

NIMS UNIVERSITY, JAIPUR



SYLLABUS

BACHELOR OF SCIENCE

(MICROBIOLOGY)

Scheme of Examination

YEAR - I

Subject	Theory	Practical	Total
Introduction to Chemistry	70	30	100
Elements of Genetics	70	30	100
Introductory Microbiology	70	30	100
Introductory cell biology & Molecular Biology	70	30	100
Mathematics	100	-	100
Basic of immunology	100	-	100
Biotransformation and Biocatalyst	100	-	100
English	100	-	100

YEAR-II

Fermentation Technology	100	30	100
Introduction to microbial Physiology	70	30	100
Introduction to Microbial Genetics	70	30	100
Basics of Food and Dairy Microbiology	70	30	100
Funtamentals of Bioinformatics	70	30	100
Introduction & recent techniques in Biotechnology	70	30	100
Environmental and Agricultural Microbiology	70	30	100
Introduction to Medical Parasitological and Mycology	100	-	100
Basics of Medical Bacteriology and Virology	70	30	100

YEAR-III

Subject	Theory	Practical	Total
Clinical Microbiology	70	30	100
Basic Techniques in Microbiology	70	30	100
Bioresource Utilization and Bioremediation	70	30	100
Introduction to Virology	70	30	100
Biostatistics	100	-	100
Introduction to Mycology and Protista	70	30	100
Pharmaceutical Microbiology	70	30	100
Elements of Industrial Entrepreneurship	100	-	100

INTRODUCTION TO CHEMISTRY

UNIT -I

Chemical bond: Type of bonding, general characteristics, hybridization involves s, p, d and f orbital, dipole moment Hydrogen bond: theories of hydrogen bonding, valance bond, weak inter and intra molecule force of attraction, Molecular orbital theory, VESPER theory.

UNIT-II

Alkanes: nomenclature, mechanism of the free radical, halogenations, activation energy. Alkenes: chemical reactivity, stability of carbonium ions, Markownikoff's rule Free radicle machanism, Stability of free ions. Dienes: methods for preparation of conjugated dienes, dielsalder reaction, Electrophilic mechanism.

UNIT-III

Stereochemistry of organic compounds: different types of stereoisomism, geometrical isomerism, optical isomerism, optical activity, R & S configuration, asymmetry synthesis. Carbohydrate: classification, reaction, constitution of glucose and fructose, mutarotation, anomers, epimerization, conversion of glucose into fructose and vice versa

UNIT-IV

Thermodynamics: laws of thermodynamics, thermodynamic state of duster, molar heat capacity, relation between ΔH and E . Joule Thompson effect, Carnot cycle, entropy, Helmholtz, Free energy, Gibbs's free energy.

UNIT-V

Chemical equilibrium: law of mass action, chatelier principle distribution law, hydrolyses, oswald dilution law, pH value, Hazet Henderson equation, Electrode: Standard electrode potential chemical cells.

Practicals: Practical based on above topics will conducted.

Books:

University General Chemistry by C.N. R. Roo.

Principles of Physical Chemistry, 4th Edition by S.N. Marrow and C.F. proton.

Essential of Physical Chemistry by B.S. Bahel and G.D. Tuli.

Concise Inorganic Chemistry by J.D Lee 5th Edition

Organic chemistry, 5th Edition by Marrison and Boyd, Prentice Hall of India pvt. Ltd. New Delhi.

An introduction to Electrochemistry by Samuel Glassine.

ELEMENTS OF GENETICS

UNIT-I

Mendelism brief history of genetics and Mendel's work, Mendelian laws, their significance and current status. Chromosomal theory of inheritance Genetics interaction: supplementary gene, complementary gene. Duplicate genes, epistasis, inhibitory and polymorphic genes.

UNIT-II

DNA as genetic material, DNA and RNA structure and type Nucleic acid, Sugar phospho diester, Nucleosome structure, euchromatin, heterochromatin, satellite DNA, telomeres, centromere, polytene chromosome and lampbrush chromosome, Genetic code, triplet codon, characteristics of triplet codon.

UNIT-III

Chromosomal mutation: classification of chromosomal mutations translocation, inversion, deletion and duplication, variation in chromosome numbers, haploidy, diploidy, aneuploidy, euploidy and polysomy. Linkage and crossing over. Heredity defects: Klinefelter syndrome, Down's syndrome, Application of polyploidy.

UNIT-IV

Mitosis : phases and process of mitosis, structure and function of spindle apparatus, anaphasic movement Meiosis, phase and process of Meiosis, synapses and synaptonemal complex, formation and fate of chiasmata and significance of crossing over. Interphase nucleus and cell cycle: S, G₁, G₂ and M phase.

UNIT-V

Microbial genetics: Recombination in bacteria, Molecular mechanism of recombination. Transformation, Transduction (generalized and specialized), Conjugation, Cytoplasmic inheritance.

Practicals: Practical based on above topics will be conducted.

Books:-

Genetics: Ahluwalia, K. B. Wiley Eastern Ltd. New Delhi.

Genetics: Altenbery, Oxford and IBH, New Delhi.

Genetics: Gupta P. K.

Principle of Genetics: Gardner E.J. Wiley Eastern Ltd. New Delhi.

INTRODUCTORY MICROBIOLOGY

UNIT-I

Evolution of earth and life. Definition, history and scope of microbiology. Defferent groups of microbes and their taxonomical classification.

UNIT-II

Bacterial cell: morphological types. Archeabacteria, eubaeterial and eucaryotes. Bacterial cell wall, its synthesis and functions. Appendages of bacterial cell and their role. Inclusions of bacterial cells. Endospore, and Reserved food materials. Viruses and their structure. Fungi and their types.

UNIT-III

Cultivation of microbes. Growth and growth curve of bacteria. Nutrition of microorganism different nutritional types of bacteria. Selective cultural methods and enrichment culture. Factors affecting microbial growth. Sterilization methods.

UNIT-IV

Basics of microbial metabolism. Different pathways of glucose break down. TCA cycle and electron transport chains. Fermentation, anaerobic respiration and bacterial photosynthesis. Biosynthesis of building blocks. Uptake solutes/nutrients into cell.

UNIT-V

Microbial genetics mutations, DNA repair. Transfer of genetic characters and recombination. Transfor-
mation, conjugation and transduction. Plasmids. Restriction and DNA modification, regulation of metabolism.

Practicals: Practicals based on above topics will conducted

Books:

1. Brock TD, Madigan MT,(1993) Biology of microorganisms. Prentice Hall Int. Inc.
2. Ananthanarayanan R. and C. K. Jayaram Paniker (1997) Text of Microbiology, Orient Longman.
3. Prescott Harley Klein:(1996) Microbiology III ed. ECB Pub.
4. Tauro,P. Kapoor,K.K.and Yadav,K.S. (1996) Introduction to Microbiology. New Age International Pub. New Delhi.

INTRODUCTORY CELL BIOLOGY & MOLECULAR

Unit- I

Cell as a basic unit of living organism- Development of cell theory. Eukaryotic and prokaryotic cells, cell division and cell cycle, anomalies in cell division, ultra structure of the cytoplasm, cytoskeleton microtubules, microtubular organelles, microfilaments The (endo membrane system), nuclear envelope, endoplasmic reticulum and golgi complex. Membrane organelles, mitochondria, chloroplast, lysozyme, peroxisomes. Molecular organization of cell membrane, passive and active transport, $\text{Na}^+\text{-K}^+$ pump, Ca^{2+} – ATPase pumps, lysosomal and vacular membrane. ATP dependent protein pumps, co-transport into prokaryotic cells, endocytosis and exocytosis, entry of viruses and toxins in to cells

Unit- II

Cell-cell interaction, receptors and models of extra-cellular signaling: cytosolic, nuclear and membrane bound receptors, autocrine, paracrine and endocrine model of action. Muscles and nerve cells, cell senescence and death, cell differentiation. Signal transduction: signal amplification and different models, cyclic AMP, role of inositol phosphatase messenger. Biosynthesis of inositol phosphatase messenger, cyclic GMP and glycoproteins in signal transduction. Calcium model of signal amplification, phosphorylation of protein kinases.

Unit- III

. Cell culture: Techniques of culturing of prokaryotic and eukaryotic cells, cell lines and cell line generation. Maintenance of cell culture, characterization of cell, immunochemistry, morphological analysis techniques in cell culture, primary cultures, contamination, differentiation and three dimensional culture.

Unit- IV

DNA and inheritance. Genetic and biochemical experiments to prove nucleic acid as a genetic material. Prokaryotes and Eukaryotes. Organization of genes. Coding and non-coding sequences. Unique, moderately repetitive and highly repetitive DNA sequence. Stellite DNA DNA replication in prokaryotes. Semi consertive mode of replication. Replication eye, forks, okazaki fragments and RNA primers. Different enzymes involved in DNA replication

Unit-V

Replication in E-coli. Initiaiton, elongation and termination of replication. Fidelity of replication. Circular DNA. DNA polymerases. Inhibition of DNA replication , DNA repair of damages caused by different agents. Mutation and its types such as spontaneous, induced and point mutations. Chromosomes aberrations. Vectors and DNA recombinant technology. Restriction and endonucleases. Plasmid, cosmid cloning vectors. Molecular cloning and application of recombinant DNA technology.

Practicals:

Practicals based on above topics will be conducted.

MATHEMATICS

UNIT-I

Set number system (in brief), complex numbers, addition, subtraction, multiplication, division, De-moivre's theorem, finding roots of a polynomial equation.

UNIT-II

Function – definition domain and range of a function, types of function, graphs of standard function $-X$, X^2 , X^3 , $/X/$, $\log a$ X E^X .

UNIT-III

Limit, differentiation (in brief), maxima and minima (upto 2 variables) rules of partial differentiation. Higher order partial differentiation.

UNIT-IV

Integration (in brief) differential equations – definition, order and degree of differential equation, homogenous and non-homogenous differential equations, exact differential equation (including integrating factor) linear differential equation. Application to growth and decay law of cooling.

UNIT-V

Matrices – definition, types of matrices, addition, multiplication of matrices, inverse of a matrix, systems of linear equations, row echelon form, rank of a matrix, homogeneous and non-homogenous system $AX=B$, consistency, Gaussian elimination method.

Books:

1. Mallick, S.C, and Arora, mathematical Analyses.
2. Jung olive maths- self study guide Cambridge lows prices edition.
3. E.D. Rainsville and P.E. bedient (1989), Elementary differential equation. McMillan, New York.

ENGLISH

Unit -I

Phonetics and Vocabulary:

Transcription of Phonetics Symbols, Words stress, Synonyms and Antonyms, Word Formation- Prefix, Suffix Grammar and usage : Transformation of sentences: Direct and Indirect Narration, Active and Passive Voice, Interchange of Degrees of Comparison, Modals

Unit- II

Comprehension, Sequences of Tenses, Elements of a Clause, Compositional Skills CVs and Job Applications , Paragraph Writing

Unit III

Letters- Formal and Informal Technical letter writing: Purpose of writing, space/layout, economy of words, use of verb/ passive voice, type face (.italics, bold, underline) and use of indentation.

Unit IV

Report writing: Preparation, report structure (purpose of report, scope, shape, presentation of report, introduction of report, style of report and index of report). Public communication: meetings, planning and discussion, planning procedure, timing, degree of formality, behavior, repetitive, interviews (complexity of situation, preparation of thinking, preparation of setting, opening of the interview, style of interview).

Recommended Readings.

- I. Sasikumar, V., Dutta And Rajeevan, A Course in Listening and Speaking-I Foundation Books. 2005.
- II. Sawhney, Panja and Verma eds. English at the Workplace, Macmillan 2003.
- III. Singh , R.P. Professional Communication. OUP. 2004
- IV. Judith Leigh. CVs and Job Applications OUP. 2004.
- V. Arthur Waldhorn and Arthur Zeiger, English made Simple Rupa and Company. **Unit- I**

BASICS OF IMMUNOLOGY

UNIT-I

Humoral and cellular component of the immune system: innate immunity, skin and mucosal surface, physiological barrier, phagocytic barrier, inflammation, adaptive immunity, immune dysfunction and its consequences, allergy and asthma. Cell and organs of immune system spleen, thymus, lymph node, lymphoid cell stem cell, B-lymphocytes and T-lymphocyte natural killer cells, mononuclear phagocytes, granulocytes cells.

UNIT-II

Antigen antibody interaction antigen, structure, properties, type, epitops, Heptane. Antibody structure and functions. Immunoglobulin structure, types and function

UNIT-III

Antigen-Antibody interaction, precipitation reaction agglutination, RIA, EIISA. Western blotting, major histocompatibility complex, general structure and function of MHC. Antigen processing and presentation immune florescence.

UNIT-IV

Immune effectors mechanism, cytokinin (properties, receptors, antagonists, secretion) the complement system (function, components, deficiencies) cell mediated effectors. Response cytotoxic T cells, natural killer cell, antibody dependent cell mediated cytotoxicity, inflammation, hypersensitive reaction.

UNIT-V

Immunology in health of disease, immune response to infectious disease, viral, bacterial, protozoon vaccine. AIDS and other immune deficiencies, cancer, organ specific, autoimmune disease, systemic autoimmune disease.

Book:

1. Essential immunology Roits, Black Well Sc. Pub. Oxford
2. Kuby. J. Immunology W.H. Freeman and Co. N.Y.
3. Clinical Immunology Prakash Sen Gupta. Oxford 2003

BIOTRANSFORMATION AND BIOCATALYST

UNIT-I

Basic organic reaction mechanism. Common prejudices against enzymes. Advantages and disadvantages of biocatalyst.

UNIT-II

Isolated enzyme versus whole cell systems. Mechanistic aspects and enzymes sources. Biocatalyst application.

UNIT-III

Hydrolytic reaction, regioselective hydrolysis. Reduction reaction. Bakers yeast- reduction oxidation reaction, enantio selection, oxidation.

UNIT-IV

Hydroxylation of steroids at inactivated carbon centers. Enzyme of organic solvents reaction engineering for enzyme.

UNIT-V

Catalyzed biotransformation. Catalytic antibodies. Biocatalyst from extreme thermophilic bacteria.

Books.

1. A text Book of Enzymology by palmer
2. A References Book of Biochemistry by Harper.

Second Year

FERMENTATION TECHNOLOGY

Unit – I

Introduction to fermentation technology. Fermenters, components and types. Media for industrial fermentation, air and media sterilization Isolation, preservation and maintenance of industrial microorganisms.

UNIT-II

Type of fermentation processes: analysis of batch, fed batch and continuous bioreactors. Measurement and control of bioprocess parameter.

UNIT-III

Downstream processing: introduction, removal of microbial cells and solid matter. Foam separation, precipitation, filtration, centrifugation, cell disruption, liquid extraction, chromatography, drying and crystallization.

UNIT-IV

Industrial production of chemicals utilizing wastes. Alcohols (ethanol), acids (citric, acetic and gluconic), antibiotics (penicillin, streptomycin, tetracycline). Single cell protein.

UNIT-V

Introduction to food technology, principles of food processing. Elementary idea of canning and packing sterilization, pasteurization of food product. Food preservation.

Book:

1. Principles of Fermentation Techniques. Stanbury,P.F., Whittaker,A. and Hall, S.J. Elsevier, Pub.
2. A Text Book of Biotechnology R. C. Dubey. S. Chand Pub. New Delhi.

INTRODUCTION TO MICROBIAL PHYSIOLOGY

UNIT-I

Definition and scope of microbial physiology, macro molecular synthesis and processing: DNA, RNA and protein synthesis in brief.

UNIT-II

Central pathways of carbohydrate metabolism: EM pathway, ED pathway, phosphoketolase pathway oxidative pentose phosphate pathway, TCA cycle, Glyoxylate cycle. Energy production: substrate level phosphorylation, oxidative phosphorylation, photo phosphorylation. Anaerobic respiration and energetics of chemolithotrophy. Fermentation: alcoholic hetero fermentation.

UNIT-III

Metabolite transport: facilitated diffusion (Passive Diffusion) Active transport system and group translocation, bacterial growth and growth kinetics. Continuous and synchronized growth.

UNIT-IV

Phototrophy. Chemotrophy. Mixotrophy. Protein degradation. Lipid and fat metabolism. Polysaccharide metabolism.

UNIT-V

Biosynthetic pathways: biosynthesis of low molecular weight building blocks, glycogenesis. Nitrogen fixation. Bacterial photosynthesis. Regulation of metabolism.

Practicals: Practical based on above topics will be conducted

Books:

- 1) Gottschalk, K, G. (1986) Bacterial Metabolism 2nd edition Springer Verlag. New York.
- 2) Nicholls, D.G. and Ferguson, S. J. Bioenergetics, San Diego, Academic Press.
- 3) Lehninger, (2005) Principles of Biochemistry 4th Edition, W.H. Freeman, New York.

INTRODUCTION TO MICROBIAL GENETICS

UNIT-I

Definition, scope and history. Genetic elements in prokaryotic and eukaryotic cells. Inheritance of characters in prokaryotic and eukaryotic cells. Bacterial and fungal genomics.

UNIT-II

Molecular concept of microbial genetics and central dogma. Gene expression at molecular level. Genotype and phenotypic gene expression. Genetic code, transcription and translation. Regulation of gene expression. Lac operon, fine structure analysis model, Mutations and their types and expression, mutagens and their effects transposons. DNA repair and reversion

UNIT-III

Extra chromosomal elements: episomes and plasmids in microbes. Types of plasmids and characters controlled by plasmids, Mechanism of plasmid replication.

UNIT-IV

Bacterial transformations, mechanism of DNA uptake and transformation transduction, conjugation, sex factor and Hfr mechanism of chromosomal transfer. Genetic mapping. Genetic recombination.

UNIT-V

Genetics of bacteria phages: T4 Lamda. Lytic and Lysogenic phages. DNA replication and phage production. PCR techniques in gene amplification. Restriction and DNA modification. Construction of a recombinant DNA molecule. Hybrid DNA clones.

Practical: Based on above topics will be conducted.

Books:

Bain bridge, B.W. 1980

1. Genetics of Microbes Glasgow: Blacked and sons.
2. Birge, E.A. 1981 Bacterial and Bacteria phage Genetic: An introduction. Heidelberg Springer.
3. Freifelder, D. 1987 Microbial Genetics. Boston Jones & Bartlett publ.
4. Levin, B 1990 gene expression Vol. I to IV New York: Wiley & London: Oxford Univ. Press.
5. Winnaker, E. L. 1987. From Gene to Clones: Introduction to Gene Technology. Wertheim: VCH verlags gesells chaff.

BASICS OF FOOD AND DAIRY MICROBIOLOGY

UNIT-I

Food and its constituents quality factors of in food. Deterioration of food microorganism food in food molds, yeasts and bacteria and their importance. Food spoilage and microbes in relation to food spoilage. Extrinsic and intrinsic factor influencing microbial group in foods.

UNIT-II

Food sanitation in manufacturing and retail trade. Food preservation: heat preservation and processing. Cold preservation and processing. Food dehydration and concentration. Irradiation, microwave processing. Canning of food.

UNIT-III

Fermented food: bread, cheese, vinegar, Fermented vegetables fermented food and their quality. Microbial foods: Single Cell Protein and other foods like mushroom. Fermented beverages, genetically modified microbial foods.

UNIT-IV

Composition and constituents of milk and milk derivatives their microorganism . Sources of contamination of milk and its spoilage. Fermented milk and of other dairy products (cheese, yogurt, curd, whey, icream, butter and ghee.)

UNIT-V

Food in relation to diseases: food poisoning, Food born diseases. Food safety microbiological considerations.

Practicals: Based on above topics will be conducted.

Books:

1. Diliello, L.R. 1982 methods in food and dairy microbiology AVI Westport, CT.
2. Varnam, A.H. 1994. Milk and milk products: technology, chemistry and microbiology Chapman & Hall, land on, New York.
3. Wood Brain, J.B. 1985 microbiology of fermented foods. Chapman & hall, London, NV.
4. Anon 1998 Food Biotechnology: present and future.
5. Adams, M.R. and Moss, M.O. 1995 Food Microbiology. Royal society of chemistry Publication Cambridge.

FUNDAMENTALS OF BIOINFORMATICS

UNIT-I

Introduction to database flat file data base, relational database, object oriented databases.

UNIT-II

Sequence analysis and phylogeny: internet sequence on the net sequence of DNA, RNA and protein. Determination of protein structure, gene and protein expression data, protein interaction data. File formats, sequence databases, genome and organism specific database. Retrieval, inters, SRS. Similarity reaches, amigo acid substitution matrices. FASTA, BLASTA various types of BLAST.

UNIT-III

Multiple sequence alignment, protein families, protein domain families, building free evolution of macro muscular sequences- genome annotation.

UNIT-IV

C-language: introduction, operators, expressions, variables, input, output statements, control statement, function, arrays, pointers, structures, unions, file handling and case studies. Introduction to PERL, variables, strings and numbers, lists analysis, hashes conditional tops, pattern matching and application.

UNIT-V

Introduction to structural database – models of protein structure – structure, function and relationship structural alignment – classification of 3D structure. CATH and Scop-concepts in protein prediction. Micro array data and analysis: tools and rescores, proteomics data qualifies, bioinformatics in drug discovery.

PRACTICALS: Practicals based on above topics will be conducted

Books:

1. Bioinformatics, 1998. Baxeranis
2. Bioinformatics 2000, higgins & taylor.
3. Nucleic acids research. 2001. Jan. genome. Database issue.
4. Introduction to bioinformatics – attired

INTRODUCTION & RECENT TECHNIQUES IN BIOTECHNOLOGY

UNIT-I

Biotechnology: definition, history and scope. Emergence of modern biotechnology. Global input and current excitement of biotechnology (on environment, health care, agriculture.) Cell and plant tissue culture technique and its application. Principle and application of genetic recombinant technology. Strain improvement Gene therapy methods.

UNIT-II

Fermentation technology. Fermentors, production of Ethanol, enzyme production from microbes. Enzymes immobilization techniques. Biotechnological product: single cell protein (alga, yeast, mushroom). Biofertilizer (BGA, VAM) biopesticides (Bacillus thuringiensis \) pharmaceuticals (antigen, interferon, vaccines, insulin).

UNIT-III

Genetic and physical mapping techniques: genetic markers. RFLP, micro and mini satellite, STS, RAPD, AFLP, SNPS. Chromosome walking and jumping. DNA sequencing techniques – maxam – Gilbert method, sanger's dideoxy chain termination method (enzymatic DNA sequencing, automated DNA sequencing method) human genome project

UNIT-IV

Polymerase chain reaction (PCR) techniques and its application. Genomic library, CDNA library. DNA microarray. Transfer of recombinant DNA into bacterial cells. Southern hybridization, Northern hybridization, western hybridization. DNA finger printing and its application Gene silencing: si RNA technology, micro RNA and application of gene silencing. Antisense RNA technology and its application

UNIT-V

Introduction to nano particles. Application of nanotechnology. Stem cell and their potential. Cloning of Dolly hybridoma technology and its application.

Books:

1. Biotechnology, satyanarayan, u
2. Plant biotechnology – J hammond P. Mc garvey and V. Yasibov

ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY

UNIT-I

Definition of environment and its components. Aerobiology. Assessment of air quality. Air borne microbes and their transmission. Diseases caused by air borne microbes.

UNIT-II

Water as an environment – fresh water habitat marine habitat. Zonation of water ecosystem upwelling, eutrophication. Aquatic environment (temperature, hydrostatic pressure, light salinity turbidity, pH), Aquatic microorganism. Phytoplankton, zooplanktons, benthic microbes. Biogeochemical transformation.

UNIT-III

Sewage and sludge: definitions, chemical characteristics and its microbiology. Waste water treatments and their efficiency. Municipal solid waste, their characteristics and treatment (composting land filling and biogas production) hazardous waste and heavy metal pollution and bioremediation. Metagenomics and its role in bioremediation.

UNIT-IV

Definition of soil, its components and characteristics. Soil microflora. Rhizospheric and phyllospheric microorganisms. Microbial interactions soil. Soil borne plant, animal and human pathogens. Rumen microorganisms and their role.

UNIT-V

Biogeochemical cycles of nitrogen, phosphorus, sulfur and carbon and plant nutrient release. Microbial oxidation reduction of plant nutrient elements in soil nitrogen fixation, its types and microbes biofertilizers and biopesficides.

Practicals: Practical based on above topics will be conducted.

Books:

- 1) Droop, M.R. and jannasch, H.W. 1977 Advances in Aquatic Microbiology. Accad. press, N Y.
- 2) Mitchell, R. 1978 Water Pollution Microbiology Wiley, New York.
- 3) Paul, E A 2002 Soil Microbiology and Biochemistry . Accad. press, N Y.
- 4) Atlas, R.M and berth, R. 1987 Microbial Ecology Fundamentals and Application (2nd Ed) Reading, M.A. Addison Wesley.

INTRODUCTION TO MEDICAL PARASITOLOGICAL AND MYCOLOGY

UNIT-I

Introduction to the subject, definitions and scope. Disease causing fungi, their morphology and classification. Dermatophytes and agents of superficial mycoses trichophyton, edidermophyton and microsporium. Yeasts of medical importance, *Candida*, *Cryptococcus*. Mycotoxins. Antifungal agents, testing methods and quality control.

UNIT-II

Dimorphic fungi of systemic mycoses. Histoplasma, Coccidioides: Sporothrix, Blastomyces and opportunistic fungi. Fungi causing mycetozoa. Recent method in diagnostic mycology. Immunity to fungal infection.

UNIT-III

Medical parasitology and its importance. Protozoal diseases and causal agents. Leishmania, Trypanosoma, Giardia, Trichomonas, Balantidium, Amoebiasis, Entamoeba, Cryptosporidiosis, Cryptosporidium, Cyclospora

UNIT-IV

Platyhelminthes – Taenia, Fasciola, Paragonimus, Schistosoma. Nematohelminthes – Ascaris, Ankylostoma, Enterobius, Trichinella, Trichurus. Wuchereria, Brugia. Examination of faeces and blood for parasites. Cultivation of protozoan parasites,

UNIT-V

Strategies in diagnosis of fungal and parasitic diseases. Collection of specimen and its processing. Nucleic acid based diagnostic techniques. Some selective tests of fungal and protozoal human pathogens.

BASICS OF MEDICAL BACTERIOLOGY AND VIROLOGY

UNIT-I

Historical aspects of medical bacteriology. Classification of important bacteria. Collection and transport of specimens, Isolation of bacteria from clinical specimens. Selective media for isolation of different medically important bacteria. Antibiotic sensitivity test and its principles.

UNIT-II

Bacterial diseases, their causal organisms and clinical features: Diphtheria. Tuberculosis Pneumonia, plague, Gas Gangrene, Leprosy, Botulism Gastroenteritis, Salmonellosis, Shigellosis, Anthrax etc.

UNIT-III

Aerobic pathogenic actinomycetes. Anaerobic gram positive, non spore forming bacilli and cocci. Anaerobic gram negative pathogenic bacilli and cocci. Mycoplasma Rickettsia, spirochetes, Treponema, Leptospira and Berrettia.

UNIT-IV

Introduction to viruses. Viruses as human disease causing agents, their characteristics and classification. Viruses of chicken pox, influenza, measles, mumps viral pneumonia, rubella, small pox, equine encephalitis, AIDS, common cold. Herpes, polio virus, hepatitis and prion diseases.

UNIT-V

Antimicrobial therapy. Methods of drug susceptibility testing. Antibiotic assay in body fluids, vaccines and schedules, passive prophylactic measures, nutritional and environmental health measures. Health education.

Practicals: Practical based on above topics will be conducted.

Book:

1. Mackie and McCartney 1996 Medical Microbiology, Churchill Livingstone
2. Shannon, D.C. and Wright, P.S.G. 1982 Microbiology in Clinical Practices
3. Baron, E.J., Peterson, L. R. and Tenover, S.M. 1990 Bailey and Scotts

Third Year

CLINICAL MICROBIOLOGY

UNIT-I

General rules and regulations of microbiological laboratory safety and quality. General concepts for specimen collection and handling. Specimen processing. Host-Microbe interaction, entry, invasion and dissemination and outcome.

UNIT-II

Diagnosis of infection: Serological methods Agglutination assay, Immunelectrophoresis, immunodiffusion assay, complement fixation assay and enzyme linked immunosorbent assay etc. Antimicrobial agents and resistance against them.

UNIT-III

Catalase positive gram-positive cocci: Staphylococcus, Streptococcus Enterococcus, Catalase positive gram positive bacilli: *Bacillus*, *Corynebacteria*, *Listeria*. Catalase negative –gram positive bacilli Lactobacillus, Erysipelothrix. Gram negative bacilli and coccobacilli Enterobacteria (oxidase negative) and Pseudomonas and Burkholderia (oxidase positive). Haemophilus, Vibrio and Bordetella.

UNIT-IV

Catalase negative gram positive anaerobic bacilli: Clostridium and Actinomyces. Epidemiology and pathogenesis of Mycobacterium. Obligate intracellular and non cultivable bacterial pathogens: Chlamydia Rickettsia, Mycoplasma and Ureaplasma.

UNIT-V

Laboratory methods for diagnosis of parasitic fungal and viral infections. Current and emerging technologies in the laboratory diagnosis of infectious diseases.

Practicals: Practicals based on above topics will be conducted.

Books:

1. Forbes, B.A., Sahm, D.F. and Weissfeld A.S. 2002 Bailey and Scott's Diagnostic Microbiology (11th edition) St. Louis Missouri.
2. Koneman, E.W. Allen, S.D., Janda, W.M., Schreckenberger, P.C. and Winn, W.C. 1992 Diagnostic Microbiology (4th edition), J.B. Lippincott Company.
3. Mahon, C.R. and Manusell, Jr. 1995 Text Book of Diagnostic Microbiology. W.B. Saunders company, Philadelphia

BASIC TECHNIQUES IN MICROBIOLOGY

UNIT-I

Growth media: types including selective and non selective media. Preparation of media. Sterilization: principles and methods – moist heat, dry heat, filtration, irradiation, chemical methods and disinfection. Sterilization of working tables and cloths.

UNIT-II

Cultivation and purification of microbial cultures. Different methods of cultivation - broth culture plate culture and slant cultures. Purification of microbial culture by streaking, spread plate, simple streaking and coordinative streaking. Cultural characteristics of microorganisms. Enumeration of microbial population.

UNIT-III

Biochemical test and identification of microbial culture. Methods of determination of microbial growth. Microbial enzyme assay. MBR test nitrate reductase test. Decarboxylase test, phenylalanine delaminase test. Enzyme induction.

UNIT-IV

Microbiological analysis of food products. Standard qualitative test of water. Quantitative analysis of water. Isolation of antibiotic producing microbes from soil. Determination antimicrobial activity of any isolate. Bacterial conjugation. Isolation of antibiotic resistant mutants. Identification of human pathogen. Microbiological analysis of urine and blood specimens.

UNIT-V

Cultivation and enumeration of bacteriophages. Cultivation of fungi and their morphology. Identification of unknown bacteria and fungi. Serological techniques.

Practicals: Practical based on above topics will be conducted.

Books:

1. Cappuccino, J.G. and Sherman, N. 2002 Microbiology Laboratory Manual Pearson education (Singapore). Indian branch New Delhi.
2. Dubey, R.C. and Maheshwari, D.K. 2006 Practical Microbiology. S. Chand & Company Ltd. New Delhi.

BIORESOURCE UTILIZATION AND BIOREMEDIATION

UNIT I

Concept of Bioresource utilization and bioremediation and there scope and importance. Bioresource and biomass and availability. Mechanism of bioresource utilization.

UNIT II

Introduction to bioresource utilization , process of bioresource utilization. Composting biogas production, jute and flax retting, coir production curing tea and coffee. Biological nitrogen fixation and bacterial photosynthesis.

UNIT III

Microbes and biocatalyst : Hydroxylation of steroids , production of polyether, stains, enzyme inhibitors, immunosuppressant's, ultero contractants , antitumor agents , biosurfactants, biopolymers, biopesticides and biotertilizers.

UNIT IV

Bioremediation: Definition and importance. Biodegrading of pollutants (Pesticides, polychloro ethylene biphenyls). Biotreatability assay of pollutants. Biodegradation technology and factors affecting technology. Phyto remediation.

UNIT V

Bioremediation of wastes, oil spills, spoilt mines etc. Bio sorptions. Bio augumentation by native flora as well as commercial inoculants. Genetic improvement of bioremediation microbial inoculants.

Practicals: Practical based on above topics will be conducted.

Books:-

1. Alexander , M. 1994 Biodegradation and Bioremediation. Academic press, san Diego.
2. Metting , F.B. Jr. 1993 (ED.) Microbial Ecology : Application in Agriculture and Environment Management, Deckkera.
3. Ganthier, M.J. 1992 (ED.) Gene transfers and Environment. Springer – verlagy Barlin.
4. Levin, M.A., Seidler, R.J. and Rognl, M(1992) (ED.) Microbial Ecology : Principles, Methods and Application.
5. Rittmann, B.E. and Mccarty, P.L.2001 Environment Biotechnology : Principles and Application.

INTRODUCTION TO VIROLOGY

UNIT- I

General characteristics of viruses. Biological status of viruses. Reproduction of viruses. Isolation & cultivation of viruses, purification of viruses and assay. Importance of viruses. Viruses of bacteria, viruses of animals.

UNIT – II

Viruses: - Microbial agents of diseases. Viruses containing different kinds of genetic material with examples. Viral pathogens of insects.

UNIT –III

Plant viruses: Classification and nomenclature : Effect of viruses on plants. Histology , Physiology and Cytology of plants affected with viruses. Common viral diseases of plants (rice, cotton, tomato and sugar-cane). Life cycle specific types of plant viruses like. Tobacco Mosaic Virus (TMV), Cauliflower Mosaic Virus and Potato Virus X : Transmission of plant viruses with vector and without vectors.

UNIT – IV

Bacterial viruses: Bacteriophage, structural organization, life cycle, one step growth curve, transcription, DNA replication, eclipse phase, phage production, burst size. Lytic and lysogenic cycles. Bacteriophage typing.

UNIT – V

Application of viruses in bacterial genetics. Brief detail on M13, M4, T3,T4 and lambda phages. Viruses of cyanobacteria, algae and fungi. Common human viral diseases and details of their causative agents (small pox, AIDS, Hepatitis B, Influenza and polio).

Practicals: Practical based on above topics will be conducted.

Books:-

1. Text Book of Microbiology by- Pelczar
2. Biotechnology by – U. Satyanarayana
3. Microbiology – Prescott.

BIOSTATISTICS

UNIT- I

Introduction to Statistics with scope in biosciences. Statistical data: Various types (raw data, grouped) representation of data using frequency distribution diagram (simple/ multiple/ subdivided bar diagram, pie diagram), Graphs (Histogram, polygon, curve). Population, sample and sampling methods (SRS, stratified sampling).

UNIT- II

Description statistics (a) measures of central tendency . Mean (definition and simple problems). Median, quartile (definition, graphical calculation). Mode (definition graphical calculation). Situations where one is preferred over the others. (b) measures of dispersion : variance (definition, simple problems). Standard deviation coefficient of variance skewness (definition, types of skewness and graphical presentation). (d) kurtosis (definition and types, graphical presentation).

UNIT – III

Probability (a) definition and its limitation, axiomatic approach. Independence and conditional problem. Standard probability, distribution (b) binomial (definition and additive property and simple examples) (c) Poisson (definition, additive property and simple examples) (d) Normal (definition , linear property and simple examples). Central limit theorem.

UNIT – IV

Inferential statistics (a) hypothesis, definition, types, (one tailed two tailed).(b) Sampling distribution and errors. (c) Types of errors (type I, II). Testing of hypothesis (two tailed only). (a) for mean (one population) Mean (2 population dependent and independent) (b) for variance (one population), variance (two populations), (c) Chi-square test for fitting distribution.

UNIT – V

Anova (one way). Anova. (two ways) followed by test (pair wise). Correlation (definition types of correlation with simple biological problems). Scatter diagram covariance, multiple correlations (definition). Partial correlation (definition & formula).

Books

1. Annadurai, B.A. text book of biostatistics New age 2007 international (p) ltd, New Delhi.

INTRODUCTION TO MYCOLOGY AND PROTISTA

UNIT – I

Definition and scope of mycology significance of fungi to mankind. General characteristics of fungi and classification.

UNIT – II

Characteristics of different phyla : Chytridiomycota , Zygomycota Ascomycota, Basidiomycota.

UNIT – III

Importance of fungi : Plant pathogen (Puccinia, Ustilago, Phytophthora, Fusarium, Claviceps), Human pathogens (Aspergillus , Candida). Industrially important fungi(yeast, fungi producing organic acids, vitamins and enzymes, antibiotics etc.). Fungi as biotransformer and bioremediator, Mushroom fungi and their importance. Mycorrhizae. Biocontrol agents. Endophytic fungi and their role. Fungi associates with insects.

UNIT – IV

Protists definition characteristics and distribution. Different types of protists and their nutrition and reproduction. Different groups ; Excavata, Amoebozoa, Chromalveolata, Archaeplastida, Rhizoria.

UNIT – V

Importance of protists : Grazers, endosymbionts , commensals and parasites. Phototrophic and saprotrophic protists . Industrial and other uses of protists. Human and plant diseases caused by protists.

Practicals: Practical based on above topics will be conducted.

Books:-

1. Alexopoulos, C.J. Mims, C.N. and Blackwell. M. 2002. Introductory Mycology (4th Edition). Wiley- India.
2. Rayner, A.D.M., Prazier, C.M. and Moore, D.1987 (eds). Evolutionary Biology of Fungi Cambridge Uni. Press. London.
3. Carlile, M.j. and Gooday, G.W. 2001 The Fungi (2nd ed.) Acad. Press. New York.
4. Griffin, D.H. 1996 Fungal Physiology (2nd ed.) Wiley- Liss, New York.

PHARMACEUTICAL MICROBIOLOGY

UNIT – I

Definitions of Pharmacy, pharmacology and pharmaceuticals. Different groups of microbes (Bacteria, fungi, protozoa, algae and viruses). Microbial growth and bacterial growth kinetics. Microbial nutrition, Cultivation and control of microbial growth. Microbial genetics .

UNIT – II

Infection and factors influencing infection. Host microbe relationship. Host defense mechanisms and mechanism of immunity. Vaccines, preparation standardization and storage. Vaccines for different diseases like diphtheria gas gangrene, tetanus, cholera, plague T.B. polio, measles, small pox, typhoid, whooping cough. Anti-diphtheria serum, ant rabies serum antivenom serum.

UNIT – III

Common diseases : Pneumonia, Gonorrhoea, Cerebrospinal – Meningitis, Diphtheria, Typhoid Fever, Bacillary and Amoebic Dysentery, Cholera, Plague, Influenza, Pertussis , Whooping Cough, Gas Gangrene, Tetanus, Tuberculosis, Leprosy, Syphilis, Rickettsia, Rabies, Poliomyelitis, Dengue, Small Pox, Chicken Pox, Malaria, Mumps, their causal organisms mode of transmission and control. Fungal diseases their causative agents.

UNIT – IV

Bacteriostatic, bactericidal, fungicidal drugs : sulfonamides, antibiotics and antifungal drugs, their mechanism of action and side effects. Commonly used antiviral drugs (NRTIs, NNRTIs, NtRTs,PIs & fusion inhibitors). Antibiotic sensitivity (MIC & MBC).

UNIT – V

Fermentation : types of fermenters and their working. Production of antibiotics (penicillin, tetracyclins, streptomycin, griseofulvin), vitamins (riboflavin & biotin)and whole cell drugs (sporoline etc) and ergotamine. Microbiological transformations (oxidation, hydrolysis, reduction, esterification and isomerization). Microbiological assay of drugs and vitamins.

Practical: Practicals based on above topics will be conducted.

Books

1. Howland, R.D. and Mycek, M.J. 2006, Pharmacology (3rd edition). Lippin Cott Williams & Wilkins.
2. Barar, F.S.K. 2007 Essentials of Pharmaceutical (4th edition) S. Chand & Company Ltd., New Delhi.
3. Jain, N.K. 2005, Pharmaceutical Microbiology. Vallabh Prakashan, Delhi.
4. Kori, S.S. and Halki, M.A. 2000 Pharmaceutical Biotechnology. Vallabh prakashan, Delhi.

ELEMENTS OF INDUSTRIAL ENTREPRENEURSHIP

UNIT – I

Principles of management – Meaning and importance, Evaluation of management of thoughts: Function of management : Planning – meaning and importance, steps in process of organizing, types of organization structures, informal organization.

UNIT – II

Directing – communication process, barriers to effect communication mediation- theories of motivation , leadership styles. Controlling control techniques. Personal management : manpower planning, sources of recruitment, relation and training of staff, job evaluation, merit rating, performance appraisal. Administration and system of wage payment, incentive, trade and industrial relations.

UNIT – III

Purchase and store management: Concept of quotation, tenders and comparative statement, inspection and quality control inventory, carrying cost and fixed cost of inventor. BEP analyses, store management, function of store keeper. Methods of inventory LIFO, FIFO. Marketing management: concept of selling, marketing.

UNIT – IV

Export and import management : concept of international trade, duties and antidumping duty cost involved in exporting product, pricing of export product. Govt. assistance- promotion, export houses. Export promotion council and patent right.

UNIT – V

Management laws: concept of contract act, offer, types of contracts, void contract. Concept of guaranty and warranty. Introduction of MRTTP and FERA. Work duty, work management, time and motion duty, chart, flow diagram, sio chart, therbligs. Quality management: TQM, quality management, ISO system.

Books

1. George, Jr. C.S. Management for Business and Industry.
2. Kootz and Donnel, Principles of Management.
3. Shukla, M.C. Business Organization and Management.