic Animals (12 Hours)**

Concepts of transgenic animal technology; strategies for the production of transgenic animals and their importance in biotechnology; stem cell cultures in the production of transgenic animals. Methods of creating transgenic mice, cattle and sheep. Human gene therapy – *in vivo* and *ex vivo* gene therapy. Molecular diagnostics for genetic diseases. Biosafety and Bioethics.

**Total Lecture Hours - 60**

**COURSE OUTCOME**

The students will be able to,

1. Gain knowledge about the production of pharmaceutical products and vaccines from microorganisms
2. Attain knowledge about the enzymes, antibiotics and other commercial products through genetic engineering
3. Learn about the production methodology of agriculture based products
4. Study about the plasmid derived vector system
5. Expand the knowledge on the development of transgenic animals, gene therapy and diagnosis of genetic diseases
6. Use the knowledge gained in this section to apply in the field of clinical research

### **TEXT BOOKS**

1. Brown T. A. (1995). Gene Cloning. 4<sup>th</sup> edn, Chapman and Hall.
2. Russell P.J, (2010). Genetics-a molecular approach, 3 rd edn, Benjamin Cummings.
3. Bernard R. Glick and Jack J. Pasternak (1998). Molecular Biotechnology.3 rd edn ASM Press, Washington, D.C.
4. Raledge C and Kristiansen B. Basic Biotechnology, 2nd edition, Cambridge University Press. 2001.
5. Gerbardt P, Murray RG, Wood WA, Kreig NR. Methods for General and Molecular Bacteriology – American Society for Microbiology Washington D.C. 1994.
6. Balasubramanian D, Bryce CFA, Dharmalingam K, Green J, Jayaraman K. Concepts in Biotechnology University Press, India. 1996.

### **REFERENCE BOOK(S)**

1. Nelson, D.L and Cox, M.M. (2008). Leininger Principles of Biochemistry, 5th edn. W.H. Freeman and Company.
2. Watson, J. D., Gilman, M., Witkowski, J., (1992). Recombinant DNA, 2nd edn, Scientific Books.
3. Old R. W. and Primrose S. B. (1989). Principles of Gene Manipulation. 4th edn. Black well Scientific Publications, London.
4. Frifelder D. (1995) Molecular Biology. 4 rth edn Narosa Publishing House, New Delhi.
5. Glover, D.M. (1984) Gene Cloning: The Mechanism of DNA Manipulation.2<sup>nd</sup> edn Chapman and Hall, London.
6. Borowitzka MA and Borowitzka LJ. Microalgal Biotechnology, Cambridge University Press. 1989.
7. Walsh G and Headon DR. Protein Biotechnology, John Wiley and Sons, New York. 1994.
8. Glazer AN, Nikaido H. Microbial Biotechnology – Fundamentals of Applied Microbiology WH Freeman and Company, New York. 1994.

### **E-RESOURCES**

1. <https://www.molbiotools.com/usefullinks.html>
2. <https://geneticgenie.org>
3. <https://www.nestgrp.com/molbiol.shtml4>
4. <https://www2.mrc-lmb.cam.ac.uk/>
5. <https://www.restrictionmapper.org/links.htm>
6. <https://www.sciencedirect.com>
7. <https://www.edx.org>
8. <https://www.khanacademy.org>
9. <https://www.dcu.ie>

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**SENGAMALA THAYAR EDUCATIONAL TRUST WOMEN'S COLLEGE  
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**SUNDARAKKOTTAI, MANNARGUDI-614016.**  
(For the Candidates admitted in the academic year 2020-2021)

**DEPARTMENT OF MICROBIOLOGY**  
M.Sc., MICROBIOLOGY

**Semester: II- EC-II: Marine Microbiology**

**Ins. Hours / Week: 4**

**Course Credit:3**

**Course Code:**

**OBJECTIVES**

- This subject aims to introduce the students to understand microbial diversity
- To attain knowledge about significance, dynamics of marine environment,
- To understand Marine food borne pathogens, and marine microbial products.

**UNIT- I: Marine Microbial Habitats and Diversity (12 Hours)**

Marine environment—properties of seawater, chemical and physical factors of marine environment—Ecology of coastal, shallow and deep sea microorganism - significance of marine microflora. Diversity of microorganism - Archaea, bacteria, actinobacteria, cyanobacteria, algae, fungi, viruses and protozoa in the mangroves and coral environments - Microbial endosymbionts – epiphytes - coral-microbial association, sponge-microbial association.

**UNIT-II: Cultivation of Marine microbes and Nutrient cycling. (12 Hours)**

Methods of studying marine microorganisms- sample collection- isolation and identification: Cultural, Morphological, physiological, biochemical and Molecular characteristics- Preservation methods of marine microbes. Role of microorganisms in carbon, nitrogen, phosphorous and sulphur cycles in the sea under different environments and mangroves.

**UNIT- III: Marine extremophiles and Bioremediation (14 Hours)**

Survival at extreme environments – starvation – adaptive mechanisms in thermophilic, alkalophilic, osmophilic and barophilic, psychrophilic microorganisms – hyperthermophiles, halophiles and their importance. Microbial consortia and genetically engineered microbes in bioremediation of polluted marine sites - heavy metals and crude oil. Biofouling and their control.

**UNIT-IV: Seafood microbiology (10 Hours)**

Pathogenic microorganisms, distribution, indicator organisms, prevention and control of water pollution, quality standards, International and National standards. Microbiology of processed finfish and shellfish products. Rapid diagnosis of contamination in seafoods and aquaculture products. Preservation methods of seafoods. Quality control and regulations for microbial quality of fishes, shellfish and Marine living resources used for food and drugs.

**UNIT-V: Marine microbial products (12 Hours)**

Bioactive natural products –anti bacterial, anti- fungal, anti- viral, anti- inflammatory, anti-tumour, anti-parasitic and antihelminthic agents from macroalgae, marine bacteria, dinoflagellates, coelenterates (corals), bryozoans, sponges and tunicates. Marine microbial products – Carrageenan, agar-agar, sea weed fertilizers –Astaxanthin,  $\beta$  carotene – enzyme —polysaccharide – biosurfactants and pigments.

**Total Lecture Hours-60**

**COURSE OUTCOME**

The students will be able to,

1. Learn about microbial diversity in marine environment
2. Gain basic knowledge about the cultivation of marine microbes and its role in nutrient cycling
3. Study about the microbes in extreme environment and remediation of waste products
4. Understand the microbes in seafood's and its diagnosis
5. Attain knowledge about the products developed from marine microbes

#### **TEXT BOOKS**

1. Bhakuni DS and Rawat DS. Bioactive marine natural products. Anamaya Publishers, New Delhi. 2005.

#### **REFERENCE BOOK(S)**

1. Belkin S and Colwell RR. Ocean and health: Pathogens in the Marine Environment, Springer. 2005.
2. Elay AR. Microbial food poisoning. Chapman and Hall, London. 1992.
3. Ford TE. Aquatic microbiology. An ecological approach. Blackwell scientific publications, London. 1993.
4. Hunter-Cevera J, Karl D and Buckley M. Marine Microbial Diversity: the key to Earth's habitability, American Academy of Microbiology. 2005.
5. James W. Nybakker Marine Biology, Benjamin Cummings. 2001.
6. Krichman DL. Microbial ecology of the oceans. Wiley – liss, New York. 2000.
7. Meller CB and Wheeler PA. Biological Oceanography, Wiley-Blackwell Publishers. 2012.
8. Mitchell R and Kirchman DL. Microbial Ecology of the Oceans, Wiley- Blackwell Publishers. 1982.
9. Munn C. Marine Microbiology: ecology and applications, Garland Science, Taylor and Francis group, NY. 2011.
10. Prescott LM, Harley JP. Klein Microbiology, WCB, Mc Grow Hill Publications. 1999.
11. Raina M. Maier, Ian L. Pepper, Charles, P. Gerba Environmental Microbiology, Academic press. 2006.
12. Shimshon Belkin and Rita R Colwell Ocean and Health: Pathogens in the marine environment. Springer. 2005.
13. Scheper T. Advances in Biochemical Engineering/Biotechnology-Marine Biotechnology I. Springer. 2005.

#### **E- RESOURCES**

1. <https://www.slideshare.net/nagat122/microorganisms-in-marine-environments>
2. <https://www.slideshare.net/MadihaSiddiqui5/soil-microbiology-nitrogen-cycle-66369511>
3. <https://www.slideshare.net/jyotimatolia/extremophiles-59367883>
4. <https://www.slideshare.net/9404577899/microbial-spoilage-of-fish-sea-products>
5. <https://www.slideshare.net/jasminekaur144/marine-natural-products-81382482>

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**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE  
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**DEPARTMENT OF MICROBIOLOGY**  
M.Sc., MICROBIOLOGY

**Semester: II- EC-II: Food and Dairy Microbiology**

**Ins. Hours / Week: 4**

**Course Credit:3**

**Course Code:**

**OBJECTIVES**

- The subject aims to study about the food microflora, food preservation
- To Learn about fermented Food products and uses of microbes in Food
- To aware students about food borne diseases and food safety regulations

**UNIT-I: Concepts of Food Microbiology (12 Hours)**

Definition- Food as a substrate for microorganisms- Concepts of food and nutrients - Physicochemical properties of foods - Food and microorganisms – Importance and types of microorganisms in food (Bacteria, Mould and Yeasts) - Sources of contamination- Factors influencing microbial growth in food , Feed and Fodder

**UNIT- II: Principles of food preservation (12 Hours)**

Food preservations: principles- methods of preservations– asepsis, removal of microorganisms, anaerobic conditions, high temperature, low temperature, Refrigeration, Dehydration, Pasteurization, Lyophilization, Canning, Sterilization and food additives.

**UNIT-III: Fermented Foods (14 Hours)**

Fermented plant products: Bread, Sauerkraut, Vinegar- Fermented Dairy Products-cheese, Yoghurt, Kefir, Kumis- Fermented Beverages From Fruits - Fermented foods in India and its importance- Prebiotics , Probiotics, Synbiotics and its Benefits- Microbes in Dairy Industry - Spoilage of foods.

**UNIT- IV: Food Borne Diseases (10 Hours)**

Food Poisoning-Food intoxication – Botulism, Staphylococcus, Food infections – Salmonellosis, Clostridium, and Campylobacter jejuni. Escherichia coli, Amoebiasis. Algal toxins and Mycotoxins.. Food borne outbreaks in India.

**UNIT-V: Food safety Regulations and Practices (12 Hours)**

Good Hygiene Practices, Food control agencies and their regulations, Hazard analysis and critical control points – FDA, EPA ISI ,HACCP; GMP, GLP. Food laws and standards in India (FSS). Food safety- control of hazards. Recent trends and development in food technologies in India.

**Total Lecture Hours -60**

**COURSE OUTCOMES**

The students will be able to,

1. Determine the role of microorganisms in food microbiology
2. Acquaint themselves with preservative techniques.
3. Implement knowledge of Fermentation technology
4. Examine and identify the role of pathogens in food borne infections and food poisoning and prevent food borne outbreaks.
5. Train about various microbiological quality standards for food, regulatory practices and policies.

## **TEXT BOOKS**

1. Adams MR and Moss MO. Food microbiology, New Age international (P) Ltd., New Delhi.2006.
2. Bamforth C.W. (2005) Food, Fermentation and Microorganisms, Blackwell Science
3. Choudhary NL. Food Processing and Biotechnology Applications, Oxford Press, New Delhi.2012.
4. Frazier WC and Westhoff DC. Food Microbiology, Sixth edition, Tata McGraw-Hill Publishing Ltd., New Delhi. 2005.
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6. Khetarpaul Neelam. Food Processing and Preservation, Daya Publishing House, Delhi. 2005.

## **REFERENCE BOOK(S)**

1. Banwarst. G.J. (2003). Basic Food Microbiology 2<sup>nd</sup> edn, CBS Publishers and distributors
2. Chris Bell, Paul Neaves, Anthony P. Williams. Food Microbiology and Laboratory Practicals 2<sup>nd</sup> edition, Blackwell Scientific Publishers, UK. 2006.
3. Hobbs, B.C. and Roberts, D, (1968). Food Poisoning and Food Hygiene 7<sup>th</sup> edn. Edward Arnold: London.
4. Lund BM, Baird Parker AC and Gould GW. The Microbiological Safety and Quality of foods. Vol. 1-2, ASPEN Publication, Gaithersberg, MD. 2000.
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6. Jay J.M., Loessner M.J. and Golden D.A. (2005) Modern Food Microbiology, 7<sup>th</sup> Edn. Springer Publishers.
7. Prescott and Dunn, (1982). Industrial Microbiology 4<sup>th</sup> edn, CBS Publishers and Distributors.
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9. Raheena Begum M. A, 2010. Text Book of Foods, Nutrition, and Dietetics, Sterling Publishers Pvt. Ltd.
10. Singh K. Dairy Technology, Oxford Book Company, New Delhi. 2012.
11. Sinha and Sharma. Food Microbiology, Oxford Book Company, New Delhi. 2012.
12. Vijaya R K, (2004). Food Microbiology ,1<sup>st</sup> edn, MJP Publishers, Chennai
13. Varun Mehta. Food Biotechnology, Campus Books International, New Delhi. 2006.

## **E- RESOURCES**

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2. [https://www.researchgate.net/publication/243462186\\_Foodborne\\_diseases\\_in\\_India\\_A\\_review](https://www.researchgate.net/publication/243462186_Foodborne_diseases_in_India_A_review)
3. [https://www.researchgate.net/publication/228662659\\_Fermented\\_Dairy\\_Products\\_Starter\\_Cultures\\_and\\_Potential\\_Nutritional\\_Benefits/link/000084160cf23f86393d5764/download](https://www.researchgate.net/publication/228662659_Fermented_Dairy_Products_Starter_Cultures_and_Potential_Nutritional_Benefits/link/000084160cf23f86393d5764/download)
4. <https://www.fda.gov/food>

**SENGAMALA THAYAR EDUCATIONAL TRUST WOMEN'S COLLEGE  
(AUTONOMOUS)**



**SUNDARAKKOTTAI, MANNARGUDI-614016.**  
(For the Candidates admitted in the academic year 2020-2021)

**DEPARTMENT OF MICROBIOLOGY**  
M.Sc., MICROBIOLOGY

**Semester: III- EC-III: Bioinstrumentation**

**Ins. Hours / Week: 4**

**Course Credit:3**

**Course Code:**

**OBJECTIVES**

- This course will give an understanding about the working principles of analytical instruments
- To develop knowledge on instrument, mode operation and application of the instruments in Biological Sciences
- To create practical skills on analytical Instruments

**UNIT- I: Basic Instruments**

**(12 Hours)**

Basic Instruments (Theory & Demo) Principles, operation protocol & applications of the following Instruments: Weighing balance, pH meter, Radioactivity, ECG, FTIR. Beer Lambert's law - Colorimeter and its applications.

**UNIT-II: Microscopy**

**(12 Hours)**

Microscopy (Hands on) Observation of different microbes. Light – Bright & Dark field; Phase contrast, Inverted Phase contrast; Fluorescent, Electron – TEM & SEM; Confocal Microscope

**UNIT- III: Spectroscopy**

**(14 Hours)**

Spectroscopy (Theory & Demo) Colorimeter, Spectrometer, UV visible spectrometer, X – ray spectrometer, ELISA reader, Atomic absorption spectrometer, Flame photometer.

**UNIT- IV: Separation Techniques**

**(10 Hours)**

Separation Techniques (Theory & Demo) Centrifugation - Principle, operation, types & applications. Chromatography - Principle, operation & applications – Paper, TLC, GC, HPLC, Column Chromatography, Ion Exchange & Affinity Chromatography.

**UNIT- V: Electrophoresis**

**(12 Hours)**

Electrophoresis (Theory & Demo) Native & denatured – zone. PCR, Biosensors. GM Counter, Scintillation Counter, Autoradiography, Flow Cytometry. Care and Maintenance of Laboratory Instruments – Autoclave, Incubator and Hot air oven.

**Total Lecture Hours-60**

**COURSE OUTCOME**

The students will be able to,

1. Gain knowledge on the various types analytical instruments and their application in quantitative and qualitative analysis of biochemical compounds present in the living organisms
2. Operate different types of microscope and identifying microorganisms
3. Determine the concentrations of metal elements using spectroscopy
4. Understanding the working principles of various types of chromatography
5. Care and Maintain the analytical Instruments

## TEXT BOOKS

1. Ahuja V.K. 2017. Laws Relating to Intellectual Property Rights. Lexis Nexis. New York.
2. Boyer R.F. 2002. Modern Experimental Biochemistry 3<sup>rd</sup> edn. Pearson Education. Uttar Pradesh.
3. Geddes.A. and L.E Baker John Wiley & Sons. 1989. Principles of Applied Biomedical Instrumentation –Instrumental methods of analysis – Den, Williard & Merrit. Asian Edition. John Wiley and Sons Ltd, Chichester, UK;
4. Goel D. and Parashar S. 2013. IPR, Biosafety and Bioethics. Pearson Education in South Asia.
5. Keith Wilson and John Walker, 1994. Practical Biochemistry – principles and techniques. Cambridge Press, New York.
6. Veerakumari L. 2015. BioInstrumentation (1<sup>st</sup> Edn). MJP Publishers. Chennai
7. Wilson K., Walker J., Clokie S and Hofmann A. 2018 Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology (8<sup>th</sup>Edn). Cambridge University Press. London

## REFERENCE BOOK(S)

1. Anderson J.B. and Poole M. 2011. Assignment and Thesis Writing. 4<sup>th</sup> edn. Wiley India Private Limited. Karnataka.
2. Bahl, A. B.S. Bahl and G.D. Tuli, 2020. Essentials of Physical Chemistry, S. Chand & Company Ltd, New Delhi.
3. Jayaraman J. 2000. Laboratory Manual in Biochemistry. New Age International (p). New Delhi.
4. Kothari C.R. and Garg G 2004. Research Methodology: Methods and Techniques. 2<sup>nd</sup> edn. New Age International Publisher, New Delhi.
5. Mooyoung. M, 1985. Comprehensive Biotechnology. Vol. 2, 3 & 4.Pergamon press. Kidlington.
6. Nelson D and Cox MM. 2009. Principles of Biochemistry. W.H. Freeman and Company, New York.
7. Plummer Mu, David T. Plummer. 1988. Introduction to Practical Biochemistry. Tata McGraw-Hill Education, Uttar Pradesh.
8. Talaro K. P. & Talaro A. 2006. Foundations in Microbiology. McGraw-Hill College Dimensi, Uttar Pradesh.
9. Willard, HH and Merritt LL 1986. Instrumental Methods of Analysis. CBS Publishers and Distributors, New Delhi.
10. Willey J, Sherwood L. and Woolverton C 2007. Prescott/Harley/Klein's Microbiology, McGraw Hill, New York.
11. Williams, BL. and Wilson, K. 1975. A Biologists Guide to Principles and Techniques of Practical Biochemistry. John Wiley and Sons. Inc., New York.
12. Wilson K. and Walker J. 2008. Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press, London.

## E-RESOURCES

1. <http://www.biologydiscussion.com/biochemistry/centrifugation/centrifugeintroduction-types-uses-and-other-details-with-diagram/12489>
2. <https://www.watelectrical.com/biosensors-types-its-working-and-applications/>
3. <http://www.wikiscales.com/articles/electronic-analytical-balance/>
4. <https://study.com/academy/lesson/what-is-chromatography-definition-types-uses.html>
5. <http://www.rsc.org/learn-chemistry/collections/spectroscopy/introduction>  
[https://www.researchgate.net/publication/285688809\\_Spectrophotometry\\_Biochemical\\_](https://www.researchgate.net/publication/285688809_Spectrophotometry_Biochemical_)

## Applications

6. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5206469/> 3

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**SENGAMALA THAYAR EDUCATIONAL TRUST WOMEN'S COLLEGE  
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**SUNDARAKKOTTAI, MANNARGUDI-614016.**  
(For the Candidates admitted in the academic year 2020-2021)

**DEPARTMENT OF MICROBIOLOGY**  
M.Sc., MICROBIOLOGY

**Semester: III- EC-III: Genetic Engineering**

**Ins. Hours / Week: 4**

**Course Credit:3**

**Course Code:**

**OBJECTIVES**

- To make the students to study about gene cloning methods and the tools and techniques involved in gene cloning and genome analysis and genomics.
- To provide in depth knowledge in artificial gene transfer mechanisms and selection of recombinants, and  
Application of genetic engineering in various fields
- To discuss the gene cloning methods and the tools and techniques involved in gene cloning and genome analysis and genomics.

**UNIT- I: Introduction to Genetic Engineering (12 Hours)**

Introduction to Genetic Engineering – Definitions, Historical perspectives. Enzymes in rDNA technology - Restriction enzymes – types – nomenclature – Properties of type II restriction endonucleases. DNA ligase. DNA modifying enzymes – alkaline phosphatase, poly nucleotide kinase and terminal transferase

**UNIT- II: Cloning vectors (12 Hours)**

Cloning Vectors – Bacterial Plasmid vectors- pBR322 & pUC vectors, Bacteriophages,  $\lambda$ , M13. Hybrid vectors – Cosmids, Phasmids, Yeast vectors- YEP, YIP, YRP, YCP & YAC. Shuttle vector, Expression vector. Cloning Strategies. Construction of genomic libraries, cDNA library construction.

**UNIT- III: Gene transfer Mechanisms (10 Hours)**

Gene transfer methods–Transformation. Artificial techniques - Calcium chloride induction, electroporation, microinjection, biolistic method liposome and viral-mediated delivery, Agrobacterium - mediated delivery. Methods of selection of recombinants- *E. coli* and yeast genomic and cDNA libraries - construction and screening.

**UNIT- IV: Transgenic Animals and Plants (14 Hours)**

Transgenic animals: Animal vectors – SV 40, Retroviral vector. Production and applications of transgenic mice. *Agrobacterium* mediated transformation: Crown gall disease, Ti plasmids, T-DNA transfer, Ti plasmid derivatives- co-integrate vectors, binary vectors. Gene transfer to plants- development of pesticide, Ins.ecticide and stress resistant plants .Plant tissue culture and its types. Biomarkers.

**UNIT-V: Genetic Engineering Techniques (12 Hours)**

Blotting techniques – Southern, Northern and Western blotting. PCR – PCR amplification and its application DNA sequencing methods – Dideoxy, chemical and Next Generation Sequencing (NGS). Chromosomal walking, chromosome jumping, site directed mutagenesis, Protein engineering. Gene therapy; DNA drugs and vaccines.

**Total Lecture Hours -60**

**COURSE OUTCOME**

The students will be able to,

1. Understand the tools of Genetic engineering.
2. Types of vectors used in recombinant DNA technology
3. Method of gene transfer and screening of recombinants
4. Methods for making transgenic animals and plants
5. The genetic engineering techniques and its applications

### **TEXT BOOKS**

1. Bernad R Glick , 2003. Molecular Biotechnology - Principles and Applications of Recombinant DNA. Third edition, ASM Press, Washington, D.C.
2. Dubey R.C 2005. A Text of Biotechnology. Multicolor Illustrative edition, S.Chand and Company Ltd., New Delhi.
3. Glick, B.K. and Pasternik, J.J. 1998. Molecular Biotechnology. Principles and applications of recombinant DNA. [Second Edition]. ASM Press.
4. Jogdand, S.N. 2005. Gene biotechnology. Himalaya Publishing House, Mumbai.
5. Mitra, 2005. Genetic engineering. Published by Macmillan India Ltd., Chennai.
6. Preeti Joshi ,2002. Genetic engineering and its application. First edition, Agrobios (India).
7. Ramawat K and Shaily Goyal.2010. Molecular Biology and Biotechnology. First edition, S.Chand and company Ltd., New Delhi.
8. Rema LP. 2006. Applied Biotechnology. MJP Publishers, Chennai.
9. Satyanarayana , 2005. Biotechnology. First edition, Books and Allied (P) Ltd., Kolkata.
10. Winnacker, E.L. 1987. From Genes to Clones. Introduction to Gene technology. (First Edition). Panima Publishing Corporation, New Delhi.

### **REFERENCE BOOK(S)**

1. Anselm FM, Brent R, Kingston RE, Moore DD, 1988. Current Protocols In Molecular Biology Greene Publishing Associates, New York.
2. Berger SI, Kimmer AR, 1987. "Methods In Enzymology", Vol 152, Academic Press, USA
3. T.A.Brown, 2007. Genome 3, Third Edition (Garland Science Publishing). USA.
4. Berger SI, Kimmer AR, 2007. Methods In Enzymology, Vol 152, Academic Press. USA.
5. Farshad Darvishi, 2014. Microbial Biotechnology: Progress and Trend Publisher: CRC Press/Taylor & Francis Group.
6. Nelson, D.L and Cox, M.M. (2008). Leininger Principles of Biochemistry, 5th edn. W.H. Freeman and Company. New York.
7. Old, R.M. and Primrose, S.B. 1995. Principles of Gene Manipulation. [Sixth Edition]. Blackwell Scientific Publication, London.
8. Primrose S.B and Twyman, R.M. 2003.Principles of Genome Analysis and Genomics Third Edition (Blackwell Publishing).
9. Rema LP. 2006. Applied Biotechnology. MJP Publishers, Chennai.
10. Singh, J., Vyas, A., Wang, S., Prasad, R. (Eds). 2020. Microbial Biotechnology: Basic Research and Applications, Springer, Nature, Singapore Pvt Ltd.

### **E-RESOURCES**

1. <http://www.mnn.com/green-tech/research-innovations/photos/12-bizarre-examples-of-genetic-engineering>
2. <http://news.discovery.com/tech/biotechnology/gut-bacteria-make-diesel-fuel-130423.htm>
3. <http://www.jove.com/about/press-releases/39/the-future-biomaterial-manufacturing-spider-silk-production-from>
4. <https://www.molbiotools.com/usefullinks.html>
5. <https://geneticgenie.org>

6. <https://www.nestgrp.com/molbiol.shtml4>
7. <https://www2.mrc-lmb.cam.ac.uk/>
8. [www.restrictionmapper.org/links.htm](http://www.restrictionmapper.org/links.htm)

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## EXTRA DISCIPLINARY COURSES (EDC) OFFERED BY THE DEPARTMENT

### SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE (AUTONOMOUS)



SUNDARAKKOTTAI, MANNARGUDI-614016.

(For the Candidates admitted in the academic year 2020-2021)

#### DEPARTMENT OF MICROBIOLOGY

M.Sc., MICROBIOLOGY

#### Semester: II- EDC-I: Bioentrepreneurship

Ins. Hours / Week: 3

Course Credit: 2

Course Code:

#### OBJECTIVES

- The main objective of this course is to concentrate on development role of resource government and non-government schemes for entrepreneurship programmes
- To know the role of skills for entrepreneurs, communication skills, problem solving skills; Business plan development
- To acquire a basic understanding on button, oyster Mushroom cultivation, Single cell protein SCP Production of Yeast and Spirulina
- To learn about the mass multiplication, production cost analysis and marketing of different types of biofertilizer

#### UNIT- I:

(9 Hours)

Concept of entrepreneur and Entrepreneurship: Definitions-concept of Entrepreneurship, development- role of resource. Government and non Govt. schemes for Entrepreneurship programmes. Bank loan & marketing network, developing small scale industry.

#### UNIT-II:

(9 Hours)

Skills for entrepreneurs - communication skills, problem solving skills; Business plan development; Market need- distribution, price, promotion and market goal setting. Financial plan - Financial support for business, business Ins.urance. Special training for developing small scale industry from SIPOT, SIDCO, DIC, TIDAL park and TICAL park.

#### UNIT- III:

(9 Hours)

Project: identification, classification, formulation, appraisal. Small, large scale production and cost benefit analysis and marketing of button, oyster Mushroom cultivation, Single cell protein- SCP Production of Yeast and Spirulina.

#### UNIT- IV:

(9 Hours)

Mass multiplication, production cost analysis and marketing of Cyanobacterial Biofertilizers, Bacterial Biofertilizers- Rhizobium, Azospirillum, Fungal Biofertilizers -VAM, Actinobacterial Biofertilizer- Frankia sp.

#### UNIT- V:

(9 Hours)

Mass production and marketing of Compost- Vermicomposting and microbial compost - Types of compost pits- Laboratory and field application; cost-benefit analysis. Preparation of value added products.

**Total Lecture Hours -45**

#### COURSE OUTCOMES

The students will be able to,

1. Understand the basic knowledge of entrepreneurship programmes

2. Learn the resource for government and non-government schemes for entrepreneurship Knowledge about different types of mushrooms
3. Able to do the mass multiplication, production cost analysis and marketing the types of biofertilizer
4. Awareness about the button, oyster mushroom cultivation, Single cell protein SCP Production of Yeast and Spirulina

#### **TEXT BOOKS**

1. Nagendra S., (2008) Entrepreneurship and management Sanguine technical publishers
2. Bhatia, B.S. and G.S Batra, (2003) Entrepreneurship and small business management. Deep and deep publications
3. Tilak, K.V.B.R., (1990). Bacterial Biofertilizers. IARI Publications, New Delhi.

#### **REFERENCE BOOK(S)**

1. Venkataraman, G.S. (1972). Algal Biofertilizers and Rice Cultivation, Today and Tomorrow's Printers and Publishers, New Delhi.
2. Naidu, N.V.R, (2008) Management and entrepreneurship. I.K. International Pvt. Ltd. 4. Greene, (2000) Entrepreneurship ideas in action. Thomson learning
3. Sandera, F.E., B.Mosse and P.B.Tinke, (1975). Endomycorrhizae, Academic Press, London.
4. Rao,N.S,(1980) Biofertilizers in Agriculture. Oxford & IBH Publishing Co. Pvt. Ltd., Bombay

#### **E-RESOURCES**

1. [https://study.com/microbiology\\_courses.html](https://study.com/microbiology_courses.html) 10.<https://study.com/academy/lesson/what-is-an-entrepreneur-definition-characteristicsexamples.html>
2. <https://study.com/academy/lesson/Ins.titutional-entrepreneurship-theory-examples.html>
3. [https://study.com/articles/Fermentation\\_Microbiologist\\_Job\\_Description\\_Salary\\_and\\_Care er Outlook.html](https://study.com/articles/Fermentation_Microbiologist_Job_Description_Salary_and_Care er Outlook.html)

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**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE  
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**SUNDARAKKOTTAI, MANNARGUDI-614016.**  
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**DEPARTMENT OF MICROBIOLOGY**

M.Sc., MICROBIOLOGY

**Semester: II- EDC-I: Horticulture**

**Ins. Hours / Week: 3**

**Course Credit:2**

**Course Code:**

**OBJECTIVES**

- To provide holistic growth of the horticulture sector through an area based regionally differentiated strategies
- To enhance horticulture production, improve nutritional security and income support to farm households
- To establish convergence and synergy among multiple on-going and planned programmes for horticulture development
- To promote, develop and disseminate technologies, through a seamless blend of traditional wisdom and modern scientific knowledge
- To create opportunities for employment generation for skilled and unskilled persons, especially unemployed youth

**UNIT- I: Basics of Horticulture**

**(9 Hours)**

Scope and importance of Horticulture and horticultural crops – Area and Production – Imports and Exports – Nutritive value of Horticultural crops – Climatic Zones of India and Tamil Nadu in relation to Horticultural crops – Scope for horticultural development in Tamil Nadu – Factors limiting horticultural crop production.

**UNIT- II: Planning and Layout**

**(9 Hours)**

Planting of orchards – fencing – wind breaks – spacing – systems of planting – cropping systems – Multitier cropping – cover crops – Intercrops – Mulching – weed control.

**UNIT- III: Horticultural Crops**

**(10 Hours)**

Tropical, subtropical, temperate and arid zone horticultural crops – propagation practices spacing and planting – varieties – nutrient, water and weed management – use of growth regulators – yield – Economics – Integrated pest and disease management – pre and post-harvest practices – processing and preservation – Marketing.

**UNIT- IV: Manures and Manuring**

**(8 Hours)**

Organic and inorganic manures – Bio fertilizers – Essential elements – functions – deficiency symptoms – fertilizer schedule – Time and method of application. Irrigation – water requirement of different horticultural crops – various irrigation methods including drip, sprinkler, fog, mist, water stress on horticultural crops.

**UNIT- V: Growth Regulators**

**(9 Hours)**

Seed and vegetative propagation – advantages and disadvantages – seed treatment - Important methods of vegetative propagation – cutting – layering – rootstock – scion – (Stock – scion

relationship) – Incompatibility – grafting – budding – specialized parts of propagation (bulbs, tubers, offsets, runners etc.) – Mist propagation – Micropropagation.

**Total Lecture Hours -45**

### **COURSE OUTCOME**

The students will be able to,

1. Demonstrate a working knowledge and appreciation of the diversity of plants, their culture and utilization.
2. Learn about planning and layout designing
3. Apply horticultural principles to the successful growth and production of horticultural plants.
4. Development of idea on Manures and Manuring
5. Become trained seed and vegetative propagation

### **REFERENCE BOOK(S)**

1. Kumar, N. 2011. Introduction to Horticulture, Oxford and IBH Publication, New Delhi
2. T. Biswas, M.S. Mukherjee 2001. A text book of Soil Science
3. Srivastava, A.C., 1990. Elements of farm machinery. Oxford IBH pub Co., New Delhi.
4. Aroara, J.S 2010, Introductory Ornamental Horticulture. Kalyoni publishers, New Delhi, India
5. Randhawa, G.S and Mukhopadhyay, A. 1998. Floriculture in India. Allied Publishers Pvt.Ltd., New Delhi.

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**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE  
(AUTONOMOUS)**



**SUNDARAKKOTTAI, MANNARGUDI-614016.**  
(For the Candidates admitted in the academic year 2020-2021)

**DEPARTMENT OF MICROBIOLOGY**

**M.Sc., MICROBIOLOGY**

**Semester: III- EDC-II: Solid Waste Management**

**Ins. Hours / Week: 3**

**Course Credit:2**

**Course Code:**

**OBJECTIVES**

- To make the students to identify the potential environmental impacts of the solid wastes and find solution to waste management problems
- To make the students aware of appropriate waste handling and disposal measures / routings in accordance with the current legislative and administrative requirements
- To categories waste material where practicable (inert material / waste fractions) for disposal considerations

**UNIT – I: Environment and Ecosystem**

**(9 Hours)**

Introduction to Environment Ecosystem –meaning- Types -Components- Structure – Functions, Levels of organization in nature- Food chain and Trophic structure, Biogeochemical Cycles, Energy flow.

**UNIT – II: Municipal solid waste**

**(9 Hours)**

Municipal solid waste Definition - Sources and types of solid waste- composition and its determinants of Solid waste-factors influencing generation-quantity assessment of solid wastes-methods of sampling and characterization.

**UNIT – III: Collection and Transfer Collection**

**(9 Hours)**

Collection of Solid waste – collection services – collection system, equipment – time and frequency of collection – labour requirement – factors affecting collection – analysis of collection system – collection routes – preparation of master schedules. Transfer and Transport: Need for transfer operation – transfer stations – types – transport means and methods – location of transport stations - Manpower requirement – collection routes: Transfer stations – selection of location, types & design requirements, operation & maintenance.

**UNIT – IV: Processing and Recovery**

**(10 Hours)**

Processing Techniques and Recovery of Energy Processing techniques – purposes, mechanical volume reduction – necessary equipments – chemical volume reduction – incinerators – mechanical size reduction selection of equipments – components separation – methods – drying and dewatering.Recovery of Resources, conversion products and energy recovery – recoverable materials – processing and recovery systems – incineration with heat recovery.

**UNIT – V: Disposal of Solid Wastes**

**(8 Hours)**

Disposal of Solid Wastes – various methods – incinerations – principle features of an incinerator – site selection and plant layout of an incinerator - sanitary landfill- methods of operation – advantages and disadvantages of sanitary land fill - site selection – reactions accruing in completed landfills – gas and leachate movement and control – equipments necessary.

**Total Lecture Hours -45**

## **COURSE OUTCOME**

The Students will be able to,

1. Obtain knowledge about biogeochemical Cycles, Energy flow.
2. Assess the activities involved for the proposed and determine the type, nature and estimated volumes of waste to be generated
3. Assessment of handling, storage, transportation and disposal methods to be adopted
4. Aware about the potential environmental impacts produced by hazardous wastes
5. Acquire skills of environmentally sound *management of solid* (non-hazardous) *wastes* and sewage

## **TEXT BOOKS**

1. Bhatia, B.S. and G.S. Batra, 2003. Entrepreneurship and small business management. Deep and deep publications
2. George Tchobanoglous et AL., 1993. Integrated Solid Waste Management. McGraw – Hill.
3. Joseph C. Daniel 1999. Environmental aspects of microbiology ,Bright Sun Publications, Chennai.
4. Purohit, S.S., Q.J. Shammi and A.K. Agarwal. 2004. A text book of Environmental Sciences. Saraswathi Purohit for Student Edition, Jodhpur.
5. Sadhan Kumar Ghosh, 2019, Energy Recovery Processes from Wastes, Springer publication.
6. Tchobanoglous Thiesen Ellasen; 1997. Solid Waste Engineering Principles and Management, McGraw - Hill.
7. Verma, P. S., V.K. Agarwal. 1989. Principles of Ecology-S. Chand & Company (Pvt) Ltd.

## **REFERENCE BOOK(S)**

1. Aker KH and Herson OS, 1994. Bioremediation, Mc Graw Hill, New York.
2. Eldowney. E. C. S, Hardman DJ, Waite DJ, Waite S. 1993. Pollution: Ecology and Biotreatment. Longman Scientific Technical.
3. Landrefh. R. E. and P.A. Rebers, 1997. Municipal Solid Wastes-Problems & Solutions” ,Lewis.
4. Mitchell.R.;(2003) Introduction to Environmental Microbiology, Prentice – Hall. Inc. Cliffs - New Jersey.
5. Nath, K.J. 1984. Metropolitan solid waste management in India. In: Holmes JR, editor, Managing solid waste in developing countries. New York. John Willey and Sons.
6. Pepper I . , Gerba C. and Gentry T. (Ed.) 2014. Environmental Microbiology , Academic Press .
7. Ramachandra, T.V. 2006. Management of Municipal solid waste. Capital Publishing Company.

## **E- RESOURCES**

1. <https://www.britannica.com/technology/solid-waste-management>
2. <https://www.downtoearth.org.in/news/waste/solid-waste-management-rules-2016-53443>
3. [https://sswm.info/sites/default/files/reference\\_attachments/EAWAG%20SANDEC%202008%20Module%206%20Solid%20Waste%20Management%20Lecture.pdf](https://sswm.info/sites/default/files/reference_attachments/EAWAG%20SANDEC%202008%20Module%206%20Solid%20Waste%20Management%20Lecture.pdf)
4. [https://agritech.tnau.ac.in/org\\_farm/orgfarm\\_introduction.html](https://agritech.tnau.ac.in/org_farm/orgfarm_introduction.html)
5. [https://agritech.tnau.ac.in/org\\_farm/orgfarm\\_introduction.html](https://agritech.tnau.ac.in/org_farm/orgfarm_introduction.html)

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**SENGAMALA THAYAR EDUCATIONAL TRUST WOMEN'S COLLEGE  
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(For the Candidates admitted in the academic year 2020-2021)

**DEPARTMENT OF MICROBIOLOGY**  
M.Sc., MICROBIOLOGY

**Semester: III- EDC-II: Basic science for Competitive Examinations**

**Ins. Hours / Week: 3**

**Course Credit:2**

**Course Code:**

**OBJECTIVES**

- This subject aims to introduce fundamental knowledge on Basic Science
- The contents of this course will enable students to encounter competitive Examinations
- Understand and aware on basic science concepts

**UNIT-I: Scientific attitude**

**(9 Hours)**

Scientific Knowledge and Scientific temper - Power of Reasoning - Rote Learning Vs Conceptual Learning - Science as a tool to understand the past, present and future

**UNIT-II: Basic Physics Concepts**

**(9 Hours)**

Nature of Universe - General Scientific Laws – Mechanics - Properties of Matter, Force, Motion and Energy - Everyday application of the basic principles of Mechanics, Electricity and Magnetism, Light, Sound, Heat, Nuclear Physics, Laser, Electronics and Communications

**UNIT-III: Basic Chemistry Concepts**

**(9 Hours)**

Elements and Compounds, Acids, Bases, Salts, Metals, Petroleum Products, Fertilizers, Pesticides Insecticides

**UNIT-IV: Basics in Life sciences**

**(9 Hours)**

Main concepts of Life Science, Classification of Living Organisms, Evolution, Genetics, Physiology, Nutrition and dietetics-Respiration

**UNIT-V: Basics in Ecology**

**(9 Hours)**

Environment and Ecology, health and hygiene -Human diseases including communicable and non – communicable diseases - prevention and remedies -Animals, plants and human life.

**Total Lecture Hours -45**

**COURSE OUTCOME**

The students will be able to,

1. Focused on syllabus of scientific knowledge and temper will help for competitive examination
2. Gain overview on physical science and mechanisms.
3. Enrich the knowledge in basics of chemistry and its applications
4. Aware of Life science Concepts and its applications.
5. Enable the learner about the thrust areas of ecology

**TEXT BOOKS**

1. Arihant Experts, 2014 “Science for General Competitions” Arihant Publications (India) Pvt., New Delhi.
2. Manohar Pandey, 2021 “General Science “Lucent Publications, Patna, Bihar.
3. Mansi Garg, Poonam Singh, and SalehaParvez, 2020 “General Science” Arihant Publications,

New Delhi

4. Ravi Bhushan, 2018 “General science” Lucent Publications, Patna, Bihar
5. Sathya Prakash, Jaya Kumar, 2018 “General Science and Technology” Dhisha Publications, New Delhi.

#### **REFERENCE BOOK(S)**

1. Adrian Bejan ,2016 “The Physics of Life” St. Martin’s Press,New York.
2. Carlo Rovelli, 2016 ” Seven Brief Lessons on Physics” USA.
3. Charles J.Krebs, 2008,”Ecology” Pearson Education Press, International, USA.
4. Ellen A.Kelter, James E. Huheey, “Inorganic Chemistry” Fourth Edition, Pearson Education Press, USA.
5. Francesco de Bello, Carlos P Carmona, 2021, “Hand Book of Trait based Ecology” Cambridge University Press,UK.
6. Gesser.H.D 2001, Applied Chemistry”Springers Publications, USA.
7. Huge D Young, Roger A. Freeman 2017,”University Physics” 14<sup>th</sup> Edition, Pearson Education services, USA.
8. Hugh R slotten,2014 “ The Oxford Encyclopedia of Science , Medicine and Technology” Oxford University Press, London.
9. Jonathan Clayden, Nick Greeves, 2014 , “Organic Chemistry” Oxford University Press, London.
10. Mc Graw Hill Experts, 2012 “Encyclopedia of Science and technology” 11 th Edition, Mc Graw Hill Publications, USA.
11. Kirk-Othmer 2001 “Encyclopedia of Chemical Technology” Wiley Publications, USA.
12. Kerry Kuehn 2016, “A Students Guide ThroughThe Great Physics Texts Volume IV- Heat Atoms And Quanta” Springer, USA.
13. N.P.O.Green, 1997,”Biological Science” Cambridge University Press, London.
14. Pepperhoff Wand M Acet 2001 Constitution and Magnetism of Iron and its alloys, Springers, USA.
15. Richard Karban 2006, “How to Do Ecology” Princeton University Press, USA.

#### **E -RESOURCES**

1. <https://www.slideshare.net/aswathkolaron/scientific-temper-relation-between-science-and-religion>
2. <https://www.slideshare.net/hacerneto/tnpsc-study-materials-201516>
3. [https://www.slideshare.net/hussain\\_761/pesticides-2](https://www.slideshare.net/hussain_761/pesticides-2)
4. <https://www.slideshare.net/mahajandhanraj/natural-pesticide-Ins.ecticides>
5. <https://www.slideshare.net/jaboink/occupatinal-health-hazards>

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