

DEPARTMENT OF BIOSCIENCES
Veer Narmad South Gujarat University, Surat – 395 007.

Outline of Syllabus for Semester System (2011-12)
M.Sc.- Biosciences
Semester – III (Microbial Science)

Theory :

Paper	Subject	Credits
Bios-(M)-301	Advance taxonomy & cytology of microbes	4
Bios-(M)-302	Virology	4
Bios-(M)-303	Immunology	4
Bios-(M)-304	Bioprocess & Bioprocess engineering Principles	4

Practicals:

Bios-(M)-305 :	Practical Based on Bios. - (M)-301 Bios. - (M)-302 Bios. - (M)-303 Bios. - (M)-304	8
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Semester – IV (Microbial Science)

Theory :

Paper	Subject	Credits
Bios-(M)-401	Genetic Engineering & Bioinformatics	4
Bios-(M)-402	Enzyme Technology	4
Bios-(M)-403	Environmental Biotechnology	4
Bios-(M)-404	Microbial Biotechnology	4

Practicals:

Bios-(M)-405 :	Practical Based on Bios. - (M)-401 Bios. - (M)-402 Bios. -(M)-403 Bios. -(M)-404	8
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M.Sc. Semester - III (Microbiology)
Bios-(M)-301 - Advanced Taxonomy & Cytology Of Microbes

UNIT: I

- Nomenclature & classification of Bacteria, Fungi & Viruses
- A Phylogenetic backbone & taxonomic framework for procaryotic systematics
- Salient features of N₂ fixing bacteria, Archebacteria, Actinomycetes

UNIT: II

- Phylogenetic Vs. Phenetic classification, Numerical taxonomy, Polyphasic taxonomy
- Conventional and molecular techniques for identification of bacteria.

UNIT: III

- Method of Studying structure of Micro organism
- Ultra structure of a bacterial & a fungal cell
- Viroids & Prions

UNIT: IV

- Growth & reproduction in bacteria, fungi & Actinomycetes
- Life cycle of *S.cerevisiae*, *Penicillium* & *Aspergillus*

M.Sc. Semester - III (Microbiology)
Bios-(M)-302 – Virology

UNIT: I

- Basic virology
- Definition, Origin, Major Groups of viruses, structure.
- Viral Replication
- Expression
- Control of Gene Expression

UNIT: II

- Viral Infection
- Pathogenesis
- Innate & Adaptive Immune Response to viral infection
- Virus Evolution & Epidemiology

UNIT: III

- Purification of viruses
- Titration of Viruses
- Antiviral agents
- Immunization
- Diagnostic virology

UNIT: IV

- Bacterial Viruses: Lambda, Mu-1, T4, P1, P22
- Plant Viruses: TMV, Potato
- Animal Viruses: Picorna, Herpes, Retro,
Paramyro, Rotavirus
- Tumor Viruses
- New & Emergent Viruses

M.Sc. Semester - III (Microbiology)**Bios - (M) - 303 – Immunology****UNIT: I*****Recognition of Antigen***

- Innate & Adaptive Immunity.
- Structure of MHC, TCR, BCR.
- Antigen processing & presentation to T-cells.

UNIT: II***Maturation, Activation & Regulation of Lymphocytes***

- Structure & function of primary & secondary lymphoid organs.
- Production, development & activation of B-cells.
- Production, development & activation of T-cells.

UNIT: III***Effector Mechanism of Immune Response***

- Cytokines.
- Effector mechanism of Humoral immunity.
- Effector mechanism of cell-mediated immunity.

UNIT: IV

- Tumor Immunology.
- Transplantation Immunology.
- Autoimmunity & autoimmune diseases, Hypersensitivity.

M.Sc. Semester - III (Microbiology)
Bios -(M)-304 – Bioprocess & Bioprocess Engineering Principles

UNIT: I

- Screening of biotechnologically important microorganisms: Cultivable & non-cultivable microorganisms.
- Exploring conventional & non-conventional sources.
- Strain improvement: objectives & methods.

UNIT: II

- Media formulation & media optimization strategies.
- Raw material for fermentation media.
- Media & air sterilization.

UNIT: III

- Bioreactor design & components of CSTR.
- Types of bioreactor.
- Aeration & agitation, Heat transfer
- Measurement & Control of variables.
- Scale up.

UNIT: IV

- Strategies to recover & purify products.
- Separation of insoluble products.
- Cell disruption & separation of soluble products.

M.Sc. Semester - IV (Microbiology)
Bios-(M)-401 - Genetic Engineering & Bioinformatics

UNIT: I

- Genetic engineering techniques.
- Restriction endonucleases
- Cloning vectors.
- Transformation strategies.
- Creating & screening library.

UNIT : II

- DNA & protein sequencing
- PCR-Basic methodology & various forms of PCR.
- DNA mapping & finger printing.

UNIT: III

- Introduction to bioinformatics
- Biological databases.
- Pairwise & multiple sequence alignment.
- Gene prediction ,finding ORF.
- Phylogenetic analysis.

UNIT: IV

- Genomics & Transcriptomics
- Proteomics
- Metabolomics
- Interactomics.

M.Sc. Semester - IV (Microbiology)

Bios-(M)-402 - Enzyme Technology

UNIT – I : Enzyme Preparation

- Potential Sources of Enzymes
- Screening for novel Enzymes
- Media for enzyme production
- Extraction and large scale purification of Enzymes

UNIT – II : Immobilized Enzymes and Biosensors

- Preparation and properties of immobilized enzymes.
- Application of Immobilized enzymes: general principles.
- What are Biosensors?
- Calorimetric, Potentiometric, and Optical biosensors.
- Electrode Probes utilizing whole cells- Microbial of Tissue enzymes.
- Immuno electrode probes

UNIT – III : Large Scale/ Industrial Uses of Enzymes

- Use of enzymes in detergents.
- Enzymes in the fruit juices, wine, brewing and distilling industries.
- Use of proteases in the leather and wool industry.
- Applications of proteases, glucose oxidase and catalase in the food industry.
- Production of glucose syrup and syrups containing maltose.
- Use of enzymes in cellulose and starch hydrolysis.
- Use of lactases in the dairy industry.
- Medical applications of enzymes.

UNIT – IV : Recent advances and future prospects in Enzyme Technology

- Reactions and stabilization of enzymes in biphasic aqueous-organic systems.
- Equilibria and kinetics in biphasic aqueous-organic systems.
- Glycosidases used in synthetic reactions
- Interesterification of lipids.
- Synthesis of artificial enzymes- Enzyme engineering.
- Use of ‘unnatural’ substrates.
- Coenzyme-regenerating systems.
- Enzymes and Bioinformatics. • Coenzyme-regenerating systems.
- Enzymes and Bioinformatics.

REFERENCES:

1. Enzymes: Biochemistry, Biotechnology and Clinical Chemistry. Trevor Palmer, Horwood Publishing Chichester, England.
2. Enzymes and Immobilized Cells in Biotechnology. Allen I. Laskin, The Benjamin/Cummings Publishing Company, INC., California.
3. Fermentation Microbiology and Biotechnology. Mansi El-Mansi & Charlie Bryce, Taylor & Francis Ltd, London.
4. Industrial Biotechnology. S. N. Jogdand, Himalaya Publishing House, Mumbai.
5. Biotechnology. Keshav Trehan, New Age International Publishers, New Delhi.
6. Fundamentals of Enzymology: Nicholes C. Price and Lewis Stevens, Oxford Univ. Press.

M.Sc. Semester - IV (Microbiology)
Bios-(M)-403 – Environmental Biotechnology

UNIT : I

- Microbial diversity & its significance.
- Nucleic acid probes & their application in environmental Microbiology
- Emerging technologies: Bioreporters, Biosensors & Microprobes.

UNIT: II

- Industrial waste treatment.
- Lignocellulose & Hemicellulose biodegradation.
- Biodegradation of pesticides, PAH, Xenobiotic compounds
- Microbiology of metal mining industry

UNIT: III

- Rhizosphere Microbiology, PGPR
- Techniques for studying interaction of soil & plant associated bacteria.
- Phytoremediation
- Mycorrhizae.

UNIT: IV

- Biofertilizers & Biopesticides
- Biological warfare
- Siderophore: microbial production & it's importance
- Edible Mushroom

References:

1. Environmental Microbiology edited by Ralph Mitchell. A John Wiley and Sons. Inc.
2. Waste Water Microbiology 2nd Edition by Bitton.
3. Chemistry and Ecotoxicology of pollution. Edited by Des. W. Connell, G.J. Miller. Wiley Interscience Publications.
4. Environmental Biotechnology. Edited by C. F. Forster and D.A., John Wase. Ellis Horwood Ltd. Publication.
5. Advances in Waste Water Treatment Technologies. 1998. Volumes II and I by R. K. Trivedy. Global Science Publication.
6. Biocatalysis and Biodegradation: Microbial transformation of organic compounds. 2000. by Lawrence P. Wacekett, C. Douglas Hershberger. ASM Publications.
7. A Manual of Environmental Microbiology. 2nd Edition. 2001 by Christon J. Hurst (Chief Editor), ASM Publications.
8. Biodegradation and Bioremediation, Academic Press, San Diego.
9. Biotechnology in the sustainable environment, Plenum Press, N.Y.

M.Sc. Semester - IV (Microbiology)
Bios-(M)-404 – Microbial Biotechnology

UNIT: I

- Production of primary metabolites: Organic acids & amino acids
- Fermentative production of citric acid & amino acids.

UNIT: II

- Production of secondary metabolites: Antibiotics, Alkaloids
- Fermentative production of Penicillin & ergot alkaloids.

UNIT: III

- Fermentative production of ethanol, beer, wines.
- Microbial production of Xanthan gum.
- Microbiology & Biochemistry of cheese production.

Unit: IV

- SCP
- Single cell oil
- Biopolymers & Bioplastics
- Microbial flavours.