



MANONMANIAM SUNDARANAR UNIVERISTY,
TIRUNELVELI-12

SYLLABUS

PG - COURSES – AFFILIATED COLLEGES

Course Structure for M.Sc. Zoology

(Choice Based Credit System)

(with effect from the academic year 2021-2022 onwards)



Semester-III				
Part	Subject Status	Subject Title	Subject Code	Credit
3	Core	Comparative Animal Physiology	ZZOM31	4
3	Core	Animal Biotechnology	ZZOM32	4
3	Core	Research Methodology	ZZOM33	4
3	Core	Microbiology	ZZOM34	4
3	Practical	Practical V	ZZOL31	2
3	Practical	Practical VI	ZZOL32	2



Total Marks: 100 Internal Exam: 25 marks + External Exam: 75 marks

A. Scheme for internal Assessment:

Maximum marks for written test: **15 marks**

3 internal tests, each of **1 hour** duration shall be conducted every semester.

To the average of the **best two** written examinations must be added the marks scored in. The **assignment** for 5 marks and Seminar for 5 marks

The break up for internal assessment shall be:

Written test- 15 marks; Assignment -5 marks; Seminar-5 Marks Total - 25 marks

B. Scheme of External Examination

3 hrs. examination at the end of the semester

A – Part : 1 mark question two - from each unit

B – Part : 5 marks question one - from each unit

C – Part : 8 marks question one - from each unit

➤ **Conversion of Marks into Grade Points and Letter Grades**

S.No.	Percentage of Marks	Letter Grade	Grade Point	Performance
1	90 - 100	O+	10	Outstanding
2	80 - 89	O	9	Excellent
3	70 - 79	A+	8	Very Good
4	60 - 69	A	7	Good
5	55 - 59	B+	6	Above Average
6	50 - 54	B	5	Pass
7	0 - 49	RA	-	ReAppear
8	Absent	AA	-	Absent

➤ **Cumulative Grade Point Average (CGPA)**

$$CGPA = \frac{\Sigma (GP \times C)}{\Sigma C}$$

- **GP** = Grade point, **C** = Credit
- CGPA is calculated only for Part-III courses
- CGPA for a semester is awarded on cumulative basis

➤ **Classification**

- First Class with Distinction : CGPA \geq 7.5*
- First Class : CGPA \geq 6.0
- Second Class : CGPA \geq 5.0 and $<$ 6.0
- Third Class : CGPA $<$ 5.0



COMPARATIVE ANIMAL PHYSIOLOGY

LEARNING OBJECTIVES (LOs)

The objectives of the course are to

- To understand the principles and facts of animal physiology.
- To emphasize on mammalian physiology and other vertebrate taxa.
- To deal with the diverse functions of the living organisms encompassing various physiological systems.

COURSE OUTCOMES (COs):

On successful completion of the course the student will be able to

CO1: assess the levels of adaptations, its mechanism, and physiological adaptations of different environments.

CO2: compare the physiological adaptations to stress, exercise, meditation, yoga and their effects.

CO3: evaluate the respiratory physiology in air, and water and its neural and chemical regulations.

CO4: Analyse the mechanism of excretion and their excretory products and the role of endocrine glands in various functions.

CO5: Compare the neural and muscular physiology and analyse the mechanism of muscular contraction.

Unit: I

Adaptation - Levels of adaptation - Mechanism of adaptation - Significance of body size - Adaptation, acclimation and acclimatization - Concepts of homeostasis. Physiological adaptations of different environments – Marine - Shores and Estuaries – Freshwater - Extreme aquatic environments - Terrestrial life - Extreme terrestrial environments - Parasitic habitats. Stress Physiology - Basic concept of environmental stress and strain; concept of elastic and plastic strain; stress resistance, stress avoidance and stress tolerance.

Unit: II

Endothermy and physiological mechanism of regulation of body temperature - Physiological adaptation to osmotic and ionic stress; mechanism of cell volume regulation - Osmoregulation in aquatic and terrestrial environments - Physiological response to oxygen deficient stress - Physiological response to body exercise - Meditation, Yoga and their effects.

Unit: III

Respiratory physiology - Respiration in air and water. Structure and function of the



respiratory Structures - Respiratory pigments – Transport of respiratory gases between the lungs and tissues - Dissociation curves – Neural and chemical regulation of respiration.

Unit: IV

Excretory physiology – Excretory organs – mechanism of excretion – physiology – adaptations of excretion to environment – Excretory products: synthesis and elimination. Endocrine glands – Feedback regulation – Pituitary – gonadal axis – Role of reproductive hormones – gamete formation; fertilization; embryonic development; parturition; lactation; neuroendocrine regulation.

Unit: V

Neural and muscular physiology – Neurons – action potential – nerve impulse transmission – neurotransmitters – mechanism of neural transmission – neurodegenerative diseases. Muscle contraction – theories – molecular mechanism of muscle contraction.

Suggested Reading Materials:

1. Eckert, R. *Animal Physiology: Mechanisms and Adaptations*. W.H. Freeman and Company, New York.
2. Hochachka, P.W. and Somero, G. N. *Biochemical Adaptation*. Princeton, New York.
3. Hoar, W.S. *General and Comparative Animal Physiology*, Prentice Hall of India.
4. Schiemdt Nielsen. *Animal Physiology: Adaptation and Environment*. Cambridge.
5. Strand, F.L. *Physiology: A regulation System Approach*. Macmillan Publishing Co., New York.
6. Pummer, L. *Practical Biochemistry*, Tata McGraw-Hill
7. Prosser, C.L. *Environmental and Metabolic Animal Physiology*. Wiley-Liss Inc., New York.
8. Wilson K. and Walker. J. *Practical Biochemistry*.
9. William S. Hoar. *General and Comparative Physiology*
10. E. L. Jordan and P. S. Verma, *Chordate Zoology*. S. Chand and Co., New Delhi.
11. C. D. Prosser and F. A. Brown *Comparative Animal Physiology*.
12. R. Nagabhushanam, M. S. Kodarkar and R. Sarojini. *Textbook of Animal Physiology*.
13. Kunt Schmidt – Nicolsen *Animal Physiology – Adaptation and Environment*, Cambridge University Press.
14. Gayton, A. C. and Hall, J. E., *A Textbook of Medical Physiology*, 9th Edn.,



15. Harcourt Brace and Company Asia Pvt. Ltd., W. B. Saunders Company.

Lab on Comparative animal physiology

1. Estimation of haemoglobin – Any method.
2. Determination of ESR – Demonstration
3. Detection of haemin crystals in blood.
4. Estimation of salt loss in fish.
5. Estimation of salt gain in fish.
6. Opercular activity of fish in relation to salinity
7. Opercular activity of fish in relation to temperature.
8. Qualitative analysis of excretory products in ammoniotelic, ureotelic and uricotelic animals.
9. ECG, EEG, Conditional reflex – Chart.

Cos cognitive level and mapping with POs and PSOs:

SEMESTER III																
CORE COURSE 3.1 COMPARATIVE ANIMAL PHYSIOLOGY																
CO	CONGNITIVE LEVEL	PO							PSO							
		1	2	3	4	5	6	7	1	2	3	4	5	6	7	8
CO1	K-1 Remember	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	K-2 Understand	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	K-3 Apply	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO4	K-4 Analyse	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO5	K-5 Evaluate	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO6	K-6 Create	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1)

ANIMAL BIOTECHNOLOGY

LEARNING OBJECTIVES (LOs)

The objectives of the course are to

- facilitate the method of conversion of natural raw materials into useful products by the application of living organism in the industrial process.
- conservation of resources via the recycling of waste material and the recovery of more valuable products.
- Diagnose diseases and apply therapeutics using biotechnology tools
- Deal with environmental pollution remedies using recombinant strains and bioethics of biotechnological products.



COURSE OUTCOMES (COs):

On successful completion of the course the student will be able to

CO1: Discuss the basic steps in gene cloning, hybridization and DNA sequencing techniques.

CO2: Evaluate human genome project, DNA sequencing, synthesis of oligonucleotides and gene transfer technology

CO3: Examine cell culture, organ culture, embryo culture and in vitro fertilization and embryo transfer.

CO4: Analyse fermentation, microbial products, protein engineering, and enzyme biotechnology.

CO5: Evaluate the microbial biomass production and genetically engineered microorganisms.

UNIT I: Genetic engineering

Gene cloning -the basic steps, types of restriction enzymes, ligases - linkers and adaptors, C DNA, selection of recombinants. Hybridization techniques, chemical synthesis of oligonucleotides, PCR and DNA sequencing techniques.

UNIT II: Gene cloning

Cloning and expression vectors, construction of chimeric DNA, nucleic acid probes, DNA libraries, polymerase chain reaction, molecular markers, DNA sequencing, synthesis of oligonucleotides. Human Genome Project. Gene transfer technology- Particle bombardment, micro injection techniques, electrophoresis, liposome fusion.

UNIT III: Microbial Biotechnology

Fermentation: Bioreactor. Microbial products: primary and secondary metabolites. Protein engineering. Bioremediation of hydrocarbons, industrial wastes and heavy metals. Single cell protein, biopolymers, bio pesticides and bio fertilizers. Xenobiotics, bio-leaching, bio-mining and bio-fuel. Enzyme biotechnology: Isolation and purification of enzymes, uses of enzymes in industries, immobilization of enzymes and their uses, Biosensors. Terminator and traitor technology. Intellectual Property Rights.

UNIT IV: Medical Biotechnology

Drug development: production of pharmaceuticals by genetically engineered cells (hormones, interferons), microbial transformation for production of important pharmaceutical (steroids and semi-synthetic antibiotics), drug design and targeting. Diagnostic kit development for micro analysis. Applications of biotechnology in medicine, Vaccines, diagnostics and forensics. Gene therapy – Pharmacogenomics.



Unit V:Industrial and Environmental Biotechnology:

Production of metabolites - Downstream processing and in situ recovery of products, microbial biotransformation, microbial biomass production (SCP). Bioremediation and phytoremediation - Genetically engineered microorganisms (GEMs) - treating oil spills, detection of pesticide in soil and their degradation, sequestering heavy metals. Biomining and Biofuels

Suggested reading materials:

1. Gupta P.K. (2009). Elements of Biotechnology. Meerut: Rastogi Publications.
2. Singh B.D. (2003). Biotechnology - Expanding Horizons. Chennai: Kalyani Publishers.
3. Satyanarayana V. (2004). Biotechnology. Kolkata: Books and Allied (P) Ltd.
4. Dubey R.C. (2006). A Text Book of Biotechnology, 4th Ed. New Delhi: S. Chand and Co. Ltd.,
5. Rema L.P. (2006). Applied Biotechnology. Chennai: MJP publishers.
6. Prakash S. Lohar, (2012). Biotechnology. Chennai: MJP publishers.
7. Satyanarayana, U. 2007. Biotechnology. Uppala author-publisher interlinks, Vijayawada, Andhra Pradesh, India.
8. Old, R.W and Primrose, S.B.1993.Principles of Gene manipulation: An introduction to Genetic Engineering. Blackwell Science Publication.
9. Ignacimuthu, S.2008. Biotechnology: An introduction, Narosa Publishing house, New Delhi.
10. Purohit, S.S.2008. Biotechnology. Student Edition, Jodhpur.

Lab on Biotechnology

1. Estimation of citric acid in citrus fruits
2. Preparation of wine - Demonstration
3. Preparation of bread - Demonstration
4. Preparation of yoghurt - Demonstration
5. Diagnosis of diseases using ELISA - Demonstration
6. Preparation of Vermicompost - Demonstration
7. Extraction of genomic DNA from bacteria - Demonstration
8. Southern and Northern blotting techniques –charts
9. Flow Charts - Bioreactor - Antibiotics production
10. Spotters:
pBR322, Lambda phage, Dolly, RAPD, Gene cloning, Stem cells

Cos cognitive level and mapping with POs and PSOs:

SEMESTER III																	
CORE PAPER X: 3.2 ANIMAL BIOTECHNOLOGY																	
CO	CONGNITIVE LEVEL	PO							PSO								
		1	2	3	4	5	6	7	1	2	3	4	5	6	7	8	
CO1	K-1 Remember	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	K-2 Understand	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	K-3 Apply	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO4	K-4 Analyse	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO5	K-5 Evaluate	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO6	K-6 Create	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1)

Research Methodology

LEARNING OBJECTIVES (Los):

The objectives of the course are enabling the student to

- understand the working principles, construction and applications of the instruments used in research related to Zoology.
- Know the general laboratory procedures and maintenance of research equipment.
- appreciate the importance, concept of research and learn the art of thesis, paper writing and publication.
- overview the concept of preparation of research proposal & funding agencies,

COURSE OUTCOMES (COs):

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

COs 1: Understand the objectives, types and importance of research. Formulate the parts of dissertation and develop report writing.

COs 2: Plan the methods of writing scientific paper and components of research paper. Realise the need of publication and know the importance of impact factor & citation index.

COs 3: Analyse the working principles of microscopy, pH meter and preparation of different buffers. Measure the pH of soil and different water samples

COs 4: Realise the need of centrifuges and their uses in research and can separate amino. Realise the principle and applications of gas liquid chromatography. acids and sugars using paper & thin layer chromatography

COs 5: Learn the principles and applications of electrophoresis, flame photometer, and bomb calorimeter. Estimate amino acids and sugars using spectroscopic techniques



Unit I: Research and Project writing Methods

Research- Definition, objectives, types and importance- Research process- Literature survey- sources- scientific databases- Research report writing- Parts of Thesis and Dissertation-Title, certificate, declaration, acknowledgements, contents- List of tables, figures, plates & abbreviations, Introduction, Review of literature, Materials and methods- Results- Presentation of data-Tables, figures, maps, graphs, photographs- Discussion-Summary, Bibliography/References and Appendix.

Unit II: Article Publication and Presentation

Writing scientific paper- Organization of scientific paper- Importance of title-abstract- key words, Introduction, Materials and Methods, Results, Discussion, Acknowledgements and References-Publication in research journals-Standards of Research journals- Peer- review- impact factor- citation index- plagiarism - Preparation of manuscript- Proof correction- proof correction marks- Method of correcting proof- Presentation in seminars and conferences- Writing chapters in books- Preparation of Research proposal and funding agencies – Research fellowships.

Unit III: Microscopy, pH and Buffer

Microscopy- General principles- Light, Phase contrast, Fluorescent, Electron, (SEM & TEM) and Confocal Microscope - Cytotechniques. pH basic principles and construction of pH meter- pH electrodes- Principles and application of buffers- Mechanism of buffer action and preparation of common buffers- Citrate, acetate, tris and phosphate- Application of buffers- pH measurements of soil and water.

Unit IV: Isolation, Fractionation and Separation

Isolation, fractionation and separation of cellular constituents- Isolation of mitochondria, and nucleic acids- Homogenization- Manual, mechanical and sonication - Centrifugation techniques- Basic principles, Different types of Centrifuges- Analytical and preparative- Chromatography- Paper, thin layer - separation of amino acids and sugars- Gas liquid chromatography - HPLC. Nuclear magnetic resonance (NMR) spectroscopy – X-ray fluorescence spectroscopy (XRF), Fourier Transform Infrared (FTIR) spectroscopy – characterization of nanoparticle.

Unit V: Electrophoresis, Colorimetry and Calorimeter

Electrophoresis- General Principles - Horizontal & Vertical gel electrophoresis, Iso electric focusing, 2D, pulse field and immune electrophoresis - Electrophoresis of proteins and nucleic acids- Spectroscopic techniques - Flame photometer, Bomb calorimeter - Principle and applications.



References

1. N. Gurumani 2016 Research Methodology for Biological Sciences. MJP Publishers, Chennai.
2. Biju Dharmapalan 2012 Scientific Research Methodology. Narosa Publishing House, New Delhi.
3. S.Palanichamy and M. Shunmugavelu 2009. Research methods in biological sciences. Palani paramount publications, Palani.
4. K. Kannan 2003 Hand book of Laboratory culture media, reagents, stains and buffers Panima publishing corporation, New Delhi.
5. Keith Wilson and John Walker 2002 practical biochemistry – Principles and techniques. Fifth edition. Cambridge Univ. Press.
6. P. Asokan 2002. Analytical biochemistry – Biochemical techniques. First edition – Chinnaa publications, Melvisharam, Vellore
7. Rodney Boyer, 2001. Modern Experimental Biochemistry. III Ed. Addison Wesley Longman Pte. Ltd, Indian Branch, Delhi, India.
8. Rodney Boyer, 2001. Modern Experimental Biochemistry. III Ed. Addison Wesley Longman Pvt. Ltd, Indian Branch, Delhi, India.
9. Wesley Longman Pvt. Ltd, Indian Branch, Delhi, India.
10. J. Jeyaraman 1981. Laboratory Manual in Biochemistry. New Age International publishers, New Delhi.

Lab on Research Methodology

1. Centrifuge – techniques, types.
2. Phase contrast microscope – principle
3. Micrometry – measurement of cells.
4. Colorimeter – Verification of Beer Lambert's law
5. Microtome techniques – staining procedure
6. Chromatography principle – paper, thin layer, column and gas chromatography
7. Electrophoresis (demonstration only) separation of nucleic acid and protein.
8. Separation of amino acids and sugars using paper chromatography
9. Separation of amino acids and sugars using thin layer chromatography
10. Estimation of Protein using VIS/ UV-VIS Spectrophotometer / colorimeter.
11. Estimation of sodium, potassium, calcium and magnesium using Flame photometer.

Cos cognitive level and mapping with POs and PSOs:

SEMESTER III COREXI: 3.3 RESEARCH METHODOLOGY																
CO	CONGNITIVE LEVEL	PO							PSO							
		1	2	3	4	5	6	7	1	2	3	4	5	6	7	8
CO1	K-1 Remember	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	K-2 Understand	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	K-3 Apply	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO4	K-4 Analyse	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO5	K-5 Evaluate	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO6	K-6 Create	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1)



Microbiology

LEARNING OBJECTIVES (Los):

The objectives of the course are to

- Promote interest in the basic and applied areas of Microbiology
- Deal with the classification of bacteria, algae, fungi, protozoa and viruses.
- Impart knowledge of role of microorganisms in industrial, food, medical and agricultural sectors.
- Emphasize the primary and secondary screening of microbes linked to fermentation industry.
- Focus on the medically important microbes, causative agents of diseases, symptoms and control measures

COURSE OUTCOMES (COs):

On successful completion of the course the student will be able to

CO1: Assess the classification of microorganisms, general properties and their structure and cultivation methods.

CO2: Analyse the bacterial morphology, nutritional requirements and culture techniques.

CO3: Evaluate the role of microbes in fermentation and microbial production of antibiotics, bio-fertilizers, insecticides etc.

CO4: Apply the microbial analysis of water purity, role of microbes in sewage treatment and biogas production and mining.

CO5: Examine various microbial pathogenesis and problems related to antibiotic resistance in man.

UNIT I

Evolution of Microorganisms & Microbiology: Members of the microbial world, Microbial evolution, Microbiology & its origin and microbiology today -Scope, history & development of Microbiology –Characterization, Classification(Haeckel, Whittaker and Carl Woese) and Identification of Microorganisms –Comparison of bacteria, archaea & eukarya – 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 - Bergey's manual of systematic bacteriology.

UNIT II:

Cultivation of microorganisms - Culture media: chemical and physical, functional types: supportive media (Transport), enriched media, selective media and differential



media. Isolation of pure cultures: streak, spread and pour plate methods - Methods of preservation and maintenance of cultures – principle and applications of lyophilizer
 Extracellular components: Capsule, slime layer, sheath, flagella and pili – Structure & Functions. Cell wall & Cell membrane: Archae bacteria, Gram positive & Gram negative – Structure & Functions. Intracellular membranes – Structure & functions. Growth curve, Auxenic, synchronous, asynchronous culture. Batch culture, fed batch & continuous culture: chemostat and turbidostat. Bacterial growth: Binary fission, Growth curve. Factors affecting growth: Physical, chemical and biological. Spore: endo and exospores. Endospore: structure, factors influencing sporulation,

UNIT III:

Etiology, transmission, pathogenesis, clinical manifestation, lab diagnosis, chemotherapy and prophylaxis of respiratory tract infections: upper respiratory tract infections (Streptococcal pharyngitis, *Corynebacterium diphtheriae*) and lower respiratory tract infections. (*Mycobacterium tuberculosis* and *Streptococcus pneumoniae*) – Urinary tract infections – Sexually transmitted infections. (*Treponema pallidum*, *Neisseria gonorrhoeae*) – Gastro intestinal infections (*Bacteri*-*Escherichiacoli*, *Salmonella sp*, *Shigella sp*, *Vibriosp*, Protozoan – *Entamoeba histolytica* – Viral-Rotaviruses). Studies on central nervous system infections (Bacterial: meningitis and tetanus) – Skin infections (Bacterial: Pyogenic Staphylococcal and Streptococcal) – Mycobacterial disease (leprosy) – Vector borne infections (Rickettsial infections) – Protozoa infections (Malaria) – Fungal infections (Dermatophytosis, Candidiasis) – Viral infections (Rabies, Poliomyelitis, Oncogenic viruses).

UNIT IV:

Rhizosphere effects – R/S ratio – Rhizoplane – Biofertilizers and role in agriculture – Bacteria (*Rhizobium*, *Azotobacter*, *Azospirillum* and *Phosphobacteria*). Algae (Blue green Algae) – and Fungi (VAM). Concept and scope of food microbiology – Food composition – Types and microorganisms in food materials. (Bacteria, Mold, and Yeasts) – Factors influencing microbial growth in food. Extrinsic and intrinsic factors. (Nutrient content, pH, buffering capacity, redox potential, relative humidity). Contamination and its sources. Spoilage of foods and its classification Principles of food preservation. (Temperature – Dehydration – Osmotic pressure – Chemicals – Radiation). Contamination, spoilage and preservation of Vegetables – Fruits – Seafood's – Meat – Milk and poultry products. Production of antibiotics (Penicillin, streptomycin). Vitamins (B12). Beverages (Beer, wine). Yeast (Baker's, brewer and food and feed yeast production). Immobilization: principle, types, significance and applications



LABORATORY MANUALS RECOMMENDED:

1. Cappuccino.J.C:7 and Sherman. N. (1996). Microbiology – Laboratory Manual. Benjamin Cummins, New York
2. Kannan. N. (1996). Laboratory manual in General Microbiology. PalanParamount Publication, Palani.
3. Gunasekharan. P. (1996). Laboratory manual in Microbiology, New Age International Ltd., Publishers, New Delhi.
4. Sundararaj, T. (2005). Microbiology – laboratory manual. (1st edition). Pubinj. Sunciararaj. T, Chennai
5. Jayaraman, J. (1985). Laboratory manual in Biochemistry. Wiley Eastern Ltd, New Delhi.
6. Plummer, D.T. (1998). An Introduction to practical Biochemistry. Tata Mc Graw Hill, New Delhi.
7. Palanivelu P. (2001). Analytical Biochemistry and Separation techniques – A Laboratory Manual.
8. Benson (2002). Microbiological applications – Laboratory Manual in General Microbiology. International edition. McGraw Hill Higher education.
9. Collins, C.R. and Lyne P.M. (1976). Microbiological methods (4th edition). Butterwoths, London.
10. Dubey, R.C. and Maheshwari, O.K., (2002). Practical Microbiology. S. Chandand Co Ltd., New Delhi.
11. Baron, E.J. and Finegold, S.M. (1995). Diagnostic Microbiology. Blackwell Scientific Press.
12. Davis, L., Dipner, M.O and Battey, J.F. (1986). Basic methods in Molecular Biology. Elseiver, Amsterdam
13. S.Rajan. (2012): Experimental Procedures in Life Sciences. Anjanaa Book House, Chennai 600107.

LAB ON MICROBIOLOGY

1. Laboratory precautions
2. Washing and cleaning of glassware
3. Hanging drop technique
4. Sterilization - principles and methods
 - a. Moist heat
 - b. Dry heat
 - c. Filtration
 - d. Fumigation
5. Counting cells/Spores of Microorganism
 - a) Haemocytometer
 - b) Ocular micrometer



- c) counting chamber
 - d) Serial dilution technique. Plating techniques – pour plate and spread plate
 - e) spectrophotometer method
6. Simple staining
 7. Negative staining
 8. Gram's staining
 9. Spore staining (Schaffer-Fulton method)
 10. Capsule staining
 11. Preparation of liquid, solid and semi-solid media
 12. Preparation of agar deeps, agar slants and agar plates
 13. Preparation of basal, enriched, selective and enrichment media
 14. Cultural characteristics of microorganisms
 15. Techniques of isolation of pure cultures – Streak plate method
 16. Fungal slide culture techniques
 17. Microbiological examination of milk*.
 - i) Methylene blue reduction test
 - ii) Rezaurin test
1. Whole cell Immobilization*.
 2. Fermentative production of ethyl alcohol by yeast*.
 3. Wine production – (DEMO)*.

Cos cognitive level and mapping with POs and PSOs:

SEMESTER III CORE XII: 3.4 MICROBIOLOGY																	
CO	CONGNITIVE LEVEL	PO							PSO								
		1	2	3	4	5	6	7	1	2	3	4	5	6	7	8	
CO1	K-1 Remember	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	K-2 Understand	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	K-3 Apply	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO4	K-4 Analyse	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	K-5 Evaluate	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO6	K-6 Create	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Strongly Correlated (3); Moderately Correlated (2); Weakly Correlated (1)

