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<th>Sem</th>
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<th>Uni. Exams Duration (Hours)</th>
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<td>MB-101</td>
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<td>Microbial Physiology and Biochemistry</td>
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MB = Microbiology, IE = Internal Elective, EE = External Elective, SSC = Self Study Course
SEMESTER-I

MB-101: GENERAL MICROBIOLOGY

Unit – I


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.


Unit – IV

Suggested Books:
Unit – I

**Nutrition:** Elemental nutrient requirements of microbes; nutritional groups of bacteria; autotrophy-phototrophy, chemotrophy and autotrophic metabolism; heterotrophy – phototrophy 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

**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 CO₂ fixation, halobacterial photosynthesis, sulphur, nitrogen and iron assimilating bacteria. Chloroplast mediated electron transport; chemolithotrophic electron transport systems. Bioluminescence.

**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.


**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 quaternary level). Denaturation of proteins.

**Enzymes:** Classification, nomenclature, kinetics of enzymes – catalyzed reactions, Michaelis-Menten equation, determination of Vmax, Km, Kcat, specificity constant kcal/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).

Suggested Books:
   John Wiley and sons, Inc.
   Willey press.

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.


Unit – II

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 tRNA; 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 E1 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:

MB-104: ANALYTICAL TECHNIQUES AND BIOSTATISTICS

Unit – I


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.


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 absorption, 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 Probability: 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:

PRACTICALS

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

1. Sterilization techniques – autoclaving, heat sterilization, filtration, UV irradiation and chemical.
4. Isolation and cultivation of pure cultures.
5. Techniques of maintenance of stock culture.
6. Anaerobic culturing of bacteria.
8. Growth curve and generation time in bacteria.
10. Cultivation of autotrophic and heterotrophic organisms.
11. Determination of characteristics of Enzyme catalysed reaction Vmax and Km.
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.
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.
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.
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


**Domain Archaea:** The unique characteristics, habitats, cell wall structure, membrane structure, pigments, genome, unique enzymes, evolutionary significance. Endospores structure, formation and germination.


Unit – II

**Taxonomy:** According 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 Archaeabacteria.

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


Unit – III


**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.


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

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:

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) Arthropod-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, Neisseria, Corynebacterium, Bacillus, Clostridium, Actinomyces, Chlamydiae, Mycoplasma, Enterobacteriaceae, 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; Paramyxvo 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**:

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), Immunofluorescent 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 (Hypogammaglobulinemia, 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 erythematosus) and their therapy.

Suggested Books:

MB-204: BIOINFORMATICS, MICROBIAL GENOMICS AND PROTEOMICS.

Unit – I

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


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

Unit – II


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


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, ProScan). DNA analyses for repeats (Direct and inverted), palindromes, folding programmes. Use of Internet, public domain databases for nucleic acid and protein sequences (EMBL, GeneBank), database for protein structure (PDB).

**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.


**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**:

**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) Choreaallontoic (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

**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)
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 VENKATESHWARA 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)


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. Crime and Theories of punishment – (a) Reformative, Retributive and Deterrent. (b) Views on manu and Yajnavalkya.
Books for study:
5. Harold H. Titus: Ethics for Today
6. Maitra, S.K: Hindu Ethics
7. William Lilly: Introduction to Ethics

SEMESTER-III

MB-301: ENVIRONMENTAL MICROBIOLOGY

Unit-I


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

**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:**

**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 fetalis.

**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 histocompatibility antigens, prolongation of allografts, grafts versus host disease.

**Tumour immunology** – Classification of tumour antigens. Humoral and cell 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 Pharmaceutical 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


Suggested Books:
8. Sandy Rubio,(2011) Validation of Microbiological Methods by Business Horizons;
9. Masakazu Tsuchiya,( 2010)Bacterial Endotoxins Test by bioprocess awards
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.


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

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.

Plant cell culture – Embryo culture, meristem culture, callus culture, anther culture, protoplast culture, cell suspension, spor 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 Shikonin 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:

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 – Characteristics 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.
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

Transfection – Salient features and its significance in transforming animal cells.

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:

PRACTICALS
MB-305: ENVIRONMENTAL MICROBIOLOGY, IMMUNOTECHNOLOGY AND PHARMACEUTICAL TECHNOLOGY
1. Isolation, identification and enumeration of microorganisms in the air and sewage.
2. Microbial antagonism in the environmental samples.
3. Isolation of thermophilic 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.
10. Sewage treatment plant-visit.
11. Preparation of hyper immune serum
11. Purification of antibodies by ammonium sulfa precipitation and dialysis
12. Antigen preparation (Flagellar & Somatic)
13. Fractionation of serum on G-20 sephadex
14. Agglutination Widal (slide & tube) test for typhoid fever VDRL test for syphilis
15. Assessment of immune diagnostic kits.
16. Immuno fluorescence technique.
17. Immuno blot Analysis of antigens and allergens.
18. Antitoxin assay preservative test
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.
9. Recovery of DNA from gels – Electroelution and extraction of DNA from low melting agarose gels.
10. Southern blotting, Electroblot immunoassay, Preparation of dot-blot 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


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.

Brief account on spersomphere and phyllospheres, their ecology and significance.
Unit – III


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.


Suggested Books:

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:


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. Aspesis-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.


**Suggested Books:**


**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-leguminous), 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-arbuscular mycorhizal (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. 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)
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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 Hippocrates 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.


**Books for study:**

5. Harold H. Titus: Ethics for Today
6. Maitra, S.K: Hindu Ethics
7. William Lilly: Introduction to Ethics
9. Manu: Manu Dharmra Sastra or the Institute of Manu: Comprising the Indian system of Duties: Religious and Civil(ed.) G.C. Haughton.
**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.


**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:**

**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.


**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.


**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 cocccobacilli (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.

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**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, Institutuhybridization.

**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.

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**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**:


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.

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


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

Books for study:
22. Maitra, S.K: Hindu Ethics
23. William Lilly: Introduction to Ethics
32. I.C. Sharma Ethical Philosophy of India. Nagin & co Julundhar.
SEMESTER – IV
HUMAN VALUES AND PROFESSIONAL ETHICS – II
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VII. Medical ethics- Views of Charaka, Sushruta and Hippocrates 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.

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23. William Lilly: Introduction to Ethics
25. Manu: Manu Dharma Sastra or the Institute of Manu: Comprising the Indian system of Duties: Religious and Civil(ed.) G.C. Haughton.
32. I.C. Sharma Ethical Philosophy of India. Nagin & co Juhlndhar.

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

PANEL OF PAPER SETTERS:

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<td>Prof. K.V.BHASKAR RAO</td>
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