

**Syllabus
MICROBIOLOGY
(UG courses)
Admitted Batch 2008 -2009**



**May 2008
A.P. State Council of Higher Education**

SUBJECT COMMITTEE

1. Prof.Gopal Reddy, Osmania University, Hyderabad
2. Prof.G.Subbarangaiyah, Andhra University, Visakhapatnam
3. Prof.P.Sreenivasulu, S.V.University, Tirupati
4. Prof.S.Ram Reddy, Kakatiya University, Warangal
5. Prof.M.Vijayalakshmi, Acharya Nagarjuna University, Guntur
6. Prof.PBBN Charyulu, S.K. University, Anantapur
7. Mr.K.Vijayakumar, Jawahar Bharathi, Kavali
8. Dr.V.V.Ramana, Singareni Degree College, Kothagudem
9. Dr.G.Ramakrishna, Govt. Arts College, Anantapur
10. Mr.G.Sai Ramalinga Reddy, SSBN College, Anantapur
11. Prof.K.Venkateswarlu, S.K.University, Anantapur

Coordinator

CURRICULUM
B.Sc. Courses (Structure)

First year:

S.no.	Subject	Hrs per week
1.	English language including communication skills	6
2.	Second language	4
3.	Core1-I	4
4.	Core2-I	4
5.	Core3-I	4
6.	Core1-lab I	3
7.	Core2-lab I	3
8.	Core3-lab I	3
9.	Foundation course	3
10.	Computer skills	2
	Total	36

Second year:

S.no.	Subject	Hrs per week
1.	English language including communication skills	6
2.	Second language	4
3.	Core1-II	4
4.	Core2-II	4
5.	Core3-II	4
6.	Core1-lab II	3
7.	Core2-lab II	3
8.	Core3-lab II	3
9.	Environmental studies	4
10.	Computer skills	2
	Total	37

Third year:

S.no.	Subject	Hrs per week
1.	Core1-III	3
2.	Core1-IV	3
3.	Core2-III	3
4.	Core2-IV	3
5.	Core3-III	3
6.	Core3-IV	3
7.	Core1-lab III	3
8.	Core1-lab IV	3
9.	Core2-lab III	3
10.	Core2-lab IV	3
11.	Core3-lab III	3
12.	Core3-lab IV	3
13.	Foundation course	3
	Total	39

STRUCTURE OF MODEL CURRICULUM

MICROBIOLOGY

Year	Paper No. Theory/Lab	Title	Work load Hrs/Week	Exam Duration Hrs	Marks
I	I Theory	Introductory Microbiology	4 Hrs	3 Hrs	100
	I Lab	Introductory Microbiology	3 Hrs	3 Hrs	50
II	II Theory	Microbial physiology and Genetics	4 Hrs	3 Hrs	100
	II Lab	Microbial Physiology and Genetics	3 Hrs	3 Hrs	50
III	III Theory	Immunology and Medical Microbiology	3 Hrs	3 Hrs	100
	III Lab	Immunology and Medical Microbiology	3 Hrs	3 Hrs	50
	IV Theory	Applied Microbiology	3 Hrs	3 Hrs	100
	IV Lab	Applied Microbiology	3 Hrs	3 Hrs	50

Total number of hours for theory papers and labs in an academic year:

Theory Paper I :	120 Hrs	Lab I:	90 Hrs (30 sessions)
Theory Paper II :	120 Hrs	Lab II:	90 Hrs (30 sessions)
Theory Paper III :	90 Hrs	Lab III:	90 Hrs (30 sessions)
Theory Paper IV :	90 Hrs	Lab IV:	90 Hrs (30 sessions)

ANDHRA UNIVERSITY
MICROBIOLOGY SYLLABUS FOR THE
ADMITTED BATCH 2008-09

120 hrs
(4 hrs/ week)

I Year B.Sc.

Paper I: INTRODUCTORY MICROBIOLOGY

UNIT – I History of Microbiology and Microscopy 30Hrs

Meaning, definition and history of Microbiology.

Contributions of Antony von Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Iwanowsky, Beijerinck, Winogradsky and Alexander Fleming.

Importance and applications of Microbiology.

Principles of microscopy – bright field, dark field, phase-contrast, fluorescent and electron microscopy (SEM and TEM). Ocular and stage micrometers. Size determination of microorganisms.

Principles and types of stains - Simple stain, differential stain, negative stain, structural stains - spore, capsule, flagella. Hanging-drop method.

UNIT – II Microbiological Techniques 30 Hrs

Sterilization and disinfection techniques

Principles and methods of sterilization.

Physical methods - autoclave, hot-air oven, pressure cooker, laminar air flow, filter sterilization.

Radiation methods - UV rays, gamma rays, ultrasonic methods.

Chemical methods - Use of alcohols, aldehydes, fumigants, phenols, halogens and hypochlorites. Phenol coefficient.

Isolation of pure culture techniques - Enrichment culturing, dilution-plating, streak-plate, spread-plate and micromanipulator.

Preservation of microbial cultures - subculturing, overlaying cultures with mineral oils, lyophilization, sand cultures, storage at low temperature.

UNIT – III Biology of Prokaryotic and Eukaryotic Microorganisms 30 Hrs

Outline classification of living organisms: Heckel, Whittaker and Carl Woese systems.

Place of microorganisms in the living world.

Differentiation of prokaryotes and eukaryotes.

Prokaryotes - General characteristics of bacteria, archaebacteria, rickettsias, mycoplasmas, cyanobacteria and actinomycetes.

Outline classification for bacteria as per the second edition of Bergey's Manual of Systematic Bacteriology (up to order level).

Ultrastructure of a bacterial cell: Invariant components - cell wall, cell membrane, ribosomes, nucleoid. Variant components - Capsule, flagella, fimbriae, endospore and storage granules.

General characteristics and classification of viruses. Morphology and structure of TMV and HIV.

Structure and multiplication of lambda bacteriophage.

Eukaryotes - General characteristics and classification (up to the order level) of eukaryotic microorganisms - Protozoa, microalgae, molds and yeasts.

UNIT – IV Biomolecules 30 Hrs

Biomolecules of microorganisms.

Outline classification and general characteristics of carbohydrates (monosaccharides, disaccharides and polysaccharides).

General characteristics of amino acids and proteins.

Structure of nitrogenous bases, nucleotides, nucleic acids.

Fatty acids (saturated and unsaturated) and lipids (spingolipds, sterols and phospholipids).

Hydrogen ion concentration in biological fluids, pH measurement.

Types of buffers and their use in biological reactions.

Principle and application of colorimerty and chromatography (paper and thin-layer).

TEXT AND REFERENCE BOOKS:

Ram Reddy, S. and Reddy, S.M. (2007). **Essentials of Virology**. Scientific Publishers India, Jodhpur.

Reddy, S.M. (2003). **University Microbiology –I**. Galgotia Publications Pvt Ltd., New Delhi.

Dube, R.C. and Maheswari, D.K. (2000) **General Microbiology**. S Chand ,New Delhi.

Prescott, M.J., Harley, J.P. and Klein, D.A. (2002). **Microbiology**. 5th Edition, WCB Mc GrawHill, New York.

Madigan, M.T., Martinkl, J.M. and Parker, J. (2000). **Brock Biology of Microorganisms**, 9th Edition, MacMillan Press, England.

Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). **General Microbiology**, 5th Ed., Prentice Hall of India Pvt. Ltd., New Delhi.

Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (1993). **Microbiology**. 5th Edition, Tata Mc Graw Hill Publishing Co., Ltd., New Delhi.

- Rao, A.S. (1997). **Introduction to Microbiology**. Prentice-Hall of India Pvt Ltd., New Delhi.
- Black, J.G. (2005). **Microbiology: Principles and Explorations**, John Wiley, USA.
- Voet, D. and Voet, J.G. (1995) **Biochemistry**, Wiley, New York.
- Zubay, G. (1998). **Biochemistry** WCB. Mc GrawHill, Iowa.
- Alexopoulos, C.J., Mims, C.W. and Blackwell, M. (1996). **Introductory Mycology**, Wiley, New York.
- Moore – Landecker, E. (1996). **Fundamentals of Fungi**, Prentice-Hall, NJ, USA.
- Atlas, R.A. and Bartha, R. (2000). **Microbial Ecology – Fundamentals and Application**, Benjamin Cummings, New York.
- Frobisher, H., Hinsdill, R.D., Crabtree, K.T. and Goodhert, D.R. (2005). **Fundamentals of Microbiology**, Saunders and Company, London.
- Power, C.B. and Dagainawala, H.F. (1986). **General Microbiology** Vol I & II (2nd Edition), Himalaya Publishing House, Mumbai.
- Sullia, S.B. and Shantaram, S. (1998). **General Microbiology**, Oxford & IBH Publishing Pvt. Ltd., New Delhi.
- Dimmock, N.J., Easton, A.J. and Leppard, K.N. (2001). **Introduction to Modern Virology**, Blackwell Science Ltd, U.K.
- Webster, J. (1980). **Introduction to Fungi**, Cambridge University Press, Cambridge, England.
- Singh, R.P. (2007). **General Microbiology**. Kalyani Publishers, New Delhi.
- Talaro, K. and Talaro, A. (1996). **Foundations in Microbiology**. 2nd Edition. UMC Brown Publications.
- Tortora, G.J., Funke, B.R. and Case, C.L. (2004). **Microbiology: An Introduction**. Pearson Education, Singapore.
- Niclin, J. et al. (1999). **Instant Notes in Microbiology**. Viva Books Pvt. Ltd., New Delhi.

PRACTICAL PAPER – I**INTRODUCTORY MICROBIOLOGY****90 hrs**
(3 hrs/ week)

1. Precautions to work in Microbiology laboratory.
2. Preparation of culture media: Solid / Liquid.
3. Sterilization techniques: Autoclaving, hot-air oven and filtration.
4. Isolation of single colonies on solid media.
5. Enumeration of bacterial numbers by serial dilution and plating.
6. Light compound microscope and its handling.
7. Microscopic observation of bacteria (Gram +ve bacilli and cocci, Gram –ve bacilli), cyanobacteria (*Nostoc*, *Spirulina*), algae (*Scenedesmus* sp., diatoms), and fungi (*Saccharomyces*, *Rhizopus*, *Aspergillus*, *Penicillium*, *Fusarium*).
8. Calibrations of microscopic measurements (Ocular, stage micrometers).
9. Measuring dimensions of fungal spores
10. Simple and differential staining (Gram staining).
11. Spore staining, capsule staining and negative staining.
12. Diagrammatic or Electron photomicrographic observation of TMV, HIV, T4 phage and adenovirus

REFERENCE BOOKS FOR LAB:

- Gopal Reddy, M., Reddy, M.N., Saigopal, DVR and Mallaiah, K.V. (2007). **Laboratory Experiments in Microbiology**, 2nd edition. Himalaya Publishing House, Mumbai.
- Reddy, S.M. and Reddy S.R. (1998). **Microbiology – Practical Manual**, 3rd Edition, Sri Padmavathi Publications, Hyderabad.
- Aneja, K.R. (2001). **Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom Production Technology**, 3rd Edition, New Age International (P) Ltd, Publishers, New Delhi.
- Dubey, R.C. and Maheswari, D.K. (2006). **Practical Microbiology**, S. Chand & Co., New Delhi.
- Cappuccino, J.G. and Sherman, N. (2005). **Microbiology – A Laboratory Manual**. 7th Edition. Pearson Education. Published by Dorling Kindersley (India) Pvt. Ltd.
- Mahy, B.W.J. and Kangro, H.O. (1996). **Virology – Methods Manual**. Academic Press, USA.
- Burleson *et al.* (1992). **Virology – A Laboratory Manual**. Academic Press, USA
- Alcama, I.E. (2001). **Laboratory Fundamentals of Microbiology**. Jones and Bartlett Publishers, USA.
- Benson, J.H. (2005). **Microbiological Applications: Laboratory Manual in General Microbiology**. 7th Edition, McGraw Hill Publications, New York.

ANDHRA UNIVERSITY**II Year B.Sc. MICROBIOLOGY SYLLABUS 2009-10****120 hrs**
(4 hrs/ week)

Paper II: MICROBIAL PHYSIOLOGY AND GENETICS**UNIT – I Nutrition, Growth and Enzymes****30 Hrs**

Microbial nutrition - nutritional requirements and uptake of nutrients by cells. Nutritional groups of microorganisms - autotrophs, heterotrophs, mixotrophs, methylotrophs.

Growth media - synthetic, nonsynthetic, selective, enrichment and differential media.

Microbial growth - different phases of growth in batch cultures.

Factors influencing microbial growth.

Synchronous, continuous, biphasic growth.

Methods for measuring microbial growth – Direct microscopy, viable count estimates, turbidometry, biomass.

Enzymes - properties and classification, enzyme unit.

Biocatalysis - induced fit, and lock and key model, coenzymes, cofactors, factors affecting catalytic activity of enzymes.

Inhibition of enzyme activity - competitive, noncompetitive, uncompetitive and allosteric.

UNIT – II Intermediary Metabolism**30 Hrs**

Aerobic respiration - Glycolysis, HMP pathway, ED pathway, TCA cycle, electron transport, oxidative and substrate-level phosphorylation. Anaplerotic reactions. β -Oxidation of fatty acids.

Glyoxylate cycle. Anaerobic respiration (nitrate, sulphate respiration).

Fermentation - Common microbial fermentations with special reference to alcohol and lactic acid fermentations.

Photosynthetic apparatus in prokaryotes. Outlines of oxygenic and anoxygenic photosynthesis in bacteria.

UNIT – III Microbial Genetics**30 Hrs**

Fundamentals of genetics - Mendelian laws, alleles, crossing over, and linkage. DNA and RNA as genetic materials.

Structure of DNA – Watson and Crick model.

Extrachromosomal genetic elements – Plasmids and transposons.

Replication of DNA – Semiconservative mechanism.

Outlines of DNA damage and repair mechanisms.

Mutations – spontaneous and induced, base pair changes, frame shifts, deletions, inversions, tandem duplications, insertions.

Various physical and chemical mutagens.

Brief account on horizontal gene transfer among bacteria – transformation, transduction and conjugation.

UNIT – IV Gene Expression and Recombinant DNA Technology 30 Hrs

Concept of gene – Muton, recon and cistron. One gene-one enzyme, one gene-one polypeptide, one gene-one product hypotheses. one gene-

Types of RNA and their functions.

Outlines of RNA biosynthesis in prokaryotes.

Genetic code. Structure of ribosomes and a brief account of protein synthesis.

Types of genes – structural, constitutive, regulatory.

Operon concept. Regulation of gene expression in bacteria – *lac* operon.

Basic principles of genetic engineering - restriction endonucleases, polymerases and ligases, vectors. DNA

Outlines of gene cloning methods.

Genomic and cDNA libraries.

General account on application of genetic engineering in industry, agriculture and medicine.

TEXT AND REFERENCE BOOKS:

Gottschalk, G. (1986). **Bacterial Metabolism**, Springer-Verlag, New-York.

Caldwell, D.R. (1995). **Microbial Physiology and Metabolism**, W.C. Brown Publications, Iowa, USA.

Moat, A.G. and Foster, J.W. (1995). **Microbial Physiology**, John-Wiley, New York.

White, D. (1995). **The Physiology and Biochemistry of Prokaryotes**, Oxford University Press, New York.

Reddy, S.R. and Reddy, S.M. (2004). **Microbial Physiology**, Scientific Publishers, Jodhpur, India.

Reddy, S.M. and Reddy, S.R. (2005). **A Text Book of Microbiology Vol-II. Microbial Metabolism and Molecular Biology**. Himalaya Publishing House, Mumbai.

Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). **Principles of Biochemistry**, 2nd Edition, CBS Publishers and Distributors, New Delhi.

Elliot, W.H. and Elliot, D.C. (2001). **Biochemistry and Molecular Biology**, 2nd Edition, Oxford University Press, U.S.A.

Verma, P.S. and Agarwal, V.K. (2004). **Cell Biology, Genetics, Molecular Biology, Evolution and Ecology**. S. Chand & Co. Ltd., New Delhi.

- Freifelder, D. (1997). **Essentials of Molecular Biology**. Narosa Publishing House, New Delhi.
- Crueger, W. and Crueger, A. (2000). **Biotechnology: A Text Book of Industrial Microbiology**, Prentice-Hall of India Pvt. Ltd., New Delhi.
- Glick, B.P. and Pasternack, J. (1998). **Molecular Biotechnology**, ASM Press, Washington D.C., USA.
- Freifelder, D. (1990). **Microbial Genetics**. Narosa Publishing House, New Delhi.
- Strickberger, M.W. (1967). **Genetics**. Oxford & IBH, New Delhi.
- Sinnot E.W., L.C. Dunn and T. Dobzhansky. (1958). **Principles of Genetics**. 5th Edition. McGraw Hill, New York.
- Glazer, A.N. and Nikaido, H. (1995). **Microbial Biotechnology – Fundamentals of Applied Microbiology**, W.H. Freeman and company, New York.
- Old, R.W. and Primrose, S.B. (1994) **Principles of Gene Manipulation**, Blackwell Science Publication, New York.
- Smith, J.E. (1996). **Biotechnology**, Cambridge University Press.
- Snyder, L. and Champness, W. (1997). **Molecular Genetics of Bacteria**. ASM press, Washington, D.C., USA.
- Maloy, S.R., Cronan, J.E. and Freifelder, D. (1994). **Microbial Genetics**, Jones and Bartlett Publishers, London.
- Lewin, B. (2000). **Genes VIII**. Oxford University Press, England
- Turner, P.C., McLennan, A.G., Bates, A.D. and White, M.R.H. (1998). **Instant Notes in Molecular Biology**, Viva Books Pvt., Ltd., New Delhi.
- Twynan, R.M. (2003). **Advanced Molecular Biology**. Viva books Pvt. Ltd. New Delhi.
- Kannan, N. (2003). **Hand Book of Laboratory Culture Medias, Reagents, Stains and Buffers**. Panima Publishing Co., New Delhi.
- Nicholl, D.S.T. (2004). **An Introduction to Genetic Engineering**. 2nd Edition. Cambridge University Press, London.
- Ram Reddy, S., Venkateswarlu, K. and Krishna Reddy, V. (2007) **A text Book of Molecular Biotechnology**. Himalaya Publishers, Hyderabad.

PRACTICAL PAPER - II

MICROBIAL PHYSIOLOGY AND GENETICS

90 hrs
(3 hrs/ week)

1. Preparation of media for culturing autotrophic and heterotrophic microorganisms - Algal medium, mineral salts medium, nutrient agar medium, McConkey agar, and blood agar.
2. Enrichment culturing and isolation of phototrophs and chemoautotrophs.
3. Setting and observation of Winogradsky column.
4. Determination of viable count of bacteria.
5. Turbidometric measurement of bacterial growth.
6. Bacterial growth curve.
7. Factors affecting bacterial growth – pH, temperature, salts.
8. Qualitative analysis of sugars and amino acids.
9. Colorimetric estimation DNA by diphenylamine method.
10. Colorimetric estimation of proteins by Biuret/Lowry method
11. Paper chromatographic separation of sugars and amino acids
12. Starch hydrolysis, catalase test and sugar fermentation test.
13. Qualitative tests for sugars and amino acids.
14. Qualitative test and estimation of glucose.
15. Verification of Beer's law.
16. Problems related to DNA and RNA characteristics, Transcription and Translation.

REFERENCE BOOKS FOR LAB:

- Wilson, K. and Walker, J. (1994). **Practical Biochemistry**. 4th Edition, Cambridge University Press, England.
- Sawhney, S.K. and Singh, R. (2000). **Introductory Practical Biochemistry**, Narosa Publishing House, New Delhi.
- Dubey, R.C. and Maheswari, D.K. (2002). **Practical Microbiology**. S. Chand & Co. Ltd., New Delhi.
- Plummer, D.T. (1988). **An Introduction to Practical Biochemistry**. 3rd Edition, Tata Mc GrawHill, New Delhi.
- Reddy, S.M. and Reddy, S.R. (1998). **Microbiology – Practical Manual**, 3rd Edition, Sri Padmavathi Publications, Hyderabad.
- Jaya Babu (2006). **Practical Manual on Microbial Metabolisms and General Microbiology**. Kalyani Publishers, New Delhi.
- Sashidhara Rao, B. and Deshpande, V. (2007). **Experimental Biochemistry: A student Companion**. I.K. International Pvt. Ltd.

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III Year B.Sc. MICROBIOLOGY SYLLABUS 2010-11

Paper III: IMMUNOLOGY AND MEDICAL MICROBIOLOGY

90 hrs
(3 hrs/ week)

UNIT – I History of Immunology and Immune System 22 Hrs

Development of immunology.

Types of immunity – innate and acquired; active and passive; humoral and cell-mediated immunity.

Primary and secondary organs of immune system – thymus, bursa fabricus, bone marrow, spleen and lymph nodes.

Cells of immune system.

Identification and function of B and T lymphocytes, null cells, monocytes, macrophages, neutrophils, basophils and eosinophils.

UNIT – II Basics of Immunology 22 Hrs

Antigens – types, chemical nature, antigenic determinants, haptens.

Factors affecting antigenicity. Antibodies – basic structure, types, properties and functions of immunoglobulins.

Components of complement and activation of complement.

Types of antigen-antibody reactions – agglutination, blood groups, precipitation, neutralization, complement fixation.

Labeled antibody based techniques – ELISA, RIA and Immunofluorescence. Polyclonal and monoclonal antibodies – production and applications.

Types of hypersensitivity – immediate and delayed.

Autoimmunity and its significance.

UNIT – III Clinical Microbiology 23 Hrs

History of medical microbiology.

Normal flora of human body.

Definition of infection, non-specific defense mechanisms, mechanical barriers, antagonism of indigenous flora.

Anti-bacterial substances – lysozyme, complement, properdin, antiviral substances, phagocytosis.

General principles of diagnostic microbiology.

Collection, transport and processing of clinical samples.

General methods of laboratory diagnosis – cultural, biochemical, serological and molecular methods.

Tests for antimicrobial susceptibility.

Antiviral agents – interferon and base analogues.

Host-pathogen interactions. Bacterial toxins, virulence and attenuation.

UNIT – IV Microorganisms and Diseases

23 Hrs

Elements of chemotherapy – therapeutic drugs. Drug resistance.

Mode of action of penicillin and sulpha drugs, and their clinical use.

Preventive control of diseases – active and passive immunization.
natural and recombinant.

Vaccines –

General account of the following diseases – causal organisms, pathogenesis, epidemiology, diagnosis, prevention and control of:

Air-borne diseases	- Tuberculosis, Influenza
Food and water-borne diseases	- Cholera, Typhoid, Hepatitis- A Poliomyelitis, Amoebiasis
Insect-borne diseases	- Malaria, Filariasis, Dengue fever
Contact diseases	- Syphilis, Gonorrhoea
Zoonotic diseases	- Rabies, Anthrax
Blood-borne diseases	- Serum hepatitis, AIDS

General account of nosocomial infections.

TEXT AND REFERENCE BOOKS:

Reddy, S.R. and Reddy, K.R. (2006). **A Text Book of Microbiology - Immunology and Medical Microbiology**, Himalaya Publishing House, Mumbai.

Tizard, I.R. (1995). **Immunology : An Introduction**, WB Saunders, Philadelphia, USA.

Riott, I.M. (1998). **Essentials of Immunology**, ELBS and Black Well Scientific Publishers, England.

Goldsby, Kindt, T.J. and Osborne, B.A. (2004). **Kuby Immunology**, 6th Edition, W.H. Freeman and Company, New York.

Lydyard, P.M., Whelan, A. and Fanger, M.W. (2000). **Instant Notes in Immunology**, Viva Books Pvt. Ltd., New Delhi.

Chakraborty, B. (1998). **A Text Book of Microbiology**, New Central Book Agency (P) Ltd, Calcutta, India.

Ananthanarayana, R. and Panicker, C.K.S. (2000). **Text Book of Microbiology**, 6th Edition, Oriental Longman Publications, USA.

Gupte, S. (1995). **Short Text Book of Medical Microbiology**, 8th Edition, Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.

Annadurai, B. (2008). **A Textbook of Immunology and Immunotechnology**. S. Chand & Co. Ltd., New Delhi.

- Dey, N., T.K. and Sinha, D. (1999). **Medical Bacteriology Including Medical Mycology and AIDS**. New Central Book Agency (P) Ltd. Calcutta, India.
- Shetty, N. (1994). **Immunology – Introductory Textbook**. New Age International Pvt. Ltd., New Delhi.
- Singh, R.P. (2007). **Immunology and Medical Microbiology**. Kalyani Publishers, New Delhi.

PRACTICAL PAPER - III

IMMUNOLOGY AND MEDICAL MICROBIOLOGY

90 hrs
(3 hrs/ week)

1. Blood tests – TC, DC and ESR.
2. Estimation of blood haemoglobin.
3. Determination of blood groups and Rh typing.
4. Antigen-antibody interactions in Widal test, VDRL test, and Precipitation – Ouchterlony double diffusion test.
5. Acid-fast staining of mycobacteria (stained/permanent slides).
6. Isolation and identification of medically important bacteria (*E. coli*, *Klebsiella*, *Pseudomonas*, *Staphylococcus* and *Streptococcus*) by cultural, microscopic and biochemical tests.
7. Antibiotic sensitivity testing – disc diffusion method.
8. Parasites – Malarial parasite, *Entamoeba* (study of permanent slides).
9. Observation of fungal pathogen (*Candida*).
10. Tests for disinfectant (Phenol coefficient).

REFERENCE BOOKS FOR LAB:

- Gopal Reddy, M., Reddy, M.N., Saigopal, DVR and Mallaiah, K.V. (2007). **Laboratory Experiments in Microbiology**, 2nd edition. Himalaya Publishing House, Mumbai.
- Talwar, G.P. and Gupta, S.K. (1992). **A Hand Book of Practical and Clinical Immunology**. CBS Publications, New Delhi.
- Baren, E.J. (1994). **Bailey and Scott's Diagnostic Microbiology**, 9th Edition, Mosby Publishers.
- Dubey, R.C. and Maheswari, D.K. (2002). **Practical Microbiology**, S. Chand & Co., New Delhi.
- Samuel, K.M. (Ed.) (1989). **Notes on Clinical Lab Techniques**, M.K.G. Iyyer & Son Publishers, Chennai.
- Wadher, B.J. and Reddy, G.L.B. (1995). **Manual of Diagnostic Microbiology**, Himalaya Publishing House, Mumbai.
- Dey, N.C., Dey, T.K., Dey, M. and Sinha, D. (1998). **Practical Microbiology, Protozoology, and Parasitology**. New Central Book Agency (P) Ltd. Calcutta.
- Mukherjee, K.L. (1996). **Medical Laboratory Technology**. Vol II. Tata Mc GrawHill Publishing Co. Ltd., New Delhi.

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Paper IV: APPLIED MICROBIOLOGY SYLLABUS 2010-11

90 hrs
(3 hrs/ week)**UNIT - I Agricultural Microbiology****23 Hrs**

Physical and chemical characteristics of soil.

Rhizosphere and phyllosphere.

Plant growth-promoting microorganisms -mycorrhizae, rhizobia, *Azospirillum*, *Azotobacter*, cyanobacteria, *Frankia* and phosphate-solubilizing microorganisms. Outlines of biological nitrogen fixation (symbiotic, non-symbiotic).Biofertilizers - *Rhizobium*.

Concept of disease in plants.

Symptoms of plant diseases caused by fungi, bacteria, and viruses.

Plant diseases caused by fungi (groundnut rust), bacteria (angular leaf spot of cotton) and viruses (tomato leaf curl).

Principles of plant disease control.

Biological control of plant diseases. Biopesticides – *Bacillus thuringiensis*, Nuclear polyhedrosis virus (NPV), *Trichoderma*.**UNIT – II Environmental Microbiology****22 Hrs**

Microorganisms of environment (soil, water and air).

Role of microorganisms in nutrient cycling (carbon, nitrogen, sulphur).

Microbial interactions – mutualism, commensalism, antagonism, competition, parasitism, predation.

Microbiology of potable and polluted waters. *E. coli* and *Streptococcus faecalis* as indicators of water pollution. Sanitation of potable water.

Sewage treatment (primary, secondary and tertiary).

Outlines of biodegradation of environmental pollutants – pesticides. Solid waste disposal – sanitary land fills, composting.

Microbiology of air and air sampling methods.

UNIT – III Food Microbiology**23 Hrs**

Microorganisms of food spoilage and their sources.

Spoilage of different food materials - fruits, vegetables, meat, fish.

Canned foods. Food intoxication (botulism and staph poisoning), food-borne diseases (salmonellosis and shigellosis) and their detection.

General account of food preservation.

Microbiological production of fermented foods – bread, cheese, yogurt.

Biochemical activities of microbes in milk.

Microorganisms as food – SCP, edible mushrooms (white button, oyster and paddy straw)

Concept of probiotics.

UNIT – IV Industrial Microbiology

22 Hrs

Microorganisms of industrial importance – yeasts, moulds, bacteria, actinomycetes.

Screening and isolation of industrially-important microorganisms.

Outlines of strain improvement.

Types of fermentation – aerobic, anaerobic, batch, continuous, submerged, surface, solid state.

Design of a stirred tank reactor fermentor. Fermentation media.

Industrial production of alcohols (ethyl alcohol), beverages (beer), enzymes, (amylases), antibiotics (penicillin), amino acids (glutamic acid), organic acids (citric acid), vitamins (B12), biofuels (biogas - methane)

TEXT AND REFERENCE BOOKS:

Stanbury, P.F., Whitaker, A. and Hall, S.J. (1997). **Principles of Fermentation Technology**, Aditya Books (P) Ltd. New Delhi.

Doyle, M.P., Beuchat, L.R. and Montville, T.J. (1997). **Food Microbiology: Fundamentals and Frontiers**. ASM Press, Washington D.C., USA.

Frazier, W.C. and Westhoff, D.C. (1988). **Food Microbiology**, Mc Graw-Hill, New York.

Jay, J.M. (1996). **Modern Food Microbiology**, Chapman and Hall, New York.

Ray, B. (1996). **Fundamentals of Food Microbiology**, CRC Press, USA.

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- Adams, M.R. and Moss, M.O. (1996). **Food Microbiology**, New Age International (P) Ltd, New Delhi.
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- Cassida, L.E. (1968). **Industrial Microbiology**, Wiley Eastern Ltd. & New Age International Ltd., New Delhi.
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- Reed, G. (Ed.) (1987). **Prescott & Dunn's Industrial Microbiology**, 4th Edition, CBS Publishers & Distributors, New Delhi.
- Subba Rao, N.S. (1999). **Soil Microorganisms and Plant Growth**. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
- Reddy, S.R. and Singara Charya, M.A. (2007). **A Text Book of Microbiology - Applied Microbiology**. Himalaya Publishing House, Mumbai.
- Singh, R.P. (2007). **Applied Microbiology**. Kalyani Publishers, New Delhi.
- Demain, A.L. and Davies, J.E. (1999). **Manual of Industrial Microbiology and Biotechnology**, ASM Press, Washington, D.C., USA.

PRACTICAL PAPER - IV

APPLIED MICROBIOLOGY

90 hrs
(3 hrs/ week)

1. Isolation and enumeration of major groups of microorganisms from rhizosphere and nonrhizosphere.
2. Study of root nodules and isolation of *Rhizobium* from legume root nodules.
3. Isolation of *Azospirillum* / *Azotobacter*.
4. Staining and observation of vesicular-arbuscular mycorrhizal (VAM) fungi.
5. Observation of plant diseases of local importance – Rusts, smuts, powdery mildews, tikka disease of groundnut, citrus canker, bhendi yellow vein mosaic, tomato leaf curl, little leaf of brinjal.
6. Isolation of antagonistic microorganisms by crowded plate technique.
7. Isolation of microorganisms of air by Petri plate exposure method.
8. Determination of biological oxygen demand (BOD) of polluted water.
9. Microbial testing of water by coliform test (multiple tube fermentation method).
10. Determination of microbiological quality of milk – MBRT.
11. Observation of different spoiled foods.
12. Isolation of fungi and bacteria from spoiled fruits and vegetables.
13. Alcohol production and estimation; Calculation of fermentation efficiency.
14. Isolation of amylase-producing organisms.
15. Citric acid production and estimation.
16. Estimation of ascorbic acid from fruit juices.

REFERENCE BOOKS FOR LAB:

- Gopal Reddy, M., Reddy, M.N., Saigopal, DVR and Mallaiah, K.V. (2007). **Laboratory Experiments in Microbiology**, 2nd edition. Himalaya Publishing House, Mumbai.
- Reddy, S.M. and Reddy, S.R. (1998). **Microbiology – Practical Manual**, 3rd Edition, Sri Padmavathi Publications, Hyderabad
- Aneja, K.R. (2001). **Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom Production Technology**, 3rd Edition, New Age International (P) Ltd., New Delhi.
- Dubey, R.C. and Maheswari, D.K. (2002). **Practical Microbiology**, S. Chand & Co., New Delhi.
- Burns, R.G. and Slater, J.H. (1982). **Experimental Microbiology and Ecology**. Blackwell Scientific Publications, USA.
- Peppler, I.L. and Gerba, C.P. (2004). **Environmental Microbiology – A Laboratory Manual**. Academic Press. New York.
- Gupte, S. (1995). **Practical Microbiology**. Jaypee Brothers Medical Publishers Pvt. Ltd.
- Kannan, N. (2003). **Hand Book of Laboratory Culture Medias, Reagents, Stains and Buffers**. Panima Publishing Co., New Delhi.

B.Sc. Core (Optional) Subject: MICROBIOLOGY

Model Question Papers (Theory and Lab)

B.Sc. Core (Optional) Subject: MICROBIOLOGY

Model Question Paper (Theory)

Paper: I/II/III/IV

Time: 3 Hrs

Max. Marks: 100

Part – A

(TWO questions are to be set from each unit)

Answer ALL questions

Each question carries 5 marks

8 x 5 = 40 Marks

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

Part – B

(TWO questions are to be set from each unit)

Answer any FOUR questions

Each question carries 15 marks

4 x 15 = 60 Marks

9. a) or } to be set from Unit I
b)
10. a) or } to be set from Unit II
b)
11. a) or } to be set from Unit III
b)
12. a) or } to be set from Unit IV
b)

A.P. State Council of Higher Education Hyderabad

MODEL CURRICULUM

B.Sc. Core (Optional) Subject: MICROBIOLOGY

ALLOCATION OF HOURS TO EACH UNIT AND EACH SUBUNIT

A.P. State Council of Higher Education :: Hyderabad

B.Sc. Core (Optional) Subject: MICROBIOLOGY**COURSE PATTERN AND SCHEME OF INSTRUCTIONS AND EXAMINATION****(Medium of Instruction and Examination shall be only in English)**

Year	Paper No. Theory/Lab	Title	Work load Hrs/Week	Exam Duration Hrs	Marks
I	I Theory	Introductory Microbiology	4 Hrs	3 Hrs	100
	I Lab	Introductory Microbiology	3 Hrs	3 Hrs	50
II	II Theory	Microbial physiology and Genetics	4 Hrs	3 Hrs	100
	II Lab	Microbial Physiology and Genetics	3 Hrs	3 Hrs	50
III	III Theory	Immunology and Medical Microbiology	3 Hrs	3 Hrs	100
	III Lab	Immunology and Medical Microbiology	3 Hrs	3 Hrs	50
	IV Theory	Applied Microbiology	3 Hrs	3 Hrs	100
	IV Lab	Applied Microbiology	3 Hrs	3 Hrs	50

Total number of hours for theory papers and labs in an academic year:

Theory Paper I : 120 Hrs Lab I: 90 Hrs (30 sessions)

Theory Paper II : 120 Hrs Lab II: 90 Hrs (30 sessions)

Theory Paper III : 90 Hrs Lab III: 90 Hrs (30 sessions)

Theory Paper IV : 90 Hrs Lab IV: 90 Hrs (30 sessions)

I Year B.Sc.**Paper I: INTRODUCTORY MICROBIOLOGY**

UNIT – I	History of Microbiology and Microscopy	30Hrs
	Meaning, definition and history of Microbiology.	2 Hrs
	Contributions of Antony von Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Iwanowsky, Beijerinck, Winogradsky and Alexander Fleming. 10 Hrs	
	Importance and applications of Microbiology.	2 Hrs
	Principles of microscopy – bright field, dark field, phase-contrast, fluorescent and electron microscopy (SEM and TEM). Ocular and stage micrometers. 10 Hrs	
	Size determination of microorganisms.	2 Hrs
	Principles and types of stains - Simple stain, differential stain, negative stain, structural stains - spore, capsule, flagella. Hanging-drop method. 4 Hrs	
UNIT – II	Microbiological Techniques	30 Hrs
	Sterilization and disinfection techniques. Principles and methods of sterilization. 2 Hrs	
	Physical methods - autoclave, hot-air oven, pressure cooker, laminar air flow, filter sterilization. 5 Hrs	
	Radiation methods - UV rays, gamma rays, ultrasonic methods. 4 Hrs	
	Chemical methods - Use of alcohols, aldehydes, fumigants, phenols, halogens and hypochlorites. Phenol coefficient. 5 Hrs	
	Isolation of pure culture techniques - Enrichment culturing, dilution-plating, streak-plate, spread-plate and micromanipulator. 8 Hrs	
	Preservation of microbial cultures - subculturing, overlaying cultures with mineral oils, lyophilization, sand cultures, storage at low temperature. 6 Hrs	
UNIT – III	Biology of Prokaryotic and Eukaryotic Microorganisms	30 Hrs
	Outline classification of living organisms: Heckel, Whittaker and Carl Woese systems. 6 Hrs	
	Place of microorganisms in the living world. 2 Hrs	
	Differentiation of prokaryotes and eukaryotes. 1 Hr	
	Prokaryotes - General characteristics of bacteria, archaebacteria, mycoplasmas, cyanobacteria and actinomycetes. 6 Hrs	rickettsias,
	Outline classification for bacteria as per the second edition of Bergey's Systematic Bacteriology (up to section level). 2 Hrs	Manual of

Microbiology 26 of 40

Ultrastructure of a bacterial cell: Invariant components - cell wall, membrane, ribosomes, nucleoid. Variant components - Capsule, endospore and storage granules.	cell flagella, fimbriae, 6 Hrs
General characteristics and classification of viruses. Morphology and TMV and HIV.	structure of 2 Hrs
Structure and multiplication of lambda bacteriophage.	2 Hrs
Eukaryotes - General characteristics and classification (up to the order level) of eukaryotic microorganisms - Protozoa, microalgae, molds and yeasts.	3 Hrs
UNIT – IV Biomolecules	30 Hrs
Biomolecules of microorganisms.	1 Hr
Outline classification and general characteristics of carbohydrates (monosaccharides, disaccharides and polysaccharides).	5 Hrs
General characteristics of amino acids and proteins.	5 Hrs
Structure of nitrogenous bases, nucleotides, nucleic acids.	5 Hrs
Fatty acids (saturated and unsaturated) and lipids (spingolipds, sterols and phospholipids).	5 Hrs
Hydrogen ion concentration in biological fluids, pH measurement.	3 Hrs
Types of buffers and their use in biological reactions.	3 Hrs
Principle and application of colorimerty and chromatography (paper and thin-layer).	3 Hrs

TEXT AND REFERENCE BOOKS:

- Ram Reddy, S. and Reddy, S.M. (2007). **Essentials of Virology**. Scientific Publishers India, Jodhpur.
- Reddy, S.M. (2003). **University Microbiology –I**. Galgotia Publications New Delhi.
- Dube, R.C. and Maheswari, D.K. (2000) **General Microbiology**. S Chand ,New Delhi.
- Prescott, M.J., Harley, J.P. and Klein, D.A. (2002). **Microbiology**. 5th Edition, WCB Mc GrawHill, New York.
- Madigan, M.T., Martinkl, J.M. and Parker, J. (2000). **Brock Biology of Microorganisms**, 9th Edition, MacMillan Press, England.
- Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). **General Microbiology**, 5th Ed., Prentice Hall of India Pvt. Ltd., New Delhi.
- Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (1993). **Microbiology**. 5th Edition, Tata Mc Graw Hill Publishing Co., Ltd., New Delhi.
- Rao, A.S. (1997). **Introduction to Microbiology**. Prentice-Hall of India Pvt Ltd., Nerw Delhi.
- Black, J.G. (2005). **Microbiology: Principles and Explorations**, John Wiley, USA.

- Voet, D. and Voet, J.G. (1995) **Biochemistry**, Wiley, New York.
- Zubay, G. (1998). **Biochemistry** WCB. Mc GrawHill, Iowa.
- Alexopoulos, C.J., Mims, C.W. and Blackwell, M. (1996). **Introductory Mycology**, Wiley, New York.
- Moore – Landecker, E. (1996). **Fundamentals of Fungi**, Prentice-Hall, NJ, USA.
- Atlas, R.A. and Bartha, R. (2000). **Microbial Ecology – Fundamentals and Application**, Benjamin Cummings, New York.
- Frobisher, H., Hinsdil, R.D., Crabtree, K.T. and Goodhert, D.R. (2005). **Fundamentals of Microbiology**, Saunder and Company, London.
- Power, C.B. and Dagainawala, H.F. (1986). **General Microbiology** Vol I & II (2nd Edition), Himalaya Publishing House, Mumbai.
- Sullia, S.B. and Shantaram, S. (1998). **General Microbiology**, Oxford & IBH Publishing Pvt. Ltd., New Delhi.
- Dimmock, N.J., Easton, A.J. and Leppard, K.N. (2001). **Introduction to Modern Virology**, Blackwell Science Ltd, U.K.
- Webster, J. (1980). **Introduction to Fungi**, Cambridge University Press, Cambridge, England.
- Singh, R.P. (2007). **General Microbiology**. Kalyani Publishers, New Delhi.
- Talaro, K. and Talaro, A. (1996). **Foundations in Microbiology**. 2nd Edition. UMC Brown Publications.
- Tortora, G.J., Funke, B.R. and Case, C.L. (2004). **Microbiology: An Intoduction**. Pearson Education, Singapore.
- Niclin, J. et al. (1999). **Instant Notes in Microbiology**. Viva Books Pvt. Ltd., New Delhi.

LAB – I: INTRODUCTORY MICROBIOLOGY**90 Hrs**

1. Precautions to work in Microbiology laboratory.
2. Preparation of culture media: Solid / Liquid.
3. Sterilization techniques: Autoclaving, hot-air oven and filtration.
4. Isolation of single colonies on solid media.
5. Enumeration of bacterial numbers by serial dilution and plating.
6. Light compound microscope and its handling.
7. Microscopic observation of bacteria (Gram +ve bacilli and cocci, Gram –ve bacilli), cyanobacteria (*Nostoc*, *Spirulina*), algae (*Scenedesmus* sp., diatoms), and fungi (*Saccharomyces*, *Rhizopus*, *Aspergillus*, *Penicillium*, *Fusarium*).
8. Calibrations of microscopic measurements (Ocular, stage micrometers).
9. Measuring dimensions of fungal spores
10. Simple and differential staining (Gram staining).
11. Spore staining, capsule staining and negative staining.
12. Diagrammatic or Electron photomicrographic observation of TMV, HIV, T4 phage and adenovirus

REFERENCE BOOKS FOR LAB:

- Gopal Reddy, M., Reddy, M.N., Saigopal, DVR and Mallaiiah, K.V. (2007). **Laboratory Experiments in Microbiology**, 2nd edition. Himalaya Publishing House, Mumbai.
- Reddy, S.M. and Reddy S.R. (1998). **Microbiology – Practical Manual**, 3rd Edition, Sri Padmavathi Publications, Hyderabad.
- Aneja, K.R. (2001). **Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom Production Technology**, 3rd Edition, New Age International (P) Ltd, Publishers, New Delhi.
- Dubey, R.C. and Maheswari, D.K. (2006). **Practical Microbiology**, S. Chand & Co., New Delhi.
- Cappuccino, J.G. and Sherman, N. (2005). **Microbiology – A Laboratory Manual**. 7th Edition. Pearson Education. Published by Dorling Kindersley (India) Pvt. Ltd.
- Mahy, B.W.J. and Kangro, H.O. (1996). **Virology – Methods Manual**. Academic Press, USA.
- Burleson *et al.* (1992). **Virology – A Laboratory Manual**. Academic Press, USA
- Alcamo, I.E. (2001). **Laboratory Fundamentals of Microbiology**. Jones and Bartlett Publishers, USA.
- Benson, J.H. (2005). **Microbiological Applications: Laboratory Manual in General Microbiology**. 7th Edition, McGraw Hill Publications, New York.

II Year B.Sc.**Paper II: MICROBIAL PHYSIOLOGY AND GENETICS**

UNIT – I	Nutrition, Growth and Enzymes	30 Hrs
	Microbial nutrition - nutritional requirements and uptake of nutrients by cells. Nutritional groups of microorganisms - autotrophs, heterotrophs, mixotrophs, methylotrophs. 5 Hrs	
	Growth media - synthetic, nonsynthetic, selective, enrichment and differential media. Microbial growth - different phases of growth in batch cultures. 6 Hrs	
	Factors influencing microbial growth. 2 Hrs	
	Synchronous, continuous, biphasic growth. 3 Hrs	
	Methods for measuring microbial growth – Direct microscopy, viable count estimates, turbidometry, biomass. 4 Hrs	
	Enzymes - properties and classification, enzyme unit. 3 Hrs	
	Biocatalysis - induced fit, and lock and key model, coenzymes, cofactors, factors affecting catalytic activity of enzymes. 4 Hrs	
	Inhibition of enzyme activity - competitive, noncompetitive, uncompetitive and allosteric. 3 Hrs	
UNIT – II	Intermediary Metabolism	30 Hrs
	Aerobic respiration - Glycolysis, HMP pathway, ED pathway, TCA cycle, electron transport, oxidative and substrate-level phosphorylation. Anaplerotic reactions. β -Oxidation of fatty acids. 13 Hrs	
	Glyoxylate cycle. Anaerobic respiration (nitrate, sulphate respiration). 7 Hrs	
	Fermentation - Common microbial fermentations with special reference to alcohol and lactic acid fermentations. 5 Hrs	
	Photosynthetic apparatus in prokaryotes. Outlines of oxygenic and anoxygenic photosynthesis in bacteria. 5 Hrs	
UNIT – III	Microbial Genetics	30 Hrs
	Fundamentals of genetics - Mendelian laws, alleles, crossing over, and linkage. DNA and RNA as genetic materials. 8 Hrs	
	Structure of DNA – Watson and Crick model. 2 Hrs	
	Extrachromosomal genetic elements – Plasmids and transposons. 2 Hrs	
	Replication of DNA – Semiconservative mechanism. 3 Hrs	
	Outlines of DNA damage and repair mechanisms. 4 Hrs	

Mutations – spontaneous and induced, base pair changes, frame shifts, deletions, inversions, tandem duplications, insertions.	4 Hrs
Various physical and chemical mutagens.	2 Hrs
Brief account on horizontal gene transfer among bacteria – transformation, transduction and conjugation.	5 Hrs

UNIT – IV Gene Expression and Recombinant DNA Technology 30 Hrs

Concept of gene – Muton, recon and cistron. One gene-one enzyme, one gene-one polypeptide, one gene-one product hypotheses.	4 Hrs	one gene-
Types of RNA and their functions.		2 Hrs
Outlines of RNA biosynthesis in prokaryotes.		3 Hrs
Genetic code. Structure of ribosomes and a brief account of protein synthesis.		4 Hrs
Types of genes – structural, constitutive, regulatory.		2 Hrs
Operon concept. Regulation of gene expression in bacteria – <i>lac</i> operon.		3 Hrs
Basic principles of genetic engineering - restriction endonucleases, polymerases and ligases, vectors.	3 Hrs	DNA
Outlines of gene cloning methods.		2 Hrs
Genomic and cDNA libraries.		3 Hrs
General account on application of genetic engineering in industry, medicine.	4 Hrs	agriculture and

TEXT AND REFERENCE BOOKS:

- Gottschalk, G. (1986). **Bacterial Metabolism**, Springer-Verlag, New-York.
- Caldwell, D.R. (1995). **Microbial Physiology and Metabolism**, W.C. Brown Publications, Iowa, USA.
- Moat, A.G. and Foster, J.W. (1995). **Microbial Physiology**, John-Wiley, New York.
- White, D. (1995). **The Physiology and Biochemistry of Prokaryotes**, Oxford University Press, New York.
- Reddy, S.R. and Reddy, S.M. (2004). **Microbial Physiology**, Scientific Publishers, Jodhpur, India.
- Reddy, S.M. and Reddy, S.R. (2005). **A Text Book of Microbiology Vol-II. Microbial Metabolism and Molecular Biology**. Himalaya Publishing House, Mumbai.
- Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). **Principles of Biochemistry**, 2nd Edition, CBS Publishers and Distributors, New Delhi.

- Elliot, W.H. and Elliot, D.C. (2001). **Biochemistry and Molecular Biology**, 2nd Edition, Oxford University Press, U.S.A.
- Verma, P.S. and Agarwal, V.K. (2004). **Cell Biology, Genetics, Molecular Biology, Evolution and Ecology**. S. Chand & Co. Ltd., New Delhi.
- Freifelder, D. (1997). **Essentials of Molecular Biology**. Narosa Publishing House, New Delhi.
- Crueger, W. and Crueger, A. (2000). **Biotechnology: A Text Book of Industrial Microbiology**, Prentice-Hall of India Pvt. Ltd., New Delhi.
- Glick, B.P. and Pasternack, J. (1998). **Molecular Biotechnology**, ASM Press, Washington D.C., USA.
- Freifelder, D. (1990). **Microbial Genetics**. Narosa Publishing House, New Delhi.
- Strickberger, M.W. (1967). **Genetics**. Oxford & IBH, New Delhi.
- Sinnot E.W., L.C. Dunn and T. Dobzhansky. (1958). **Principles of Genetics**. 5th Edition. McGraw Hill, New York.
- Glazer, A.N. and Nikaido, H. (1995). **Microbial Biotechnology – Fundamentals of Applied Microbiology**, W.H. Freeman and company, New York.
- Old, R.W. and Primrose, S.B. (1994) **Principles of Gene Manipulation**, Blackwell Science Publication, New York.
- Smith, J.E. (1996). **Biotechnology**, Cambridge University Press.
- Snyder, L. and Champness, W. (1997). **Molecular Genetics of Bacteria**. ASM press, Washington, D.C., USA.
- Maloy, S.R., Cronan, J.E. and Freifelder, D. (1994). **Microbial Genetics**, Jones and Bartlett Publishers, London.
- Lewin, B. (2000). **Genes VIII**. Oxford University Press, England
- Turner, P.C., Mclennan, A.G., Bates, A.D. and White, M.R.H. (1998). **Instant Notes in Molecular Biology**, Viva Books Pvt., Ltd., New Delhi.
- Twynan, R.M. (2003). **Advanced Molecular Biology**. Viva books Pvt. Ltd. New Delhi.
- Kannan, N. (2003). **Hand Book of Laboratory Culture Medias, Reagents, Stains and Buffers**. Panima Publishing Co., New Delhi.
- Nicholl, D.S.T. (2004). **An Introduction to Genetic Engineering**. 2nd Edition. Cambridge University Press, London.
- Ram Reddy, S., Venkateshwarlu, K. and Krishna Reddy, V. (2007) **A text Book of Molecular Biotechnology**. Himalaya Publishers, Hyderabad.

LAB – II: MICROBIAL PHYSIOLOGY AND GENETICS**90 Hrs**

1. Preparation of media for culturing autotrophic and heterotrophic microorganisms - Algal medium, mineral salts medium, nutrient agar medium, McConkey agar, and blood agar.
2. Enrichment culturing and isolation of phototrophs and chemoautotrophs.
3. Setting and observation of Winogradsky column.
4. Determination of viable count of bacteria.
5. Turbidometric measurement of bacterial growth.
6. Bacterial growth curve.
7. Factors affecting bacterial growth – pH, temperature, salts.
8. Qualitative analysis of sugars and amino acids.
9. Colorimetric estimation DNA by diphenylamine method.
10. Colorimetric estimation of proteins by Biuret/Lowry method
11. Paper chromatographic separation of sugars and amino acids
12. Starch hydrolysis, catalase test and sugar fermentation test.
13. Qualitative tests for sugars and amino acids.
14. Qualitative test and estimation of glucose.
15. Verification of Beer's law.
16. Problems related to DNA and RNA characteristics, Transcription and Translation.

REFERENCE BOOKS FOR LAB:

- Wilson, K. and Walker, J. (1994). **Practical Biochemistry**. 4th Edition, Cambridge University Press, England.
- Sawhney, S.K. and Singh, R. (2000). **Introductory Practical Biochemistry**, Narosa Publishing House, New Delhi.
- Dubey, R.C. and Maheswari, D.K. (2002). **Practical Microbiology**. S. Chand & Co. Ltd., New Delhi.
- Plummer, D.T. (1988). **An Introduction to Practical Biochemistry**. 3rd Edition, Tata Mc GrawHill, New Delhi.
- Reddy, S.M. and Reddy, S.R. (1998). **Microbiology – Practical Manual**, 3rd Edition, Sri Padmavathi Publications, Hyderabad.
- Jaya Babu (2006). **Practical Manual on Microbial Metabolisms and General Microbiology**. Kalyani Publishers, New Delhi.
- Sashidhara Rao, B. and Deshpande, V. (2007). **Experimental Biochemistry: A student Companion**. I.K. International Pvt. Ltd.

III Year B.Sc.**Paper III: IMMUNOLOGY AND MEDICAL MICROBIOLOGY**

UNIT – I	History of Immunology and Immune System	22 Hrs
	Development of immunology.	2 Hrs
	Types of immunity – innate and acquired; active and passive; humoral and cell-mediated immunity.	6 Hrs
	Primary and secondary organs of immune system – thymus, bursa fabricus, bone marrow, spleen and lymph nodes.	6 Hrs
	Cells of immune system.	2 Hrs
	Identification and function of B and T lymphocytes, null cells, monocytes, macrophages, neutrophils, basophils and eosinophils.	6 Hrs
UNIT – II	Basics of Immunology	22 Hrs
	Antigens – types, chemical nature, antigenic determinants, haptens.	2 Hrs
	Factors affecting antigenicity.	1 Hr
	Antibodies – basic structure, types, properties and functions of immunoglobulins.	2 Hrs
	Components of complement and activation of complement.	2 Hrs
	Types of antigen-antibody reactions – agglutination, blood groups, neutralization, complement fixation.	4 Hrs
	Labeled antibody based techniques – ELISA, RIA and Immunofluorescence.	3 Hrs
	Polyclonal and monoclonal antibodies – production and applications.	3 Hrs
	Types of hypersensitivity – immediate and delayed.	3 Hrs
	Autoimmunity and its significance.	2 Hrs
UNIT – III	Clinical Microbiology	23 Hrs
	History of medical microbiology.	1 Hr
	Normal flora of human body.	2 Hrs
	Definition of infection, non-specific defense mechanisms, mechanical barriers, antagonism of indigenous flora.	3 Hrs
	Anti-bacterial substances – lysozyme, complement, properdin, antiviral substances, phagocytosis.	2 Hrs
	General principles of diagnostic microbiology.	1 Hr
	Collection, transport and processing of clinical samples.	3 Hrs
	General methods of laboratory diagnosis – cultural, biochemical, molecular methods.	5 Hrs
	Tests for antimicrobial susceptibility.	2 Hrs

- Dey, N., T.K. and Sinha, D. (1999). **Medical Bacteriology Including Medical Mycology and AIDS**. New Central Book Agency (P) Ltd. Calcutta, India.
- Shetty, N. (1994). **Immunology – Introductory Textbook**. New Age International Pvt. Ltd., New Delhi.
- Singh, R.P. (2007). **Immunology and Medical Microbiology**. Kalyani Publishers, New Delhi.

LAB – III: IMMUNOLOGY AND MEDICAL MICROBIOLOGY**90 Hrs**

1. Blood tests – TC, DC and ESR.
2. Estimation of blood haemoglobin.
3. Determination of blood groups and Rh typing.
4. Antigen-antibody interactions in Widal test, VDRL test, and Precipitation – Ouchterlony double diffusion test.
5. Acid-fast staining of mycobacteria (stained/permanent slides).
6. Isolation and identification of medically important bacteria (*E. coli*, *Klebsiella*, *Pseudomonas*, *Staphylococcus* and *Streptococcus*) by cultural, microscopic and biochemical tests.
7. Antibiotic sensitivity testing – disc diffusion method.
8. Parasites – Malarial parasite, *Entamoeba* (study of permanent slides).
9. Observation of fungal pathogen (*Candida*).
10. Tests for disinfectant (Phenol coefficient).

REFERENCE BOOKS FOR LAB:

- Gopal Reddy, M., Reddy, M.N., Saigopal, DVR and Mallaiiah, K.V. (2007). **Laboratory Experiments in Microbiology**, 2nd edition. Himalaya Publishing House, Mumbai.
- Talwar, G.P. and Gupta, S.K. (1992). **A Hand Book of Practical and Clinical Immunology**. CBS Publications, New Delhi.
- Baren, E.J. (1994). **Bailey and Scott's Diagnostic Microbiology**, 9th Edition, Mosby Publishers.
- Dubey, R.C. and Maheswari, D.K. (2002). **Practical Microbiology**, S. Chand & Co., New Delhi.
- Samuel, K.M. (Ed.) (1989). **Notes on Clinical Lab Techniques**, M.K.G. Iyyer & Son Publishers, Chennai.
- Wadher, B.J. and Reddy, G.L.B. (1995). **Manual of Diagnostic Microbiology**, Himalaya Publishing House, Mumbai.
- Dey, N.C., Dey, T.K., Dey, M. and Sinha, D. (1998). **Practical Microbiology, Protozoology, and Parasitology**. New Central Book Agency (P) Ltd. Calcutta.
- Mukherjee, K.L. (1996). **Medical Laboratory Technology**. Vol II. Tata Mc GrawHill Publishing Co. Ltd., New Delhi.

Paper IV: APPLIED MICROBIOLOGY

UNIT - I	Agricultural Microbiology	23 Hrs
	Physical and chemical characteristics of soil.	2 Hrs
	Rhizosphere and phyllosphere.	1 Hr
	Plant growth-promoting microorganisms -mycorrhizae, rhizobia, <i>Azospirillum</i> , <i>Azotobacter</i> , cyanobacteria, <i>Frankia</i> and phosphate-solubilizing microorganisms. Outlines of biological nitrogen fixation (symbiotic, non-symbiotic).	8 Hrs
	Biofertilizers - <i>Rhizobium</i> .	1 Hr
	Concept of disease in plants.	1 Hr
	Symptoms of plant diseases caused by fungi, bacteria, and viruses.	3 Hrs
	Plant diseases caused by fungi (groundnut rust), bacteria (angular leaf spot of cotton) and viruses (tomato leaf curl).	3 Hrs
	Principles of plant disease control.	2 Hrs
	Biological control of plant diseases. Biopesticides – <i>Bacillus thuringiensis</i> , polyhedrosis virus (NPV), <i>Trichoderma</i> .	2 Hrs Nuclear
UNIT – II	Environmental Microbiology	23 Hrs
	Microorganisms of environment (soil, water and air).	2 Hrs
	Role of microorganisms in nutrient cycling (carbon, nitrogen, sulphur).	4 Hrs
	Microbial interactions – mutualism, commensalism, antagonism, competition, parasitism, predation.	4 Hrs
	Microbiology of potable and polluted waters. <i>E. coli</i> and <i>Streptococcus faecalis</i> as indicators of water pollution. Sanitation of potable water.	5 Hrs
	Sewage treatment (primary, secondary and tertiary).	2 Hrs
	Outlines of biodegradation of environmental pollutants – pesticides.	2 Hrs
	Solid waste disposal – sanitary land fills, composting.	2 Hrs
	Microbiology of air and air sampling methods.	2 Hrs
UNIT – III	Food Microbiology	22 Hrs
	Microorganisms of food spoilage and their sources.	3 Hrs
	Spoilage of different food materials - fruits, vegetables, meat, fish.	3 Hrs
	Canned foods. Food intoxication (botulism and staph poisoning), diseases (salmonellosis and shigellosis) and their detection.	5 Hrs food-borne
	General account of food preservation.	2 Hrs
	Microbiological production of fermented foods – bread, cheese, yogurt.	3 Hrs
	Biochemical activities of microbes in milk.	2 Hrs

Microorganisms as food – SCP, edible mushrooms (white button, oyster and paddy straw). 2 Hrs

Concept of probiotics. 2 Hrs

UNIT – IV Industrial Microbiology 22 Hrs

Microorganisms of industrial importance – yeasts, moulds, bacteria, actinomycetes. 2 Hrs

Screening and isolation of industrially-important microorganisms. 3 Hrs

Outlines of strain improvement. 2 Hrs

Types of fermentation – aerobic, anaerobic, batch, continuous, submerged, surface, solid state. 4 Hrs

Design of a stirred tank reactor fermentor. Fermentation media. 3 Hrs

Industrial production of alcohols (ethyl alcohol), beverages (beer), enzymes (amylases), antibiotics (penicillin), amino acids (glutamic acid), organic acids (citric acid), vitamins (B12), biofuels (biogas - methane). 8 Hrs

TEXT AND REFERENCE BOOKS:

Stanbury, P.F., Whitaker, A. and Hall, S.J. (1997). **Principles of Fermentation Technology**, Aditya Books (P) Ltd. New Delhi.

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Subba Rao, N.S. (1993). **Biofertilizers in Agriculture and Forestry**, 3rd Edition Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

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Lynch, J.M. and Poole, N.J. (1979). **Microbial Ecology – A Conceptual Approach**, Blackwell Scientific Publications, USA

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- Reddy, S.R. and Singara Charya, M.A. (2007). **A Text Book of Microbiology - Applied Microbiology**. Himalaya Publishing House, Mumbai.
- Singh, R.P. (2007). **Applied Microbiology**. Kalyani Publishers, New Delhi.
- Demain, A.L. and Davies, J.E. (1999). **Manual of Industrial Microbiology and Biotechnology**, ASM Press, Washington, D.C., USA.

LAB - IV: APPLIED MICROBIOLOGY**90 Hrs**

2. Isolation and enumeration of major groups of microorganisms from rhizosphere and nonrhizosphere.
2. Study of root nodules and isolation of *Rhizobium* from legume root nodules.
3. Isolation of *Azospirillum* / *Azotobacter*.
4. Staining and observation of vesicular-arbuscular mycorrhizal (VAM) fungi.
5. Observation of plant diseases of local importance – Rusts, smuts, powdery mildews, tikka disease of groundnut, citrus canker, bhendi yellow vein mosaic, tomato leaf curl, little leaf of brinjal.
6. Isolation of antagonistic microorganisms by crowded plate technique.
7. Isolation of microorganisms of air by Petri plate exposure method.
8. Determination of biological oxygen demand (BOD) of polluted water.
9. Microbial testing of water by coliform test (multiple tube fermentation method).
10. Determination of microbiological quality of milk – MBRT.
11. Observation of different spoiled foods.
12. Isolation of fungi and bacteria from spoiled fruits and vegetables.
13. Alcohol production and estimation; Calculation of fermentation efficiency.
14. Isolation of amylase-producing organisms.
15. Citric acid production and estimation.
16. Estimation of ascorbic acid from fruit juices.

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- Gopal Reddy, M., Reddy, M.N., Saigopal, DVR and Mallaiiah, K.V. (2007). **Laboratory Experiments in Microbiology**, 2nd edition. Himalaya Publishing House, Mumbai.
- Reddy, S.M. and Reddy, S.R. (1998). **Microbiology – Practical Manual**, 3rd Edition, Sri Padmavathi Publications, Hyderabad
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