YOGI VEMANA UNIVERSITY, KADAPA

M.Sc. MICROBIOLOGY SYLLABUS CBCS PATTERN (w.e.f 2015-16)

SEMESTER-I

Paper	Title of the paper	Instruction hrs./week	Internal assessment Marks	Semester end marks	Total marks	Credits
MBT 101	General Microbiology	4	25	75	100	4
MBT 102	Bacteriology and Virology	4	25	75	100	4
MBT 103	Biological Chemistry	4	25	75	100	4
MBT 104	Biophysical and Analytical Techniques	4	25	75	100	4
MBP 101	General Microbiology, Bacteriology and Virology	8	-	100	100	4
MBP 102	Biological Chemistry and Biophysical and Analytical Techniques	8	-	100	100	4

SEMESTER-II

MBT 201	Microbial Physiology and Metabolism	4	25	75	100	4
MBT 202	Molecular Biology	4	25	75	100	4
MBT 203	Microbial Genetics	4	25	75	100	4
MBT 204	Biostatistics and Bioinformatics	4	25	75	100	4
MBP 201	Microbial Metabolism and Molecular biology	8	-	100	100	4
MBP 202	Microbial Genetics and Biostatistics and Bioinformatics	8	-	100	100	4
Non Core-I	Fundamentals of Microbiology	4	25	75	100	4

SEMESTER-III

MBT 301	Recombinant DNA Technology	4	25	75	100	4
MBT 302	Bio-processing Technology	4	25	75	100	4
MBT 303	Immunology	4	25	75	100	4
MBT 304	Medical and Diagnostic Microbiology	4	25	75	100	4
MBP 301	Recombinant DNA Technology and Bio process Technology	8	-	100	100	4
MBP 302	Immunology, Medical and Diagnostic Microbiology	8	-	100	100	4
Non Core-II	Microbial Technology and Entrepreneurship	4	25	75	100	4

SEMESTER-IV

MBT 401	Agricultural Microbiology	4	25	75	100	4
MBT 402	Environmental Microbiology	4	25	75	100	4
MBT 403	Food Microbiology	4	25	75	100	4
MBT 404	Industrial Microbiology	4	25	75	100	4
MBP 401	Agricultural Microbiology and Environmental Microbiology	8	-	100	100	4
MBP 402	Food Microbiology and Industrial Microbiology	8	-	100	100	4
	Total for Core Papers	**128**	**400**	**2000**	**2400**	**96**
	Total for Non-Core Papers	**8**	**50**	**150**	**200**	**8**
	Grand Total	**136**	**450**	**2150**	**2600**	**104**

SEMESTER – I

MBT 101: GENERAL MICROBIOLOGY

UNIT - I (16hrs)

History and scope of Microbiology: Discovery of Microorganisms, Theory of spontaneous generation, germ theory of diseases; Major contribution and events in the field of microbiology, importance of microorganisms in human welfare.
Study of microorganisms: Microscopy – principles and applications of light, phase– contrast, dark field, fluorescent, scanning and transmission electron microscopes. Confocal microscopy. Preparation of microbiological samples for microscopy–simple and differential staining, special and structural staining. Negative – contrast staining for virus samples.
Systematic position of the microorganisms in the living world:- Five kingdom classification, Carl Woes classification; taxonomy - nomenclature, taxonomic ranks, major characteristics used in identification and classification: morphological, physiological, ecological, genetic and molecular.

UNIT - II **(**14 hrs)

Structure and function of prokaryotic and eukaryotic cells. Physical and chemical approaches for sterilization and disinfection (control of Micro organisms by heat, radiation, pH, pressure, filters, chemical agents and safety precautions). Concepts of containment facility.

Microbiological media: Types of media – natural and synthetic media (basal, defined, complex, enrichment, selective, deferential and transport media).

UNIT - III (18 hrs)

Isolation, cultivation and enumeration of microorganism: Approaches for obtaining pure cultures form different samples,(enrichment, dilution plate, streak plate, spread plate and micromanipulator) cultivation of aerobic and anaerobic microorganisms continuous, batch, synchronous and stock cultures, enumeration and measurement of growth of microorganisms.

Methods of identification and characterization of microorganisms by staining techniques – simple, negative differential, capsular, spore, flagellar staining. Giemsa staining and AFB, (Acid Fast Bacilli), lactophenol mounts for fungi. Preparation of tissue for thin sectioning (fixation, dehydration, infiltration, embedding and sectioning). Maintenance and preservation of microbial cultures: (sub culturing technique, sterile soil or sand preservation, glycerol, deep freezing, liquid paraffin oil, drying and freeze drying).

UNIT – IV (16 hrs)

Introduction to Mycology: systematic position and classification of fungi.General characters, structure, reproduction, life cycles and economic importance of: Myxomycotina:- *Physarium*, *Plasmodiophora* Mastigomycotina:- *Synchytrium*, *Phytophthora*, *Albugo* Zygomycotina :- Mucor, Rhizopus, Pilobolus. Ascomycotina:- Yeast, *Aspergillus*, *Penicillium*, *Neurospora*,
Basidiomycotina:- *Punccinia*, *Ustilago*, *Agaricus.* Deoteromycotina: - *Alternaria*, *Fusarium*, *Colletotrichum*, *Trichoderma*

General ccount classification, structure, reproduction and Economic importance of algae (*Chlorella*, *Senedesmus*, *Geladiella*, *Gracellaria*, Nostoc and Anabena).

References:

1. Alexopoulus CJ and C W. Mims.(1993).Introductory Mycology(3rd edition).Wiley Eastern Ltd, NewDelhi.

2. Jefreery C Pommerville, 2011, Findamentals of Microbiology, Barlett Series

3. Bergys Manual of Determinative Bacteriology(9th Edition), Williams and Wilkins, Baltimore

4. Black, J.G. (2005). Microbiology: Principles and Explorations, John Wiley, USA

5. Dube R C and Maheswari D. K (2000) General Microbiology. S. Chand, New Delhi Mc Graw-Hill Publishing company Ltd, New Delhi.

6. Elizabeth Moore-Landecker. (1996). Fundamentals of the fungi. (4th edition).Prentice Hall International, Inc, London..

7. K. Talaro and A. Talaro (1996) Foundations in Microbiology 2nd ed. Wm. C. Brown Publ.

8. Madigan MT Martinkl. J.M and Parker J (2008). Brock Biology of Microorganisms. (9th edition). MacMillan Press, England.

9. Pelczar Jr, M.J. Chan, E.C.S. and Kreig, N.R. (1993). Microbiology, Mc. Graw Hill. Inc, New York

10. Prescott LM Harley JP and Klein DA (2007). Microbiology (7th edition) McGraw Hill, New York.

11. S.B. Sullia, Oxford (1999) General Microbiology, IBH Publishers

12. R.M. Atlas Wm. C. Brown (1997). Principles of Microbiology. 2nd ed. Publ.

13. Sullia, S.B. and Leaderberg J (1998). General Microbiology, Oxford & IBH Publishing Pvt. Ltd., New Delhi.

14. Schaechter M and Leaderberg J (2004). The Desk encyclopedia of Microbiology. Elseiver Academic press, California

15. Salle, A.J. (1996). Fundamental principles of Bacteriology.(7th edition).Tata McGraw-Hill publishing company Ltd, New Delhi.

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

17. Rami Reddy and SM Reddy (2005). A text book of Microbiology. Vol I and II.

MBT 102: BACTERIOLOGY AND VIROLOGY

UNIT – I (16hrs)

Morphological types- cell walls of archaeabacteria, Gram positive, Gram negative bacteria and L-forms, capsule types, composition and function, Cell membrane- structure, composition and properties.

Structure and function of flagella, cilia, pili, gas vesicles, chromosomes, carboxysomes, magnetosomes, phycobilisomes, nucleoids, spores and cell division. Reserve food materials- poly-β-hydroxybuterate, polyphosphate granules, cyanophycin granules and sulfur inclusions.

UNIT - II (12hrs)

Salient features and classification of bacteria as per the second edition of Bergey's Manual of Systematic Bacteriology.

Characteristics, classification and economic importance of major bacterial groups: *Enterobacteriae, Rickettsiae, Mycoplasma, Mycobacteria*, oxygenic and anoxygenic photosynthetic bacteria and actinomycetes (as per First edition of Bergey's manual).

UNIT- III (18hrs)

Brief outline on history and properties of viruses, chemical composition of viruses, morphology, architecture, principles of symmetry with reference to T4, TMV, Adeno, Polio and Influenza. Sub viral particles- satellite viruses, viroids, DI particles and prions.

Taxonomy of viruses: classification and nomenclature of viruses as per ICTV. General methods of detection, isolation, cultivation, characterization and assay / quantification of plant, animal and bacterial viruses.

UNIT - IV (18 hrs)

Life cycles of bacterial viruses; one step growth curve, lytic and lysogenic cycles with reference to T_4, λ and ϕ X 174. Importance of Phages.

Replication strategies of plant viruses (TMV, CaMV) and animal viruses (Adeno, Influenza, Herpes, SV 40, and Retro viruses). Transmission management of plant and animal viral diseases, interferon, antiviral drugs and vaccines.

References:

1. Alan J. Cann (1997). Principles of Molecular virology.(2nd edition).Academic press, California.

2. Bergey's Manual 2nd Ed. "Systemic Bacteriology" 2001-2005

3. Dimmock NJ, Primrose SB. (1994) Introduction to Modern Virology IV edition. Blackwell Scientific Publications, Oxford.

4. Flint, S.J., Enquist, L.W., Krung, R. Racaniello, VR. and Skalka, A.M. (2000). Principles of Virology ASM Press.

5. Roger Hull (2002). Mathews' Plant Virology. (4thEdition). Academic press- Harcourt Science and technology company, New York.

6. Ram Reddy S and Reddy SM (2007) essentials of Virology Scientific Publishers (India) Jodhpur.

7. W.D. Frost and E.F. Mc Camp Bell (2010). Text book of general Bacteriology, Bibliobazaars Publications.

8. J.K. Struthers and R.P. Westram 2000. Clinical Bacteriology. Mansion Publication Ltd.

9. William Henarl 2000. Bergey's Manual of dDeterminative Bacteriology. 9th Edition Lippincott Publications.

10. S.H. Gillespie and P.M. Hawkey 2006. Priciples and practice of Clinical Bacteriology. John Wiley.

MBT 103: BIOLOGICAL CHEMISTRY

UNIT – I

(16 hours)

Introductions of biomolecules: Classification of carbohydrates: outline, structure and properties of mono, di and oligosaccharides and their identification and analysis. Structure, occurrence and biological significance of polysaccharides (starch, cellulose, chitin, peptidoglycons).

Lipids- classification, physico chemical properties, separation, distribution, characterization and safonicification and iodine number. Nomenclature, outline, structure, properties and functions of glycerides, neutral lipids (waxes, fats and oils) phospholipids, spingophospholipids and glycolipids. Steroids- plantsterol, ergosterol, stigmosterol and cholesterol. Lipoproteins- classification composition and important features of bacterial lipids.

UNIT –II

(16 hours)

Amino acids and Proteins – Essential and non essential amino acids. Peptide bond, peptides of non protein origin (glutathione, tyrosedine, gramicidin, valinomycin), Acid – base properties of peptides, chemical properties and chemical synthesis of peptides. Proteins – classification, physico – chemical properties and biological functions of proteins. Structural organization. Ramachandran plot. Peptides and proteins sequencing, and evolution of proteins.

Nucleic acids: types and their composition, modified bases, nucleosides, nucleotides and polynucleotides; structure and properties of bases and functions of nucleotides; DNA and RNA, denaturation and renaturation of nucleic acids, factors influencing hybridization, cot values.

UNIT –III

(17 hrs)

Enzymes: Classification and nomenclature. Kinetics of enzyme catalyzed reaction – Michalis – Menten equation, Line weaver-Burk plot. Factors effecting enzyme activity (concentration, pH temperature, concentration of enzyme and substrates on rate of enzyme catalyzed reactions).

Enzyme functional groups. factors contributing to the catalytic efficiency, mechanism of action of lysozyme, chymotripsin and RNase. Regulatory enzymes, non covalently regulated enzymes allo – steric and covalently regulated enzymes, isozymes, ribozymes and abzymes.

UNIT -IV

(15hrs)

Principles of Bioenergetics, laws of thermo dynamics, enthalpy, entropy, concept of free energy, chemical equilibrium. Energetics of ATP and other high energy compounds. Oxidation and reduction reactions. Measurement of redox potentials, electron carriers in bacteria and mitochondria. Chemi–osmotic theory, biological energy transducers, respiration limited proton translocation and bioluminescence.

References:

1. Conn and Stump, Outlines of Biochemistry (5th edition)BRUENING & DOI.

2. Donald Voet and Judith G. Voet (1995). Biochemistry – Second Edition. John Willey and Sons, Inc.

3. Geofferey, L and Zubay (1998). Biochemsitry. (Fourth Edition) Wm. C. Brown Publishers.

4.Jeremy M. Berg. John L. Tymoczko and Lubert Stryer (2002). Biochemistry. (5th edition).W. H. Freeman and company, New York.

5. Lubert Stryer.(1995). Biochemistry.(4th edition). W.H. Freeman and company, New York.

6. Lehninger(2000)Prniciples of Biochemistry, 3rd edition, NELSON &COX (Worth) Publ.

7. Martin, Mayer and Roadwell Harper's Review of Biochemistry (2006).

9. Thomas M. Devlin. (2002). Textbook of Biochemistry with clinical correlations. (5th edition). A John Wiley and sons, Inc., publication, New York.

10. Trudy McKee and James R. McKee. (1999). Biochemistry-An Introduction. (2nd edition).WCB McGraw- Hill, U.S.A

11. U. Satyanarayana U.Chakrapani (2005) Biochemistry, 3rd Edition, Books and allied Publications.

MBT 104: BIOPHYSICAL AND ANALYTICAL TECHNIQUES

UNIT – I (14 hrs)

Buffers and measurement of pH, Ionization, Pka, Henderson-Hasselbalch equation, types of electrodes and biosensors. Viscosity and viscometer, Osmosis and Osmometer, Cell disruption methods-freezing and use of liquid N_2.

Concentration of Biomolecules: Salting out with ammonium sulfate, flash evaporation, lyophilization, dialysis, hallow fibre membranes, membrane filtration and their applications.

UNIT – II (18 hrs)

Centrifugation – Preparative, differential, isophycnic and equilibrium, Isodensity centrifugation. Analysis of sub Cellular fractions. Analytical and ultra centrifugation and its applications (Molecular weight determination, estimation of purity Detection of conformational change).

Chromatography – principles, methodology and applications of liquid – solid chromatography (Paper and TLC) and Gas – liquid chromatography, Ion – exchange, gel permeation, affinity chromatography. FPLC and HPLC.

UNIT –III (12hrs)

Spectroscopy - laws governing light absorption, principles, Instrumentation and biological applications of colorimetry, UV-VIS, Infrared (IR) Atomic absorption (AAS), electron Spin – resonance (ESR), NMR, and mass spectrometry. X-Ray crystallography. Circular Dichroism (CD) and Optical Rotary Dispersion (ORD).

UNIT – IV (20 hrs)

Electrophoresis - electrophoretic process. polyacrylamide gel electrophoresis and SDS-PAGE. Iso electric focusing (IEF), two – dimensional gel electrophoresis, determination of molecular weight, pulse field electrophoresis. Methodology and applications of Southern, Western and Northern blots.

Radio Isotopes - Half life, detection and measurement, GM counter, liquid scintillation counter, gama-ray counters, Cerenkov counting autoradiography and Quenching. Laboratory safety measures in handling isotopes and biological applications.

References:

1. Avinasu, Kakoli, Nirmalendu Nath, UPHADYAM, 4th relied ed. July 2011. Himalaya publishing house.

2. B.L. Williams and K. Wilson (Edward Arnold) A Biologists's guide to principles and Technuques of practical biochemistry, 2nd edition. Ed.

3. C.R. Cantor and P.R. Schimmel, W.H. Freeman & Co., NY., Biophysical Chemistry.

4. David Freifelder, (1982) Physical Biochemistry: Applications to Biochemistry and Molecular Biology, 2nd ed. H. Freeman and company.

5. David J. Holmes and Hazel peck. Analytical biochemistry Publ.

6. Drewer Pesec, AJ. And As worth, R.B. Experimental techniques in Biochemistry.

7. K. Wilson and J.Walker (1995) Practical Biochemistry: Principles and Techniques 4th ed. Cambridge University Press.

8. R.F. Boyer (1993) Modern Experimental Biochemistry. 2nd ed. The Benjamin Cummings Publ. Company.

9. S.K. Sawhney and Randhir singh (2000) Introduction to Practical Biochemistry (ed.) Narosa Publ. House.

10. S. Sadasivam and A. Manikam (1992) Biochemical Methods for Agricultural Sciences. Wiley Eastern Ltd.

MBP: 101 – General Microbiology and Bacteriology and Virology

1. Microbiological laboratory safety measures
2. Sterilization Methods
   a. Physical and chemical methods
   b. Phenol coefficient method (Redial-Walker test)
3. Preparation of different media for cultivation of bacteria and fungi
4. Plating techniques – streak plate, spread plate methods
5. Enumeration of Bacteria by serial dilution viable count
6. Isolation and enumeration of bacteria and fungi from soil
7. Isolation of bacteria from diseased plant leaf
8. Isolation of fungi from plant leaves and seeds
9. Slide culture technique
10. Hanging drop experiment for bacterial mobility
11. Study of morphological features of bacteria, fungi and algae
12. Microbiological staining techniques
    Simple, Gram, negative, spore, capsular, acid fast and Lacto phenol – cotton blue staining
13. Determination of thermal death point of Bacteria
14. Biochemical tests - IMVIC Tests; catalase; oxidase; coagulase, amylase, urease; gelatin hydrolysis; oxidation – fermentation tests; sugar fermentation; triple sugar iron test; H2S test.
15. Isolation of Bacteriophage from sewage water
16. Growth phases of phage and burst size one step growth curve
17. Cultivation of viruses in embryonated Eggs: different routes of inoculation
18. Sap transmission of a plant virus
19. Aphid transmission of a plant virus
20. Graft transmission of plant virus
21. Virus inclusion bodies (slides)

Suggested books/manuals.

1. Microbiological Applications: Laboratory Manual in General Microbiology, 7th ed. By J. Benson.
2. Microbiology: A Laboratory Manual. 4th edition. By J.G. Cappucciono and N. Sherman.
3. Experiments in Microbiology, Plant Pathology, Tissue culture and Mushroom cultivation. 3rd edition. By K.R. Aneja.
4. Practical Microbiology, 2002 by R.C. Dubey and D.K. Maheshwari.
5. Laboratory Manual in Microbiology, 2000. By P. Gunasekaran.
6. Laboratory Experiments in Microbiology by Johnson.
7. Laboratory Manual in Microbiology by Alcamo.
8. Virology – A Laboratory Manual, 1992. By Burleson, et al., Academic Press.
9. Virology Methods Manual, 1996. B.W.J. Mahy and H.O. Kangro. Academic press.
10. A Laboratioy Manual. By SM Reddy and S Rami Reddy. Scientific Publications (2005)

MBP: 102 – Biological Chemistry and Biophysical and Analytical Techniques

1. Qualitative tests for identification of Carbohydrates, amino acids, nucleic acids
2. Quantitative tests for Protein (Lowry and Bradford methods), glucose (DNS method), Glycine, bilirubin, cholesterol, Inorganic phosphorous.
3. Determination of activity of peroxidase and polyphenol oxidase from leaves/tubers/fruits
4. Purification and study of acid phosphatase from potato tubers: Extraction of enzyme; effect of substrate concentration; temperature; pH on enzyme activity.
5. Measurement of pH
6. Micrometry for cell size determination
7. Cell counting by Haemocytometer
8. Verification of Beer's Law
9. Determination of λ max for coloured solutions
10. Determination of DNA and RNA by UV spectrophotometry and DPA methods.
11. Determination of nucleic acid bases by UV spectrometry
12. Paper chromatography for separation of amino acids / pigments
13. TLC for separation of lipids / amino acids
14. Dialysis
15. SDS – PAGE for separation of proteins
16. Agarose gel electrophoresis for DNA separation
17. Isolation of chloroplasts by sucrose density gradient centrifugation
18. Ion – exchange column chromatography
20. Gel permeation column chromatography (demonstration).
21. Spun column chromatography (demonstration).
22. Separation and determination of concentration of green / yellow pigments by spectrophotometry

Suggested books/manuals.

1. Biochemical Methods per Agricultural Sciences, 1992. By S. Sadasivam and A. Manikam
2. Practical Biochemistry: Principles and Techniques 1995, 4th ed. By K. Wilson and J. Walker, Cambridge University Press.
3. Modern Experimental Biochemistry. 1993. 2nd ed. By R.F. Boyer. The Benjamin Cummings Publ. Company.
4. Physical Biochemistry: Applications to Biochemistry and Molecular Biology, 1982, 2nd ed. By David Freifelder. W.H. Freeman and Company.
5. Introduction to Practical Biochemistry. 2000. by S.K. Sawhney and Randhir Singh (eds.) Narosa Publ. House.
6. An introduction to Practical Biochemistry, 1987. D.T. Plumber.
7. Laboratory Manual in Biochemistry, 1996. By J.Jayaraman.
8. Florence C. Barseson, Thomas M. Chanders Danny. Wild Brank – Practical Virology.
9. Manual of Biochemistry Deshpande and Shashidhar Rao I K International Publishers.

SEMESTER – II

MBT 201: MICROBIAL PHYSIOLOGY AND METABOLISM

UNIT – I (12 hrs)

Microbial nutrition- classification of microorganisms based on carbon, energy and electron sources. Major and minor nutritional elements and growth factors.

Chemotrophism - sulphur, ammonia, nitrite, iron, hydrogen, carbon monoxide oxidizers and their importance, Chemoheterotrophism - Acetogens, methanogens, methanogenesis and its importance.

UNIT – II (12hrs)

Phototrophism - Oxygenic and anoxygenic photosynthetic organisms. Photosynthetic pigments, photochemistry of PSI and PSII. Modes of CO_2 fixation (Calvin cycle, reductive acetyl CoA pathway, HP pathway). Halobacterial photosynthesis. Anaplerotic reactions.

Carbohydrate metabolism – EMP, ED, HMP and phosphoketolase pathway in microorganisms. Gluconeogenesis and its significance.

UNIT – III (20hrs)

Aerobic respiration: TCA cycle- intracellular location and reactions, amphibolic nature, Glyoxalate cycle. Mechanisms of substrate–level phosphorylation. Respiratory electron transport in mitochondria and bacteria. Mechanism of oxidative phosphorylation, uncouplers and inhibitors.

Anaerobic respiration: sulphate and nitrate respiration and their ecological significance. Fermentation: alcoholic, lactate, propionate, mixed acid butyrate and butanol fermentations and their industrial importance. Concepts of primary and secondary metabolism. Biosynthesis of secondary metabolites with special reference to penicillin and polyketides.

UNIT – IV (22 hrs)

Lipid metabolism – Biosynthesis of glycerol's phospholipids and glycolipids oxidation of saturated and unsaturated fatty acids. Protein metabolism – Assimilation of inorganic nitrogen and sulphur, biosynthetic pathways of amino acids and their regulation with emphasis on tryptophane and histidine. Catabolism of amino acids (transamination, decarboxylation, deamination). Degradation of proteins-proteases, exo-endo peptidases.

Nucleotide metabolism – Biosynthesis of purine and pyrimidines, nucleotide-salvage and de novo pathways. Biosynthesis of deoxy ribonucleotides and regulation.

References:

1. Arora D.K and Seema Gupta, (1996). Bacterial Physiology. Anmol Publications. New Delhi.

2. Caldwell, D.R. (1995). Microbial Physiology and metabolism, Wm. C. Brown Publishers, USA

3. Lansing M. Prescott, John P. Harley and Donald A. Klein. (2007). Microbiology. (5^{th} edition). McGraw-Hill company, New York

4. Larry McKane and Judy Kandel. (1996). Microbiology-Essentials and applications.(2nd edition).McGraw Hill, Inc., Newyork..

5. Lubert Stryer. (1995). Biochemistry. (4^{th} edition). W.H. Freeman and company, New York.

6. Moat, A.G. and Foster, J.W. (1988). Microbial Physiology (Second Edition). John Wiley & Sons, New York.

7. S. Ram Reddy and S.M. Reddy (+92006) Microbial Physiology, Scientific publications (India) Jodhpur
.
8. Voet D and Voet J.G. (1995). Biochemistry. 2^{nd} ed. John Wiley and Sons.

9. White, D. (1995). The physiology and biochemistry of Prokaryotes, Oxford University Press, Oxford, New York.

10. Zubay, G. (1998). Biochemistry WCB. Mc Graw – Hill, Iowa.

11. Lehninger, Nelson and Cox Principles of Biochemistry, 3^{rd} Edition.

12. Gotchak. – Bacterial metabolism.

MBT 202: MOLECULAR BIOLOGY

UNIT – I (20hrs)

Chromosome organization in Prokaryotes and eukaryotes.

Modes of DNA replication, (semi conservative, rolling circle, unidirectional and bidirectional). DNA synthesis by reverse transcription, Inhibitors of DNA replication.
DNA damage and repair mechanisms (methyl directed mismatch repair, short patch repair). excision repair, recombination repair, SOS system.

UNIT – II (15hrs)

Transcription - Structural features of rRNA, tRNA and mRNA and their Functions. General principles, basic apparatus of transcription. RNA polymerases, mechanism, promoters, enhancers and other regulatory sequences, inhibitors of transcription.

Post-transcriptional modifications- Transcriptional attenuation, cutting and trimming of rRNA, mRNA modification (capping, polyadenylation and splicing),cutting and modification of tRNA, catalytic RNA, group I and group II intron splicing and RNase P.

UNIT – III (15hrs)

Translation: Basic features of genetic code, Wobble concept, prokaryotic and eukaryotic ribosomes, RNA pol. I, II and III. Initiation, elongation and termination factors. inhibitors of protein synthesis.

Post translational modifications: Protein folding, structural analysis, signal hypothesis, protein targeting and *in vitro* transcription and translation systems.

UNIT – IV (20hrs)

Regulation of gene expression – Operon concept, regulatory elements of operon – inducers, apo-repressors and co – repressors. Genetic evidence for positive and negative regulation. Catabolite repression. structure, function and regulation of *lac*, *trp* and *ara* operons. Global regulatory responses- heat shock response, stringent response, SOS response and regulation by small molecules such as ppGPP, pppGPP and cAMP.

Eukaryotic translational control – translation control by gene, inhibitory RNA (RNAi), Antisense, RNA. Hormone and Environmental factors affecting gene expression. Coordinate regulation of unlinked genes (Britten – Davidson model).

References:

1. Baumberg, S ed. (1999): Prokaryotic Gene Expression, Oxford, United Kingdom, Oxford University Press.

2. Brock T.D (1990): The Emergence of Bacterial Genetics, Cold Spring Harbor, New York.

3. Burrel, M.M. (1993). Enzymes of Molecular Biology, Humana Press.

4. Brown, T.A. (1995). Gene Cloning. An introduction 3rd edition. Chapman and Hall.

5. Brown T.A. (1999): Genomes, BIOs Scientific Publishers Oxford.

6. Gardener EJ, Simmons M.J. and Snustad D.P. (2001): principles of Genetics, 8th Edi. John Wiley & Sons, Inc

7. Griffith AJF Gelbart W.M. Lewontin, RC and Miller JH (2002): Modern Genetic Analysis 2nd Edi. W.H. Freeman, New York.

8. Lewin, B. (2004): Genes VIII. Oxford University Press, Oxford.

9. Lodish, H. Biology, 4th ed. Scientific American Books, W.H. Freeman, New York.

10. Maloy S.R. Cronan J.E., (Jr) and Freifelder D (1994): Microbial genetics, Jones and Bartlett Publishers.

11. Molecular Biology of cell. Albert et al 4th Edition Garland Publishing Inc.

12. Macinski, G.M. and Freifelder, D. (1998). Essentials of Molecular Biology, 3rd Edition, John and Bartlett Publishers.

13. Nelson DL and Cox MM (2000): Lehninger Principles of Biochemistry, 3rd ed. Worth Publishing, New York.

14. Primrose, S. Twyman R and Old B (2001): Principles of Gene Manipulation, 6th ed. Blackwell Science.

15. S. Ram Reddy, K. Venkateshwrlu, V. Krishna Reddy, (2007): Molecular Biotechnology, Kakatiya University.

MBT 203: MICROBIAL GENETICS

UNIT – I (20hrs)

Modern concept of gene- gene structure, co-lineartity and one gene - one ezmyme concept, types of genes. Genenral properties of mutations- molecular basis of mutations (base substitution, insertion and deletions Frameshift mutations, transitions, transversion, site directed mutagenesis), spontaneous (non-adoptive, mutation rate and hotspot) induced (chemical, physical and base analogue mutagens)**.**

Mutation screening methods (bacteria, bacteriophages and fungi), evaluation of mutagens using microbial systems. Mutation analysis, Benzers concepts with reference to rII locus in T4 bacteriophage.

UNIT – II (15hrs)

Gene Transfer mechanisms - Transformation, conjugation, transduction and transfection: mechanism and applications. Over view of bacterial genetic map, Mapping of genes.

Molecular recombination (bacteriophages, and *E.coli*) Genetic models of Recombinations (Holliday model, invasion model and break repair model) synapses of homologus duplexes, breakage and reunion. Role of RecA in recombination, Legitimate and illegitimate recombinations. Genetic analysis of recombinations (complementation test).

UNIT – III (15hrs)

Plasmids: Occurrence, types, classification, purification of plasmids and functions. Transfer and replication of plasmids and its applications in modern biology.

Transposons: transposable elements, IS elements, P elements, transposition, reverse transposons and their applications in genetic analysis. Uses of phages in microbial genetics, phenotypic mixing, ploidy, DI particle and genetic evolution of viruses (Influenza, HIV, Herpes).

UNIT – IV (15hrs)

Cell cycle – over view, phases of cell cycle, regulations of cell cycle, progression (MPF cyclins and cyclin dependent kinases, cell differentiation) cell cycle check points, inhibitors of cell cycle.

Molecular Biology of tumerogenesis: Terminology, types of tumors, physical, chemical and biological carcinogens. Carcinogenesis, metastasis, Protooncogenes, oncogenes, Tumor suppressor genes, apoptosis, role of oncogene products in signal transduction. Induction of tumors by *Agrobacterium.*

References:

1. Maloy, S.R., Cronan Jr. Je. Freifelder D (1998). Microbial genetics. Jones and Barlett Publishers.

2. Watson, J.D., Hopkins, N.H., Roberts, J.W., Steitz, J.A. and Weiner, A.M. (1998). Molecular biology of the gene, 4th edition, Benjamin/Cummings publishing company.

3. Voet, D, and Voet, J.G (1995): Biochemistry, 2nd ed. John Wiley and Sons, New York.

4. Watson, J.D. Baker T.A ., Bell S.P., Gann A, Levine M ad Losick R (2004): Molecular Biology of the gene, 5th Ed. Pearson Education, Inc.

5. Weaver R.F. (2002): Molecualr Biology, 2nd Edi., Mc Graw-Hill Higher Education, New York.

6. Winnacker, E.L. (1987). From genes to /Clones: Introduction to Gene technology VCK Publications, Federal Republic of Gernmany.

7. White R.J (2001): Gene Transcription, Mechanisms and Control.

8. Microbial Genetics by Frifielder.

9. Introduction to Genetics by Gardner.

10. Fundamentals of Microbial Genetics by T.A. Brown.

MBT 204: BIOSTATISTICS AND BIOINFORMATICS

UNIT – I (20hrs)

Measures of Central tendency - mean (arithmetic, harmonic and geometric) median and mode; Correlation, Co-efficient, Simple linear regression; basic idea of Significance Test, hypothesis tests, levels of significance, Student 't', 'Chi' square and goodness of fit.

UNIT – II (15hrs)

Analysis of co–variance: introduction, procedure, t-Test for multiple comparisons. line fitting through graph points, standard curves, MLR. Construction of histograms and interpretation.

UNIT – III

Introduction to computers - Types of operating systems, concepts of networking and remote login, basic fundamentals of working with unix.E). special software for microbiological approach.

Bioinformatics: Definition, scope and relevance of bioinformatics, databases, genomics, proteomics, databases, Universal resource locators (URL), software and tools, molecular mining, molecular modeling, drug designing, gene therapy, structure and functional relationship of biomolecules and other application of bioinformatics.

UNIT – IV (22hrs)

Sequence analysis: Concepts, importance and alignment methods, comparative, multiple sequence alignments and scoring methods. Homology algorithms for proteins and nucleic acids, open reading frame annotations, consortia of motifs, related structure/ functions of protein (PROSITE, PFAM, Profile scan) determination – Databases and visualization tools, methods of structure prediction for known and Unknown folds.

Applications of Bioinformatics: - *Ab initio* methods for determining proteins structure, In silico Analysis drug designing and modeling.

References:

1. Bioinformatics Basics: Applications in Biological Science and Medicine, CRC Press London Sokal & Rohif, (1973) Introduction to Biostatistics - Toppan Co. Japan.

2. A Practical Guide to the Analysis of Genes and Proteins by Baxevanis A.D. and Ouellette, Third Edition. John Wiley and Son Inc., 2005.

3. Bioinformatics Sequence and Genome Analysis by Mount D.W., CSHL Press, 2004.

4. Introduction to Bioinformatics by Tramontano A., Chapman & Hall/CRC, 2007.

5. Understanding Bioinformatics by Zvelebil, M. and Baum, Chapman & Hall/CRC, 2008.

6. Introduction to Biostatistics by K.S. Sharma.

7. Introduction to Bioinformatics by Attawood.

NC- 1: Fundamentals of Microbiology

UNIT – I (18hrs)

Basic microbiology- History and achievements, Major contribution of Leeuwenhoeck, Edward Jenner, Alexander Flemming, Joshep Lister, Robert Koch, Louis Pasteur, Hargobind Khorana.

General Characteristics- Prokaryotic and eukaryotic microbes. preparation of culture media, Isolation and characterization of Microorganisms, pure culture techniques, preservation and maintenance of microorganisms.

UNIT – II (15hrs)

Microscopy- Dark field, bright field, resolving power, numerical aperture, chromatic aberration, phase contrast microscopy, fluorescent microscopy, inverted microscopy, stereo microscopy, electron microscopy, TEM and SEM.

Staining Techniques- Simple staining, negative staining, differential staining, Gram and acid fast staining, flagella staining, capsule and endospore staining.

UNIT – III (10hrs)

Whittaker's five– kingdom system of classification- Major characteristics used in identification and classification of microbes: Morphological, physiological, ecological genetic and molecular.

UNIT – IV (18hrs)

Control of microbes- Sterilisation, disinfection, antiseptic, tyndallisation, pasteurization: Physical- dry heat, moist heat, UV light, ionizing radiation, filtration, HEPA filter, Chemical- phenol and phenolic compounds, (halogen aliphatic alcohol, formaldehyde, ethylene oxide, heavy metals) anionic and cationic detergents.

Scope of Microbiology- significance of microbes in human health, agriculture, food and dairy industries, waste management and environment protection**.**

References:

1. Microbiology Pelczar, Chan and Krieg. (Indian edition)
2. Microbiology Vol II Power and Daginawala.
3. Outlines of Biochemistry Cohn and Stumpf.
4. Microbiology by Dubey & Maheswari
5. Microbiology by Purohit.

MBP 201 - Microbial Metabolism and Molecular biology

1. Determination of microbial growth curve
2. Effect of temperature, pH and salts on bacterial growth
3. Demonstration of Oligodynamic action
4. Isolation of photosynthetic bacteria
5. Estimation of bacteriochlorophyll pigments
6. Isolation of chemoautotroph's : Thiobacillus ferroxidans
7. Demonstration of microbial stratification in aquatic ecosystem through Winograndsly column
8. Carbohydrate fermentation: acid and gas production
9. Isolation of hydrocarbon utilizing bacteria
10. Alcoholic and lactate fermentations
11. Assay of microbial enzymes (cellulase, Pectinase, lipase and proteases)
12. Isolation and cultivation of anaerobic microorganisms
13. demonstration of microbial toxins
14. Isolation and cultivation of antibiotics producing organisms.
15. Setting of macular biology/Genetic engineering laboratory
16. Creating ribonuclease free environment in the laboratory
17. Isolation of DNA from microbes, plant/ animal tissues
18. Estimation of DNA by DPA method.
19. Isolation of RNA from bacteria/yeast
20. Estimation of RNA by Bial's Orcinol method
21. Determination of purity of DNA by spectrophotomeric method
22. Transformation
23. Isolation of plasmid DNA

Suggested books/manuals.

1. Biotechnology: A Laboratory Course. 1996. 2nd ed. J.M. Becker, et al. Academic Press.
2. Methods in Biotechnology. 2002. By Ignacimuthu.

MBP 202 – Microbial Genetics and Biostatistics and Bioinformatics

1. Isolation of auxotrophic mutants
2. Replica plating technique
3. UV survival curve
4. Petite mutants
5. Phage titration
6. Induction of mutations in bacteria by physical/chemical agents.
7. Observation of mitotic dividions in onion root tips and meotic divisions in flower buds
8. Observation of lambrush chromosomes in Chironomus salivary glands
9. Demonstration of Ame's test
10. Demonstration of conjugation in bacteria

b). Problems

1. DNA characteristics (Tm value, GC/AT, Chargaff's rule)
2. Tran cription
3. Translation
4. Mutations.
5. Phage titrations
6. Restriction mapping

11. Graphical representation of data, histograms and frequency curves.
12. Descriptive statistics of distribution: mean, mode, median, variance, standard deviation and standard error.
13. Probability distribution – binomial, poisson and normal distributions.
14. Tests of significance on means and proportions – standard normal deviate test,
15. Paired and unpaired test.
16. Application of Chi square test, contingency tables with Yate's correction.
17. Correlation and regression coefficients and their testing, partial and multiple correlation coefficients, multiple regression.
18. Application of analysis of variance (ANOVA). Distance of similarity analysis
19. Basics of computers – basic commands – file creation, copying, moving & deleting in Linux & Windows.
20. Using email, browsering and search engines
21. Using biological databases – Pubmed, NCBI, Swissprot – protein data bank and genebank
22. Different types of sequence analysis queries in BLAST and FASTA
    Multiple sequence alignments and Phylogenetic alignments (phylogenetic tree analysis).
23. Usage of gene and protein structure prediction softwares.
24. Genomic and proteomics available on the web and their use.
25. Statistical software available on the web and their use.
26. Micrometry (measurement of microorganisms) analysis by mean, S.D & S.E

Suggested books/manuals.

1. Recombinant DNA Laboratory manual. 1989. J.W. Zyskind and S.I. Bernstein. Academic Press.

MBT 301: RECOMBINANT DNA TECHNOLOGY

UNIT – I (15hrs)

Scope and importance of recombinant DNA technology/Genetic engineering.

Restriction enzymes - modification, classification, Nomenclature and importance. Restriction maping, DNA ligages, Polynucleotide Kinase, alkaline phosphotases,S1 nuclease, Terminal transferase, Bal 31 nuclease.

UNIT – II (18hrs)

Cloning Vectors – Characteristics, classification, advantages and disadvantages. Natural and artificial plasmids and their importance in E. coli (plasmids, phagemids, cosmids and BAC s), Yeast (YAC s, shuttle vector), higher plants (Ti plasmid, binary vectors) and animal cells (SV 40 and retrovirus vectors). Characteristics of expression vectors. (Shot-gun method, southern analysis and c DNA synthesis).

Vector digestion, generation of cohesive ends and blunt ends. Ligation by linkers, adaptors and homopolymer tails. Preparation of DNA probes, construction of DNA libraries – genomic and c DNA libraries. Screening of recombinants – genetic, biochemical and hybridization methods. Microarrays and Macro arrays.

UNIT – III (16hrs)

Polymerase chain reaction – principle, types (RT-PCR, nested PCR, inverse PCR, immunocapture PCR and Real-Time PCR), primer designing and applications of PCR. Sequencing methods – Sangar's and Maxam-Gilbert's methods. Automated sequencing. Profiling of nucleic acids by DNA fingerprinting, RFLP, RAPD and AFLP.

Introduction of recombinant DNA molecules in appropriate hosts – competent cell preparation, electroporation, microinjection and particle gun-bombardment methods and selection of transfermants. *Agrobacterium* – mediated transformation. Transfection - Salient features and its significance. *In vitro* packaging of recombinant cosmids.

UNIT – IV (18hrs)

Expression of cloned genes – IPTG, x-gal, lac, taq promoters. Expression of fusion protein tags, purification of tags, plasmid copy number, inducible expression system, inclusion bodies and solubulization of proteins.

Genetically engineered organisms (GEO): Transgenic Microorganisms, animals and plants as protein/cell factories, genetic engineering for fungal and bacterial diseases. Recombinant DNA technology applications in biology.

References:

1. J.M. Walker and R. Rapley (2002). 4th ed.: Molecular biology and Biotechnology. (Panima Publ.)
2. Demain, A.L., Manual of Industrial Microbiology and Biotechnology, (1999) second edition., Editor in Chief, ASM Press.

3. H. Kreuzer and A. Massey. Recombinant DNA and biotechnology: A guide for Teachers 2nd ed.. ASM Press.

4. H. Kreuzer and A Massey. Recombinant DNA and biotechnology: A guide to students 2nd ed. ASM Press.

5. C. Ratledge and B. Kristiansen: .Basic Biotechnology, 2001. 2nd ed. Cambridge University Press.

6. Sambrook and Russel, Molecular Cloning, 2001. Vol. I – III CSH Press.
7.
    a. D. Freifelder - Essential of Molecular Biology
    b. D. Freifelder - Microbial genetics
    c. Gerald Karp (2004) 2nd edition - Cell and Molecular Biology
    d. Lewin, B (2004): Genes VIII, Oxford University Press Oxford.
    e. Lubert Stryer.(1995). Biochemistry.(4th edition). W.H. Freeman and company, New York.
    f. Lehninger (2000)Prniciples of Biochemistry, 3rd edition, Nelson and Cox (Worth) Publ.

8. Molecular Biology of the Gene by James Watson, Tania Baker, Stephen Bell, Alexander Gann, Michael Levine & Richard Losick , 6th Edition; CSHL Press; 2007.

9. Molecular Biotechnology by T.A. Brown.

MBT 302: BIO - PROCESSING TECHNOLOGY

UNIT – I (15hrs)

History of fermentation technology, primary and secondary metabolites, Exploitation of Microorganisms in fermentation Process. components of fermentation process.

Industrial media and Inoculum: Carbon, nitrogen, mineral sources, buffers, antifoam agents, medium optimization. Sterilization of media and fermenter, sterilization kinetics of microorganisms batch and continuous sterilizations. . Inoculum development,Starter culture technology, Storage of cultures for repeated fermentations

UNIT – II (15hrs)

Fermenter – Design and types of fermenters, bioreactor configuration, design features, individual parts, baffles, impellers, foam separators, sparger, culture vessel, cooling and heating devices, probes for online monitoring, computer control of fermentation process, measurement and control of process.

Growth of cultures in the fermenter, Importance of media in fermentation, media formulation and modification. Kinetics of growth in batch culture, continuous culture with respect to substrate utilization, specific growth rate, steady state in a chemostat, fed-batch fermentation, yield of biomass, product, calculation for productivity, substrate utilization kinetics.

UNIT – III (20hrs)

Fermentation process: Aeration and agitation. Power requirement, oxygen transfer kinetics. Concepts of Newtonian, Non – Newtonian and plastron fluids, apparent viscosity, foam and antifoam. Physical, chemical and Biological sensors. Scaling up of process.

Downstream processing: solid-liquid separation, release of intracellular components, concentration of biological products, purification, production formulation, monitoring of downstream processing, process integration.

UNIT- IV (15hrs)

Process economics: The starting point, cost estimates, process design, design exercise, capital cost estimates, the operating cost estimates.

Legal protection and IPR: WTO, IPR in India, Convention on Biodiversity (CBD), Patent Co-operation Treaty (PCT), forms of patents and patentability, process of patenting, Global scenario of patents and India’s position, patenting of biological materials

References:

1. Demain, A.L. and Davies, J.E. (1999). Manual of Industrial Microbiology and Biotechnology. ASM Press.

2. Glick, B.R. and Pasternak, J.J. (1994). Molecular Biotechnology, ASM Press.

3. Stanbury, P.F., Whitaker, A. and Hall, S.J. Principles of Fermentation Technology, Pergamon Press.

4. Doran, P. M. (1995). Bioprocess Engineering principle. Academic Press. London.

5. Moses, V. Cape, R. E. and Springham, D. G. (1999) Biotechnology: The science and the Business. 2nd ed. Harwood Academic. New York.

6. Nielsen, J., Villadsen, J. and Liden, G. (2002). Bioreaction Engineering. 2nd ed. Kluwe Academic/Plenum Publishers. New York.

7. Garcia, A., Bonen, M. R., Ramirez-Vick, J., Sadaka, M. and Vuppu, A. (1999). Bioseparation process science. Blackwell. Massachusetts.

8. Sommleitner, B. (2000). Bioanalysis and biosensors for bioprocess monitoring. Advances in biochemical engineering/biotechnology. Vol.66. Springer-Verlag. Berlin.

MBT 303: IMMUNOLOGY

UNIT – I (15hrs)

History and scope of immunology, structure, composition and function of cells and organs involved in immune system. Immune response (humoral and cell mediate) Types of immunity, innate immunity, acquired immunity; immunohematology, blood groups, blood transfusion and Rh – incompatibility, phagocytes, inflammation, and extra cellular killing.

Antigens and Antibodies: Antigens – structure, properties – types (Iso and allo), haptens, adjuvants, antigenic specificity. Antibodies- structure, heterogeneity, types and sub types, properties (physico chemical and biological), theories of antibody diversity – production of polyclonal, monoclonal and recombinant antibodies and their applications.

UNIT – II (15hrs)

Antigen - Antibody interactions: Invitro methods – Flocculation, Precipitation, Immuno diffusion, Agglutination Phagocytosis Opsonization, Neutralization, Complement fixation. Immuno electrophoresis, Immunoflorescence. RIE, CIE, RIA, ELISA and Western Blot, Flow cytometry.

Complement system: complement components, types, complement activation, regulation of complement system, biological consequences and pathways of complement activation, and complement deficiencies.

UNIT – III (10hrs)

Structure and functions of MHC and the HLA system; HLA and tissue transplantation tissue typing, graft versus host reaction and rejection. Antigen Processing and presentation, T-Cell maturation and differentiation, T- cell activation, co-stimulation and T-Cell Receptors.

Auto immunity, autoimmune diseases and their treatment, tumor immunology–tumor specific antigens, immune response to tumor, immunodiagnosis of tumors, immunodeficiency, Immunotherapy of tumors (alphafeto-protein, carcino embryonic antigen).

UNIT – IV (20hrs)

Hypersensitivity reactions: classification and types (type I. Anaphylaxis; type II Antibody dependent cell cytotoxiciy; Type III Immune complex mediated reactions; type IV cell mediated hypersensitivity reactions)

Immunization: Objectives of immunization, Active and passive, types of vaccines: whole organism vaccines, recombinant vector vaccines, DNA vaccines, synthetic peptide vaccines, subunit vaccines, immunization procedures, adverse reactions of vaccines. immunotherapy, various cytokinines and Assay methods.

References:

1. Coleman, R.M Lambard, M. F and Siccard R.E. 1992, Fundamentals of Immunology 2nd Ed.
2. Kuby, J. 1992 Immunology New York, W.H. Freeman.
3. Paul, W.E 1990 Fundamental Immunology 2nd Ed.
4. Riott, I.M. 1991, Essential Immunology 7th Ed.
5. Tizarrd, I.R. 1998. Immunology An Introduction 2nd Ed
6. Ross, G.D. Ed Immuno biology of the Complement System.
7. Riott, I.M. Brostoff, J. and Male, R.K. 1989. Immunology 2nd Ed.
8. Leskowitz, Alan R. Lisi (1988).Immunology – a short course elibezamini and Sidney Inc. New York.
9. J.H.L. Playfier (1987) 4th Ed. Immunology at a glance Blackwell Scientific Publication.
10. John W. Kinball –Introduction to Immunology.
11. Abul Abbas, Andrew K. Kich Amn Jordan S. Pober. Cellular and Molecular Immunology 3rd ed.

MBT 304: MEDICAL AND DIAGNOSTIC MICROBIOLOGY

UNIT – I (20hrs)

Classification and characteristics of medically important microorganisms: infection, virulence, pathogenicity, sources and modes of transmission of infections. Normal Microflora of human body: Detailed study of morphology, cultural characteristics, biochemical properties, pathogenesis, diagnostic laboratory tests, epidemiology and prophylaxis of the following organisms, *Haemolytic Streptococci, Pneumococci, Corynebacterium diphtheria Mycobacterium tuberculosis* and *M. leprae, Neisseria meninigitdis, Hemophilus influenzae*.

Bacteria causing sexually transmitted diseases – clinical significances - *Treponema, Neisseria gonorrhea,* LGV agent (*chlamydia H. ducreyi, Calymmoto Bacterium, Grannulomatis*). Bacteria causing water borne infections *(E. coli, Salmonella, Shigella, Vibrio*), and wound infections (C*lostridium tetani, C. welchii, Staphylococci, Pseudomonas*).

UNIT - II (15hrs)

Detailed study of morphology, cultivation, pathogenesis, diagnostic laboratory tests, epidemiology, prevention and treatment of air borne, waterborn, insect borne, contact, and sexually transmitted viral diseases. *Enterovirus,* and zoonotic viral infections.*Influenza virus,Chicken gunea, Rhinovirus, rubella, adenovirus, mumps, measles, varicella, zoster* virus *rabies, Japanese encephalitis*.HAV, HBV, HCV, HIV.

Superficial mycoses, cutaneous and subcutaneous mycoses, Opportunistic mycoses and their control. Detailed study of morphology, pathogenesis, Prevention of Malaria. Amoebiasis, Leshmaniasis, Toxoplasmosis, Exhninococcus grannulosus, Ascariasis, Ancylostomiasis, Filariasis.

UNIT - III (15hrs)

Types of specimens, specimen collection, handling, transport, processing of material for laboratory investigations, specific and non specific laboratory tests, morphological identification (light and electron microscopy), culture isolation detection of antigen by immunological assays, serological tests, antibody stains, Immuno blotting.

Molecular diagnosis:- DNA – DNA or DNA – RNA hybridization, 16srRNA, target ramification systems (PCR, reverse transcript PCR, TMA, NASBA, LAMP) probe amplification systems – Ligase chain reaction (LCR), signal amplification techniques.

UNIT – IV (20hrs)

Antimicrobial agents: Bacterial, viral, fungal and protozoan. Microorganisms producing the antimicrobials, screening and assay of antimicrobial compounds, *(in vitro* and *in vivo)* minimum inhibitory concentrations (MIC), MLC.

Mode of action of antimicrobials: Cell wall, nucleic acid, purine, pyromidine, protein. respiration, oxidative phosphorylation ,enzyme inhibitors, cell membrane disruptors, and metabolites, analogues, drug resistance and its side effects.

References:

1. G.F. Brooks, J.S. Butel and S.A. Morse, (2002) 5th edition Medical Microbiology Mc Graw – Hill pebbles.

2. Murray PR et al (1999) Manual of clinical Microbiology (Ed.) American Society for Microbiology.

3. Lippincott – Raven, (1996) Fields Virology (3rd Edition) Fields BN et al (editions) Davies et al Microbiology 4th edition.

4. Ananthanarayana, R & Panicker CKJ 6th Ed Test Book of Microbiology, Orient Longman, (2000).

5. Evans EGV et al (ed.) Medical Mycology Oxford University press

6. Reichmann, DD et al Churchill Livingstone, 1997 Clinical virology,

7. Skinner, FA and Carr, JG 1974 (ed.) The Normal microbial Flora of Man, Academic press, London,

8. Beily and Scott (2001) Diagnostic Microbiology 4th ed. ASM Press. Principles and Applications, American Society for Microbiology, 1993

9. Panjarathinam R Orient Longman (1990). Text book of Medical Parasitology.

NC-2: Microbial Technology and Entrepreneurship

UNIT – I (15hrs)

Microorganisms in the service of man and society– Past, Present and Future. Traditional Microbial Technologies – Curdling of Milk, Bread and Wine, making other traditional foods of India and the World.

Microorganisms of Industrial importance – Over view of Isolation, Screening and Maintenance, Microbial Industries and Commercially important products, Status and Demand and Production – Indian and Global Scenario.

UNIT – II (15hrs)

Raw materials for Microbial Processes – Availability and utilization, Significance of locally available raw material. Production of Pharmaceutically and Commercially important products – Alcohol and Alcoholic beverages.

Antibiotics, Enzymes, Vitamins and Monoclonal anti bodies. Production of fermented milk products Yogurt and Cheese.

UNIT – III (15hrs)

Microbes in Agriculture – Composting, Nitrogen fixation, Vermi composting, over view of bio fertilizers and bio pesticides – Production and applications. Microbial fuels – Alternate sources of energy – Methane and Hydrogen production, their significance, microorganisms in the recovery of precious metals, bio degradable polymers from microorganisms.

Single cell proteins and Single cell oil – Mushroom cultivation, oil from micro organisms Genetically engineered micro organisms – Applications in health, industries, agriculture, environment, fate of genetically engineered micro organisms in the environment.

UNIT – IV (15hrs)

Microbial entrepreneurship – Government schemes for commercialization of microbial (Biotech) technology, Govt. regulations, Entrepreneurship – Developing a business plan, basic concept of financial, management, major financial statement – over view of Human resource management.

Legal and statutory requirements, Marketing, Negotiation skills, Rural and Women entrepreneurship. Patenting and intellectual property rights

References:

1. Martin Gross, 2003, Entrepreneurships in Biotechnology
2. De Hayne and J Kapelers, 2006, Innovation and Entrepreneurships in Biotechnology
3. Richard Dana Ono, 1991, Business of Biotechnology, Butterworths
4. Crueger and Crueger , Biotechnology: A Text book of Industrial Microbiology, 2nd Ed.
5. Casida, Industrial Microbiology
6. Demain AL, Biology of Industrial Microorganisms
7. Frazier WC and Westhof DC, Food Microbiology, 3rd Ed. TMH
8. Doyle PM et al, Food Microbiology- Fundamentals and Frontiers, 2nd Ed. ASM Press
9. Ananta Krishnan CP et al, 1994, Dairy Microbiology, Sri Lakshmi Publications, Chennai
10. Rabinson RK, 1990, Dairy Microbiology, Elsewhere applied Science, London

MBP: 301 – Recombinant DNA Technology and Bio process Technology

1. Restriction digestion of sticky ends & blunt ends
2. RNA polymerase activity
3. Polyribosome's
4. Southern blotting
5. Ti plasmid / crown gall disease
6. Replica plating
7. DNA Ladder 1000bp (super coiled plasmid)
8. Lambda DNA (ECORI/ Digest)
9. λ DNA/ ECORI/ Hind !!! digest
10. PBR 322 DNA/ Hinf 1 digest
11. PBR 322 DNA/ Ahe 1 Digest
12. Lambda / Hind !!!, PUC 18 / save 3A1 PUC 18/ Taq / digest
13. Restriction analysis and Agarose electrophoresis
14. Dioxic growth
15. Preparation of competent cells.
16. Use of logerttherms in microbial growth during fermentation process.
17. Determination of mid of of the bacterial growth curve.
18. Harvesting of microbial cells and demonstration of yield of products.
19. Manometric study in fermentation process.
20. Bacterial growth kinetics
21. Mid point of bacterial growth curve
22. Mono metric study in fermentation process
23. Design of fermenter

Suggested Books/Manuals.

1. Recombinant DNA Laboratory Manual. 1989. J.W. Zyskind and S.I. Bernstein. Academic Pess.
2. Manual of Industrial Microbiology and Biotechnology, 2nd edition, by Demam A.L., Editor in chief 1999, ASM Press.
3. Recombinant DNA and Biotechnology: A Practical guide to students 2nd edition. H. Kreuzer and A. Massey.
4. Molecular clonming Vol. I, II, III, A Practical by Sambrook, and Russel (2001) CSH press.
5. Experimental Biochemistry, A Student companion (2003) Vijay Deshpandes. I.K. Int. Pvt. Ltd.

MBP: 302 – Immunology, Medical and Diagnostic Microbiology

1. Separation of serum proteins by SDS PAGE.
2. Production of polyclonal antibodies- demonstration of different routes of immunization, bleeding of experimental animals, collection of blood, serum separation, purification and characterization of immunoglobulins.
3. *In vitro* serological tests: single radial immuno diffusion and double diffusion, Ochterlonly double diffusion, immunoelectrophoresis--counter immunoelectrophoresis, rocket immunoelectrophoresis, DAC- ELISA. DAS-ELISA.
4. Agglutination reactions, Widal, HA, blood typing
5. Floculation- VDRL.
6. Neutralization tests.
7. separation of serum WBC, RBC, Plasma proteins.
8. CBP & differential blood picture.
9. Lymphoblast transformation B Jerme plaque test
10. Blot Transfer and detection of protein on blot by staining
11. Lymphocyte viability test
12. Indirect Agglutination
    a. Hepatitis
    b. Pregnancy test (HCG)
13. Identification of Staphylococcus and Mycobacteria using Gram stain and acid – fast Staining techniques
14. Collection and culture of nosocomial microorganisms
15. Bacterial examination of blood, urine and pus.
16. Examination of Blood smear for malaria.
17. Blood hemoglobin estimation
18. Erythrocyte sedimentation rate.
19. Liver function test for hepatitis virus
20. Slide observations: *Candida albicans, Mycobacterium leprae,* bacterial spores, *Corynebacterium* sp., *Clostridium tetani, Aspergillus fumigatus.*
21. Preparation of different types of culture media, stating techniques – Gram's staining, F.B. Staining, Albert staining, Capsular staining etc.,
22. Identification of various pathogenic bacteria by biochemical, enzymatic and serological methods.
23. Bacteriological examination of urine, blood, pus, sputum, stools etc, from patients for diagnosis.
24. Microscopic studies of virus infected materials,
25. Handling of lab animals.
26. Examination of pathogenic fungi.
27. Examination of stools for helminthes and Amoeba.
28. Examination of blood smear to identify malarial parasite.
29. Isolation, observation and identification of normal microbial flora of human body.

Suggested Books/Manuals.

1. Manual of clinical Microbiology by Murray PR et al (1999) American Society for Microbiology.
2. A Practical Manual for Medical Microbiology – M aechie and Maecortney 4th ed. (1990).
3. Practical Medical Microbiology (14th ed.) collect JG et al Edinburgh: Churchill living (1996) store.
4. A Practical book for Microbiology, Techniques and Immunology by Ochie et al (1996) 4th ed. ASM Press.

MBT 401: Agricultural Microbiology

UNIT – I (15hrs)

The soil: Definition, components, physical chemical characteristics and classification. Qualitative and quantitative nature of bacteria, actinomycetes, fungi, algae, Protozoa and nematodes. Influence of environmental factors on soil microflora. Methods of isolation and enumeration of soil micro flora.

Soil organic matter – nature, microbial degradation of carbohydrates, Proteins and other nitrogenous substances, fats, hydrocarbons and pesticides in soil. Humous significance and degradation. Soil enzymes – Nature, isolation, occurrence and ecological significance.

UNIT – II (15hrs)

Plant – microbe interactions - Rhizosphere. Microflora on plant growth, Ecology of phyllosphere microflora, Biological importance of Phyllosphere microorganisms, Plant growth promoting rhizobacteria (PGPR). Diversity of nitrogen fixers; Mechanism of symbiotic and asymboitic nitrogen fixation; nodule formation and gene regulation of nitrogen fixation.

Biofertilizers- Microbes used, cultivation and mass production of biofertilizers and bioinoculants (Rhizobium, Frankia, Azotobacter, Azolla, Azospirillum, and Blue- green algae, Mycorrhizae), Phosphate solublizing bacteria (PSB), Vermicomposting, methods and applications.

UNIT – III (15 hrs)

Plant pathology: Brief history and development of plant pathology, types of plant diseases and their significance. Symptoms of plant diseases. Basic procedures in the diagnosis of plant diseases. Host pathogen interactions- virulence factors of pathogens and defense mechanisms of plants against pathogens. Environmental effects on disease development and disease epidemiology. Control of plant diseases by various approaches.

Biocontrol of Pests and pathogens: Introduction, biocontrol of foliar and soil borne pathogens and microbial pesticides (bacteria, virus, fungi) production, formulations, economics, safety, advantages and disadvantages. Development of genetically modified crop plants for control of pests.

UNIT – IV (20hrs)

Plant diseases: Symptomatology, etiology, epidemiology, disease cycle, control measures of fungal diseases: damping off of seedlings, Phytopthora leaf rot and stem rots, downy mildew of grapes, powdery mildew of cucurbits, rust of groundnut, Fusarium wilts, red rot of sugarcane, tikka disease of groundnut, blast disease of rice. Bacterial diseases: Citrus canker, blight of rice and angular leaf spot of cotton. Viral and viroid: rice tungro, sugarcane mosaic/ streak, potato leaf roll and spindle tuber viroid diseases, tomato/ tobacco leaf curl, tobacco mosaic, yellow mosaic of grain legumes, pigeon pea sterility mosaic, peanut bud and stem necrosis, citrus tristeza and yellow mosaic, papaya ring spot, banana bunchy top, vein leaving of bendi. Phytoplasmal diseases: Little leaf of brinjal.

References:

1. Stolop H.- Microbial ecology : Principles, methods, & applications & biological nitrogen fixation.
2. N.S. Subba Rao - Soil microorganisms and plant growth
3. R.S. Singh - An introduction to principles of plant pathology
4. Lynch poole - Microbial ecology : A conceptual approach
5. N. S. Subba Rao - Advances in Agriculture Microbiology
6. G. Rangaswamy and D.J. Bhagya Raj - Agricultural Microbiology
7. B.N. Richard - An introduction to soil ecosystem
8. N.S. Subba Rao - Bio fertilizedrs
9. R.S. Methortra - Plant pathology
10. S.A. J. Tarr - Principles of plant pathology
11. Vander Plank - Plant disease resistance
12. Vidyasekaran - Molecular plant pathology
13. Charudattan R (1982), . John Wiley & Sons. Biological Control of Weeds with Plant Pathogens
14. George N Agrios (2000), Plant Pathology. 4th Ed. Academic Press.
15. Norris J.R. and Pettipher G.L, (1987), Essays in agricultural and Food Microbiology. John Wiley and Sons. Singapore.
16. Singh. R.S (1997), Introduction to Principles of Plant Pathology. 3rd Ed. Oxford and IBH.
17. Subba Rao N.S (1995), Soil Microorganisms and Plant Growth. Oxford and IBH.
18. Sylvia D M, Jeffrey J Fuhrmann, Peter G Hartel, David A Zuberer (1997), Principles and Applications of Soil Microbiology. 1st Edition, Prentice Hall

MBT 402: ENVIRONMENTAL MICROBIOLOGY

UNIT – I (18hrs)

Habitat for microorganisms: General description of soil, water, air. Physical and chemical factors influencing the distribution of microbial flora. Types of microbial interactions, community dynamics.

Bio – geochemical cycles and ecological significance. Role of microorganisms in cycling of bioelements – carbon, nitrogen, sulphur, phosphorus and iron, Ecological significance of ammonification, nitrification and denitrification.

UNIT – II (12hrs)

Aerobiology- Microbes and microbial propagules in air. Methods for microbial analysis of air, Brief account of air – borne transmission of microbes – viruses, bacteria and fungi, their disease fore casting and preventive measures.

Aquatic Microbiology - Water ecosystems types – fresh water (ponds, lakes, streams). Marine habitats (esturies, mangroves, deep sea, hydrothermal vents ,saltpans, coral reefs). Zonations of water ecosystem, up welling, eutrophication, food chain. Potability of water, Sampling and microbial assessment of water quality and water purification.

UNIT – III (12hrs)

Bioremediation- Bioremediation of contaminated soil and water using microbial consortia, reversal of global warming, Degradation of xenobiotics – oil slicks, detergents, plastics, recalcitrance of pesticides in soil (eg. DDT), volatilization of toxic metals by microorganisms Fate of engineered microorganisms in the environment.

Biofouling and corrosion- Biofouling organisms, problems due to biofouling, antifouling paints and its environmental pollution, biotechnological approach to biofouling control, aerobic and anaerobic corrosion.

UNIT – IV (20hrs)

Extremophiles – Microbes in extreme environments, adoption mechanisms, applications of extremophiles. Microbial leaching of mineral ores – organisms involved, factors affecting leaching, leaching process of uranium, copper and gold.

Waste treatment - Solid and liquid wastes and their characterization. Liquid waste treatment (microbial diversity and treatments), solid waste treatment- saccharification, gasification, composting, utilization of solid wastes for food (SCP, mushroom, composting, yeast), fuel (ethanol, methanol) and fertilizers. Treatment of industrial fermentation unit effluents.

References:

1. Alexander, M. (1977). Introduction to Soil Microbiology. John Wiley and Sons Inc New York.

2. Alexander, M. (1971). Microbial Exology. John Wiley and Sons Inc. New York.

3. Baker K. H. and Herson, D.S. (1994), Bioremediation. Mc Graw Hill Inc., New York

4. Burns R.G. and Slater J.H. (1982), experimental Microbial Ecology, Blackwell Scientific Publications. Oxford, London.

5. Burges A. and Raw F, (1967), soil Biology. Academic Press, London

6. Gabriel bitton, (1999), Waste Water Microbiology. 2nd Edition. Wiley – Liss.

7. Harriet A. Burge, (1995), Bioaerosols. Lewis Publishers Inc.

8. Ian L. pepper, Charles P Gerba, Jeffrey W (1995), Environmental Microbiology: Laboratory Manual. Academic Press.

9. Marshall K. C (1985), Advances in Microbial Ecology. Vol 8, Plenum press.

10. Robert L. Tate, (2000), Soil Microbiology 2nd Edition. John Wiley and Sons.

11. Atlas and Batra - Microbial Ecology – Fundamentals and applications 1998

12. D. Colwd 1999 Microbial diversity Academic press.

13. C.J. Hurst, editor inchief 2002, ASM press 2nd edition Manual of environmental Microbiology

14. Paul A. Rochell 2004, Environmental Molecular Microbiology – Protocols & Applications

15. Eugenia J. Alguin, Gloriasanchez, Elizabethhernandez, environmental Biotechnology cleaner, Bioprocess 2005

16. Mark coyne,2004, Soil Microbiology: An exploratory approach.

MBT 403: FOOD MICROBIOLOGY

UNIT – I (15hrs)

Importance of microbes in food. Microbiological (yeasts, bacteria) contamination of food. Factors influencing food spoilage (intrinsic and extrinsic), microbial growth, survival and death in food.

Contamination and spoilage - Microbial spoilage of cereals, sugar products, vegetables, fruits, meat and meat products, milk and milk products, fish and sea foods, poultry, spoilage of canned foods. Detection of spoilage and characterization.

UNIT – II (15hrs)

Principles of food preservation. Preservation methods, food additives, canning, processing for heat treatment – D, Z, and F values and working out treatment parameters.

Food-borne disease and their control - Food infection and intoxication, detection of food borne pathogens and their toxins by conventional, rapid automated method, molecular and immunological techniques. Food control agencies and its regulations, Employee's health standards, waste treatment, disposal, quality control.

UNIT – III (10hrs)

Food fermentation - Bread, cheese, vinegar, fermented vegetables, fermented meat, poultry and fish products, fermented foods of therapeutic and mutational value, fermented dairy products; experimental and industrial production methods, spoilage and defects of fermented dairy products – oriental fermented foods, their quality standards and control.

UNIT – IV (20hrs)

Microbes as Food - Single cell proteins (SCPs), edible mushrooms and their cultivation, bioconversions, production of alcohol, fermented beverage, bear and wine. Genetically modified foods.

Enumeration of microorganisms in food – Direct microscopic count (DMC), standard plate count, MPN method, reductase test, membrane filters and molecular methods. Hazard analysis and critical control points (HACCP).

References:

1. M.P Dolye et al. (2001) Food Microbiology: Fundamentals and frontiers. 2nd ed. ASM Press.

2. Adams, M.R. and Moss M.O. (1995) Food Microbiology. Royal Society of Chemistry Publication, Cambridge.

3. Frazier WC and Westhoff DC (1988). Food Microbiology Tata Mc Graw Hill Publishing Company Ltd., New Delhi.

4. Stanbury, PF., Whitekar, A and Hall,. S.J. (1995) Principles of Fermentation Technology. 2nd Edition. Pergamon Press.

5. S.N. Tripathy (2004) Food Biotechnology Dominant Publishers and Distributors, Delhi.

6. S.P. Narang (2004) Food Microbiology methods of Enumeration. APH Publishing corporation, Delhi.

7. A.H. Patel Industrial Microbiology (2004) Rajiv Beri for micmillan India Ltd. New Delhi.

8. Alexander N: Microbial Biotechnology – Fundamentals of Applied Microbiology (1995).

MBT 404: INDUSTRIAL MICROBIOLOGY

UNIT – I (10hrs)

Introduction- History, industrially important microorganisms and their characteristics, Strain improvement through conventional and modern genetic engineering approaches.

Screening of microbes for products – Primary and secondary screening, detection and assay of products by physico- chemical and biological assays. strategies for selection and improvement, maintenance, preservation of Industrial strains.

UNIT – II (18hrs)

Yeast & Yeast products : Production of active dry baker's yeast, instant yeast, quality of bakers yeast, production of brewer's yeast, food and fodders yeasts.

Immobilization of cells and enzymes: Techniques and supports – Adsorption, covalent linkage, entrapment and cross-linkage, their advantages and disadvantages, applications of microbial fermentations with immobilized cells / enzymes.

UNIT – III (20hrs)

Industrial production of enzymes: cellulases, amylases, proteases, phytases, pectinases, xylanases laccases lipases, glucose isomerase. Scope, utility and methodology of biotransformation, biotransformation of antibiotics, steroids and nonsteroids.

Biofuels Production of ethanol, methane, hydrogen. Commercial production of useful products (ethanol and acids) from starch and lignocellulose. Organic acids- citric acid, lactic acid, acetic acid.

UNIT – IV (20hrs)

Industrial production of Vitamin $B_{12,}$ single cell oils (SCOs). Biopolymers (PHAs and PHBs), extra cellular polymers, xanthenes, rhamnosan, dextrans, pullalan,Biosurfactants-classification, production and applications.

Antibiotic and Vaccine production – History of antibiotics, producing organisms, inductrial production of pencillin, streptomycin, avermectins, production of anticarcinogenic agents from microbes. Production of bacterial and viral vaccines.

References:

1. P.F Stanbury al. Aditya books (2005) Principles of Fermentation Technology. 2nd edition published by Elsevier, Reed Elsevier India Pvt. Ltd.

2. C. Ratiedge and B. Kristiansen (2001). 2nd ed. Basic Biotechnology, Cambridge University Press.

3. A.L. Demain and Davis Second edition. (1999) Manual of Industrial Microbiology and biotechnology Editor in chief, ASM press.

4. Cruger & Cruger (2004) Ed. Biotechnology: A text book of Industrial Microbiology. Panima publishing corporation New Delhi/Bangalore.

5. M.J. Waites et al. Blackwell Science. (2001)Industrial Microbiology: Am Introduction.

6. Prescot & Dunn (2002) Industrial Microbiology published by Agrobios (India)

7. Peppler H.J Pertman D (editor) 1979, Microbial Technology, Vol-1and 2 Academic Press New York

8. E.M.T EL-MANSI and C.F.A BRYCE, (2004Reprinted), Fermentation Microbiology and Biotechnology Taylor and Francis Ltd, New Fatter Lane London Ec4P 4EE.

9. Ajit Varma and Gopik Podila (2007) Biotechnological Applications of Microbes, I.K. International Pvt. Ltd. New Delhi (India)

10. Jeffrey M. Becker et al (2004) Biotechnology Laboratory course 2nd edition. Academic press Elsevier India Pvt. Ltd.

11. Nduka okfor (2007) Modern Industrial Microbiology and Biotechnology, Published by Science Publishers, Enfield NH, USA.

MBP: 401 – Agricultural Microbiology and Environmental Microbiology

1. Determination of physico – chemical characteristics of the soil environment – Soil Texture and P^H and conductivity.
2. Estimation of organic matter content in soils.
3. Study of microbial activity in soil by respirometry (CO2 evolution)
4. Decomposition of cellulose in soil by microflora
5. Isolation and study of Rhizosphere microflora, determination of R:S ratio.
6. Isolation of Rhizobium from root nodule.
7. Population estimation of Azotobacter form rhizosphere soil
8. Population estimation of Azospillum sp. in rhizosphere soil
9. Population estimation of nitrifiers form rhizosphere soil
10. Isolation of phosphate solubilising bacteria from rhizosphere soil
11. Observation of VA mycorrhizae in crop plants
12. Estimation and enumeration of bacteria, actinomycetes and fungi in soil by Dilution – Planting method
13. Visit to local field crops for observation of diseases caused by bacteria, fungi and viruses.
14. Humus estimation in the soil
15. Estimation of moisture content of soil
16. Observation of bacteroids of rhizobia by section cutting
17. Observation of Phyllosphere microbial flora
18. Contact slide technique
19. Winogradsky's column
20. Ammonification in soil
21. Nitrification in soil
22. Denitrification in soil
23. Isolation of antibiotic producing microorganisms from soil
24. Most probable Number Test for coli forms
25. Quantitative analysis of water for microbial members (SPC)
26. Chemical oxygen demand (COD)
27. Effect of heavy metals on the growth of bacteria.
28. Microbial inter relationships (Synergism), Antagonism

Suggested Books / Manuals

1. APHA 5^{th} edition (2001) Prince Hall.
2. Experiments in Microbiology, Plant Pathology and Biotechnology. IV edition K.R. Aneja .
3. Principles and Methods of Plant Molecular Biology, Biochemistry and genetics (2005) Agrobios. India.
4. Practical Microbiology by, RC. Dubey and D.K. Maheswari (2008) S. Chand Publ.
6. Manual Industrial Microbiology and Biotechnology Second edition. (1999) A.L. Demain, Editor in chief, ASM press.

MBP: 402 – Food Microbiology and Industrial Microbiology

1. Assay of microbial product (A) in the given culture broth
   Draw the conclusions base on your observations.
   (a). Streptomycin
   (b). Lactic acid
   (c). Ethyl alcohol
   (d). Penicillin
   (e). Indole acetic acid
2. Assay of microbial enzyme / product in the given culture broth and
   Write principle, procedure and conclusions of the experimental results
   (a). DMC of milk
   (b). β - Amylase
   (c). Protease
   (d). Lipase
   (e). Asparginase
   (f). Phosphatase
   (g). Siderophore
   (h). Characterization of wine
3. Write the principle, procedure and critical notes on given experiment
   (a). Mycotoxin (Aflatoxin)
   (b). Litmus milk
   (d). Bioassay of vit. B_{12}
   (d). Antagonism
   (e). Preparation of Immobilized cells
   (f). Mycorrhizal root infection index
4. Isolation of Yeasts from grapes
5. Preparation of wine from grape juice and estimation of alcohol
6. Estimation of ethanol by dichromate method
7. Production of citric acid by fungus and its estimation
8. Determination of lactic acid concentration In commercial curd samples
9. Antibiotic Sensitivity test
10. Microbiological examination of spoiled foods
11. Enumeration of surface Microflora of vegetables
12. Microbiological examination of milk
13. Detection of number of bacteria in milk by breeds count
14. Determination of milk quality by Methylene blue reduction test (MBRT)
15. Role of yeasts in bread making
16. Extraction and analysis of aflotoxins
17. Immobilization of microbial cells/enzymes.
18. Culturing of mushrooms
19. Visits to Food and Industrial chemical production units

Suggested Books / Manuals

1. A. Manual of Industrial Microbiology and Biotechnology 2nd edition (1999) A.L. Demain and Davis Editor in chief, ASM press.
2. Experiments in Microbiology, Plant Pathology and Biotechnology by K.R. Aneja 4th ed. (2005).
3. Practical Microbiology by R.C. Dubey and D.K. Maheswari (2008)
4. Microbiology – A Laboratory Manual by S.M. Reddy and S.Ram Reddy, 3rd Ed. (2005).
5. Laboratory experiments in Microbiology by Gopal Reddy et al (2005) 1st ed. Himalaya Publications.