S.V.K.P& Dr K.S.RAJU ARTS & SCIENCE COLLEGE (A), PENUGONDA

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B.Sc., MICROBIOLOGY
SYLLABUS
SEMESTER II TO V
2024-2025

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PENUGONDA-534 320, West Godavari District., (A.P.)

II Semester Syllabus
MICROBIOLOGY HONOURS (23MB21 MAJOR/MINOR)
(w.e.f. 2023-24 Admitted Batch)
INTRODUCTION TO MICROBIOLOGY

Hours/Week: 5 **Credits:4**

Unit-1: **History of Microbiology** **No. of Hours: 10**

1. Discovery of Microscope and microbial world by Antonvon Leeuwenhoek; Aseptic techniques with reference to Charak Samhita, Sushruta Samhita and Ignaz Philipp Semmelweis
2. Golden era of Microbiology- Refutation of abiogenesis; Germ theory of Disease; Discovery of vaccination; Discovery of penicillin
3. Major contributions of Scientists: Edward Jenner, Louis Pasteur, Robert Koch, Joseph Lister, Ivanowsky, Martinus Beijerinck and Sergei Winogradsky

Unit-2: Place of Microorganisms in the living world **No. of Hours:10**

1. Haeckel's three Kingdom concept, Whittaker's five kingdom concept, three domain concept of Carl Woese
2. Definition and scope of Microbiology; Applications of Microbiology; Diverse groups of Microorganisms
3. Origin of microbial life on earth- Timeline, Miller's Experiment, endosymbiosis (cyanobacteria), distinguishing features of eukaryotic and prokaryotic cell

Unit-3:Prokaryotic microorganisms and Viruses **No. of Hours:10**

1. General characteristics of Bacteria (Morphology, metabolic diversity and reproduction)
2. General characteristics of Archaea differentiating them from Bacteria
3. General characteristics of viruses (Nature, composition, size, host specificity, diversity in structure)

Unit-4:Eukaryotic microorganisms **No. of Hours:10**

1. Fungi-Habitat,nutrition,vegetativestructureandmodesofreproduction;
2. Algae- Habitat, thallus organization, photosynthetic pigments, storage forms of food, reproduction.
3. Protozoa–Habitat, cell structure, nutrition, locomotion, excretion, reproduction, encystment.

Additional Inputs: Economic importance of Algae and Fungi

Unit - 5: Growing Microbes in Lab: Fivel's **No. of Hours: 05**

1. Inoculation-Aseptic methods of introducing inoculum to growth media; Composition of basic growth media, solid and liquid
2. Incubation and Isolation- Ambient temperature for growth of microorganisms; Concept of Pure culture, mixed culture and contaminated culture
3. Inspection and Identification-Observation of colour, size and shape of colonies; Wet mount and simple staining of bacteria and fungi

Additional Inputs: Method of Gram Staining

S.V.K.P& Dr K.S.RAJU ARTS & SCIENCE COLLEGE (A), PENUGONDA
II Semester Syllabus (w.e.f. 20203-24 Admitted Batch)

23MB21P MICROBIOLOGY

PRACTICAL SYLLABUS

Hours/week-2 **Credits-1**

1. Good Laboratory Practices and Biosafety
2. Compound Light microscope-Parts and its handling
3. Microscopic observation of bacteria, Algae and Fungi and protozoa
4. Observation of electron micrographs of viruses (Lambda, T4, TMV, HIV, SARSCoV-2,Polio)
5. Laboratory equipment -Working principles of Autoclave, Hot air oven, Laminar air flow chamber

References:

1. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (1993). Microbiology. 5th Edition,Tata McGraw Hill Publishing Co., Ltd.,New Delhi.
2. Dube, R.C. and Maheswari, D.K. (2000) General Microbiology. S Chand, New Delhi. Edition), Himalaya Publishing House, Mumbai.
3. Prescott, M.J., Harley, J.P. and Klein, D.A. (2012). Microbiology. 5thEdition,WCB McGraw Hill, NewYork.
4. Reddy, S.M. and Reddy, S.R. (1998). Microbiology Practical Manual, 3 rd Edition, Sri Padmavathi Publications, Hyderabad.
5. Singh,R.P.(2007).General Microbiology. Kalyani Publishers, NewDelhi.
6. Stanier,R.Y.,Adelberg,E.A.andIngram,J.L.(1991).General Microbiology,5thEd.,Prentice Hall of India Pvt. Ltd.,NewDelhi.
7. JayaBabu (2006). Practical Manual on Microbial Metabolisms and General Microbiology. Kalyani Publishers, NewDelhi.
8. Opal Reddy etal., Laboratory Experiments in Microbiology

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II Semester Syllabus
MICROBIOLOGY
(w.e.f. 2023-24 Admitted Batch)
23MB22 BACTERIOLOGY AND VIROLOGY

Hours/Week: 5 **Credits:4**

Unit-1:Bacterial Taxonomy and Ultra structure **No. Of Hours: 9**

1. Introduction to prokaryotic diversity and taxonomy. Types of classification-Numerical and Phylogenetic
2. Introduction to Bergy's manual of Systematic Bacteriology
3. Non-Culturables and Metagenomics
4. Ultrastructure of a BacterialCell- Invariable components-cellwall, Structure and Functions of cell membrane, cytoplasm, nucleoid; Variable components- plasmid, inclusion bodies, flagella (structure and arrangement), pili, capsule, endospore.

Unit-2: Type studies of Bacteria and Archae **No. Of Hours: 9**

1. Salient features of:

a) Photosynthetic bacteria- Purple bacteria, Green bacteria and *Anabaena*
b) Gliding bacteria-Myxobacteria and Cytophaga group
c) Filamentous-Actinomycetes
d) Spore forming bacteria-Bacillus and Clostridia
e) Miscellaneous-Mycoplasma, Rickettsia, Chlamydia

2. Salient features of Fermentative bacteria, Sulphur bacteria, Nitrogen fixing bacteria
3. Salient features of Extremophiles-Methanogens and halobacteria.

Unit-3:General Properties and Classification of Viruses **No. Of Hours: 9**

1. Discovery of viruses, Nature and definition of viruses, general properties
2. Heirarchy of ICTV nomenclature
3. Outline of Baltimore system of classification.
4. Cultivation of Viruses, Virus Purification and Assay.

Unit-4:Replication of Viruses **No. Of Hours: 9**

1.General features of Viral Replication

2.Replication of T4, lambda, TMV ,HIV

3.Replication of Polio, Influenza, AdenoViruses

Unit-5:Pathogenic and other Viruses **No. Of Hours:** 9

1. Defective Viruses- viroids, virusoids, satellite viruses and Prions.
2. Emergence of Viral Pathogens, Introduction to Oncogenic viruses, Concept of Oncogenes and Protooncogenes
3. Role of viruses in Ecosystems; Applications in Biotechnology

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II Semester Syllabus (w.e.f. 20203-24 Admitted Batch)
23MB22P MICROBIOLOGY
PRACTICAL SYLLABUS

Hours/week-2 **Credits-1**

1. Study of bacteria by colony observation and staining-simple, gram
2. Observation of motility and capsule
3. Isolation of bacteria using Winogradsky column and observation
4. Study of viruses (Bacteriophage, TMV and HIV) using micrographs
5. Isolation and enumeration of bacteriophages (PFU) from water/ sewage sample using double agar layer technique.
6. Studying isolation and propagation of animal viruses by chick embryo technique.
7. Study of cytopathic effects of viruses using photographs.
8. Perform locallesion technique for assaying plant viruses.

References:

1. Prescott, M.J.,Harley,J.P.and Klein,D.A. Microbiology. 5th Edition WCB McGraw Hill, New York,(2002).
2. Tortora, G.J., Funke ,B.R. and Case, C.L. Microbiology : An Introduction. Pearson Education, Singapore, (2004).
3. Alcomo,I.E.Fundamentals of Microbiology. VI Edition, Jones and Bartlett Publishers. Sudbury.Massachusetts,(2001).
4. BlackJ.G.Microbiology-Principles and Explorations. JohnWiley&SonsInc. NewYork, (2002).
5. Tom Besty, D.C Jim Koegh. Microbiology Demystified McGRAW-HILL.
6. Christopher Burrell Colin Howard Frederick Murphy. Fenner and White's Medical Virology 5th Edition. Academic Press

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III Semester, Syllabus

EUKARYOTIC MICRO ORGANISMS – 23MB31

(w.e.f. 2023-24 Admitted Batch)

Credits - 3

Unit 1: Fungi — No. of Hours: 9

1. Habitat, distribution, nutritional requirements, fungal cell ultra-structure, fungal wall, Outline classification of Fungi
2. Reproduction in different fungal groups- Phycomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes
3. Heterokaryosi s, heterothallism and parasexual mechanism.
4. Fungal dimorphism (Candida albicans)

Additional inputs- General charecters of Fungi

Unit 2: Importance of Fungi — No. of Hours: 9

1. Role of fungi in biotechnology: food, medicine and pharmaceutical industry (baking, brewing, antibiotics, alcohols, enzymes, organic acids, and pharmaceuticals)
2. Beneficial Role of fungi in Agriculture: Biofertilizers, Myco toxins; Biologicalcontrol (Myco fungicides, Myco herbicides, Myco insecticides).
3. Mushrooms and its cultivation. (White button, Milky and Oyster)
4. Fungi as plant and animal pathogens (Cercospora, Puccinia, Candida, Aspergillus)

Unit 3: Algae — No. of Hours: 9

1. Algae- occurrence, thallus organization, algae cell ultra-structure, pigments, flagella, eyespot food reserves, outline classification
2. Vegetative, asexual and sexual reproduction in Algae
3. Photosynthetic apparatus, and outline of Photosynthesis in Algae
   General charecters of Algae.

Unit 4: Importance and cultivation of Algae — No. of Hours: 9

1. Importance of algae in agriculture, industry, environment and food withexamples.
2. Algal culture techniques- Indoor, Outdoor, Closed, Open, Batch, continuous,Fed batch
3. Culture media and growth parameters for algal cultivation (Spirulina)

Unit 5: Protozoa **No. of Hours: 9**

1. General characteristics with special reference to Amoeba, Paramecium

2. Pathogenic Protozoa- Plasmodium, Leishmania and Giardia

3. Importance of protozoa (in waste management, soil fertility, industry and scientific study)

4. Culturing protozoans from natural sources-Hay water, pond water, Chalkley's solution

5. Haplobiontic (Nemalion), Haplontic (Chlamydomonas), Diplontic (Cladophora), Diplobiontic (Polysiphonia) and Diplohaplontic (Cladophora) life cycles. deleted

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III SEMESTER
EUKARYOTIC MICRO ORGANISMS – 23MB31P
PRACTICAL SYLLABUS **Credits - 1**

1. Preparation of Potato Dextrose Medium.
2. Isolation and identification of pathogenic and non-pathogenic fungi.
3. Study of host-pathogen interaction.
4. Study of the vegetative and reproductive structures of following genera through temporary and permanent slides: Mucor, Saccharomyces, Penicillium, Agaricus and Alternaria
5. Purification and preservation of pure cultures of common algae and fungi.

References

1. Alexopoulus, C.J., Mims,C.W. and Blackwel, M, Introductory Mycology.John Wiley,New York.
2. Mehrotra, R.S. and K.R.Aneja An Introduction to Mycology. New AgeInternational press, New Delhi
3. Webster, J. Introduction to fungi. Cambridge University Press. Cambridge, U.K. (1985).
4. Bessey E.A. Morphology and Taxonomy of fungi. Vikas Publishing House Pvt. Ltd.,New Delhi.
5. Jhon Webster and R W S Weber. Introduction to Fungi. Cambridge University Press 2007.
6. A. V. S. S. .Sambamurty. A Textbook of Algae. I.K. International Publishing House Pvt.Limited, 2010
7. H.D. Kumar and H.N. Singh.A Textbook on Algae (Macmillan internationalcollege edition)

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III SEMESTER

BIOMOLECULES AND ENZYMOLOGY – 23MB32(MAJOR/MINOR)

(w.e.f. 2023-24 Admitted Batch)

Credits -3

UNIT-I: Carbohydrates **No. of hours: 9**

1. General characters and outline classification of Carbohydrates
2. Monosaccharides- Glucose, fructose, ribose; Stereo isomerism of monosaccharides, epimers, mutarotation and anomers of glucose
3. Disaccharides- concept of reducing and non-reducing sugars;Sucrose, Lactose
4. Polysaccharides- Storage -Starch, glycogen, Structural-Cellulose peptidoglycan and chitin
5. Sugar derivatives- glucosamine.

Additional inputs- Properties of Carbohydrates

UNIT-II: Lipids and fatty acids **No. of hours: 9**

1.Definition and classification of lipids. Structure and properties of lipids. Importance of lipids in biological systems.
2. Introduction to fatty acids: definition, structure, and nomenclature. Saturated and unsaturated fatty acids.
3. Triglycerides: structure, function, and metabolism. Phospholipids: structure, function, and role in cell membranes. Steroids: structure, biosynthesis, and physiological roles.Waxes: structure, functions, andapplications.

UNIT-III: Amino acids and Proteins. **No. of hours: 9**

1. Biochemical structure and notation of standard protein amino acids
2. General characteristics of amino acids and proteins.
3. Primary, secondary, tertiary and quaternary structures of Protein
4. Non protein amino acids: Gramicidin, beta-alanine, D-alanine andD- glutamic acid.

UNIT-IV: Nucleic acids and Vitamins **No. of hours: 9**

1. Structure and functions of DNA and RNA.
2. Base composition. A+T and G+C rich genomes. Basic concept of nucleic acids protein interactions.
3. Concept and types of vitamins and their role in metabolism.

Additional inputs- Properties of Nucleic acids.

UNIT-V: Enzymes **No. of hours: 9**

1. Structure of enzyme, Apoenzyme and cofactors, prosthetic group- TPP, coenzyme - NAD, metal cofactors; Definitions of terms – enzyme unit, specific activity and turnover number
2. Classification of enzymes, Mechanism of action of enzymes: active site, transition state complex and activation energy. Lock and key hypothesis, and Induced Fit hypothesis.

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III SEMESTER

BIOMOLECULES AND ENZYMOLOGY- 23MB32P

PRACTICAL SYLLABUS **credits -1**

1. Qualitative tests for sugars
2. Qualitative Analysis of Aminoacids.
3. Colorimetric estimation DNA by diphenylamine method.
4. Colorimetric estimation of proteins by Biuret/Lowry method

III. References:

1. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company Caldwell, D.R. (1995). Microbial Physiologyand Metabolism, W.C. Brown Publications,Iowa, USA.
2. Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). Principles ofBiochemistry, 2 nd Edition, CBS Publishers and Distributors, New Delhi.
3. Sashidhara Rao, B. and Deshpande, V. (2007). ExperimentalBiochemistry: A student Companion. I.K. International Pvt. Ltd.
4. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A shortcourse, 2nd ed., W.H.Freeman
5. Voet,D. and Voet J.G (2004) Biochemistry 3rd edition, John Wileyand Sons
6. White, D. (1995). The Physiology and Biochemistry of Prokaryotes,Oxford University Press, New York.

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III SEMESTER

MICROBIAL AND ANALYTICAL TECHNIQUES – 23MB33

(w.e.f. 2023-24 Admitted Batch)

Credits -3

Unit -1: Microscopy **No. of Hours: 9hrs**

1 Microscopy: Principle, mechanism and applications of Bright fieldmicroscope.
2 Principle, mechanism and applications of electron microscope (SEMand TEM). Micrometry.
3 Staining Techniques – Simple, negative and Differential stainingtechniques (Gram staining, spore staining, Acid fast staining).

Additional inputs- Phase contrast Microscopy.

Unit-2: Sterilization and disinfection techniques **No. of Hours: 9hrs**

1. Sterilization, Disinfection, Antiseptic, Germicide, Sanitizer, Fungicide, Virucide, Bacteriostatic and Bactericidal agent. Physical methods of microbial control: Dry heat- Incineration, Hot air oven; Moist heat- Pressure cooker, autoclave; Filter sterilization- laminar air flow, Membrane filter;Radiation methods – UV rays, Gamma rays.

2. Chemical methods of microbial control: disinfectants, types and mode of action-alcohols, aldehydes, fumigants, phenols, halogens and heavy metals.

Unit -3: Microbiological techniques **No. of Hours:9hrs**

1 Pure culture isolation: Streaking, serial dilution and plating methods, micromanipulator; cultivation.
2 Maintenance and preservation/stocking of pure cultures: sub culturing, overlaying cultures with mineral oils, lyophilization, sand cultures, storage at low temperature, Culture collection centers (MTCC, ATCC, DSMZ);
3 Cultivation of anaerobic bacteria; Accessing Viable non-culturable bacteria (VNBC). Buffers in culture medium. Cultivation of fungi, Actinomycetes, yeasts.

Unit-4: Spectrophotometry & Chromatography **No. of Hours: 9**

1 Spectroscopy – Principles, laws of light absorption, Instrumentation and applications of UV- visible spectrophotometer. Colorimetry and turbidometry.
2 Chromatography: Principles and applications of paper chromatography (Ascending, Descending and 2-D), Thin layer chromatography.
3 Principle and applications of column chromatography (Partition, adsorption, ion exchange, exclusion and affinity chromatography). Column packing and fraction collection.

Additional input- HPLC

Unit - 5: Centrifugation, Electrophoresis & Radio isotopes **No. of Hours: 9**

1 Centrifugation-Principles, types and applications.
2 Electrophoretic technique (agarose and SDS polyacrylamidegel) its Components, working principle and applications
3 Radioisotopes– characters and applications of radioisotopes, principle of autoradiography.

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III SEMESTER

MICROBIAL AND ANALYTICAL TECHNIQUES 23MB32P

PRACTICAL SYLLABUS **credits - 1**

1. Study of bright field, dark field and phase contrast, Electron microscope micrographs to visualize microbial cells.
2. Simple staining & Negative staining.
3. Gram's staining.
4. Sterilization of medium using Autoclave, Sterilization of glassware using Hot AirOven.
5. Isolation of pure cultures of bacteria by streaking method.
6. Isolation of bacteria from natural habitat by spread and pour plate method (usingserial dilution method)
7. Separation of monosaccharides/amino acids by paper/thinlayer chromatography.
8. Demonstration of column packing in gel filtration chromatography.
9. Determination of absorption max for an aromatic amino acid.
10. Separation of bacterial cells (cell pellet) from broth culture by using a laboratory scale centrifuge.
11. Separation of DNA fragments by Agarose gel electrophoresis.

V References:

1. Pelczar M., Chan E.C.S. and Krieg, N.R. Microbiology. Tata Mc Grew Hill Publishing Co. Ltd., New Delhi.
2. Stainier R.V., Ingraham, J.L., Wheelis, M.L. and Painter P.R. The Microbial World. Printice-Hall of India (Pvt.) Ltd., New Delhi
3. Wilson& Walker. Principles and Techniques in Practical B i o c h e m i s t r y . 5th EditionCambridge University Press (2000).
4. Murphy D.B. Fundamental of Light Microscopy & Electron Imaging.1st Edition. Wiley Liss. (2001).
5. K L Ghatak. Techniques and Methods In Biology PHI Publication (2011)
6. Pranav Kumar. Fundamentals and Techniques of Biophysics and Molecular Biology(2016)
7. Aurora Blair. Laboratory Techniques & Experiments in Biology.Intelliz Press
8. D.T Plummer. An Introduction to Practical Biochemistry. McGraw Hill Publication 1987
9. Beckner, W.M., Kleinsmith L.J and Hardin J. The world of cell. IV edition Benjamin /Cummings (2000)

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III SEMESTER

CELL BIOLOGY AND GENETICS – 23MB34

(w.e.f. 2023-24 Admitted Batch)

Credits - 3

Unit 1 **Hours : 09**

1. Cell theory and cell organelles (Mitochondria, Chloroplasts, Lysosomes, Glyoxysomes and Peroxisomes, Golgi apparatus and ER).
2. Cell cycle and its regulation.
3. Cytoskeleton: Structure and organization of actin, myosin and intermediate filaments, microtubules, and their role.

Unit 2 **Hours : 09**

1. Structure and functions Cell membrane, proton pumps associated (Na-K, Cacalmodulin etc. and their distribution), phagocytosis, pinocytosis, exocytosis.
2. Nuclear envelope, structure of nuclear pore complex, nuclear lamina, transport across nuclear membrane, Nucleolus.
3. Elementary knowledge of development and causes of cancer; Oncogenes and suppressor genes,

Unit 3 **Hours : 09**

1. Protein sorting and Transport Intracellular signal transduction pathways (GPCR ,ERK Pathway, mTOR Signaling)
2. Programmed Cell Death; Stem cells.
3. Specialized chromosomes (polytene, lampbrush)

Unit 4 **Hours : 09**

1. Mendalien Genetics , Mono hybrid and Dihybrid cross , Law of dominancesegregation and Independent assortment.
2. Chromosome theory of inheritance, Pedigree analysis, Incomplete dominanceand co-dominance,
3. Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Allele frequencies, Genotypefrequencies.

Unit – 5 **Hours : 09**

1. Linkage and Crossing over, Molecular mechanism of crossing over. Recombinationfrequency as a measure of linkage intensity,
2. Hardy-Weinberg Law, role of natural selection, Genetic drift. Speciation
3. Sex determination – Sex linked inheritance, extra chromosomal Inheritance

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III SEMESTER
CELL BIOLOGY AND GENETICS – 23MB34P

PRACTICAL SYLLABUS **credits - 1**

1. Cell counting and Viability
2. Mitosis from onion root tips
3. Meiosis of onion root tips
4. Study of ultra structure of cell (Plasma membrane, Nucleus, Nuclear Pore Complex,Chloroplast, Mitochondrion, Golgi bodies, Lysosomes, SER and RER)
5. Identification and study of types of cancer, cancer cells by permanent slides/photographs.
6. Study of Linkage, recombination, gene mapping using marker-based data fromDrosophila.
7. Demonstration of DNA fingerprinting.
8. Pedigree chart analysis.

References:

1. A.J.F Griffiths, S. R Wessler, S. B Carroll & J. Doebley, An Introduction to GeneticAnalysis,. 10th Ed., W.H. Freeman & Company (New York) 2010
2. Geoffrey M. Cooper and Robert E. Hausman - The cell a molecular approach.
3. Bruce Alberts , Rebecca Heald, et al. Molecular Biology Of The Cell
4. Arnold Berk (Author), Chris A. Kaiser (Author), Harvey Lodish (Author), Angelika Amon (Author), Molecular Cell Biology.
5. Benjamin Lewin Genes
6. Eldon John Gardner, Michael J. Simmons, D. Peter Snustad Principles of Genetics
7. Karp G, John Wiley Cell Biology
8. Jane B. Reece (Author), Martha R. Taylor (Author), Eric J.Simon (Author),Jean L. Dickey , Campbell Biology: Concepts and Connections
9. Veer Bala Rastogi, Genetics B D Singh, Genetics

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IV SEMESTER
MOLECULAR BIOLOGY AND MICROBIAL GENETICS - 23MB41(MAJOR/MINOR)

Credits - 3

Unit - 1: DNA/RNA as genetic material, Replication of DNA **No. of Hours: 9**

1.1 Experimental evidences that established DNA and RNA as genetic material. Genome organization in prokaryotes and eukaryotes.

1.2 Replication of DNA in prokaryotes.: Bidirectional and unidirectional replication, Semiconservative replication, Proof of Semiconservative replication (Messelson – Stahl Experiment). Mechanism of DNA Replication in Prokaryotes: step by step process, Enzymes and factors involved in replication- Primase, Helicase, Gyrase, DNA polymerases, DNA ligase, SSB proteins.

1.3 Extra chromosomal genetic elements: General characters, types and applicationsof Plasmids and transposons.

Unit - 2: Concept of gene, Transcription **No. of Hours: 9**

2.1 Classical Concept of gene: Muton, Recon and Cistron; One gene-one enzyme and one gene - one polypeptide and One gene – One Product hypotheses.

2.2 Modern concept of gene: Definition of gene; Open reading frame; structural, constitutive and regulatory genes; uninterrupted genes, Split genes- concept of introns and exons.

2,3 Protein synthesis in Prokaryotes: Transcription- Definition, difference from replication, promoter, RNA Polymerase, mechanism of transcription. RNA splicing in eukaryotes;

Unit - 3: Translation and regulation of gene expression **No. of Hours: 9**

Protein synthesis in Prokaryotes

3.1 Genetic code: Salient features, Wobble hypothesis.

3.2 Translation- Charging of tRNA, aminoacyl tRNA synthetases, Mechanisms of initiation, elongation and termination of polypeptides. Inhibitors of protein synthesis.

3.3 Regulation of gene expression in bacteria – lac operon

Additional input- Trp operon

Unit - 4: Mutations and DNA repair **No. of Hours: 9**

4.1 Mutations: Definition and types of Mutations (Spontaneous and induced, Somaticand germline); Physical and chemical mutagens;

4.2 Molecular basis of mutations (base pair changes, frame shifts, deletions, inversions, tandem duplications, insertions); Functional mutants (loss and gain of functionmutants); Uses of mutations.

4.3 Outlines of DNA repair mechanisms: Direct repair, Excision repair, MismatchRepair, Recombination Repair, SOS Repair.

Unit - 5: Genetic recombination in bacteria **No. of Hours: 9**

5.1 Conjugation - discovery, F-factor, F+ & Hfr, mechanism of conjugation, applications of conjugation;

Transformation- Discovery, mechanism of transformation, Competence Factorsaffecting transformation and application of transformation.

Additional input- Transduction.

IV SEMESTER

MOLECULAR BIOLOGY AND MICROBIAL GENETICS -23MB41P

PRACTICAL SYLLABUS **credits -1**

1. Isolation of genomic DNA from E. coli
2. Estimation of DNA using UV spectrophotometer (A260measurement).
3. Problems related to DNA and RNA characteristics, Transcription and Translation.
4. Resolution and visualization of DNA by Agarose Gel Electrophoresis.
5. Problems related to DNA and RNA characteristics, Transcription and Translation.
6. Induction of mutations in bacteria by UV light.
7. Study of different conformations of plasmid DNA through agarose gel electrophoresis.
8. Demonstration of bacterial transformation
9. Instrumentation in molecular biology – Ultra centrifuge, Transilluminator, PCR
10. Study of different types of DNA and RNA using micrographs and model / schematic
11. representations
12. Study of semi-conservative replication of DNA through micrographs / schematic
13. Representations

III. References

Text books:

1. James D. Watson Tania A. Baker, Stephen P. Bell Alexander Gann, Michael Levine, Richard Losick, 2013, Molecular Biology of the Gene, 5th Edition, PearsonEdu Publishers.
2. Roger Y. Stanier, Edward A. Adelberg, John L. Ingraham, 1977, GeneralMicrobiology 5th edition, London Macmillan.
3. David Freifelder1986 Molecular Biology 3rd edition, Jones & Bartlett Publishers
4. T.A. Brown, Gene cloning and DNA analysis- An Introduction, 4thedition
5. Bernard R. Glick and Jack. J. Pasternak, Molecular Biotechnology. 3rd edition
6. David Freifelder.Essentials of molecular biology.Jones and Bartlett Publishers,1998

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IV SEMESTER
MICROBIAL PHYSIOLOGY AND METABOLISM – 23MB42 (MAJOR/MINOR)
(w.e.f. 2023-24 Admitted Batch)

Credits - 3

UNIT I: Microbial Nutrition **No. of hours: 9**

1. Nutritional requirements of Microorganisms
2. Methods of uptake of nutrients by cells- Primary and secondary active transport,concept of uniport, symport and antiport Group translocation; Iron uptake
3. Nutritional groups of microorganisms-based on C, energy and electron. sources
4. Growth media - synthetic, nonsynthetic, selective, enrichment and differentialmedia.

UNIT II: Microbial Growth **No. of hours: 9**

1. Microbial Growth- Definitions of growth, generation time and specific growth rate;different phases of growth in batch cultures;
2. Synchronous, continuous, biphasic growth.
3. Factors influencing microbial growth
4. Methods for measuring microbial growth - Direct microscopy, viable countestimates, turbidometry and biomass.

UNIT IV: Thermodynamics; Breakdown of Carbohydrates **No. of hours: 9**

1. Thermodynamics in biological systems - Concept of free energy, Enthalpy, Standard Free Energy change of reaction, Entropy. First and Second law of Thermodynamics. Open andClosed system.
2. Structure and properties of ATP, Standard Free energy change of hydrolysis of ATP and other high energy compounds. Biological oxidation-reduction reactions. Structure and Function of NAD and FAD.
3. Breakdown of carbohydrates· Glycolytic pathways- EMP, HMP shunt/pentose phosphatepathway and ED; TCA cycle.

Additional inputs: Anapleuritic reactions

UNIT V: Microbial Respiration and Fermentation **No. of hours: 9**

1. Aerobic respiration - ETS and oxidative phosphorylation
2. Anaerobic respiration, chemoautotrophy - oxidation of inorganic compounds - N, S,Fe and H.
3. Fermentative modes in microorganisms with special reference to alcoholic, Lacticacid fermentations

Additional inputs: Chemiosmotic Theory

UNIT V: Bacterial Photosynthesis **No. of hours:9**

1. Photosynthetic pigments, Photosynthetic apparatus in prokaryotes
2. Outline of oxygenic photosynthesis in bacteria
3. Outline of anoxygenic photosynthesis in bacteria

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IV SEMESTER

MICROBIAL PHYSIOLOGY AND METABOLISM – 23MB42P

PRACTICAL SYLLABUS **credits -1**

1. Effect of Temperature on bacterial growth
2. Effect of pH on bacterial growth
3. Colony count in Plates
4. Study and plot the growth curve of E. coli by turbidometric and standard plate countmethods
5. Observation and identification of permanent slides of cyanobacteria

References:

1. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company Caldwell, D.R. (1995). Microbial Physiology and Metabolism, W.C. BrownPublications,Iowa, USA.
2. Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). Principles of Biochemistry, 2nd Edition, CBS Publishers and Distributors, New Delhi.
3. Sashidhara Rao, B. and Deshpande, V. (2007). Experimental Biochemistry: A studentCompanion. I.K. International Pvt. Ltd.
4. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed.,W.H.Freeman
5. Voet,D. and Voet J.G (2004) Biochemistry 3rd edition, John Wiley and Sons
6. White, D. (1995). The Physiology and Biochemistry of Prokaryotes, OxfordUniversity Press, New York.

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IV SEMESTER

r DNA TECHNOLOGY, BIOINFORMATICS AND BIOSTATISTICS – 23MB43

(w.e.f. 2023-24 Admitted Batch)

Credits - 3

UNIT- I: Recombinant DNA Technology **No. of Hours: 9**

1. Basic principles of genetic engineering. Steps in gene cloning.
2. Restriction endonucleases- applications of Type II restriction enzymes in geneticengineering; DNA polymerases and ligases;Use of linkers and adaptors
3. Vectors – Cosmid , Bacteriophages , BAC, YAC
4. Transformation of DNA by Chemical method, Electroporation.

UNIT- II: Applications of r-DNA technology **No. of Hours: 9**

1. Genomic and C-DNA Libraries, RFLP, RAPD,
2. Basics of Polymerase chain Reaction
3. Application of genetic engineering in industry, agriculture and medicine, Hybirdoma Technology.

UNIT- III: Techniques in genetic engineering and IPR **No. of Hours: 9**

1. Blotting Techniques.
2. Labeling of DNA, DNA foot printing.
3. DNA Sequencing-Sanger's method
4. Outlines of Intellectual property Rights (Patents, Trademark, Copyright)

UNIT- IV: Bioinformatics **No. of Hours: 9**

1. Bioinformatic resources : NCBI, EBI, DDBJ, PUBMED, BIOMED.
2. Sequence Databases – GENBANK, BLAST, FASTA, ExPasy, PDB, NDB, UNIPROT –SWISS PROT.
3. Sequence alignment – Sequence homology, pairwise sequence alignment, automated DNA sequencing, ChIP.

UNIT- V: Biostatistics **No. of Hours: 9**

1. Measurement of central tendency : Mean , Median, Mode.
2. Measurement ofdispersion : Range, Mean deviation ,Standard deviation.
3. Use of Biostatistic softwares.
4. Sample and population ; Types of Data , methods of Data presentation.

IV SEMESTER

r DNA TECHNOLOGY, BIOINFORMATICS ANDBIOSTATISTICS – 23MB43P

PRACTICAL SYLLABUS **credits -1**

1. Isolation of plasmid DNA by Agarose gel Electrophoresis.
2. Preparation of Recombinant vector by using T4 DNA Ligase.
3. To Understand the concept of DNA fingerprinting by Random Ampilification ofPolymorphic DNA.
4. Nucleic acid and protein databases.
5. Sequence alignment
6. Sequence homology and Gene annotation.

References

1. Ghosh Z. and Bibekanand M. (2008) Bioinformatics: Principles and Applications.Oxford University Press.
2. Pevsner J. (2009) Bioinformatics and Functional Genomics. II Edition. Wiley- Blackwell. 3.Campbell A. M., Heyer L. J. (2006) Discovering Genomics, Proteomicsand Bioinformatics. II Edition. Benjamin Cummings. Crueger W, Crueger A (1990)
Biotechnology: A text Book of Industrial Microbiology 2nd edition Sinauerassociates,Inc.
3. Demain, A. L and Davies, J. E. (1999). Manual of Industrial Microbiology and Biotechnology, 2nd Edition, ASM Press.
4. Glazer AN and Nikaido H (2007) Microbial Biotechnology, 2nd edition, CambridgeUniversity Press Glick BR, Pasternak JJ, and Patten CL (2010) Molecular Biotechnology 4th edition, ASM Press Gupta PK (2009) Elements of Biotechnology2nd edition, Rastogi Publications
5. Prescott, Harley and Klein's Microbiology by Willey JM, Sherwood LM, WoolvertonCJ (2014), 9th edition, Mc Graw Hill Publishers.
6. Ratledge, C and Kristiansen, B. (2001). Basic Biotechnology, 2nd Edition, CambridgeUniversity Press.
7. Stanbury PF, Whitaker A, Hall SJ (1995) Principles of Fermentation Technology 2ndedition., Elsevier Science

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V Semester Syllabus
MICROBIOLOGY
(w.e.f. 2020-21 Admitted Batch)
20MB5A1 - FOOD AND DIARY MICROBIOLOGY

UNIT – 1 No. of Hours:10
Microbiology of foods: Foods as a substrate for microorganisms, Intrinsic and extrinsic parameters that affect the microbial growth in food. Survival of microbes in foods. natural flora and source of contamination of foods in general. Identification of specific groups – Bacteria, Viruses, Fungi and Protozoa. Food sanitation and control.

UNIT – II No. of Hours:10
Microbial spoilage of food: Spoilage of canned foods, cereals, fruits, vegetables, bread, eggs, meat and fish. Food intoxication -Staphylococcal poisoning, botulism, Food infection – Salmonellosis, Shigellosis, Mycotoxins produced by fungi - Aflatoxins in stored food and grains.

UNIT – III No. of Hours:10
Principles of food preservation -Methods of food preservation- Physical methods-high temperature, canning, freezing, dehydration, and radiation. chemical methods- salt, sugar, organic acids, SO_2, nitrite and nitrates, ethylene oxide, antibiotics and bacteriocins Organic acids, nitrates and cresols. Food processing- Thermal processing, Chemical processing (Sugar, Salt, Smoke, acid and chemicals). Packaging materials

UNIT – IV No. of Hours:10
Fermented Foods: Dairy starter cultures, fermented dairy products: yogurt and cheese (Types and Production), other fermented foods: acidophilus milk, kumiss, kefir, dahi, dosa, sauerkraut, soy sauce and tampeh. Microorganisms as food – single cell protein, yeast, algae and fungal organisms. Mushrooms: Types and cultivation. Probiotics: Health benefits, types of microorganisms used, probiotic foods available in market.

UNIT – V No. of Hours: 10
Dairy Microbiology (Skill-based unit): Physical and chemical properties of milk, Microorganisms in milk, Sources of microbial contamination of milk - milch animal, utensils and equipment, water, milking environment. Methods of preservation of milk and milk products: Pasteurization, sterilization, dehydration, Fermentation in milk: Souring, lactic acid fermentation and proteolysis.

SUGGESTEDREADINGS:

1. Beety C. Hobbs, Food Microbiology, Arnold-Heinemann Publishing Private Limited, New Delhi
2. Hammer B.W and Babal, Dairy Bacteriology, Prentice Hall Incorporated, London.
3. Jay J.M., Modern Food Microbiology, CBS Publishers and Distributors, New York
4. Pelczar M.J., Chan E.C.S and Krieg N.R., Microbiology, McGraw Hill Book Company, New York
5. Salle A.J., Fundamental Principles of Bacteriology, Tata McGraw-Hill Publishing Company Limited, New Delhi.
6. Varnam A.H. and Evans M.G., Foodborne Pathogens, Wolfe Publishing House, London
7. M.P. Dayle et al, 2001, Food Microbiology: Fundamentals & Frontiers, 2nd edition, ASM press.
8. Adams, M.R. and Moss M.O. 1995, Food Microbiology, Royal Society of Chemistry ==Publication, Cambridge.
9. Frazier W.C. and West haff D.C,1988, Food Microbiology, Tata Mc.Graw Hill Publishing Company Limited, New Delhi.
10. Stantury, P.F., Whitekar, A. and Hall, S.J., 1995, Principles of Fermentation Technology.
11. Banwart, GJ, 1989, Basic Food Microbiology, CBS Publishers and Distributors, Delhi
12. Hobbs BC and Roberts.D, 1993, Food Poisoning and Food Hygiene, Edward Arnold (A division at Hodder and Strong ton) London.

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V Semester Syllabus (w.e.f. 2020-21 Admitted Batch)
MICROBIOLOGY

BSc	Semester : V (Skill Enhancement Course-Elective)	Credits:1
20MB5A1P	Food and Diary Microbiology Lab	Hrs/Wk:2

1. Isolation and identification of microbes from infected fruits and vegetables
2. Isolation and identification of microbes from idly batter and pickles
3. Isolation and identification of microbes from home-made and commercial curd
4. Preparation of yogurt
5. Determination of microbiological quality of milk sample by MBRT
6. Estimation of fat content of milk by Gerber's method
7. Estimation of Lactose in milk
8. Estimation of Lactic acid in milk

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V Semester Syllabus
MICROBIOLOGY
(w.e.f. 2020-21 Admitted Batch)
20MB5A2-ENVIROMENTAL and AGRICULTURE MICROBIOLOGY

UNIT – 1 **No. of Hours:10**

Ecology- Basic concepts of Ecology and Environment, Ecosystem – Concept, components, food chains, food webs and trophic levels. Energy transfer efficiencies between trophic levels. Microflora of fresh water and marine habitats. Aero microflora and dispersal of microbes. Host-Microbe interactions: Mutualism, synergism, commensalism, competition, amensalism, parasitism, predation. Microbes and biogeochemical cycles - nitrogen, sulphur, carbon and phosphorus.

UNIT – II **No. of Hours:10**

Outlines of Waste management: Sources and types of solid waste, Methods of solid waste disposal (composting and sanitary landfill). Liquid waste management: Composition and strength of sewage (BOD and COD), Primary, secondary and tertiary sewage treatment. Microorganisms and pollution: methyl mercury, acid rain water, carbon monoxide. Microbial Bioremediation of common pesticides, organic (hydrocarbons, oil spills) and inorganic (metals) matter. Biofouling.

UNIT – III **No. of Hours:10**

Soil Microbiology- Microorganisms, soil structure, soil profile, Physio-chemical conditions, Microbial composition, sampling techniques, Role of Microorganisms in organic matter decomposition (cellulose, Hemicellulose, Lignin's). Rhizosphere and Phyllosphere microflora. Management of soil biota for maintaining soil fertility. Conversion of waste lands into fertile lands. Management of soil nutrients. Microbes in composting.

UNIT – IV **No. of Hours:10**

Microorganisms in Agriculture: Biofertilizers - definition, types (bacterial - Rhizobium, Azotobacter; phosphate solubilizers (PSB) - examples of Bacterial sps., BGA, Azolla; kind of association, mode of application, merits and demerits. Biopesticides - introduction, types (Bacterial - Bacillus thuringiensis, viral - NPV, fungal - Trichoderma), mode of action, factors influencing, genes involved and target pests. Mycorrhiza-Importance of mycorrhizal inoculums, types of mycorrhizae associated plants, Production and field applications of Ectomycorrhizae and VAM.

UNIT – V **No. of Hours: 10**

Contributions of G. Rangaswamy, Beijerinck, Winogradsky and Winogradsky'scoloumn. Study of microbes as plant pathogens: Fungi –Puccinia graminis,Plasmo paraviticola, Cercospora arachidicola Bacteria - Xanthomonas oryzae, Xanthomonas campestris Mycoplasma - sandal spike, grassy shoot Viruses - TMV (Tobacco Mosaic Virus), tomato leaf curl. Advantages, social and environmental aspects of transgenic plants (Bt crops, golden rice).

SUGGESTED READING

1. Atlas RM and Bartha R. (2000). Microbial Ecology: Fundamentals & Applications. 4th edition, Benjamin/Cummings Science Publishing, USA
2. Barton LL & Northup DE (2011). Microbial Ecology. 1st edition, Wiley Blackwell, USA
3. Campbell RE. (1983). Microbial Ecology. Blackwell Scientific Publication, Oxford, England.
4. Coyne MS. (2001). Soil Microbiology: An Exploratory Approach. Delmar Thomson Learning.
5. Lynch JM &Hobbie JE. (1988). Microorganisms in Action: Concepts & Application in Microbial Ecology. Blackwell Scientific Publication, U.K.
6. Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition, Academic Press.
7. Martin A. (1977). An Introduction to Soil Microbiology. 2nd edition. John Wiley & Sons Inc. New York & London.
8. Okafor, N (2011). Environmental Microbiology of Aquatic & Waste systems. 1st edition, Springer, New York.
9. Singh A, Kuhad, RC & Ward OP (2009). Advances in Applied Bioremediation. Volume 17, Springer-Verlag, Berlin Hedeilberg
10. Subba Rao NS. (1999). Soil Microbiology. 4th edition. Oxford & IBH Publishing Co. New Delhi.

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MICROBIOLOGY

BSc	Semester: V (Skill Enhancement Course-Elective)	Credits:1
20MB5A2P	Environmental and Agriculture Microbiology Lab	Hrs/Wk:2

1. Enumeration of bacteria, fungi and actinomycetes from soil
2. Enumeration and identification of rhizosphere micro flora
3. Isolation of rhizobium from root nodules.
4. Isolation of Azotobacter from soil.
5. Observation& description of any three bacterial and fungal plant diseases
6. Analysis of soil - pH, Moisture content and water holding capacity.
7. Study of air flora by Petri plate exposure method.
8. Analysis of potable water by Standard plate count
9. Determination of coliform count in water by MPN (Presumptive, confirmed and completed test).
10. Determination of Biological Oxygen Demand (BOD) of waste water samples.

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V Semester Syllabus
MICROBIOLOGY
(w.e.f. 2020-21 Admitted Batch)
20MB5B1-CLINICAL and DIAGNOSTIC MICROBIOLOGY

UNIT – 1 No. of Hours:10
Diseases- sources and types of diseases. Epidemiology of Infectious diseases, Diseases in population- Epidemic, Pandemic, Endemic diseases, Sporadic, outbreaks, Portals of Entry and Exit, Herd Immunity, Control of Disease transmission. Methods of transmission and role of biological vectors- (1) House fly (2) Mosquitoes (3) sand fly in disease transmission.

UNIT – II No. of Hours:10
Types of Infections –Description of pathogenesis, etiology and laboratory diagnosis of bacteraemia, blood stream infections, Respiratory tract infections (Pneumonia, Flu) Central Nervous System infections (meningitis, encephalitis) Urinary tract infections and Gastrointestinal tract infections (*E. coli and Klebsiella*). Sexually transmitted diseases: *Treponema, Neisseria.*

UNIT – III No. of Hours:10
Identification of organisms - microscopic examination of specimen for Bacterial pathogens – simple, differential staining, Giemsa, Leishman, Wright stains and motility. Biochemical reaction – Sugar fermentation test, antibiotic Susceptibility testing – MIC, Kirby Bauer, dilution methods. Cultural tests- IMVIC tests. Isolation and identification of viruses.

UNIT – IV No. of Hours:10
Clinical lab technology- Methods of collection of urine, blood, sputum, stool etc. The techniques of preservation of samples. Separation of blood plasma and serum. Blood smear preparations, E.S.R, P.C.V, Blood indices - Platelet count: BT, CT. Examination of urine: Sample collection, microscopic examination- crystals, casts, sediments, pregnancy tests. Examination of Stool - Indication, Collection, Microscopic examination and its significance

UNIT – V No. of Hours: 10

Serology – Antigen - antibody reactions – Agglutinations (blood grouping, WIDAL) Hemagglutination, Precipitation (VDRL), Complementation fixation test, Immunodiffusion, Immunoelectrophoretic (rocket, counter current). ELISA, RIA. Quantitative study of Antigen - Antibody precipitin reactions, Western blot analysis for HIV.

SUGGESTEDREADING

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication

2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication

3. Virology, Sawant, K.C., 2005, First edition, Dominant Publishers and distributors, Delhi.

4. Subash O. Panija Textbook of Medical Parasitology, 1996. First edition. All India Publishers and Distributors Regd. 920 Poonamallee High Road, Chennai.

5. Rajesh Karyakarte and Ajith Damle (2005) Medical Parasitology, books and Allied (P)Ltd. Kolkata.

6. Jaya Ram Paniker, Textbook of Medical Parasitology, Published by 'Jaypee Brothers', 4th Edition.

7. Coloratlas, Textbook of Diagnostic Microbiology (5th Edition), edited by Eimer.W. Koneman, published by Lippinett.

8. Mosby, Diagnostic Microbiology by Bailey and Swotts, 10th Edition, published.

9. David Greenwood, Richard C.B.Slack, John.F.Peutherer, Medical Microbiology, 16th Edition.

10. SharmaJ.B., Medical Microbiology – A Clinical perspective, paras publishing.

11. Patrick R.Murray, Ken.S.Rosenthal, George.S.Kobayashi, Michael A. Ptaller, Medical Microbiology, 3rd Edition.

12. Jawetz, Melnick and Adelberg's, Medical Microbiology (2004) 23rd Edition, Mc Graw Hill.

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V Semester Syllabus (w.e.f. 2020-21 Admitted Batch)
MICROBIOLOGY

BSc	Semester: V (Skill Enhancement Course-Elective)	Credits:1
20MB5B1P	Clinical and Diagnostic Microbiology Lab	Hrs/Wk:2

1. Preparation of different media used in diagnostic Microbiology (culture media/observation): Blood Agar, Mannitol salt agar, MacConkey agar,
2. Collection of throat swabs – culturing the specimen. And laboratory examination for *streptococcus pyogenes*
3. Examination of urine for pathogenic microorganisms –collection of urine, microscopic examination of urine, Enterobacteriaceae – *Escherichia coli, Klebsiella pneumonia*
4. Mycology – Direct microscopy – cultures using Sabouraud's Dextrose agar medium, Wet mount preparations using Lactophenol cotton blue/KOH mount
5. Blood grouping and Rh typing
6. Hemoglobin estimation
7. RBC and WBC count
8. Bleeding time and Clotting time,
9. Medical Parasitology – *E. histolytica, G. lamblia, Trypanosomas, Leishmania and Plasmodium* (Permanent Slide Observation)
10. Laboratory diagnosis of common helminthes infections (permanent slide observations of Helminths' Round worm, Hook worm and Pin worm)

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V Semester Syllabus
MICROBIOLOGY
(w.e.f. 2020-21 Admitted Batch)
20MB5B2- MOLECULAR BIOTECHNOLOGY, BIOSTATISTICS AND BIOINFORMATICS

UNIT – 1 No. of Hours:10
r-DNA technology- Introduction, DNA sequencing- Maxam-Gilbert and Di-deoxy methods. Blotting techniques - Southern, Northern and western blotting. DNA finger printing. PCR- principle, types, applications. DNA Microarray technique. Restriction endonucleases and other enzymes involved in rDNA technology. Ligases- DNA ligases, ligation of fragments with cohesive ends & blunt ends; homopolymer tailing.

UNIT – II No. of Hours:10
Cloning strategies- Transformation, microinjection, Ballistic Gun Method, Electroporation, Liposome and Ti- plasmid mediated Gene Transfer. Cloning vectors- Plasmids, Cosmids and bacteriophages, Phagemids, YACs and BACs. Construction of genomic and cDNA libraries. Selection of transformed cells. Screening methods (Genetic marker and blue white screening).

UNIT – III No. of Hours:10
Applications of rDNA technology-In medicine (recombinant insulin), industry (production of amylase) and agriculture (Biopesticides, Biofertilizers). Role of microorganisms in creation of transgenic animals and plants. Genetically engineered microbes for industrial applications- Biogas, Biosensors, Bioplastics, Recombinant vaccines, Golden rice. Introduction to GM crops and challenges-Bt cotton, brinjal, ELSI (Ethical, legal and social issues) of Biotechnological inventions.

UNIT - IV No. of Hours:10
Biostatistics: Measures of Central tendency and distribution – mean, median, mode, range, standard deviation, variance. Basic principles of Probability theory, Bayes theorem, Normal distribution, Statistical inference. Comparison of variance (F-test), t-test for comparison of means, Chi square test. Analysis of variance (ANOVA) One way and two way. Correlation and Linear regression analysis

UNIT – V No. of Hours: 10
Bioinformatics-Introduction to Bioinformatics and internet, Scope of Bioinformatics. Biological databases: NCBI, EMBL. Concept of World Wide Web: HTML, HTPP. Searching sequence databases using BLAST and FASTA. Genomics- Sequencing, Assembly, annotation, comparative genomics. Proteomics- Peptide finger printing. Gene prediction – Statistical based approaches and Similarity based approaches, Molecular phylogenetics.

SUGGESTEDREADINGS:

1. Primrose, Modern Biotechnology, Black well scientific publication Oxford.
2. Old & Primrose, Principles of Gene Manipulation: An introduction to genetic engineering.
3. J.D. Watson et al., Recombinant DNA, Wiley scientific 7. J.M. Walker, Molecular Biology &Biotechnology, Roya society of chemistry.
4. H. Krenzer, Recombinant DNA & Biotechnology. 9. M.Schena, DNA micro arrays.
5. David Freifelder, 2008, Molecular Biology, 2nd Edition, Narosa Publishing House.
6.Daniel, 2006 , Biostatistics, Eighth Edition. John Wisely and sons.
7. Durbin, Eddy, Krogh, Mathison, Biological sequence analysis.
8. T.A. Attwood and D.J. parry – smith, 2001, Introduction of Bioinformatics.
9. David W, 2005, Bio-informatics; sequence and Genome Analysis, 2nd Edition by Mount CBS publishers

S.V.K.P& Dr K.S. RAJU ARTS & SCIENCE COLLEGE (A), PENUGONDA
V Semester Syllabus (w.e.f. 2020-21 Admitted Batch)
MICROBIOLOGY

BSc	Semester: V (Skill Enhancement Course-Elective)	Credits:1
20MB5B2P	Molecular Biotechnology, Biostatistics and Bioinformatics Lab	Hrs/Wk:2

1. Isolation of DNA from E. coli/coconut.

2. Transformation in Bacteria using plasmid.

3. Agarose gel electrophoresis

4. Restriction digestion of DNA and Ligation of DNA molecules

5. Activity of DNase and RNase on DNA and RNA.

6. Isolation of Plasmid DNA.

7. Demonstration of PCR

8. Use of Internet/software for sequence analysis of nucleotides and proteins: Studies of public domain databases for nucleic acid and protein sequences.

9. Genome sequence analysis

10. Problems related to measures of central tendency, dispersion, t-test and chi square test.

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PENUGONDA-534 320, West Godavari District., (A.P.)

V Semester Syllabus
MICROBIOLOGY
(w.e.f. 2020-21 Admitted Batch)
20MB5C1-PHARMACEUTICAL MICROBIOLOGY

UNIT – 1 No. of Hours:10
Microbiological Laboratory and Safe Practices -Quality assurance, quality control definition, history and introduction. Standard Methods involved in assessment of microbial quality control. Laboratory facility design for quality control: Sterilization, disinfection and decontamination. Personnel training: Hygiene and handling techniques. Good Manufacturing practices and good laboratory practices.

UNIT – II No. of Hours:10
Microbial Spoilage - Types of microbial spoilage factors affecting spoilage. Design of specialized media for identification of pathogens- raw material, water, pH. Uses of media. sample preparation from Aqueous, soluble, insoluble, medical and pasteurized materials. Selective and indicator media used in pharmaceutical and food industries. Control of microbial risk in medicines -Sterility tests, Microbial limit tests and endotoxin tests/LAL test.

UNIT – III No. of Hours:10
Techniques for enumeration of microorganisms: Counting methods: pour plate, spread plate, membrane filtration. Most Probable Number (MPN) and MIC. Turbidimetric methods. Staining techniques for identification bacteria and Fungi. Biochemical, molecular and immunological methods. Instruments associated in QC and QA: Principle involved, working conditions, uses and precautions of Laminar Air Flow (LAF), Autoclave, Incubator, pH meter, Colony counter, Hot air oven, Centrifuges and storage devices.

UNIT - IV No. of Hours:10
Introduction- History of drug design, Current approaches and philosophies in drug design, Molecular mechanisms of diseases and drug action with examples. Pharmaceutical products of microbial origin (antibiotics) animal origin (sex hormones), plant origin (Alkaloids & Morphine). Sources of Drugs- Microbial drugs, Plants as a source of drugs, *E. coli* as a source of recombinant therapeutic proteins.

UNIT – V No. of Hours: 10
Expression of recombinant proteins in yeasts, animal cell culture systems. Rational drug design and Combinatorial approaches to drug discovery. Drug development process- Impact of genomics and related technologies upon drug discovery: Gene chips, Proteomics, Structural genomics and Pharmacogenetics. Drug manufacturing process- Guides to good manufacturing practice. Vaccines- Traditional vaccine preparations, Attenuated and inactivated viral and bacterial vaccines, Toxoids. Peptide vaccines.

SUGGESTEDREADINGS:

1.W.B.Hugo& A.D. Russell, Pharmaceutical Microbiology edited, 6thEdition, BlackWell science.
2.Shanson D.C., Microbiology in clinical practice, 2ndedition, London; Wright.
3.T Sammes Ellis Horwood, topics in Antibiotic chemistry VolI to V.
4.Wulf Crueger, Biotechnology – A text book of Industrial Microbiology, 2nd Edition,Panima publishers
5. A.H .Patel,1984, Industrial Microbiology, Macmilan India Limited.
6. Coulson C.J., London; Taylor and Francis, Molecular mechanisms of drug action.
7. Denyes S.P.& Baird R.M. Chichester, Ellis Horwood, Guide to microbiologicalControl in Pharmaceuticals.
8. Murray S.Cooper, Quality control in the Pharmaceutical Industry-Edt., Vol-II,Academic press, NewYork.
9.Sydney H. Willin, Murray M. Tuckerman, William S. Hitchings IV, GoodManufacturing practices of pharmaceuticals, second Edt., Mercel Dekker NC, New york.
10.Rajesh Bhatia, Rattan lalpunjani, Quality assurance in Microbiology, CBSPublisher&Distributors, NewDelhi.

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V Semester Syllabus (w.e.f. 2020-21 Admitted Batch)
MICROBIOLOGY

BSc	Semester: V(Skill Enhancement Course-Elective)	Credits:4
20MB5C1P	Pharmaceutical Microbiology Lab	Hrs/Wk:4

1. Isolation and enumeration of bacteria from spoiled food / pharmaceutical source.
2. Quality Assurance of water by MPN method.
3. Preparation of any two selective and indicator media commonly used Q.A & Q.C
4. Microbial quality of in and around laboratory conditions.
5. Isolation and Identification of fungi by using selective media and staining procedures.
6. Identification of MIC of any one antibiotic (Penicillin/streptomycin) by tube dilution method
7. Antibiotic sensitivity by Well diffusion method-antibacterial and antifungal
8. Isolation of Actinomycetes from soil.
9. Identification of antibacterial activity of actinomycetes
10. Assay of any one antibiotic (Penicillin).

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V Semester Syllabus
MICROBIOLOGY
(w.e.f. 2020-21 Admitted Batch)
20MB5C2-BIOSAFETY AND INTELLECTUAL PROPERTY RIGHTS

UNIT – 1 No. of Hours:10
Biosafety: Introduction; biosafety issues in biotechnology; Biological Safety Cabinets & their types; Primary Containment for Biohazards; Biosafety Levels of Specific Microorganisms. Biosafety Guidelines: Biosafety guidelines and regulations (National and International)

UNIT – II No. of Hours:10
GMOs- Concerns and Challenges; Role of Institutional Biosafety Committees (IBSC), RCGM, GEAC etc. for GMO applications in food and agriculture; Environmental release of GMOs; Risk Analysis; Risk Assessment; Risk management and communication; Overview of International Agreements - Cartagena Protocol. RES guidelines for using radioisotopes in laboratories and precautions.

UNIT – III No. of Hours:10
Introduction to Intellectual Property: Types of IPR, Trade secrets, Trademarks, patents, Copyright & Related Rights, Industrial Design and Rights, Geographical Indications- importance of IPR, Management of IPR, Advantages and Disadvantages. International co-operation of IPRs, legal protection of biotechnological inventions – World Intellectual Property Rights Organization (WIPO).

UNIT - IV No. of Hours:10
Grant of Patent and Patenting Authorities: Types of patents, properties of patents, patentability, patenting life forms and biotechnological inventions. Patent Filing Procedures; Patent licensing and agreement; Patent infringement- meaning, scope, litigation, case studies, Rights and Duties of patent owner.

UNIT – V No. of Hours: 10
Agreements and Treaties: International conventions, GATT, TRIPS Agreements; Role of Madrid Agreement; Hague Agreement; WIPO Treaties; Budapest Treaty on international recognition of the deposit of microorganisms; UPOV & Berne conventions; Paris Convention Treaty (PCT); Indian Patent Act 1970 & recent amendments. Intellectual properties Appellate board (IPAB).

SUGGESTEDREADINGS:

1. Bare Act, 2007.Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., New Delhi.
2. Kankanala C (2007). Genetic Patent Law & Strategy, 1st Edition, Manupatra Information Solution Pvt. Ltd. New Delhi.
3. Mittal, D.P. (1999). Indian Patents Law, Tax mann, Allied Services (p) Ltd.
4. Singh K K (2015). Biotechnology and Intellectual Property Rights: Legal and Social Implications, Springer India.
5. Goel D &Prashar S (2013). IPR, Biosafety and Bioethics. Pearson
6.Sydney H. Willin, Murray M. Tuckerman, William S. Hitchings IV, Good Manufacturing practices for pharmaceuticals, second Edt., Mercel Dekker NC New york
7. Senthil Kumar Sadhasivam and Mohammed Jaabir, M. S. 2008. IPR, Biosafety and biotechnology Management. Jasen Publications, Tiruchirappalli, India.
8. Singh B.D.,1998, Biotechnology, Kalyani publishers, Rajinder Nagar, Ludhiana

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V Semester Syllabus (w.e.f. 2020-21 Admitted Batch)
MICROBIOLOGY

BSc	Semester: V (Skill Enhancement Course-Elective)	Credits:1
20MB5C2P	Biosafety and Intellectual Property Rights Lab	Hrs/Wk:2

1. Study of components and design of a BSL – III laboratory (models)
2. Filing applications for approval from bio safety committee (models)
3. Study of bio safety measures in pharmaceutical industry.
4. Study on QA & QC parameters followed in R&D laboratory.
5. Filing primary applications for patents
6. Study of steps of patenting process
7. A case study of patents application-Gene technology/ processes
8. A case study of Patent disputes-AMUL/kwality
9. A case study on patents of biotechnological inventions
10. A case study of copy rights-Delhi university case