# 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.Subbarangaiah, 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

**120 hrs**
**(4 hrs/ week)**

## MICROBIOLOGY SYLLABUS FOR THE ADMITTED BATCH 2008-09

## 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., 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 Daginawala, 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.

*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: Autoclving, 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. Diagramatic 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

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.

## 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, turbiodometry, 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.

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, DNA polymerases and ligases, vectors.

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., Venkateshwarlu, 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.

# ANDHRA UNIVERSITY

## 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.

Identiification 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 Immunofluroscence. 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 medial 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. Vaccines – natural and recombinant.

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). **Imuunology – Introductory Textbook**. New Age International Pvt. Ltd., New Delhi.

Singh, R.P. (2007). **Immunology and Medical Microbiology**. Kalyani Publishers, New Delhi.

## *PRACTICAL PAPER - III*

**90 hrs**
**(3 hrs/ week)**

## IMMUNOLOGY AND MEDICAL MICROBIOLOGY

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.

## ANDHRA UNIVERSITY

## 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 poisioning), 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.

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

Rangaswami, G. and Bhagyaraj, D.J. (2001). **Agricultural Microbiology**, 2nd Edition, Prentice Hall of India, New Delhi.

Atlas, R.M. and Bartha, R. (1998). **Microbial Ecology - Fundamentals and Applications**, Addison Wesley Longman, Inc., USA

Paul, E.A. and Clark, F.E. (1989). **Soil Microbiology and Biochemistry,** Academic Press, USA.

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

Alexander, M. (1985). **Introduction to Soil Microbiology**, 3rd Edition. Wiley Eastern Ltd., New Delhi.

Adams, M.R. and Moss, M.O. (1996). **Food Microbiology**, New Age International (P) Ltd, New Delhi.

Banwart, G.J. (1987). **Basic Food Microbiology**, CBS Publishers and Distributors, New Delhi.

Patel, A.H. (1984). **Industrial Microbiology**, Mac Milan India Ltd., Hyderabad.

Cassida, L.E. (1968). **Industrial Microbilogy**, Wiley Eastern Ltd. & New Age International Ltd., New Delhi.

Crueger, W. and Crueger, A. (2000). **Biotechnology – A Text Book of Industrial Microbiology**, Panima Publishing Corporation, New Delhi

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 Manua**l. 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 b) } to be set from Unit I

10. a) or b) } to be set from Unit II

11. a) or b) } to be set from Unit III

12. a) or b) } to be set from Unit IV

# 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

## 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, rickettsias, mycoplasmas, cyanobacteria and actinomycetes. 6 Hrs

Outline classification for bacteria as per the second edition of Bergey's Manual of Systematic Bacteriology (up to section level). 2 Hrs

Ultrastructure of a bacterial cell: Invariant components - cell wall, cell membrane, ribosomes, nucleoid. Variant components - Capsule, flagella, fimbriae, endospore and storage granules. 6 Hrs

General characteristics and classification of viruses. Morphology and structure of TMV and HIV. 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 Daginawala, 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: Autoclving, 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. Diagramatic 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

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, turbiodometry, 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

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 – *lac* operon. 3 Hrs

Basic principles of genetic engineering - restriction endonucleases, DNA polymerases and ligases, vectors. 3 Hrs

Outlines of gene cloning methods. 2 Hrs

Genomic and cDNA libraries. 3 Hrs

General account on application of genetic engineering in industry, agriculture and medicine. 4 Hrs

**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

Identiification 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, precipitation, neutralization, complement fixation. 4 Hrs

Labeled antibody based techniques – ELISA, RIA and Immunofluroscence. 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 medial 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, serological and molecular methods. 5 Hrs

Tests for antimicrobial susceptibility. 2 Hrs

Antiviral agents – interferon and base analogues. 2 Hrs

Host-pathogen interactions. Bacterial toxins, virulence and attenuation. 2 Hrs

**UNIT – IV Microorganisms and Diseases 23 Hrs**

Elements of chemotherapy – therapeutic drugs. Drug resistance. 2 Hrs

Mode of action of penicillin and sulpha drugs, and their clinical use. 3 Hrs

Preventive control of diseases – active and passive immunization. 3 Hrs

Vaccines – natural and recombinant. 2 Hrs

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 | 12 Hrs |

General account of nosocomial infections. 1 Hr

**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). **Imuunology – 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 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.

## 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, *Azospirillum, Azotobacter,* cyanobacteria, *Frankia* and phosphate-solubilizing microorganisms. Outlines of biological nitrogen fixation (symbiotic, non-symbiotic). 8 Hrs

Biofertilizers - *Rhizobium*. 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 – *Bacillus thuringiensis,* Nuclear polyhedrosis virus (NPV), *Trichoderma*. 2 Hrs

**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. *E. coli* and *Streptococcus faecalis* 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 poisioning), food-borne diseases (salmonellosis and shigellosis) and their detection. 5 Hrs

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.

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.

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

Rangaswami, G. and Bhagyaraj, D.J. (2001). **Agricultural Microbiology**, 2nd Edition, Prentice Hall of India, New Delhi.

Atlas, R.M. and Bartha, R. (1998). **Microbial Ecology - Fundamentals and Applications**, Addison Wesley Longman, Inc., USA

Paul, E.A. and Clark, F.E. (1989). **Soil Microbiology and Biochemistry,** Academic Press, USA.

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

Alexander, M. (1985). **Introduction to Soil Microbiology**, 3rd Edition. Wiley Eastern Ltd., New Delhi.

Adams, M.R. and Moss, M.O. (1996). **Food Microbiology**, New Age International (P) Ltd, New Delhi.

Banwart, G.J. (1987). **Basic Food Microbiology**, CBS Publishers and Distributors, New Delhi.

Patel, A.H. (1984). **Industrial Microbiology**, Mac Milan India Ltd., Hyderabad.

Cassida, L.E. (1968). **Industrial Microbilogy**, Wiley Eastern Ltd. & New Age International Ltd., New Delhi.

Crueger, W. and Crueger, A. (2000). **Biotechnology – A Text Book of Industrial Microbiology**, Panima Publishing Corporation, New Delhi

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.

## 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.

**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 Manua**l. 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.