SRI VENKATESWARA UNIVERSITY::TIRUPATI

S.V.U.COLLEGE OF SCIENCES

DEPARTMENT OF MICROBIOLOGY

(Revised syllabus for regular students those who study in S.V.U. College (Campus), Tirupati)
(with effect from the batch of students who admitted during the academic year 2015-16)

M.Sc. MICROBIOLOGY

(CHOICE BASED CREDIT SYSTEM)

SCHEME OF INSTRUCTION AND EXAMINATION

Sem	Course code	Title of the course	Core / elective	No. of Credits	Uni. Exams Duration (Hours)	IA	SEE	Total Marks
I	MB-101	General Microbiology	Core	04	3	30	70	100
	MB-102	Microbial Physiology and Biochemistry	Core	04	3	30	70	100
	MB-103	Microbial Genetics	Core	04	3	30	70	100
	MB-104	Analytical Techniques and Biostatistics	Core	04	3	30	70	100
	MB-105	**Practical :** General Microbiology, Microbial Physiology and Biochemistry	-	04	4	-	100	100
	MB-106	**Practical :** Microbial Genetics, Analytical Techniques and Biostatistics	-	04	4	-	100	100
II	MB-201	Essentials of Bacteriology and Virology	Core	04	3	30	70	100
	MB-202	Medical Microbiology	Core	04	3	30	70	100
	MB-203	Immunology	Core	04	3	30	70	100
	MB-204	Bioinformatics, Microbial Genomics and Proteomics	Core	04	3	30	70	100
	MB-205	**Practical :** Essentials of Bacteriology and Virology and Medical Microbiology	-	04	4	-	100	100
	MB-206	**Practical:**Immunology , Bioinformatics, Microbial Genomics and Proteomics	-	04	4	-	100	100
	--	Human Values and Professional Ethics-I	Common	04	-	30	70	100
III	MB-301	Environmental Microbiology	Core	04	3	30	70	100
	MB-302	Immunotechnology and Pharmaceutical Technology	Core	04	3	30	70	100
	MB-303	Molecular Biology and Cell Culture	IE	04	3	30	70	100
	MB-304	Genetic Engineering and r-DNA Technology	IE	04	3	30	70	100
	MB-305	**Practical :** Environmental Microbiology, Immunotechnology and Pharmaceutical Technology	-	04	4	-	100	100
	MB-306	**Practical :** Molecular Biology and Cell Culture and Genetic Engineering and r-DNA Technology	-	04	4	-	100	100
IV	MB-401	Agricultural Microbiology	Core	04	3	30	70	100
	MB-402	Industrial Microbiology	Core	04	3	30	70	100
	MB-403	Food and Dairy Microbiology	IE	04	3	30	70	100
	MB-404	Field Trip/Tour Report	IE	04	3	30	70	100
	MB-405	**Practical :** Agricultural Microbiology and Industrial Microbiology, Food and Dairy Microbiology	-	04	4	-	100	100
	MB-406	**Project**	-	04	4	-	100	100
	--	Human Values and Professional Ethics-II	Common	04	-	30	70	100
	MB-407	Applied Microbiology	EE	04	3	30	70	100
	MB-408	Diagnostic Microbiology	SSC	04	3	-	100	100

MB = Microbiology, IE = Internal Elective, EE = External Elective, SSC = Self Study Course

SEMESTER-I

MB-101: GENERAL MICROBIOLOGY

Unit – 1

Discovery of microorganisms: Development of microbiology, contributions of pioneers, future of microbiology. Origin and evolution of Microorganisms. Scope and significance of Microbiology. General characteristics of different groups of microorganisms.

Classification of microorganisms: Introduction – Hackel's three -kingdom concept – Whittaker's five - kingdom concept and three domain concept of Carl Woese and phylogenetic trees. Basis of microbial classification. Concepts, nomenclature and taxonomic ranks.

General characters of Fungi (Yeasts, Dermatophytes, Opportunistic pathogens) – Algae (Cyanobacteria, Chlorella), Protozoa (Entameoba, Giardia, Leishmania, Plasmodium).

Unit – II

Cytology: Characteristics of prokaryotic and eukaryotic cells. Comparison of the structure and function of each component of Eubacterial cell and Archaebacteria. Biosynthesis of bacterial cell wall.

Sporulation: Structure of bacterial endospores, physiology and biochemistry of sporulation.

Unit – III

Microbiological Methods: Microscopic examination of microorganisms staining methods- Gram, Acid - fast, flagellar, capsule and spore staining, Culture media – Types, lab preparation and media commonly used for growth of microorganisms (bacteria, fungi and algae). Sterilization and disinfection by physical and chemical methods.

Cultural methods: Isolation of pure cultures. Cultivation of aerobic and anaerobic microbes, methods of preservation and maintenance of cultures, revival of stored cultures. Methods of identification of bacteria (biochemical, serological and molecular methods).

Unit –IV

Nutrition and growth: Nutritional groups of bacteria (autotrophy and heterotrophy), carbon assimilation in bacteria. Nutritional mutants, their isolation and use in metabolic studies. Growth cycle of bacteria, estimation of bacterial growth, factors influencing growth (physical and chemical), synchronous and continuous culture methods.

Suggested Books:

1. Michael Madigan, John Martinko, Kelly Bender, Daniel Buckley, David Stahl (2014). Brock Biology of Microorganisms with Mastering Biology- 4th Edition. Global Edition.
2. Gerard Tortora, Berdell Funke, Christine Case (2013). AnIntroduction Microbiology 11th Edition: Pearson New International Edition.
3. John Lammert (2006).Techniques for Microbiology A Student Handbook. Pearson New International Edition.
4. Robert Bauman (2013). Microbiology with Diseases by Taxonomy (4th Edition). Pearson New International Edition.
5. George Wistreich (2006).Microbiology Perspectives A Photographic Survey of the Microbial World (2nd Edition).
6. Ted Johnson, Christine Case (2015). Laboratory Experiments in Microbiology (11th Edition). Pearson New International Edition.
7. Stanier R.Y, Adelberg E.A, Ingraham J.L (1976). General Microbiology, 4th ed. Macmillan.
8. Presacott L.M, Harley J.P and Klein DA (1996). Microbiology, 3rd edition Brown publishers.
9. Alcamo IE (1983). Fundamentals of Microbiology, 5th ed. Benjamin-Cummings, 1983.
10. Madigan *et al*., (1997). Brock Biology of Microorganisms. 8th ed. Prentice-Hall International, Inc.

MB -102: MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY

Unit – I

Nutrition: Elemental nutrient requirements of microbes; nutritional groups of bacteria; autotrophy-photoautotrophy, chemoautotrophy and autotrophic metabolism; heterotrophy – photoheterotrophy and chemoheterotrophy, heterotrophic metabolism in bacteria; nutritional mutants and their use in metabolic studies.

Uptake and Transport of nutrients in microbes – Structural organization of plasma membrane in relation to transport, types and mechanisms of transport (passive, simple, facilitated, active, chemical modification) with reference to sugars, amino acids and ions; methods for studying of transport, coupling of transport of ions and metabolites to ATP/proton gradient.

Microbial Growth: Building of macromolecules from elemental nutrients, supramolecules, cell components and cells; cell cycle in microbes and generation times; batch culture phases and importance of each phase, continuous cultures, synchronous culture, factors influencing the microbial growth.

Unit – II

The concepts of microbial metabolism, primary and secondary metabolism and their significance.

Bioenergetics: Concepts of free energy and thermodynamic principles in biology, energy transformation, ATP cycle, standard free energy of hydrolysis of phosphate compounds, energy transducers, redox potentials, free energy changes in redox reactions.

Photosynthesis: Oxygenic and anoxygenic photosynthesis, photosynthetic pigments, basic photochemistry of PS I and PS II and photosynthetic electron transport; modes of CO_2 fixation, halobacterial photosynthesis, sulphur, nitrogen and iron assimilating bacteria. Chloroplast mediated electron transport; chemolithotrophic electron transport systems. Biolumenescence.

Aerobic respiration: TCA cycle – Intracellular location and reactions of the cycle, amphibolic nature of the cycle, energetics of the cycle; the glyoxalate cycle. Mechanisms of substrate-level phosphorylation; respiratory electron transport in mitochondria and bacteria along with its components (carriers); mechanism of oxidative phosphorylation, uncouplers, inhibitors;

Anaerobic respiration : Nature of fermentation, the relationship of oxygen to growth and fermentation, biochemical mechanisms of lactic acid, ethanol, butanol, citric acid and acetone fermentations, study of fermentations, relationships between fermentation and energy production; nitrate and sulphate respiration.

Unit - III

Carbohydrates: Metabolism and classification Pathways underlying the utilization of different sugars (Glycolysis TCA cycle, EMP, ED, HMP and Phosphoketolase) in microorganisms, gluconeogenesis; synthesis of peptidoglycans and glycoproteins.

Lipids: Classification, oxidation and biosynthesis of fatty acids, triacyl glycerols, phospholipids and glycolipids; oxidation of saturated and unsaturated fatty acids; microbial metabolism of aromatic and aliphatic hydrocarbons.

Nucleic acids: Occurrence, composition, functions and types of nucleic acids. Structure of purines, pyrimidines and their analogues derivatives. Biosynthesis of purine and pyrimidine nucleotides. Biosynthesis of deoxy-ribonucleotides. Regulation of nucleotide synthesis. Catabolism of nucleotides.

Amino acids: Classification, catabolism of amino acids, transamination, oxidative deamination, urea cycle, ammonia transport.

Unit – IV

Proteins: Classification, physico – chemical properties and biological functions of proteins, Structural organization of proteins – (primary, secondary, tertiary and quarternary level). Denaturation of proteins.

Enzymes: Classification, nomenclature, kinetics of enzymes – catalyzed reactions, Michaelis-Menten equation, determination of Vmax, K_M K_{cat} specificity constant kcat/kM and their significance. Effect of pH, temp, concentration of enzyme and conc. of substrates on the rate of enzyme – catalyzed reactions. Mechanism of action of enzymes (Lysozyme and chymotrypsin).

Enzyme inhibition: Reversible inhibition – competitive, uncompetitive, non competitive allosteric and irreversible inhibition. Activators, proenzymes, coenzymes, isoenzymes and immobilized enzymes.

Suggested Books:

1. Prescott *et al*., (2000). Microbiology. By W.m.c Brown Publ.
2. Lodish *et al*., (2000). Molecular Cell Biology.
3. Stainer et al.,(1999). General Microbiology. By Macmillan Educational Ltd.
4. Lehninger *et al.*, (2005). Principles of Biochemistry. CBS publishers.
5. Donald Voet J, G. Voet charlotte W (2009). Fundamentals of Biochemistry. pratt John Wiley and sons, Inc.
6. Stryer L (2006). Biochemistry. 4th ed. Freeman and Company.
7. Michael PS, Albert GM, John WF (2002). Microbial Physiology (4th Edition). Willey press.
8. Cohen GN (2011). Microbial Biochemistry. Springer science+ bioscience publications.
9. Rodney Boyer (2002). Interactive Concepts in Biochemistry. John Wiley & Sons Publishers, Inc.
10. Niederhoffer EC (2000) Biochemistry and Molecular biology. SIU School of Medicine.

MB-103: MICROBIAL GENETICS

Unit – I

Genetic notations, conventions and terminology, Nucleic acids as genetic information carriers-experimental evidences.

Nature of Genetic material: Evidence to prove DNA & RNA as genetic material. Structure and forms of DNA and organization of genome in Prokaryotes and Eukaryotes.

Gene as unit of expression: Modern concept of gene, colinearity of gene and polypeptide, types of genes (constitutive, structural, regulatory, luxury, overlapping, split genes etc.,). Genetics of Bacteria and Fungi.

Genome diversity: Viruses – linear, circular and dividend genomes of RNA and DNA viruses. Prokaryotes – nucleoid and chromosome organization, genome evolution in microbes. Eukaryotes – chromosome organization / structure, histones, nucleosomes, genome complexity, chromosomal banding. Organelle genomes. Genetic mapping of genomes.

Unit – II

Mutations and Mutagenesis: Types of mutations, molecular basis of mutations, isolation and analysis of mutations, significance of mutations, mutagenic agents, mechanism of mutagenesis, Site directed mutagenesis and its applications. Evaluation of mutagenes by Ames test.

DNA replication: General principles, various modes of replication, inhibitors of DNA replication.

DNA damage and repair: Photo reactivation, Excision repair, post replication, recombination and SOS repair mechanisms. Role of rec gene in DNA repair. Types of DNA damage-domination, oxidative damage, alkylation and pyrimidine dimmers; repair pathways.

Maturation and processing of different RNAs: Methylation, processing of rRNA; capping, polyadenylation, splicing and editing of mRNA; processing and modification of tRNA. Catalytic RNAs (ribozymes). Inhibitors of transcription. *In vitro* transcription systems.

Unit – III

Translation (Protein biosynthesis): Central dogma theory and flow of genetic information. Steps of protein biosynthesis (activation of amino acids, initiation, elongation, termination) in prokaryotes and eukaryotes; post-translational modification of proteins and their sorting and targeting; regulation of translation; inhibitors of protein biosynthesis; in-vitro translation systems.

Regulation of gene expression: An overview on levels of regulation, terminology and operon concepts.

DNA binding proteins: Enhancer sequences and control of transcription. Identification of protein – binding sites on DNA, control of transcription by interaction between RNA polymerases and promoter region, use of alternate sigma factors, controlled termination, attenuation and antitermination.

Unit – IV

Biology of plasmids: Types of plasmids, Properties, purification, detection, replication and curing incompatibility grouping, copy number replication and regulation of Col E_1 and F plasmid, Natural and artificial methods of plasmid transfer, their significance and applications.

Transposons: Transposable elements in prokaryotes and eukaryotes, types of bacterial transposons – Insertional sequences, complex transposons, Mechanisms of transposition (Replicative and non replicative) and temperature exploitation of Transposable elements in genetics. Transposable viruses and retroposons, Transposon mutagenesis.

Suggested Books:

1. Uldis NS, Ronald EY (2002). Modern Microbial Genetics 2nd edition. Willey publications.
2. Keya Chaudhari (2013).Microbial Genetics. Teri press.
3. Stanley R, Maloy JE, David Freifelder C (2006). Microbial Genetics 2nd edition. John Wiley & Sons Publishers, Inc.
4. Kenneth W. Adolph (2002). Methods in Molecular Genetics: Microbial Gene Techniques. AP publications.
5. Jyotsna Rathi (2006). Microbial Physiology Genetics and Ecology. . John Wiley & Sons Publishers, Inc.
6. William HE and Elloit DC (2000). Biochemistry & Molecular biology Oxford University press.
7. Stent GS and Calendar R (1986). Molecular Genetics. CBS Publishers.
8. David freifeider and Malaclinik GM(1996). Essentials of molecular biology.
9. Streips UN and Yasbin RE (1991). Modern Microbial Genetics. Wileyliss.
10. David Freifeider (1995). Microbial Genetics. Narosa Publishers.

MB-104: ANALYTICAL TECHNIQUES AND BIOSTATISTICS

Unit – I

Microscopy: Principles and applications of Bright field, Dark field, Fluorescent, Phase Contrast, Transmission and Scanning Electron microscopes. Confocal microscopy, planning tunneling microscope, preparation of microbiological samples for microscopy.

Centrifugation: Sedimentation analysis, differential, rate- zonal and equilibrium density gradient centrifugations - applications. Isolation of cells, sub cellular organelles, viruses and macromolecules.

Electrochemical techniques: Redox reactions, pH and Clark oxygen electrodes; biosensors.

Unit – II

Chromatography Techniques: Paper, Thin layer, Ion exchange Chromatography, Gel permeation chromatography, Affinity chromatography, HPLC, GLC.

Electrophoresis: Paper, starch gel, agarose, PAGE, Iso-electrophoresis, Isoelectric focusing. Blotting techniques - Western, Southern and Northern. Electro elution of biomolecules from gel/paper.

Unit – III

Spectroscopy: Working principle and applications of visible, UV, IR, NMR, Raman, ESR, and mass, Spectrophotometry, fluorimetry and flame photometry, plasma emission and atomic absoption, ORD, CD, X-ray diffraction and X-ray crystallography.

Radio isotopes: Nature & types of radioactivity, detection and measurement of radioactivity, autoradiography, biological applications of radio isotopes.

Unite – IV

Elements of Biostatistics: Introduction to Biostatistics; Methods of representation of statistical data; population and sample designs; Random and Non- random sampling methods. Measures of central tendency – Mean, Median and Mode.

Concept of Prabability: Concept of correlation and regression.

Statistical applications in biology: Experimental designs; measures of dispersion: standard deviation, standard error. Tests of significance: Student's "t" test, Paired and unpaired t test; Analysis of variance (ANOVA), Chi-square test.

Suggested Books:

1. Chap J. L (2003). Introductory Biostatistics. Wiley publications.
2. Roger E (1995). Chromatography of Synthetic & Biological Odymers. Halted Press.
3. Wilson K and J. Walker J (1995). Practical Biochemistry Principles and Techniques 4th ed. Cambridge press.
4. Sawhney S.K and Randhir Singh (2000). Introduction to Practical Biochemistry. Narosa Publ. House.
5. Sadasivam S and Manikam A (2005). Biochemical Methods. Revised 2nd Ed. New Age International Publishers, New Delhi.
6. Upadhyaya and Upadhyaya (2007). Biophysical and Chemical Principles and Techniques. Himalaya Publishing House, New Delhi.
7. Gurumani N (2006). Research Methodology for Biological Sciences New Age Publications, New Delhi.
8. Skoog P.A, Halter F.J and Niemen T.A(2001). Principles of Instrumental Analysis. Harvest College Publications, Amsterdam.
9. Stephen LR. Ellison, Vicki J. Barwick, Trevor J. Duguid Farrant (2009). Practical Statistics for the Analytical Scientist: A Bench Guide. RSC publishing.
10. Joan Welkowitz, Barry H. Cohen, R. Brooke Lea(2012). Introductory Statistics for the Behavioral Sciences, 7th Edition. RSC publishing.
11. Barbara H. Stuart (2013). Forensic Analytical Techniques. Wiley

PRACTICALS

MB-105: GENERAL MICROBIOLOGY, MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY.

1. Sterilization techniques – autoclaving, heat sterilization, filtration, UV irradiation and chemical.
2. Preparation of Media – Specify.
3. Staining techniques of bacteria: Simple, differential and special staining- spore, capsule and flagellar staining.
4. Isolation and cultivation of pure cultures.
5. Techniques of maintenance of stock culture.
6. Anaerobic culturing of bacteria.
7. Testing the efficiency of disinfectant action, Dettol, phenol (Reidal – Walker test).
8. Growth curve and generation time in bacteria.
9. Effect of Temperature & P^H on the growth of bacteria.
10. Cultivation of autotrophic and heterotrophic organisms.
11. Determination of characteristics of Enzyme catalysed reaction Vmax and K_M.
12. Effect of Temperature and pH on the rate of enzyme catalyzed reaction.
13. Isolation of acid and alkaline phosphatase from different bacteria.
14. Qualitative tests for carbohydrates and identification of unknown carbohydrates.
15. Qualitative tests for amino acids and Proteins, Lipids and Nucleic acids.
16. Estimation of sugar and glucose by Benedicts and DNS method.
17. Estimation of protein by Biuret, Lowry method. UV absorption.
18. Estimation of cholesterol, blood urea, creatinine

MB -106: MICROBIAL GENETICS, ANALYTICAL TECHNIQUES AND BIOSTATISTICS.

1. Screening and isolation of streptomycin mutant resistant bacteria by gradient plate technique.
2. Lethality curve construction.
3. Induction of mutation in bacteria using UV light, photoreactivation.
4. Induction of mutation in bacteria by chemical mutagens and detection by Ame's test.
5. Transfer of genes in bacteria by Transformation, Transduction and Conjugation.

6. Curing of plasmids from *E. coli* strains.
7. Preparation of buffers and measurement of pH.
8. Separation of amino acids, sugars and lipids by paper chromatography and TLC.
9. Separation of nucleic acids by Agarose gel electrophoresis.
10. Polyacrylamide gel electrophoresis for proteins.
11. Absorption spectra of amino acids and nucleotides.
12. Isolation and spectrophotometric determination of cyanobacterial pigments.
13. Classification of data, computation of mean and standard deviation.
14. Correlation and regression coefficients.
15. Fitting of straight line, a parabola, a power curve and an exponential curve.
16. One way ANOVA with equal number of observations and with unequal number of observations and ANOVA with two way classified data.
17. Simple statistical with Excel.

SEMESTER –II

MB – 201: ESSENTIALS OF BACTERIOLOGY AND VIROLOGY

Unit – I

History and development of Bacteriology.

Domain Eubacteria – morphological types – cell walls, Gram positive – Gram negative eubacteria – L-forms, cell wall synthesis, antigenic properties – capsule – types, composition and function, cell membranes – structure – composition – properties, nucleoid – cell division.

Domain Archaea: The unique characteristics, habitats, cell wall structure, membrane structure, pigments, genome, unique enzymes, evolutionary significance.

Endospores structure, formation and germination.

Reserve food materials – polyhydroxybutyrate – polyphosphate granules – oil droplets-cyanophycin granules and sulphur inclusions.

Unit – II

Taxonomy: Aaccording to the Bergey's Manual of Systematic Bacteriology. Principles of Bacterial Taxonomy, Classification of bacteria and general characteristics of each group, including Rickettsiae, PPLO, Actinobacteria and Chlamydiae. General characteristics and classification of Archaebacteria.

Plant pathogenic bacteria – Characteristics of *Xanthomonas, Pseudomonas, Agrobacterium, Corynebacterium, Erwinia, Xylella.*

Characteristics of non-pathogenic / beneficial bacteria : *Rhizobium, Azospirillum, Azotobacter, Cyanobacteria (Nostoc, Anabaena, Spirulina), Nitrosomonas, Nitrobacter, Frankid, Klebsiella, Zymomonas, Nocardia, Streptomyces, Acetobacter, Lactobacillus, Streptococcus, Leuconostoc, Serratia, pseudomonas, Alcaligenes, Bacillus, Thiobacillus, Desulfovibrio Methylophilus, Methylococcus.*

Unit – III

History of Virology: Discovery of viruses and development of Virology (contribution of pioneers). Nature, origin and evolution of viruses. New emerging viruses.

Nomenclature and classification of viruses : Criteria used for naming and classification of viruses. Current ICTV classification of viruses of bacteria, plants, animals, humans, algae, fungi and protozoans. Major characteristics of the virus families / genera / groups.

Sub-viral agents: Characteristics of sub-viral agents – Viroids, Satellite viruses, Satellite nucleic acids and Prions.

Isolation and cultivation of viruses: Animal viruses - experimental animals, embryonated eggs, animal cell cultures-primary and secondary cell cultures. Plant viruses - experimental plants and tissue cultures. Infectivity assay methods of viruses-physical, serological and chemical approaches. Assay and maintenance of viruses, qualitative and quantitative analysis of viruses.

Purification of viruses: Extraction of viruses from tissues, clarification, concentration of viruses in clarified extracts by physical and chemical methods,

Properties of viruses: Biological characteristics of viruses, host-range, transmission (vector and non-vector), virus stability. Physical-morphology and structure, sedimentation, electrophoretic mobility, buoyant density. Biochemical – chemical composition, nucleic acids, proteins, enzymes, lipids, carbohydrates, polyamines, cations. Antigenic nature of viruses.

Architecture of viruses: Morphology, structure and composition of viruses-Principles of virus structure- Icosahedral, helical and binal symmetry.

Unit – IV

Viral genomes: Diversity of viral genomes – DNA genome – linear and circular, single stranded and double stranded. RNA genomes – positive and negative, linear and circular, single and double stranded, partite of viral genomes – mono, bi, tri and multipartite genomes.

Replication of viruses: Outlines of replication of viruses – approaches to study replication of viruses, replication strategies of viruses.

Prevention and Control of viruses: The infection control policy aseptic techniques, cleaning and disinfection, protective clothing, isolation; Prevention – sanitation, vector control, vaccines and immunization; Control- chemoprophylaxis, chemotherapy (antiviral drugs, Interferon therapy), efficacy of infection control.

Suggested Books:

1. Bergey's Manual of Systamatic Bacteriology, Vol. 1-4, 1st Edition.
2. Holt J.G. *et al.,* (2000). Bergey's Manual of Determinative Bacteriology, 9th ed. By Lippincott Williams and Wilkins.
3. Prescott *et al.*, (1999). Microbiology. 3rd ed. by Wm. Co. Brown Publ.
4. Flint SJ *et al* (2000) Principles of Virology by ASM Press.
5. Cann A (2005) Principles of Molecular Virology.. 4th ed..by Academic Press.
6. Hull R, . (2001) Plant Virology, 4th edby R.E.F. Matthews. Academic Press.
7. Walkey. DGA,(1985) Applied Plant Virology. Heinemann Publications.
8. Fields, BN,. Knipe DM and P.M. Howley. (1996) Fields Virology. Lippincott-Raven Publishers.
9. Fabio Bagnoli and Rino Rappuoli (2015) .Advanced Vaccine Research Methods for the Decade of Vaccines. Caister Academic Press.
10. Sergio Sánchez and Arnold L. Demain (2015). Antibiotics: Current Innovations and Future Trends. Caister Academic Press.
11. Patrick Arbuthnot and Marc S. Weinberg (2014). Applied RNAi: From Fundamental Research to Therapeutic Applications. Caister Academic Press.

MB –202: MEDICAL MICROBIOLOGY

Unit – I

Principles of Medical Microbiology: Historical developments Classification of medically important microorganisms. Normal microbial flora of human body: Origin of normal flora; Infectious diseases.

Infection: Sources of infection for man; vehicles or reservoirs of infection. Exogenous infection: 1) Patients 2) carriers – (Healthy; convalescent; contact; paradoxical and chronic) 3) Infected animals (zoonosis) 4) Soil endogenous infection. Mode of spread of infection: 1) Respiratory 2) skin 3) Wound and burn infection 4) Venereal infections 5) Alimentary tract infection 6) Arthorpod-borne blood infections 7) Laboratory infections. Nosocomial infections: common types of hospital infections, their diagnosis and control.

Pathogenesis: Adhesion in various hosts, cell damage, release of pathogens, Transmissibility, infectivity and Virulence. Opportunistic pathogens and True pathogens. Toxigenicity: Invasiveness, other aggressins (Hyaluronidase), coagulase, fibrinolysins or kinase, depolymerizing enzymes, (mucinase, lipases, proteases, nucleases, collagenase, neuraminidase). Organotropism, variation and virulence.

Unit – II

Microbial Toxins: Types of microbial toxins, Endotoxins, Exotoxins, LC_{50} of toxins, Effective dose of toxins, Assay of toxins, Mechanism of action of Diphtheria, Cholera, Staphylococcal toxin and Clostridial neurotoxins. Virulence and virulence factors of microbial toxins. Signs and symptoms of microbial intoxication.

Diagnostic methods: Collection, transport and preliminary processing of clinical samples. Clinical, microbiological, immunological and molecular diagnosis of microbial diseases.

Principle of Chemotherapy: Chemotherapeutic agents, Mechanism of action of antimicrobial agents, Synthetic compounds and antibiotics and their assay in body fluids, drug resistance, Mechanisms of drug resistance, MDR. Various methods of drug susceptibility testing. Brief account on available vaccines and schedules, passive prophylactic measures.

Unit – III

Bacterial diseases: Symptoms, diagnosis , treatment and prevention of the diseases caused by *Staphylococcus, Streptococcus, Pneumococcus, Neisseria, Corynebacterium, Bacillus, Clostridium, Actinomycete, Rickettsiae, Chlamydiae, Mycoplasma, Enterobacteriacea, Vibrios, Yersinia; Haemophilus; Bordetella, Brucella; Mycobacteria, Spirochetes; Salmonella* species.

Unit – IV

Viral diseases: Virus-host interactions at cellular and organism levels. Common diseases caused by Poxviruses; Herpes virus; Adeno viruses; Picorna viruses; Orthomyxo viruses; Paramyxo viruses; Arbo viruses, Rhabdo viruses, Hepatitis viruses; Oncogenic viruses; Human Immuno deficiency viruses (HIV/AIDS). Prion diseases – Kuru, CJD disease and GSS syndrome.

Fungal diseases: Diseases caused by dermatophytes, dimorphic fungi and opportunistic fungal pathogens. Description and classification of pathogenic fungi and their laboratory diagnosis.

Parasitic diseases: Disease caused by parasites like *Entamoeba, Plasmodium, Trichomonas, Leishmania* and *Toxoplasma, Giardia, Wuchereria, Dracunculus.*

Suggested Books :

1. Ananthanarayan R, Panikar CKJ (2000). Textbook of Microbiology. 2000. 6th Edition. Orient Longman Ltd.
2. Warren Levinson (2014).Review of Medical Microbiology and Immunology. Mc Graw Hill education.
3. Bailey & Scott's (2011). Diagnostic Microbiology (10th Edition), Published by: Mosby.
4. Coloratlas and Text book of Diagnostic microbiology (5th Edition), edited by: Eimer W Koneman, published by: Lippinctt.
5. Subash CP (2000). Text Book of Medical Parasitology, by published by : All India Publishers & Distributors. 1st edition.
6. Jayaran Paniker C.K, Text Book of Medical Parasitology (4th Edition), by Published by: Jaypee Brothers.
7. Cruichshank *et al.*,(2012). Manual of Clinical Microbiology, 4th ed. by E.H. Lennette et al. ASM Publications.
8. Patrick R. Murray, Ken S. Rosenthal, Michael A. Pfaller (2012). Medical Microbiology. Elsevier saunders.
9. Koen Venema and Ana Paula do Carmo (2015).Probiotics and Prebiotics: Current Research and Future Trends. Caister Academic Press.
10. Sergio Sánchez and Arnold L. Demain (2015). Antibiotics: Current Innovations and Future Trends. Caister Academic Press.

MB -203: IMMUNOLOGY

Unit – I

History: Historical perspective of Immunology, milestones in immunology.

Cells and Organs of the Immune system: Hematopoiesis, Lymphoid cells, stem cells, Mononuclear cells, Granulocytes, Mast cells, Dendritic cells. Lymphoid organs – Primary and Secondary lymphoid organs.

Types of immunity: Innate immunity and adaptive immunity, comparative immunity, Immune dysfunction and its consequences.

Immune responses to infectious diseases : Viral, bacterial, protozoan and other parasitic diseases.

Unit– II

Antigens: types, properties, study of antigenicity, immunogenicity versus antigenicity, factors influencing immunogenicity. Epitopes, haptens, mitogens, superantigens. Viral and bacterial antigens.

Antibodies: Basic and fine structure of Immunoglobulins, classes and biological activities of Immunoglobulins, Antigenic determinants – Iso, allo and idiotypes. Immunoglobulin super family, antibody diversity, organization and expression of immunoglobulin genes. Production of polyclonal antibodies-animals, additives, adjuvants, routes, dose, collection and preservation of antisera, purification of immunoglobulins, quantitative and qualitative analysis of immunoglobulins.

Recombinant antibodies: Production and their advantages over conventional antibodies.

Antigen and Antibody interactions: Affinity, Avidity, Cross reactivity.

***In vivo* serological reactions:** Phagocytosis, Opsonization, Neutralization, Protection tests.

***In vitro* serological tests:** Precipitation tests in liquid and semisolid media, single and double immuno diffusion tests. Immuno electrophoresis tests (Rocket, counter current). Agglutinations tests-HA and HI, latex agglutination. Complement fixation tests, Labeled antibody based tests – Enzyme linked immunosorbent assays (ELISA), Western blotting, Radio immuno assay (RIA), Immunoflueorescent and Immuno specific electron microscopy. Infectivity neutralization test. The relative advantages and disadvantages and their applications in Microbiology.

Unit – III

Humoral immune response: Primary and secondary immune responses, induction, regulation of the immune effector response.

Cell mediated immune response: Induction and mechanism, antibody-dependent cell mediated cytotoxicity (ADCC).

Immune effector mechanisms: Cytokines, Lymphokines, Chemokines and their classification, properties and functions.

Complement cascade system: Complements nomenclature, classification, complement components, functions, activation, regulation, biological consequences, complement deficiencies.

Hypersensitive and Allergic reactions : Classification, types I, II, III and IV.

Unit-IV

Immunopathology : Immunodeficiencies – Primary immunodeficiency (genetic) diseases due to B cell, T-cell and combined defects (Hypogamma globulinemia, SCID, ADA) phagocyte and complement defects. Autoimmune diseases – Autoimmunity, induction, mechanism of tissue damage in autoimmunity. Autoimmune diseases – Organ specific (Autoimmune anemias, Autoimmune thyroid diseases, Diabetes mellitus, Multiple sclerosis), Systemic autoimmune diseases (Rheumatoid arthritis, Systemic lupus erythematousus) and their therapy.

Suggested Books:

1. Immunology. 2000. 4th edition. J. Kuby. W.H. Freeman and Company.
2. Immunology. 1996. 4th edition. I. Roitt, J. Brostoff and David Male. Mosby publications.
3. Fundamental Immunology. 1992. 2nd edition. R.M. Coleman, M.F. Lombard and R.E. Sicard. Wm. C. Brown Publishers.
4. Immunology. 1997. 3rd edition. R.M. Hyde. B.I. Waverly Pvt. Ltd.
5. Immunology. 1995. 4th edition. I.R. Tizard. Saunders College Publishing.
6. Immunology – The Science of self and non-self discrimination. 1982. Jon Klein. John Wiley and Sons.
7. Immunology – An illustrated outline. 1986. David Male. Churchill Living Stone.
8. Viruses that affect immune system. 1991. H.Y. Fan, I.S.Y. chen, N. Rosenberg and W. Sugden. American Society for Microbiology.
9. Immunobiology : The immune system in health and disease, 1994. C.A. Janeway, Jr., P. Travers. Current biology Ltd

MB-204: BIOINFORMATICS, MICROBIAL GENOMICS AND PROTEOMICS.

Unit – I

Introduction to Biological Databases: Types of databases, Nucleic Acid Sequence databases, Protein sequence databases.

Bioinformatics and its applications: Structure-function relationship. Sequence assembling using computer. Computer applications in molecular biology, Protein domains and human genome analysis program (BLAST, FASTA, GCC etc.) Search and retrieval of biological information and databases sequence, databank. (PDB and Genbank), accessing information (Network expasy, EMB Net, ICGEB Net).

Protein structure, prediction: Protein structure analysis, sequence based protein prediction. Homology or comparative modeling: Remote homology (Threading), Protein function prediction.

Unit – II

Molecular Modeling & Drug Designing: Introduction to the concepts of molecular modeling Molecular structure and internal energy, energy minimization of small molecules empirical representation of molecular energies. Benefits of Pharmacogenomics. Drug discovery, Structure based drug designing and virtual screening by Automated docking, *de novo* sequence.

Molecular Docking and docking systems: Introduction to molecular docking, Protein – ligand docking.

Docking program: Flexible docking, evaluation of docking prediction. Geometry based, energy based, scoring docked complexed, QSAR. Grid method, Gragment method, Kinetic methods, descriptor method.

Unit – III

Introduction to Omics platforms: Genomics, Transcriptomics, Proteomics and Metabolomics .

Whole genome analysis: Preparation of ordered cosmid libraries, bacterial artificial chromosomal libraries, shotgun libraries and sequencing, conventional sequencing (Sanger, Maxam and Gilbert Methods), automated sequencing.

Sequence analysis: Computational methods, homology algorithms (BLAST) for proteins and nucleic acids, open reading frames, annotations of genes, conserved protein motifs related structure / function (PROSITE, PFAM, Pro Scan). DNA analyses for repeats (Direct and inverted), palindromes, folding programmes. Use of Internet, public domain databases for nucleic acid and protein sequesnces (EMBL, GeneBank), database for protein structure (PDB).

Unit – IV

DNA Microarray:
Printing of oligonucleotides and PCR products on glass slides, nitrocellulose paper. Whole genome analysis for Global patterns of gene expression using fluorescent-labelled cDNA or end labeled RNA probes. Analysis of single nucleotide polymorphism using DNA chips.

Proteomics: Proteome, metaproteome, structural proteomics, functional proteomics.
Proteomic Tools: 2DE, MALDI – TOF, LC – MS/MS analysis, ICAT, ITRAQ, AQUA, ESI –Q-IT-MS, SELDI – TOF-MS, yeast two hybrid analysis.

Integration of omic approaches: Application of omic technologies in bioprospecting, biodegradation and medicine. Systems approaches using high through put technologies for biomining microorganisms. Strategies for the analysis of bacterial biodegradation path ways, Concept of Laboratory-on-a-chip (LOC).

Suggested Books:

1. Manuel Fuentes and Joshua LaBaer (2014). Proteomics: Targeted Technology, Innovations and Applications. Caister Academic Press.
2. Stephen M& Krawez SA (2000). Bioinformatics: Methods and Protocol
3. Marcello P, Kimberlee G (2000).Principles of Biostatistics. Published by Duxbury, Thomson Learning, USA.
4. Sorensen (2007). Genomics and proteomics-karine element A. CRC publishers
5. Nicholson (2007). The handbook of metabonomics and metabolomics. Willey publishers.
6. Philip Stanford (2008).Methods in micro array Normalization. Willey publishers.
7. Supratim Choudhart & David B (2009). Genomics-Fundamentals and Applications. Carlson.
8. Mark Pagel and Andrew Pomiankowski (2000). Evolutionary Genomics and Proteomics. W.H. Freeman and Company.
9. Robert S. Matson (2003). Applying Genomic and Proteomic Microarray Technology in Drug Discovery. CRC Press.
10. D. M. Dziuda DM(2006). Data Mining for Genomics and Proteomics: Analysis of Gene and Protein Expression Data. Willey publishers.

PRACTICALS

MB-205: ESSENTIALS OF BACTERIOLOGY, VIROLOGY AND MEDICAL MICROBIOLOGY

1. Isolation of bacteria from diseased plant leaf
2. Slide culture technique
3. Examination of Curd
4. Isolation of Bacteriophages from sewage
5. Quantification of Bacteriophages by plaque assay
6. Cultivation of animal viruses
   (a) Egg inoculation methods
   (i) Choreoallontoic (ii) amniotic (iii) Yolk sac (iv) allontoic routes
7. Tissue culture method – Chick fibroblast culture
8. Assay and identification of viruses
   (i) Haemagglutination inhibition test
9. Purification of virus by elution method
10. Mechanical sap transmission of plant viruses
11. Determination of bean common mosaic virus seed transmission efficiency
12. Collection and processing of clinical samples (throat swab, urine, blood and faeces)
13. Examination of Helminth parasites – spotters / slides
14. Culturing of anaerobes by MC Intosh Filde's Jar

15. Examination of stool for *Ascaris* eggs
16. Examination of blood for malarial parasite
17. Antibiotic sensitivity test
18. VDRL test
19. WIDAL test (slide test)
20. Latex agglutination test for HBV
21. Identification of pathogenic bacteria based on biochemical tests HIV, DOT-BLOT test.

MB-206: IMMUNOLOGY, BIOINFORMATICS, MICROBIAL GENOMICS AND PROTEOMICS.

1. Primary & Secondary lymphoid organs
2. Production of polyclonal antibodies – demonstration of different routes of antigen inoculation, bleeding of experimental animals and collection of serum
3. Purification of immunoglobulins
4. Electrophoretic separation of normal and immunoserum.
5. Invitro serological tests Single & Double immunodiffusion tests; HA & HI tests; Immuno electrophoresis; counter current & rocket electrophoresis; DAC-ELISA (indirect).
6. Dot ELISA
7. Sandwich ELISA
8. Antigen Capture ELISA
9. Antibody Capture ELISA
10. Rocket Immuno Electrophoresis
11. ASO titre.
12. Programming in C language (4-5 programmes)
13. Searching of databases (web searching).
14. MEDLINE searches for literature on a given topic, locating related materials on Medline
15. Web based biological sequence analysis of protein coding regions Hands.

SRI VENKATESWARA UNIVERSITY :: TIRUPATI

S.V.U. COLLEGE OF SCIENCES

COMMON SYLLABUS FOR ALL P.G. COURSES (CBCS & NON-CBCS)

SEMESTER – II

HUMAN VALUES AND PROFESSIONAL ETHICS – I

Syllabus

(With effect from 2014-15)

(effective from the batch of students admitted from the academic year 2014-15)

I. Definition and Nature of Ethics- Its relation to Religion, Politics, Business, Law, Medicine and Environment. Need and Importance of Professional Ethics- Goals – Ethical Values in various Professions.

II. Nature of Values- Good and Bad, Ends and Means, Actual and potential Values, Objective and Subjective Values, Analysis of basic moral concepts- right, ought, duty, obligation, justice, responsibility and freedom, Good behavior and respect for elders, Character and Conduct.

III. Individual and society:
Ahimsa (Non-Violence), Satya (Truth), Brahmacharya (Celibacy), Asteya (Non possession) and Aparigraha (Non-stealing). Purusharthas (Cardinal virtues)- Dharma (Righteousness), Artha (Wealth), Kama (Fulfillment Bodily Desires), Moksha (Liberation).

IV. Bhagavad Gita – (a) Niskama karma. (b) Buddhism – The Four Noble Truths – Arya astanga marga, (c) Jainism – mahavratas and anuvratas. Values Embedded in Various Religions, Relirious Tolerance, Gandhian Ethics.

V. Crime and Theories of punishment – (a) Reformative, Retributive and Deterrent. (b) Views on manu and Yajnavalkya.

Books for study:

1. John S Mackenjie: A manual of ethics.
2. "The Ethics of Management" by Larue Tone Hosmer, Richard D. Irwin Inc.
3. "Management Ethics – integrity at work" by Joseph A. Petrick and John F. Quinn, Response Books: New Delhi.
4. "Ethics in Management" by S.A. Sherlekar, Himalaya Publishing House.
5. Harold H. Titus: Ethics for Today
6. Maitra, S.K: Hindu Ethics
7. William Lilly: Introduction to Ethics
8. Sinha: A Manual of Ethics
9. Manu: Manu Dharma Sastra or the Institute of Manu: Comprising the Indian System of Duties: Religious and Civil(ed.) G.C. Haughton.
10. Susruta Samhita: Tr. Kaviraj Kunjanlal, Kunjalal Brishagratha, Chowkamba Sanskrit series, Vol. I, II and III, Varnasi, Vol I OO, 16-20, 21-32 and 74-77 only.
11. Caraka Samhita: Tr. Dr. Ram Karan Sarma and Vaidya Bhagavan Dash, Chowkambha Sanskrit Series office, Varanasi I,II,III Vol I PP 183-191.
12. Ethics, Theory and Contemporary Issues, Barbara Mackinnon, Wadsworth/Thomson Learning, 2001.
13. Analyzing Moral Issues, Judith A. Boss, Mayfield Publishing Company, 1999.
14. An Introduction to Applied Ethics (Ed.) John H. Piet and Ayodhya Prasad, Cosmo Publications.
15. Text book for Intermediate logic, Ethics and Human Values, board of Intermediate Education & Telugu Academic Hyderabad.
16. I.C. Sharma Ethical Philosophy of India. Nagin & co Julundhar.

SEMESTER-III

MB-301: ENVIRONMENTAL MICROBIOLOGY

Unit-I

Brief account of the habitat for microorganisms: soil, water and atmosphere. General description of soil, water, air. Physical and chemical factors influencing the distribution of microbial flora. Extremophiles-Acidophilic, alkalophilic, thermophilic, barophilic, osmophilic and halophilic microbes – mechanisms and adoption obligate anaerobes. Application of thermophiles and extremophiles.

Population interactions: beneficial and antagonistic. Bio-geo chemical cycles and ecological significance – role of microorganisms in cycling of – carbon, nitrogen, sulfur and phosphorus. Microbial leaching of mineral ores – organisms involved, factors affecting leaching, leaching processes of uranium, copper and gold.

Unit – II

Microbiology of the air: Microbes and microbial propagules in air, methods for microbial analysis of air, standard limits. Significance of aerobiological studies, Nature and diseases caused by aeroallergens and their control.

Aquatic Microbiology: Distribution of microorganisms in fresh and marine environments, Methods for sampling and analysis of water, microflora, role of microbes in self purification of water: Water pollution and its control.

Marine Microbiology: Marine polysaccharides – biomedical and biotechnological applications.

Unit-III

Sewage Microbiology: composition and sources of sewage, Microbial diversity, primary, secondary, tertiary and quaternary treatments.

Processing of solid wastes: – composting, Bio-gas generation, saccharification, gasification. Use of commercial blends of microorganisms of immobilized cells/ enzymes and biosensor technology in waste water management.

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

Unit-IV

Bioremediation: Microorganisms for environmental cleanup of contaminated and heavy metal polluted sites, Applications of bioremediation: Replacement of petrochemicals, reversal of Global warming.

Degradation of Xenobiotics – oil spills, detergents, plastics, recalcitrant pesticides in soil (eg.DDT). Fate of engineered microorganisms in the environment. Volatilization of toxic metals by microorganisms.

Space Microbiology -an overview-Aims and objectives of space research. Life detection methods-related to microorganisms, monitoring of astronauts microbial flora: Alterations in the load of medically important microorganisms, changes in mycological autoflora, and changes in bacterial autoflora.

Suggested Books:

1. Sharma PD (2006)Environmental Microbiology; Narosa Publishing House, New Delhi.
2. Jiemba Patrick K (2004) Environmental Microbiology Principles & applications; Science Publishers, Inc.
3. Vashisth pratham (2006) Environmental Biotechnology; Dominant Publishers and Distributors, New Delhi.
4. Olguin Eugenia J Sanchez Gloria, Hernandz Elizabeth (2003) Environmental Biotechnology and cleaner Bioprocessing; Taylor and Francis, Lon
5. Mohapatra pradipta Kumar (2006)Text Book of Environmental Biotechnology; I.K.
6. Ian L. Pepper Professor ,Charles P. Gerba, Terry J. Gentry ,Raina M. Maier (2008) International Publishing House Pvt. Ltd., New Delhi.
7. Singh D. P,S.K. Dwivedi (2004) Environmental Microbiology and Biotechnology
8. Rao P. Venugopala(2006) Principles of Environmental Science and Engineering Paperback
9. Campbell RE (1983) Microbial Ecology. Blackwell Scientific Publications, Oxford, England
10. Bertrand**,** J.-C., Caumette, P., Lebaron**,** P., Matheron, R., Normand, P., Sime-Ngando, T. (Eds.) (2015), Environmental Microbiology: Fundamentals and Applications
11. Dinda, S. C. (2011), Advances in Pharmaceutical Technology. PharmaMed Press

MB – 302: IMMUNO TECHNOLOGY AND PHARMACEUTICAL TECHNOLOGY

Unit-I

Overview of Immunotechniques

Transfusion Immunology: Blood cell components, blood group systems in human and in animals, Rh typing, transfusion reactions, diseases associated with blood transfusion – Haemolytic anemias, Erythroblastosis featalis.

Transplantation immunology – Relationship between donor and recipient, immune response to graft rejection, clinical characteristics of allograft rejection. Transplantation antigens. MHC class I & II as targets of graft rejection, Tests for histocompatability antigens, prolongation of allografts, grafts versus host disease.

Tumour immunology – Classification of tumour antigens. Humoral and cenn mediated immune responses to tumours, immune surveillance, limitations of the effectiveness of the immune response to tumours, immunodiagnosis,, Tumour immune prophylaxis immunotherapy of tumours.

Unit-II

Immunoprophylaxis: Types of vaccines – Conventional (BCG, Sall, Influenza, DPT) DNA vaccines, Glycoconjugate vaccines Deletion vaccines, DC based vaccines. Basis of attenuation Recent developments in vaccine technology, Vaccine technology, Vaccine deliver system and approaches to enhance immunogenicity immunomodulators and immunomodulation, adjuvant, cytokines interleukins based immune therapy.

Hybridoma technology: Production, purification an characterization of monoclonal antibodies. Application of monoclonals in biomedical research, clinical diagnosis treatment and drug targeting.

Unit – III

Historical review of the involvement of microbiology with pharmaceutical practice, Role of Microorganisms in Pharamaceutical industry, the impact of microorganisms in pharmaceutical device manufacture, microbial contamination control in pharmaceutical manufacturing.

Implementation of Rapid Microbiological Methods(RMM) for pharmaceutical laboratories, the broader picture of microorganisms and pharmaceutical manufacturing: Challenges, Solutions and Pharmacopoeial guidance.

Unit – IV

Drug targeting principles: Targeting, Principles and its importance in therapeutics, Methods in drug targeting, advantages and disadvantages in targeting, protein and peptide based drug delivery systems

The drug development process: Drug Discovery the impact of genomics and related technologies upon drug discovery. Delivery of Biopharmaceuticals-Oral delivery systems – Pulmonary delivery – Nasal, transmucosal and transdermal delivery systems.

Immunopharmacology: The interferon family, cytokines as Biopharmaceuticals. TNF – therapeutic aspects. Haemopoietic growth factors, Growth factors, Hormones of therapeutic interest, Blood products, therapeutic enzymes and Nucleic acid therapeutics.

Suggested Books:

1. Harlow, David Lane, Panima (2006). Antibodies. A Lab Manual, Ed. Publishers, Bangalore.
2. Talwer (2004). Practical Manual in Microbiology. Academic Press, New York.
3. Surendra Narain and Ravindra Narain (2004) Immuno Biotechnology by. Domirant Publishers, New Delhi.
4. Abbas and Lippincott (2006). A Short Course in Immunology. Blackwell Publishers, New York.
6. Elgert (2004). Immunology by Press London2004). Practical Manual in Microbiology. Academic Press, New York.
7. Surendra Narain and Ravindra Narain (2004) Immuno Biotechnology by. Domirant Publishers, New Delhi.
10. Tim Sandle, (2011)Selection of Microbiological Culture Media and Testing Regimes
11. Sandy Rubio,(2011) Validation of Microbiological Methods by Business Horizons;
12,Masakazu Tsuchiya,(2010)Bacterial Endotoxins Test by bioprocess awards
13.Michael J. Miller,(2013)The Implementation of Rapid Microbiological Methods by European Pharmaceutical company
14. Sandle, T. (2012). The CDC Handbook: A Guide to Cleaning and Disinfecting Cleanrooms, Grosvenor House Publishing: Surrey, UK
15. Sandle, T. and Saghee, M.R. (2013). Cleanroom Management in Pharmaceuticals and Healthcare, Euromed Communications: Passfield, UK

MB – 303: MOLECULAR BIOLOGY AND CELL CULTURE

Unit – I

Gene transfer mechanisms in bacteria: Transformation, conjugation, sexduction and transduction (generalized, abortive, co transduction, specialized,) and gene mapping. Role of Rec gene products.

Plasmids: bacterial and yeast plasmids, purification, properties, detection, transfer, replication and curing, significance / importance.

Transposal / mobile genetic elements: Prokaryotes – (IS elements, composite and complex transposons), mechanisms of transposition and importance – Eukaryotes (Yeast, Drosophila and Maize) – retrotransposons, retroelements. Exploitation of transposable elements in genetics.

Unit – II

DNA damage and repair: types of DNA damage-deamination, oxidative damage, alkylation and pyrimidine dimers; repair pathways – mismatch, short patch repair, nucleotide/base, excition repair, recombination repair and SOS system.

Transcription (RNA biosynthesis): Types of RNA and their role, organization of protein and RNA (rRNA, tRNA, 5 sRNA) encoding transcription units (promoters and regulatory elements) Types of RNA polymerases. Promoters and other regulatory elements and transcription factors.

Translation (Protein biosynthesis): Central dogma theory and flow of genetic information, genetic code and its elucidation, structure and composition of prokaryotic and eukaryotic ribosomes, structural features of rRNA, mRNA and tRNA in relation to function, steps of protein biosynthesis (activation of amino acids, initiation, elongation, termination) in prokaryotes and eukaryotes; post-translational modification of proteins and their sorting and targeting.

Regulation of gene expression: An overview on levels of regulation, terminology and operon concepts, enzyme induction and repression; positive and negative regulation in *E. coli*- lac and ara operons; regulation by attenuation – his and trp operons; antitermination – N protein and nut sites in Lambda phage. Organization and regulation of nif and nod gene expression in bacteria; gal operon in yeast. Global regulatory responses-heat shock response, stringent response and regulation by small molecules such as cAMP and PPGPP.

Unit – III

Animal Cell Culture: Scope of animal cell culture, principles and methodology of animal cell cultures, physical chemical and metabolic function of the constituents of culture media and reagents, primary, secondary and continuous cell lines, stem cell and embryonic cell isolation and culture, organ culture. Sub culturing, maintenance and preservation of cell cultures.

Industrial importance of animal cell culture products – viral vaccines for human and animal use, production of interferon, interleukins, retroviruses and adenoviruses and produced for use in gene therapy, large scale production of Bio-Insecticides – Baculoviruses, NPV, GV, cell cultures used for diagnostic assay system, therapeutics.

Unit – IV

Plant cell culture – Embryo culture, meristem culture, callus culure, anther culture, protoplast culture, cell suspension, spore culture, protoplast isolation culture and fusion regeneration and somatic hybridization and regeneration of plants.

Scope of plant cell culture – Major sources of pharmaceuticals, dyes, food colours and flavours, enzymes, polysaccharides, fragrances, insecticides, herbicides, products of secondary metabolites. Production of Shikonim and culturing of Microalgae. Industrial advantages and disadvantages of plant tissue culture – Cell and organ differentiation – Clonal propagation or micropropagation. Application of cell culture for mutant selection, production of secondary metabolites, transformations, production of transgenic plants for herbicide resistance, insect resistance and disease resistance, nutritional quality improvement, as bioreactors for vaccines.

Suggested Books:

1. Lodish *et al.,* (1995). Molecular Cell Biology. 3rd ed.. Scientific American books, WH Freeman and Company.
2. David Freifelder (1995). Molecular Biology. by Narosa Publ. House.
3. Stryer L (1995). WH. Biochemistry. Freeman and Co.
4. Zubay GL(1998). Biochemistry 4th ed. W.C.B. Publ.
5. David Freifelder (1995). Microbial Genetics. by Narosa Publ. House.
6. Watson *et al.*, (1998) Molecular biology of the Gene. 5th ed. Addison Wesley Longman.
7. Wulf Crueger and annelies Crueger (2000) Biotechnology : A Text book of Industrial Microbiology (2ed) Panima publishing Mc Graw Hill book.
8. Caside L (1999) Industrial Microbiology. John Wiley & Sons Inc., New Delhi.
9. Peppler (2003) Microbial techonology. CRC Press, Canada.
10. Harvey Lodish, Arnold Berk, Chris A. Kaiser, and Monty Krieger(2006) Molecular cell biology.6th edition.W.H. Freeman Publisher.

MB-304: GENETIC ENGINEERING AND RECOMBINANT DNA TECHNOLOGY

Unit – I

Scope and milestones of genetic engineering, Restriction and modification enzymes – Classification, nomenclature and importance of restriction endonucleases. Other enzymes needed in genetic engineering-exonucleases, ligases, polymerases, DNA modification enzymes and topoisomerases.

Gene isolation and purification – general methods.
Insertion of DNA and ligation – salient features and methods used.
Transformation – DNA uptake by bacterial cells.
Cloning Vectors – Characterstics of a cloning vector, disadvantages of natural plasmids in gene cloning, Artificial plasmids as cloning vectors – Construction of pBR322, vectors used for cloning genes in E.coli (plasmids, bacteriophage derivatives, cosmids BACs) yeast (YACS, shuttle vectors), higher plants (Ti plasmid derivatives, caulimovirus) and animal cells (constructs of SV40 and retroviruses). Phage vectors and cosmid vectors, DNA and RNA probes Synthesis and their applications. Bacterial strains used for cloning.

Unit - II

Expression of heterologous genes: expression of eukaryotic genes in bacteria, expression of heterologous genes in yeast, insect and mammalian cells.
Salient features of expression vectors.
Processing of recombinant proteins: Refolding and stabilization. Industrial products of protein engineering.
Over expression of cloned genes- Amplification of DNA: Polymerase chain reaction (PCR). Principle, types)RT-PCR, nested, primer design and application of PCR. PCR ampication of cloned gene. Characterstics of expression vectors. Constructin of expression vectors: Vectors having inducible lac, taq promoters. Codon optimization Engineering hosts for over expression. IPTG – Induction of a cloned gene expression. Expression of proteins with His tag and its significance in simultaneous expression and purification of recombinant proteins. Problems associated with expression of cloned genes – Inclusion bodies, solubilisation and reconstruction of expressed proteins. Characterization of recombinant proteins.

Cloning strategies – Generation of DNA fragments containing a gene (shot-gun method, southern analysis, and cDNA synthesis). Joining of DNA fragments to vector molecules. Introduction of recombinant DNA molecules into appropriate **cloning hosts** – Preparation of competent cells. Screening of recombinants for a positive clone – Genetic, biochemical and hybridization methods, Construction of **DNA libraries** – genomic and c DNA libraries–methods, problems to be addressed, relative advantages and disadvantages, application/hoes.

Unit - III

Restriction mapping of linear and circular DNA. Sequencing of cloned gene – Sanger's method, Maxam-Gilbert's method and automated sequencing. Application of site – directed mutagenesis in protein engineering. Studying gene regulation – Northern blot, primer extension, S1 mapping and reporter assays. Development of a recombinant *E.coli* strain expressing human insulin. Agrobacterium –medicated gene cloning for developing a transgenic plant**.**

Transfection – Salient features and its significance in transforming animal cells.
DNA Finger Printing – RAPD, RELP and FELP analysis and their applications. Antisense technology and its application. Gene knockout technology**.**
Gene therapy – Strategies of gene delivery and application of gene therapy.

Unit - IV

Genetic Engineering in plants: Use of *Agrobacterium tumifaciens* and Arhizogenes, Ti Plasmids, Strategies for gene transfer to plant cells,Direct DNA transfer to plants,Gene targeting in plants,Use of plant viruses as episomal expression vectors.

Transgenic plants: Construction of plant cell expression vector with desired genes, biological and physical approaches for delivering genes into plant tissues, identification and regeneration of transformed tissues to transgenics. Transgenic plants as bioreactors.

Transgenic animals: Construction of animal cell expression vectors and delivering of genes into cultured animal cells. Production and use of transgenic animals (mice, sheep/goat, cow).

Applications and implications of genetic engineering in biology, agriculture, medicine and industry.

Suggested Books:

1. Kuby (2008). Immunology 5th Janis.
2. Ivan Roitt, *et al*., (2000.)Immunology 5th edition.
3. Benzamin (2005). Immunology. Academic Press, New York.
4. Chaper, Harvey, Shah, Snowden (2006). Clinical Immunology by Blackwell Publishers, New York.
5. Harlow, David Lane. Panima (2006). Antibodies A Lab Manual. Ed. Publishers, Bangalore.
6. Male, Cocke, Onen, Trowsdade, Champion (2009). Advanced Immunology. Mosby Publications, London. 3rd Ed.,
7. Talwer (2004). Practical Manual in Microbiology. Academic Press, New York.
8. Surendra Narain and Ravindra Narain (2004). Immuno Biotechnology by Domirant Publishers, New Delhi.
9. Abbas and Lippincott (2006). A Short Course in Immunology. Blackwell Publishers, New York.
10. Elgert (2004). Immunology. London Press.
11. Dr. K Rajagopal(2012) Recombinant DNA Technology and Genetic Engineering

PRACTICALS

MB-305: ENVIRONMENTAL MICROBIOLOGY, IMMUNOTECHNOLOGY AND PHARMACEUTICAL TECHNOLOGY

1. Isolation, identification and enumeration of microorganisms in the air and sewage.
2. Microbial antibiosis in the environmental samples.
3. Isolation of thermopholic organisms from compost.
4. Isolation and cultivation of green sulfur bacteria from polluted waters.
5. Impact of nitrogen sources on the heterocyst differentiation & frequency of heterocystous blue green algae.
6. Metal tolerance in bacteria isolated from polluted & non-polluted waters.
7. Cultivation of anaerobes isolated from sediments or deeper layers of soil.
8. Demonstration of corrosion of metals by anaerobic sulfate reducing bacteria.
9. Bioremediation and degradation of pesticides.
10. Sewage treatment plant-visit.
11. Preparation of hyper immune serum

11.Purification of antibodies by ammonium sulfa precipation and dialysis
12.Antigen preparation (Flagellar & Somatic)
13.Fractionation of serum on G-20 sephadex
14.Agglutatination Widal (slide & tube) test for typhoid fever VDRL test for syphilis Assessment of immune diagnostic kits.
15. Immuno flurocence technique.
16. Immuno blot Analysis of antigens and allergens.
17. Invitro analysis for antibacterial properties
18. Antibiotic assay preservative test
19. Bioburden Testing
20. Interferon, interleukin assay.
21. Microbial Limit test (MLT)
22. Bacterial Endotoxins Test

MB – 306: MOLECULAR BIOLOGY, CELL CULTURE, GENETIC ENGINEERING AND RECOMBINANT DNA TECHNOLOGY

1. Isolation of DNA and RNA from microbes, plant/animal tissues
2. Isolation of plasmids from Bacteria (Medi. Prep.)
3. Restriction enzyme analysis of plasmids
4. Isolation of microbial genomes, bacterial plasmids and microbial mutants
5. Demonstration of conjugation and Transformation in bacteria
6. Induction of mutations in Bacteria by physical / chemical agents
7. Preparation of primary cell cultures and secondary cell cultures from animal and plant samples.
8. Mapping of bacterial genes by conjugation / transformation (problems).
9. Recovery of DNA from gels – Electroelution and extraction of DNA from low melting agarose gels.
10. Southern blotting, Electroblot immunoassay, Preparation of dot-blots for Hybridization.
11. Transformation of *E. coli* with recombinant plasmid DNA, Curing of plasmids.
12. Restriction enzyme mapping of plasmids.
13. Demonstration of nucleic acid sequencing.

SEMESTER-IV

401 – AGRICULTURAL MICROBIOLOGY

Unit – I

The developments and scope of Agricultural Microbiology, Contribution of the pioneers.

The Soil: Definition, components, important physical and chemical characteristics, classification outlines.

Microbial diversity in the soil: Qualitative and quantitative nature of bacteria, actinomycetes, fungi, algae, Protozoa and nematodes. Influence of environmental factors on soil microflora. Methods of study, isolation and enumeration of soil microbial flora.

Unit – II

Soil organic matter: Nature, synthesis significance and decomposition: Microbial degradation of polysaccharides, Proteins and other nitrogenous substances, fats, hydrocarbons and pesticides in soil. Soil humus, its significance and degradation.

Soil enzymes: Nature, isolation, occurrence and ecological significance.
The Rhizosphere – Nature, extent, qualitative and quantitative aspects and activities of rhizosphere microorganisms, nature and ecological role or root exudates, significance of rhizosphere microbial flora on plant growth, plant pathogens and rhizosphere.
Plant growth promoting rhizobacteria (PGPR) and siderophore production.
Brief account on spermosphere and phyllospheres, their ecology and significance.

Unit – III

Ecology and biology of non-symbiotic and symbiotic (including stem-nodulating rhizobia) nitrogen fixers, associative symbiosis and their ecological / agronomic significance.The symbiotic relationships – symbiotic nitrogen fixers.Legume - *Rhizobium* interaction, biochemistry and mechanism of nitrogen-fixation; genetics of nitrogen fixation, methods of evaluation of Biological Nitrogen Fixation. Factors influencing nitrogen fixation.Free-living nitrogen fixing bacteria-*Azotobacter* and *Azospirillum*, response of plants to their inoculation. Nitrogen-fixing Cyanobacteria and their importance in rice cultivation.

Mycorrhizal associations: Morphology, ecology, nature of associations and their ecological significance. VAM – distribution fungi involved, propagation, effect on crop productivity. Biopesticides – *Bacillus thuringiensis*, NPV & CPV, Biofertilizers – microbes used, methods of preparation, application and significance in improving soil fertility and productivity. Cultivation, mass production and inoculation of *Rhizobium, Azotobacter, Azospirillum, Azolla* and *Cyanobacteria*.

Unit – IV

Principles of Plant Pathology: Brief history and development of plant pathology (contributions of pioneers). Modes of entry of pathogens into host survival and transmission of plant pathogens. Survival of soil-borne plant pathogens. Host-pathogen interactions-virulence factors of pathogens and defense mechanisms of plants against pathogens. Control of plant diseases, by various approaches. Biological control of plant diseases including the use of microbial pesticides, their safety, advantages and disadvantages.

Plant diseases: Symptomology of the plant diseases caused by fungi, bacteria and viruses. Symptoms, etiology, epidemiology / disease cycle and control measures with reference to the following diseases: **Fungal:** damping-off of seedlings, smut of bajra, downy mildew of grapes, powdery mildew of cucurbits, rusts of wheat, groundnut, *Fusarium* wilts, red rot of sugarcane, tikka disease of groundnut, blast disease of rice.
Bacterial: Citrus canker, blight of rice, 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, pigeon pea sterility mosaic, peanut bud and stem necrosis, citrus tristeza and yellow mosaic, banana bunchy top. **Phytoplasmal:** Little leaf of brinjal.

Suggested Books:

1. Rangasamy and Bagyaraj(2001) Agricultural Microbiology.G.. Printice Hall..
2. Marks S Coyne(1999). Soil Microbiology: An Exploratory Approach, Delmar Publications
3. Subba Rai NS. Soil(1999) Microbiology (Soil Microorganisms and Plant Growth) 4th ed. Oxford IBH Publications Co.Pvt.Ltd.
4. PaulE.A. and Clark .F.E.(1996). Soil Microbiology and Biochemistry, 2nd ed Academic Press
5. BrownR.G.(1999). Sarup & Sons. Plant Diseases and their control,New Delhi., CRC Press Inc.
6. Prabakaran G (2004).Introduction to Soil and Agricultural Microbiology.
7. Agrios. G.N. (1996) Plant Pathology,A.P.
8. Rangasami, and A. Mahadevan. Diseases of Crop Plants .Printice-Hall.
9. Suubba Rao , NS (1995) Soil Microbiology and Plant Growth.
10. Marks S Coyne (1999). Soil Microbiology: An Exploratory Approach, Delmar Publications
11. Mishra,R.R.(1996) Soil Microbiology: CBS Publishers & Distributers .
12. Ian Dirk van Elsas, Jack T.Trevors and Elizabeth M.H. Wellington (ed.) (1997) Modern Soil Microbiology: Marcel Dekker, Inc.

MB – 402: INDUSTRIAL MICROBIOLOGY

Unit – I

Overview of Industrial Microbiology

Industrial application of microorganisms: Bacteria, fungi, their characteristics and exploitation for industrial products.

Screening of microbes for products: Primary and secondary screening, detection and assay of products by physico-chemical and biological assays.

Industrial strains: Strategies for selection and improvement, maintenance, preservation and containment of recombinant organisms.

Bioreactors : Types, their designs and working principles, agitation, aeration, antifoam, pH and temperature controls, cleaning and sterilization, variations in fermentor design surface, submerged and – Batch and continuous (Flow-through) fermentors, Fed-back fermentors, Tubular fermentors, membrane fermentors, fluidized bed, packed bed bioreactor, solid state fermentations.

Inoculum and media: Inoculum preparation, substrates for fermentation media; solid state, surface and submerged fermentations. Batch and continuous fermentations, direct, dual or multiple fermentations, scale-up of fermentations and fermentation economics. Fermentation kinetics. Computer control of fermentation processes.

Immobilization of enzymes and microbial cells: Methods of immobilization, changes in kinetics after immobilization, whole-cell immobilization, Industrial applications of immobilized enzymes and cells.

Unit – II

Downstream processing : A multistage operation, solid-liquid separation, release of intracellular components, concentration of biological products, purification by chromatography, product formulation, monitoring of downstream processing, process integration.

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

Industrial productions: Ethanol, Butane, Citric acid, Lactic acid, Glutamic acid, Lysine, vitamins C and B12, antibiotics like Penicillin, Tetracyclines, enzymes like Amylases, Pectinases, steroids and hormones and vaccines like rabies, hepatitis B.

Biofuels: Microbial groups involved in biogas production and interaction among them, factors affecting biogas production, design of digester, feed stocks, uses of spent slurry.

Unit – III

Commercial production of useful products-single cell protein (SCP). Production of bacterial, yeast and mold cultures for food fermentation and their applications. Recombinant DNA products – Interferon.

Microbial transformations: Types of bioconversion reactions, biotransformation of steroids, Application of microbial systems / processes in plastic, petroleum, mining and mineral processing industries.

Patenting: Concept and its composition and protection of right and their limitation and intellectual property rights (IPR); patenting biotechnology inventions.

Unit – IV

Microbial production of recombinant molecules: Requirement of recombinant molecules in pharmaceutical, health, agricultural and industrial sectors and in research / diagnostic labs. Rationale for the design of vectors for oven expression of recombinant proteins; selection of suitable promoter sequences, ribosome binding sites, transcription terminator, fusion protein tags, purification tags, protease cleavage sites and enzymes, reporter/marker genes, plasmid copy number, inducible expression systems. Over expression conditions, production of inclusion bodies, solubulisation of insoluble proteins. Purification protocols and up-scaling products. Determination of purity and activity of over expressed proteins. Experiments using model systems : *E. coli*, Yeast, Baculovirus and *Agrobacterium.*

Suggested Books:

1. Ratiedge C & Kristiansen B (2001). Basic Biotechnology, 2nd ed. by Cambridge University Press.
2. Demain AL (1999).Manual of Industrial Microbiology and Biotechnology, Second edition. Editor in Chief, ASM Press.
3. Crueger W & Crueger A (2000).Biotechnology: A test Book of Industrial Microbiology. Second edition, Ed. Panima Publishing Corporation.
4. Waites MJ.*et al*.,(2001). Industrial Microbiology. Blackwell Science.
5. Prescott & Dunn's (1999). Industrial Microbiology. Fourth edition, Edited by Gerald Reed. CBS Publishers and distributors..
6. Casida LE. Jr(1999).Industrial Microbiology. New Age International Publ.
7. Alexander N (1995). Microbial Biotechnology – Fundamentals of Applied Microbiology.
8. Mital KM (1996). Biogas systems : Principles and Applications. New Age International (P) Ltd. Publ.
9. Glick BR. and Pastermak JJ (1994). Molecular Biotechnology: Principles and Applications of recombinant DNA. Panima Publ. Corporation.
10. Glazer AN and Nikaido. WH (1995).Microbial Biotechnology; Fundamentals of Applied Microbiology. Freeman and Company.

MB-403: FOOD AND DAIRY MICROBIOLOGY

Unit – I

Introduction to food and Dairy Microbiology

Food as substrate for microorganisms: Microorganisms important in food microbiology – Moulds, Yeasts and Bacteria- General characteristics-classification and importance. Principles of food preservation. Asepsis-removal of microorganisms, (anaerobic conditions, high temperatures, low temperatures, drying). Factors influencing microbial growth in food-extrinsic and intrinsic factors; Chemical preservatives and Food additives. Canning, processing for heat treatment-D, Z, and F values and working out treatment parameters.

Contamination and spoilage: 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

Food-borne infections and intoxications : Bacterial and nonbacterial- with examples of infective and toxic types- *Brucella, Bacillus, Clostridium, Escherichia, Salmonella, Staphylococcus, Vibrio, Yersinia;* Campylobacter, Listeria, protozoa, fungi and viruses. Mycotoxins in food with reference to *Aspergillus* species. Food borne outbreaks-laboratory testing procedures; Prevention Measures- Food sanitation in manufacture and retail trade, Food control agencies and its regulations, Plant sanitation- employee's health standards- waste treatment – disposal – quality control.

Quality assurance in foods: Microbiological standards of food Government regulatory practices and policies – FDA, EPA, HACCP (Hazard analysis and critical control points), ISI.

Unit – III

Food fermentations: Bread, cheese, yogurt, vinegar, fermented vegetables (Sauerkraut) fermented dairy products; Experimental and Industrial production methods. Spoilage and defects of fermented dairy products – oriental fermented foods, their quality standards and control.

Food preservation methods: Radiations – UV, gamma and microwave, temperature, chemically and naturally occurring antimicrobials. Biosensors in food industry.

Microbiology of cheese and beverage fermentation: Microbiology of fermented milk products (acidophilous milk-yogurt). Role of microorganisms in beverages – tea and coffee fermentations, vinegar fermentation.

Unit – IV

Microbes as food: Single cell proteins (SCP's) and mushrooms along with commercial production. Bioconversions – production of alcohol-fermented beverages – beer and wine.

Steroid conversion: Industrial Enzymes production – amylases, proteinases, cellulases, amino acid production- glutamic acid and lysine.

Advanced Food Microbiology: Genetically modified foods. Bio - sensors in food. Applications of microbial enzymes in dairy industry (proteases, lipases), utilization and disposal of dairy-by-product-whey.

Suggested Books:

1. Doyle MP. *et al.,* (2001). Microbiology: Fundamentals and Frontiers. ASM Press. 2nd ed.
2. Elmer H. Marth, James Steele (2001). Applied Dairy Microbiology, 2nd Edition. CRC Press.
3. Tamime AY (2006). Probiotic dairy products. SDT publishers.
4. Pieter Walstra, Jan T.M. Wouters and Tom J. Geurts (2006). Dairy science and technology, 2nd Edition. Willey Library.
5. Adams M.R and Moss M.O (1995).Food Microbiology: Royal Society of Chemistry Publication, Cambridge.
6. Frazier WC and Westhoff Dc (1988). Food Microbiology.Tata McGraw Hill Publishing Company Ltd.,New Delhi.
7. Stanbury PF, Whitekar,A (1995). Hall Principles of Fermentation Technology. 2nd Edition, S.J. Pergamon Press.
8. Banwart GJ. (1989). Basic Food Microbiology.CBS Publishers and Distributors, Delhi.
9. Hobbs BC and Roberts D (1993).Food poisoning and Food Hygiene.Edward Arnold (A division of Hodder and Stoughton) London.
10. Robinson RK (1990).Dairy Microbiology.Elsevier Applied Sciences, London

PRACTICALS

MB-405: AGRICULTURAL MICROBIOLOGY, INDUSTRIAL, FOOD AND DAIRY MICROBIOLOGY.

1. Measurement of physico-chemical characteristics of soil
2. Enumeration of microorganisms in the soil and Rhizosphere (Leguminous & non-leguminus), R/S Ratio, contact slide technique.
3. Demonstration of degradation of cellulose by microorganisms in the soil.
4. Study of legume root nodules, isolation of Rhizobium and inoculation
5. Observation of vesicular-anbuscular mycorthizal (VAM) association in plants
6. Demonstration of seed and root exudates
7. Estimation of urease activity in soil
8. Observation of disease symptoms in local crops, isolation of plant pathogens-fungal and bacterial- from infected tissues
9. Isolation of phosphorus solubilizing organisms from the soil
10. Microbiological examination of spoiled foods.
11. Enumeration of surface microflora of vegetables.
12. Isolation of Yeasts from grapes
13. Preparation of wine from grape juice and estimation of alcohol
14. Estimation of ethanol by dichromate method
15. Production of citric acid by fungus and its estimation
16. Determination of lactic acid concentration in commercial curd samples
17. Enumeration of surface microflora of foods and vegetables
18. Detection of number of bacteria in milk by breeds count
19. Determination of milk quality by methylene blue reduction test
20. Extraction and analysis of aflatoxins
21. Immobilization of microbial cells/enzymes.

21. Extraction and detection of aflatoxin from infected foods
22. Isolation of food poisoning bacteria from contaminated foods, dairy products

MB-406: PROJECT AND FIELD/TOUR TRIP

Practical experience in locating, collecting and interpreting the scientific information for the purpose of MSc., Microbiology field trip/tour report. The student works individually, under faculty/Scientist supervision in laboratories, Research labs, National Institutes to perform the procedures, record the results and present the project work at the end of the Fourth Semester. The project work of the student will be evaluated by seeing the performance of presentation and interpretation of the results.

SEMESTER – IV

HUMAN VALUES AND PROFESSIONAL ETHICS – II

COMMON SYLLABUS FOR ALL P.G. COURSES (CBCS & NON-CBCS)

Syllabus

(With effect from 2015-16)

(effective from the batch of students admitted from the academic year 2014-15)

I. Value Education- Definition – relevance to present day - Concept of Human Values – Self introspection – Self esteem. Family values - Components, structure and responsibilities of family Neutralization of anger – Adjustability – Threats of family life – Status of women in family and society – Caring for needy and elderly – Time allotment for sharing ideas and concerns.

II. Medical ethics- Views of Charaka, Sushruta and Hippocratus on moral responsibility of medical practitioners. Code of ethics for medical and healthcare professionals. Euthanasia, Ethical obligation to animals, Ethical issues in relation to health care professionals and patients. Social justice in health care, human cloning, problems of abortion. Ethical issues in genetic engineering and Ethical issues raised by new biological technology or knowledge.

III. Business ethics- Ethical standards of business-Immoral and illegal practices and their solutions. Characterics of ethical problems in management, ethical theories, causes of unethical behavior, ethical abuses and work ethics.

IV. Environmental ethics- Ethical theory, man and nature – Ecological crisis, Pest control, Pollution and waste, Climate change, Energy and population, Justice and environmental health.

V. Social ethics- Organ trade, Human trafficking, Human rights violation and social disparities Feminist ethics, surrogacy/pregnancy. Ethics of media- Impact of Newspapers, Television Movies and Internet.

Books for study:

1. John S Mackenjie: A manual of ethics.
2. "The Ethics of Management" by Larue Tone Hosmer, Richard D. Irwin Inc.
3. "Management Ethics – integrity at work' by Joseph A. Petrick and John F. Quinn, Response Books: New Delhi.
4. "Ethics in management" by S.A. Sherlekar, Himalaya Publishing House.
5. Harold H. Titus: Ethics for Today
6. Maitra, S.K: Hindu Ethics
7. William Lilly: Introduction to Ethics
8. Sinha: A Manual of Ethics
9. Manu: Manu Dharma Sastra or the Institute of Manu: Comprising the Indian system of Duties: Religious and Civil(ed.) G.C. Haughton.
10. Susruta Samhita: Tr. Kaviraj Kunjanlal, Kunjalal Brishagratha, Chowkamba Sanskrit series, Vol. I, II and III, Varnasi, Vol I OO, 16-20, 21-32 and 74-77 only.
11. Caraka Samhita: Tr. Dr. Ram Kraran Sarma and Vaidya Bhagavan Dash, Chowkambha Sanskrit Series office, Varanasi I,II,III Vol I PP 183-191.
12. Ethics, Theory and Contemporary Issues, Barbara Mackinnon, Wadsworth/Thomson Learning, 2001.
13. Analyzing Moral Issues, Judith A. Boss, Mayfield Publishing Company, 1999.
14. An Introduction to Applied Ethics (Ed.) John H. Piet and Ayodhya Prasad, Cosmo Publications.
15. Text book for Intermediate logic, Ethics and Human Values, board of Intermediate Education & Telugu Academic Hyderabad.
16. I.C. Sharma Ethical Philosophy of India. Nagin & co Julundhar.

MB- 407: APPLIED MICROBIOLOGY

Unit – I

History and scope of Microbiology: Milestones in Microbiology, Nobel laureates in Microbiology, spontaneous theory, Germ theory of disease, scope and application domains of Microbiology.

Types of Microscopes and role of Microscopy in Microbiology: Types of Microscopes-light, Dark field, fluorescence, phase contrast, compound, electron microscopes and their principles and applications related to microbiology.

Taxonomy of Microbes: Nomenclature classification and identification of Microorganisms – Bacteria viruses and other organisms. Phenotypic and Genetic characteristics, epigenetic analysis.

Unit-II

Morphology and structure of Microbes : Nature of bacteria cell – Bacterial shape, pattern of arrangement and size, structure of cell wall, endospore of bacteria, protoplast, spheroplast and L-form Bacteria, **Viruses** – structure and composition of viruses, enveloped and non-enveloped, symmetry of viruses – helical, cubical and binal, DNA and RNA viruses, segment and non segmented viruses, partite viruses.

Fungi and yeast – Morphology and arrangement of fungal and yeast structures.

Bacterial growth and Nutrition : Nutritional requirement culture media, interaction of bacteria with its physical environment, isolation and preservation of pure culture, Multiplication of bacteria, methods used to determine the bacterial growth, culturing of bacterial cell – synchronous, batch and continuous growth, growth on solid and liquid medium.

Biochemical aspects of Microorganisms: Microbial enzymes and their properties, classification of enzymes and their metabolism. Autotrophic generation of energy – Photosynthesis, chemosynthesis. Heterotrophic generation of energy – Anaerobic respiration, fermentation, aerobic respiration. Catabolism of substrates – Carbohydrates, proteins, nucleic acids, amino acids, fats.

Unit - III

Microbial genetics : Molecular nature of Microbial genes – genetic elements in Prokaryotes, genetic elements in viruses, Phenotypic changes in Bacteria, transcription, translation, replication of prokaryotes, replication of viruses and bacteriophages, gene transfer in prokaryotes. Regulation of genes and metabolism.

Viruses and sub-viral agents: Structure and composition, symmetry, Taxonomy, virus-Host relationship, cultivation of viruses – animal cell cultures, chick embryo. Oncogenic viruses – Cancer. Viroids, satellite viruses and nucleic acids, prions, Rickettsiae, Mycoplasmas.

Biochemical and Agricultural Microbiology: Biogeochemical cycles – Carbon, Nitrogen, sulfur and other miscellaneous element cycles. Microbial diseases of crops, Microbial pesticides.

Environmental Microbiology: Biodegradation of wastes and pollutants – sewage treatment and methods of disposal, biodegradation of xenobiotics, petroleum waste oil, pesticides, synthetic polymers. Microbiology of water – aquatic microorganisms, Bacterial indicators of water, purification of water. Microbiology of air – types of air contamination, methods of control of microbial flora of air.

Unit-IV

Medical Microbiology: Microbiota of human body, determinants of infection, toxigenecity. Host defences – nature host resistance, physical, mechanical and chemical barriers. Microbial disease – respiratory and gastro – intestinal tract disease, contact diseases. Chemotherapeutic agents – antibacterial, antifungal and antiviral agents.

Industrial Microbiology : Fermentation – screening of industrial microorganisms, strain improvement, fermentors and extraction of fermentation products, immobilization of enzymes, production of pharmaceuticals, food products, chemicals, petroleum and bioleaching products.

Food Microbiology: Food spoilage, food products and preservation of food products.

Biotechnology: Molecular cloning, protoplast fusion, Recombinant DNA technology and its applications.

Suggested Books:

1. Applied Microbiology. V.V. Kale and K.P. Bhusari, 2001. Himalaya Publishing house.
2. Applied Microbiology.S.N.Prasad,.2000. Campus Book International.
3. Immunology. 2000. 4th edition. J. Kuby. W.H. Freeman and Company.
4. Bacterial and Bacteriophage Genetics. 4th ed. 2000. By E.A. Birge. Springer.
5. Manual of Environmental Microbiology, second edition, by C.J. Hurst, Editor in Chief, 2002. ASM Press.
6. Environmental Microbiology by Ralph Mitechell.
7. Biotechnology : A test Book of Industrial Microbiology. Second edition, 2000. Ed. W.Crueger & A.Crueger.Panima Publishing corporation.
8. Industrial Microbiology : An Introduction by M.J. Waites et al. Blackwell Science. 2001.
9. Prescott & Dunn's Industrial Microbiology.Fourth edition, 1999.Edited by Gerald Reed. CBS Publishers and distributors.
10. Food Microbiology: Fundamentals and Frontiers. 2nd ed. 2001. ed by M.P. Doyle et al., ASM Press..

MB-408: DIAGNOSTIC MICROBIOLOGY

Unit – I

General Issues: Laboratory safety measures; Role of Microbiologist; laboratory physical design, management and organization; Quality in clinical microbiology – QC and QA programs; Hospital infection – Incidence, types, prevention and control of Nosocomial infections.

Role of Microscopy in the diagnosis of diseases: Bright-Field (light), phase contrast, fluorescent, Dark-Field and electron microscopy. Principles and application of Microscopy. Concepts for specimen collection, preparation and identification of Microbial samples for Microscopy.

Laboratory cultivation, Isolation and diagnosis of Microorganisms: Principles of bacterial, viral and fungal cultivation by conventional and advanced methods. Serological diagnosis, Immuno chemical methods and Molecular methods for identification of infections diseases.

Principles of Antimicrobial action and resistance – Antimicrobial action and mechanism of Antibiotic resistance. Laboratory methods for detection of Antimicrobial resistance – Testing methods.

Unit – II

Laboratory methods for diagnosis of Microbial diseases : General characteristics, epidemiology, pathogenesis, spectrum of diseases, laboratory diagnosis, Antimicrobial susceptibility test, therapy and prevention of the following diseases.

Bacteriology: Overview of Bacterial identification methods and strategies Gram positive cocci (Catalase positive and negative), Gram positive Bacilli (Non-branching catalase positive and negative), Gram positive Bacilli (Branching or partially acid-fast), Gram negative Bacilli and coccobacilli (oxidase positive and negative, oxidase variable), Gram negative cocci, Anaerobic bacteria, Mycobacteria, Mycoplasmas, spirochetes.

Parasitology: Protozoa, Helminths (Roundworms), Cestodes (Topeworms), trematodes (Flukes), Nematodes.

Mycology : Yeasts, molds, superficial mycoses, Dermatophytes, Aspergillus, Candida.

Virology : Adeno, Arena, Bunya, Corona, Filo, Flavi, Hepadna, Herpes, Orthomyxo, Papova, Paramyxo, Parvo, Picorna, Pox, Reo, Retro, Rhobdo, Toga and miscellaneous viruses.

Organ systems : Blood infections, respiratory tract-lower and upper, oral, CNS, eyes, ear urinary tract, genital tract and Gastrointestinal tract infections.

Unit – III

Immunological and Molecular methods as mentioned below -

Immunological methods – Direct whole pathogen agglutination assays, particle agglutination tests, Flocculation tests (VDRL RRR tests), Counter immuno electrophoresis (CIE), Immunodiffusion assays (ID), Haemagglutination inhibition assays (HI), Neutralization assays (NA), Complement fixation assays (CFA), enzyme linked immuno assays (ELISA), Indirect fluorescent antibody tests (IFAT), Immunomicroscopic methods, radio immuno assays (RIA), Fluorescent immuno assays (FIA), Western blot immunoassay, optical immunoassay (OIA).

Molecular methods: Nucleic acid-based methods – Nucleic acid hybridization methods, Filterhybridization, southern hybridization, Instituhybridization.

Amplification methods – Target nucleic acid amplification PCR, Multiplex PCR, Nested PCR, Arbitrary primed PCR, Quantitative PCR, RT-PCR. Nucleic acid prob amplification, probe signal, sequencing and enzymatic digestion of nucleic acids, nucleic acid sequencing, high density DNA probes.

Non nucleic acid-based analytic methods: chromatography – GLC, HPLC, Electrophoretic protein analysis.

Unit – IV

Diagnosis by organ system : General consideration, Diseases of the organ systems, Laboratory diagnosis of various infections mentioned below – Blood stream infections, Infections of Lower respiratory tract and Upper respiratory tract, Infections of Oral cavity and Neck, Meningitis and other infections of the central nervous system, Infections of the Eyes, Ears and Sinuses. Infections of the urinary tract, Genital tract, Gastrointestinal tract, Skin, Soft tissue and Wound infections.

Suggested Books :

1. Bailey & Scoott's Diagnostic Microbiology. Eleventh edition, 2002. B.A. Forbes, D.F. Sahm & A.S. Weissfeld. Mosby, Inc.
2. Molecular Microbiology – Diagnostic Principles and Practice. 2004. Edited by David H. Persing. ASM Press.
3. Mackie & McCartnet Practical Medical Microbiology. Fourteenth edition, 1999. Edited by G.J. College, A.G. Fraser, B.P. Marmion & A. Simmons. Churchill Livingstone.

SRI VENKATESWARA UNIVERSITY :: TIRUPATI
S.V.U. COLLEGE OF ARTS
COMMON SYLLABUS FOR ALL P.G. COURSES (CBCS & NON-CBCS)
SEMESTER – II

HUMAN VALUES AND PROFESSIONAL ETHICS – I

Syllabus
(With effect from 2014-15)
(effective from the batch of students admitted from the academic year 2014-15)

VI. Definition and Nature of Ethics- Its relation to Religion, Politics, Business, Law, Medicine and Environment. Need and Importance of Professional Ethics- Goals – Ethical Values in various Professions.

VII. Nature of Values- Good and Bad, Ends and Means, Actual and potential Values, Objective and Subjective Values, Analysis of basic moral concepts- right, ought, duty, obligation, justice, responsibility and freedom, Good behavior and respect for elders, Character and Conduct.

VIII. Individual and society:

Ahimsa (Non-Violence), Satya (Truth), Brahmacharya (Celibacy), Asteya (Non possession) and Aparigraha (Non-stealing). Purusharthas (Cardinal virtues)- Dharma (Righteousness), Artha (Wealth), Kama (Fulfillment Bodily Desires), Moksha (Liberation).

IX. Bhagavad Gita – (a) Niskama karma. (b) Buddhism – The Four Noble Truths – Arya astanga marga, (c) Jainism – mahavratas and anuvratas. Values Embedded in Various Religions, Relirious Tolerance, Gandhian Ethics.

X. Crime and Theories of punishment – (a) Reformative, Retributive and Deterrent. (b) Views on manu and Yajnavalkya.

Books for study:

17. John S Mackenjie: A manual of ethics.
18. "The Ethics of Management" by Larue Tone Hosmer, Richard D. Irwin Inc.
19. "Management Ethics – integrity at work" by Joseph A. Petrick and John F. Quinn, Response Books: New Delhi.
20. "Ethics in Management" by S.A. Sherlekar, Himalaya Publishing House.
21. Harold H. Titus: Ethics for Today
22. Maitra, S.K: Hindu Ethics
23. William Lilly: Introduction to Ethics
24. Sinha: A Manual of Ethics
25. Manu: Manu Dharma Sastra or the Institute of Manu: Comprising the Indian System of Duties: Religious and Civil(ed.) G.C. Haughton.
26. Susruta Samhita: Tr. Kaviraj Kunjanlal, Kunjalal Brishagratha, Chowkamba Sanskrit series, Vol. I, II and III, Varnasi, Vol I OO, 16-20, 21-32 and 74-77 only.
27. Caraka Samhita: Tr. Dr. Ram Karan Sarma and Vaidya Bhagavan Dash, Chowkambha Sanskrit Series office, Varanasi I,II,III Vol I PP 183-191.
28. Ethics, Theory and Contemporary Issues, Barbara Mackinnon, Wadsworth/Thomson Learning, 2001.
29. Analyzing Moral Issues, Judith A. Boss, Mayfield Publishing Company, 1999.
30. An Introduction to Applied Ethics (Ed.) John H. Piet and Ayodhya Prasad, Cosmo Publications.
31. Text book for Intermediate logic, Ethics and Human Values, board of Intermediate Education & Telugu Academic Hyderabad.
32. I.C. Sharma Ethical Philosophy of India. Nagin & co Julundhar.

SEMESTER – IV
HUMAN VALUES AND PROFESSIONAL ETHICS – II
COMMON SYLLABUS FOR ALL P.G. COURSES (CBCS & NON-CBCS)
Syllabus
(With effect from 2015-16)
(effective from the batch of students admitted from the academic year 2014-15)

VI. Value Education- Definition – relevance to present day - Concept of Human Values – Self introspection – Self esteem. Family values - Components, structure and responsibilities of family Neutralization of anger – Adjustability – Threats of family life – Status of women in family and society – Caring for needy and elderly – Time allotment for sharing ideas and concerns.

VII. Medical ethics- Views of Charaka, Sushruta and Hippocratus on moral responsibility of medical practitioners. Code of ethics for medical and healthcare professionals. Euthanasia, Ethical obligation to animals, Ethical issues in relation to health care professionals and patients. Social justice in health care, human cloning, problems of abortion. Ethical issues in genetic engineering and Ethical issues raised by new biological technology or knowledge.

VIII. Business ethics- Ethical standards of business-Immoral and illegal practices and their solutions. Characterics of ethical problems in management, ethical theories, causes of unethical behavior, ethical abuses and work ethics.

IX. Environmental ethics- Ethical theory, man and nature – Ecological crisis, Pest control, Pollution and waste, Climate change, Energy and population, Justice and environmental health.

X. Social ethics- Organ trade, Human trafficking, Human rights violation and social disparities Feminist ethics, surrogacy/pregnancy. Ethics of media- Impact of Newspapers, Television Movies and Internet.

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19. "Management Ethics – integrity at work' by Joseph A. Petrick and John F. Quinn, Response Books: New Delhi.
20. "Ethics in management" by S.A. Sherlekar, Himalaya Publishing House.
21. Harold H. Titus: Ethics for Today
22. Maitra, S.K: Hindu Ethics
23. William Lilly: Introduction to Ethics
24. Sinha: A Manual of Ethics
25. Manu: Manu Dharma Sastra or the Institute of Manu: Comprising the Indian system of Duties: Religious and Civil(ed.) G.C. Haughton.
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30. An Introduction to Applied Ethics (Ed.) John H. Piet and Ayodhya Prasad, Cosmo Publications.
31. Text book for Intermediate logic, Ethics and Human Values, board of Intermediate Education & Telugu Academic Hyderabad.
32. I.C. Sharma Ethical Philosophy of India. Nagin & co Julundhar.

PANNEL OF PAPER SETTERS AND EXAMINERS FOR M.Sc., INDUSTRIAL MICORBIOLOGY THEORY AND PRACTICALS (FIRST SEMESTER TO FOURTH SEMESTER)

PANNEL OF PAPER SETTERS:

S.No	Name & address of the paper setters	S.No	Name & address of the paper setters
1	**Prof.D.SREENIVASULU** Department of Veterinary Microbiology College of Veterinary Sceience SVVeterinary University TIRUPATI-517 502 Andhra Pradesh Ph: 0877-2253994	13.	**Prof. K.V.BHASKAR RAO** School of Biotechnology Vellore Institute of Technology(VIT), VELLORE – 632 014 Tamilnadu Phone: 09894350824 E-mail: kvbhaskararao@vit.ac.in

	Phone: 9849502820 Email:dsreenivasulu10@gmail.com		
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