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Shiksha Mandal's

Bajaj College of Science, (Autonomous) Wardha

M.Sc. II Syllabus

Microbiology

2024-2025

(As Per New Education Policy)

SEMESTER-III

DICIPLINE SPECIFIC COURSE (DSC) – 9

Molecular Biology and Genetics (MBG)
PMB631T

Course outcomes:

After successfully completing this course, students will be able to:

- Understand the process of Replication and Recombination
- Understand the concept of gene expression by transcription and translation process AND operon systems in bacteria
- Understand in detail about various types of DNA repair mechanisms in eukaryotes and prokaryotes.
- Learn about gene mapping by using conjugation, transduction and transformation.

UNIT-I: - Replication Repair and Recombination

Replication:-Initiation-Priming in *E.Coli* and Eukaryotes.
Elongation:-Holoenzyme and processivity of replication.
Termination:-In prokaryotes and eukaryotes.
DNA Repair:-Direct reversal of DNA damage, Base excision repair by nucleotide excision.
Homologous recombination:-Rec BCD; gene conversion. Holiday model, recombinase mechanism.

UNIT-II: - Gene Expression

Transcription:-Comparative study of prokaryotic and eukaryotic transcription process, Class I, II, III promoters, Enhancers and silencers, General and specific transcription factors.
Post transcriptional events:-mRNA, rRNA and tRNA processing through splicing mechanism, trans splicing, RNA editing, post transcriptional control of gene expression, gene silencing RNA interference, Catalytic RNA and antisense RNA **(detail definition and functions).**
Gene inhibition expression advanced techniques: Knockout, Knockdown, Introduction to CRISPER genome editing
Translation:-Initiation, elongation and termination mechanism. Post translational modifications.

UNIT-III: - Gene Regulation Expression

Lac, Arabino and trp.operons.
Chromatin remodeling and mRNA and protein degradation control.

UNIT-IV:- Genetics of Bacteria and Bacteriophages

Gene mapping in bacteria by conjugation, transformation and transduction.
Mapping bacteriophage gene by recombination analysis, deletion mapping and complementation.
Transposons: Bacterial, P elements and retroposons. Molecular markers as advanced technique: Mapping by using molecular markers, Restriction fragment length polymorphism (RFLP), Random amplified polymorphic DNA (RAPD), molecular docking.

SEMESTER - III

DICIPLINE SPECIFIC COURSE (DSC) – 10

Recombinant DNA technology and Nano Biotechnology (RDTN)
PMB632T

Course outcomes:

After successfully completing this course, students will be able to:

- Understand the important aspects of rDNA technology like cloning, gene sequencing, and other molecular tools.
- Learn the important molecular techniques like polymerase chain reaction.
- Understand important things about nanobiotechnology and its applications.
- Students will also learn about tissue culture and stem cell technology.

UNIT-I: - Molecular Cloning Methods.

DNA cloning, restriction enzymes, cloning vectors, genomic library, c DNA library and chromosome libraries. Screening and identification of genes, Expression vectors, heterologous probes, oligonucleotide probes, microarrays.

PCR: Steps, advantages, limitations, application, Real time (RT)-PCR, Next generation sequencing.

UNIT-II: - Other molecular tools for studying genes

Restriction mapping: DNA sequencing dideoxy and pyrosequencing, DNA fingerprinting.
S1 Mapping, primer expressions, Dnase footprinting, DMS footprinting. Nuclear run-on transcription, reporter gene transcription.

UNIT-III: - Tissue Culture and stem cell technology

Tissue culture: Tissue culture media and supplements, serum-free media, cell lines and cryopreservation of cells. Primary culture, subculture, suspension culture techniques, transformation and immortalization. Quantitation and characterization of cells.

Stem cell technology-embryonal stem cell and multipotent stem cells, present perspective.
Gene therapy, Types of stem cells.

UNIT-IV:- RDT Products and Nanobiotechnology

Tissue plasminogen activator [TPA]. Tissue growth actor B.
Dnase; PDGF. GEMS/GMO.

Transgenic plants and plant products, Comparative account, Concept of nano biotechnology and its application. DNA and mRNA vaccine as r-DNA technology products.

Types on nanomaterials & biological nanoparticles.

Paper –XI
DICIPLINE SPECIFIC COURSE (DSC) – 11

Drugs and Disease Management (DDM)
PMB633T

Course outcomes:
After successfully completing this course, students will be able to:

- Learn the concept of prodrug & drug latentiation.
- Learn about the mechanism of action of different Anti infective agents like Iodophores (providone-Iodine),Benzylkonium chloride, genital violet,
- Understand the mechanism of action of different antifungal agents, antitubercular, antiprotozoal, antimalarial & antihistaminic agents

UNIT-I: -
Drug latentiation and Prodrug: History, carrier-linked prodrugs, bioprecursorsprodrugs, carboxylic acids and alcohols, amines, carboxyl compounds.
Drug-microbe: Host relationship, mechanism of drug action and drug resistance including MDR.

UNIT-II:- Antimicrobial agents (chemistry & mode of action)
Antiinfective agents: Iodophores (providone-Iodine), Benzylkonium chloride, genital violet, mercury compounds.
Antifungal agents: Clotrimazole, Ketoconazole, Tolnaftate, Amphotericin B, Nystatin, Griscofulvin.
Antitubercular agents: Isoniazid, Ethambutol, rifamycin , cycloserine.

UNIT-III: - Antiparasitic agents (chemistry & mode of action)
Antiprotozoal agent: Metranidazole, 8-hydroxyquinoline
Antimalarials: Quininesulphate, Chloroquine, Primaquine phosphate, Pyrimethamine.

UNIT-IV:- Anti-inflammatory agents (chemistry & mode of action)
Histamines and Antihistaminic agents: Cimetidine, Ramitidine, Omeprazole.
Analgesic agents: Morphine and their derivatives
anti-inflammatory analgesics- Phenylbutazone and oxyphenbutazone,
Prostaglandins.

SEMESTER - III

DICIPLINE SPECIFIC ELECTIVE (DSE) – 3

Microbial Diversity, Evolution and Ecology (MDEE)-I
PMB635T

Course outcomes:

After successfully completing this course, students will be able to:

- Understand the evolutionary processes and theories based on evolution.
- Learn the important molecular techniques for determining the evolutionary relationships viz: 16S rRNA sequencing.
- Lean in detail about diversity of microorganisms.

UNIT-I: - Microbial Evolution and Systematic

Evolution of Earth and early life forms.

Primitive life forms:-RNA world, molecular coding, energy and carbon metabolism, origin of Eukaryotes, endosymbiosis.

Methods for determining evolutionary relationships:-Evolutionary chronometers, Ribosomal RNA sequencing, signature sequences, phyllogenetic probes, microbial community analysis.

Derivation of Microbial Phyllogeny:- characteristics of domain of life, classical taxonomy, chemotaxonomy, bacterial speciation.

UNIT-II: -Microbial Diversity: Archaea

General Metabolism and Autotrophy in archea

Phylum Euryarchaeota:-Halophilicarchaea, methanogens, thermoplasma.

Phylum Crenarchaeota:-Energy metabolism, Thermoproteales, sulfolobales, desulfolobales.

PhyllumNanoarchaeota:-Nanoarchaeum.

Heat stable biomolecules and extremophiles, Evolutionary significance of hyperthermophiles.

UNIT-III :-Microbial Diversity: Bacteria

Phylum Proteobacteria:-Free living N2 fixing bacteria, purple phototrophic bacteria, nitrifying bacteria, sulphur and iron oxidizing bacteria, sulphate and sulphur reducing bacteria.

Phylum prochlorophytes and cyanobacteria,

Phylum:Planctomyces,

Phylum;Verrucomicrobia.

UNIT-IV:- Microbial Diversity.

Phylum: Cytophaga

Phylum: Green Sulfur Bacteria.

Phylum: Deinococci.

Phylum: Green non –sulfur bacteria.

Phylum: Branching Hyperthermophiles, Thermotoga and Aquifex.

Phylum: Nitrospira and Deferribacter.

SEMESTER-III

DICIPLINE SPECIFIC ELECTIVE (DSE) – 3

Bioinformatics (BIF)-I
PMB635T

Course outcomes:
After successfully completing this course, students will be able to:

- Understand the basic concepts of computer organization, Internet, Browser, Homepage.
- Understand the concept of phylogenetics.
- Learn about genomics and gene recognition.

UNIT-I: -
Basic Concept of Computer Organization, Internet, File Transfer Protocol, Browser, Home Page, Hyper text transfer protocol, Uniform Resource Locator, Hyperlink and Web Applications.

UNIT-II: -
Database types, levels of omics, genome projects.
C-value paradox, reassociationkinetics.
Data researches and pairwise alignments:-
Dot Plots, Simple alignments, Dynamic programming global and local alignments BLAST,FASTA,Scoringmatrices,and alignment scores. Multiple sequence alignments.Pattern of substitution within genes, substitution number estimations, molecular clocks.

UNIT-III: - Phyllogenetics
Phyllogenetic trees,Pair wise alignment, distance matrix method, maximum likelihood approach,multiple sequence analysis,
Parsimony,Inferred ancestral sequence, consensus tress,comparison of phyllogenetic methods.

UNIT-IV:- Genomics and Gene recognition
Prokaryotes genomes, prokaryotic gene structure GC content prokaryotic gene density, eukaryotic genomes, eukaryotic gene structure, ORF,GC content expression, Tranposition, Repetetive elements, gene density.

DICIPLINE SPECIFIC ELECTIVE (DSE) – 12

PRACTICAL-V
LABORATORY EXERCISE 5
PMB634P

Course outcomes:

After successfully completing this course, students will be able to:

- Learn how to isolate genomic and plasmid DNA.
- Understand DNA amplification & restriction digestion, DNA ligation etc.
- Learn about bacterial transformation and cloning

1) Isolation of genomic DNA of bacteria.
2) Isolation of plasmid DNA.
3) Amplification of DNA by PCR.
4) Restriction digestion and RFLP
5) Demonstration of ligation.
6) Demonstration of cloning
7) Demonstration of bacterial transformation.
8) Demonstration of UV induced mutagenesis in *E.coli*.

RESEARCH PROJECT
RP

PMB638P

Course outcomes:

After completion of project work students will able to:

- Learn how to do literature survey and to plan
- Understand how to locate a problem
- Perform research work on various topics that will impart deeper knowledge of facts & methods in Microbiology / life science.
- Capable of contributing to research and development work.
- Plan and use adequate methods to conduct qualified tasks in given frameworks
- Present and discuss the conclusions as well as the knowledge and arguments that form the basis for these findings.
- Evaluate their work.

List of recommended books

- The Biochemistry of copperBy:JackPeisach,PhillipAisen.
- Biochemistry:- By Rex Montgomery.
- Lehninger Principles of BiochemistryBy:-David L. Nelson and Cox
- Metabolic Pathways By:-David M.Greenberg.
- Harper's BiochemistryBy:RobertK.Myrray.
- Enzymes: By Trevor Palmer.
- Enzyme structure and mechanism By:AlanFersht.
- Methods in Enzymology By: S.Berger,A.Kimmel.
- Fundamentals of Enzymology By;N.Price,L.stevens.
- Immobilization of Enzymes and cells By:Gordon Bickerstaff.
- Industrial MicrobiologyBy:A.H.Patel
- Industrial MicrobiologyBy:L.E.Casida.
- Food Microbiology.By:WilliamC.Frazier,DennisC.Westhaff.
- Prescott and Dunns Industrial microbiology.By;Gerald Reed.
- Basic Food Microbiology.By:Georgej.banwart.
- Medical Microbiology.By:G.F.Brooks,J.S.Butel,S.A.morse.
- Text book of Microbiology.By:Ananthanarayan and Panikar.
- Medical Microbiology.By:B.S.Nagoba and A.Pichare.
- Clinical Microbiology and Infection control.By;Elaine Larson.
- Bacterial Pathogenesis;Molecular and cellular mechanism.By;CamilaLocht and Michel Simonet.
- Medical Microbiology.By:David Greenwood.
- Medical Microbiology.By:J.P.Dugaid.
- Small Dnatumorviruses.By:Kevin Gaston.
- Viruses and Interferon;currentresearch.By:KarenMossam
- Lentiviruses and Macrophages:Molecular and Cellular intereactions.By:MoiraDesporf.
- The Biology of Animal viruses.By;C.A.mims.
- Animal virology.By:DavidBaltimore,A.Huang,c.fox
- Oncogenic viruses and host cell genes.By:E.Kurstak,KarlMaramorosch.
- Bacterial and Bacteriophage Genetics.By:EdwardA.Birge.
- Molecular Genetics of Bacteria.By:J.W.Dale.
- Molecular Biology of the gene.By:J.D.Watson,N.h.Hoppkins,J.W.Roberts,J.A.Steitz&A.M.Weiner.
- Microbial Genetics.By:Maloy{T.A}.Jones and Bartlett publications.
- Mobile DNA.By;NancyCraig,MartinGelletallan,lambowitz.
- Methods of General and Molecular biotechnology.By:Philip Gerhardt ASM publication.
- Recombinant DNA.By;Watson J.D. Essentials of Molecular Biology.By:Malcimski.
- Molecular genetics of Bacteria.By:Larry,Synder and Wendy Champness.
- Molecular biology.By;F.Weaver.WCB/MCGraw Hill.
- Molecular Biology of Gene.Watson et al,Benjamin-cumminas,USA.
- Molecular Biotechnology.Glick-1994.

- Genetic EngineeringBy:SandyaMitra.
- Environmental MicrobiologyBy:RalphMitchell,John Wiley and Sops.Inc.
- Environmental BiotechnologyBy:C.F.Froster and D.A.JohnWase,ElisHorwood.
- Biocatalysis and Biodegradation: Microbial Transformation of organic compounds. 31 y:Lawrencep.Wacekett.
- A manual of environment Microbiology.By:ChristonJ.hurst,ASM publication.
- Biodegradation and bioremediation Academic pressBY:San Diego.
- Biotechnology in the sustainable environment,Plenumpress,NY
- Basic principles of Geomicrobiology. By:A.D.Agate.
- Environmental MicrobiologyBy:R.M.Maier,I.C.Papper and C>P>Gerba.
- Methods in Microbiology:Lynch and Hobbie.
- Experimental Microbial Ecology.By:Arosison Academic Press.
- Advances in Applied microbiology.By:D.Pearlman academic press.
- Microbiology of Extreme environments,edited by Clive Edward,Open University press,Milton Keynes.
- Principles of Biochemistry.By:DonaldJ.voet,JudithG.Voet,CharlotteW.Pratt.
- Brock Biology of Microorganisms.By:John M. Martinko.
- Introduction to Genetic analysis.By;Griffiths,Wessler.lewontin,Gelbart,Suzuki,Miller.
- Biophysical Chemistry VOL:I,II,III;
- The conformation of biological macromolecules. By;Cantor and Schimmel. Hans-Peter schmauder,Michaelschweizer,LilianM.Schweizer.
- Ecology,Theories and applications.By:PeterStiling.
- Environmental Science working with the Earth.By:Miller.
- Genetics A Molecular Approach.By:PeterJ.Russell.
- Culture of Animal Cells; a manual of basic technique.By:R.IANFreshney.
- Molecular Biology.RobertF.Weaver.
- Microbial Biotechnology,Principles and Applications.Lee Yuan Kun.
- Microbial Biotechnology,Fundamentals of Applied Microbiology. By:AlexanderN.Glazer.HiroshiNikaido.
- Process Biotechnology Fundamentals.By:S N Mukhopadhay.
- Textbook of Organic Medicinal and Pharmaceutical Chemistry.By:JaimeN.Delgado William A.Remers.
- KubyImmunologyBy:Kindt,Goldsey,Osborne.
- ImmunologyBy:Roitt,Brostoff,male.
- ImmunologyBy:DavidMale,Jonathanbrostoff,DAVID B ROTH,IvanRoitt.
- The elements of ImmunologyBy:FahimHalim Khan.
- ImmunologyBy:RichardA.Goldsby,Thomas J Kindt,Barbaraa.Osborne,Janiskuby.
- Fundamental immunologyWilliamE.Paul.
- Biophysical ChemistryBy:UpadhayaUpadhyayaNath.
- Biostatistics and Microbiology: A Survival manual Daryl S.Paulson Springer

- CSIR-NET LIFE SCIENCES Sure success Series: B.L.Chaudhary,KailashChaudhary, ArunChaudhary: New Age International Publishers
- Food processing Handbook:Edited by James G.Brenon(Wiley-VCH)
- Advances in Microbial physiology: Robert K.Poole
- Pharmaceutical Microbiology : Reddy A.Venkateswara
- Fundamental Agricultural Microbiology: K.R.Aneja
- Water & waste water technology (3rd edition): Mark J hammer &Hommer, Jr prentice hall at indiapvtltd.Newdelhi.
- Organic Chemistry of Drug Design and Drug Action" by Silverman
- A Textbook of Drug Design and Development" by PovlKrogsgaard-Larsen and Tommy Liljefors
- New Drug Development: Design, Methodology, and Analysis" by J Rick Turner
- Molecular Mechanisms Of Drug Action: Christopher J. Coulson, CRC Press.

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M.Sc. II Syllabus

Microbiology

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SEMESTER-IV
DICIPLINE SPECIFIC COURSE (DSC) – 13

Virology (VIR)
PMB641T

Course outcomes:
After successfully completing this course, students will be able to:

- Learn discovery, Origin and evolution of viruses.
- Learn Morphology, structure and chemical composition of viruses.
- Understand life cycle of different bacteriophage like ΦX174, T4, lambda, M13 etc.
- Learn about life cycle, pathogenesis and laboratory diagnosis of plants and animal viruses.

UNIT-I: -History, Classification and composition of viruses
Brief outline on discovery of viruses (Origin and evolution), Terminology, Differentiation with other groups of microorganisms.
Nomenclature and classification of viruses (Regenmortelet.al.2005, 8thReportof ICTV). Genetic classification
Morphology and structure of viruses (size and shape/symmetry).
Chemical composition of viruses (viral capsid, spikes, envelopes and types of viral nucleic acids). Assay of Viruses. Concept of Viriods

UNIT-II: -Bacterial viruses
Bacteriophages-Structural organization; life cycle (Extracellular phase; attachment, penetration of Nucleic acid, transcription, translation, replication, maturation and release of phage particles) of ΦX174, T4, lambda, $M_{13}$and MU Phages. Bacteriophage typing, One step growth curve.

UNIT-III: -Animal and Plant viruses
Lifecycle, pathogenesis and laboratory diagnosis of following viruses.
Animal Viruses: -
RNA viruses: Rhabdovirus, HIV, Coronaviridae (SARS, MERS, Corona)
DNA viruses: Pox, Herpes, Adeno and Hepatitis viruses.
Oncogenic viruses: Papovaviruses, EBvirus, HTLV viruses.
Plant virus: TMV, Cauliflower mosaic virus, potato virus.

UNIT-IV: -General methods of Diagnosis and antiviral drugs
General, Serological and Molecular methods of diagnosis: - Haemadsorption inhibition; haemagglutination; Haemagglutination inhibition (HAI)
Antiviral agents: Types of IFN, induction and Molecular basis of antiviral effect of interferon Structure and Mechanism of action of: Amantadine, Rimantidine,Vidarabine, Acyclovir, Ganciclovir, Ribavirin, Foscarnet, Stavudine, Lamivudine.
NNRTIS (non-nucleoside RT inhibitors)-Nevirapine; Delavirdine and Efavirenz.
Protease inhibitors-Saquinavir, Indinavir and Ritonavir.

SEMESTER-IV
DICIPLINE SPECIFIC COURSE (DSC) –14

Microbial Fermentation Technology (MFT)
PMB642T

Course outcomes:
After successfully completing this course, students will be able to:

- Learn in detail about bioreactors & its types & different types of fermentation.
- Understand in detail about fermentation kinetics, downstream processes, types of processing units and systems, storage and packaging methods.
- Understand methods for production of valuable products viz: Biofuels, antibiotics, organic acids, and also food and healthcare products.

UNIT-I: -General Principles of Fermentation
Bioreactors: Bioreactor types, immobilized bioreactors, types of fermentation.
Fermentation kinetics and Monods Model: -Growth kinetics and Monod's Model, Substrate accelerated death, specific growth rate, stringent response, Ntr and Pho system, growth limiting substrate, maintenance energy, growth yield and product formation.
Process optimization: factors of optimization, Packet Burman design, One factor at a time design, rheology of fermentation fluid, oxygenation, and oxygen transfer kinetics. chemostat, turbidostat.

UNIT-II: -Downstream Processing and scaleup.
Downstream processes: types of processing units and systems, Storage and packaging methods.
Scale up; scale down, criteria involved in scale up. Productivity, power requirements Basic control theory.

UNIT-III: -Industrial Fermentation Products
Biofuels: -Ethanol production from cellulosic substrates, Hydrogen, Methane
Antibiotics: -β-lactum antibiotics (Synthetic penicillin), Streptomycin, Cephalosporin.
Biopreservative: Lactobacillus sakei. Biopolymers: -Xanthan, Polyhydroxy alkanotes.
Thermostable enzymes: -Proteases. Biosurfectants: a comparative account.

UNIT-IV: -Food and Health care products
SCP- various types and processes. Carotenoides
Amino acids: -Lysine,Glutamic acid.
Vitamins: -riboflavin, Vit.B12. Fatty acids (Palmetate, oleate)

SEMESTER-IV

DICIPLINE SPECIFIC COURSE (DSC) –15

Vaccines and Delivery system (VD)

PMB643T

Course outcomes:

After successfully completing this course, students will be able to:

- Understand the important aspects of vaccines & about active and passive prophylactic measures.
- Learn the contents and immunization schedule of important vaccines like BCG, Hepatitis vaccine, Influenza vaccine, Polio vaccine, DPT, MMR etc.
- Learn about the advanced vaccines & vaccines delivery system.

UNIT-I: -Vaccines

Definition and discovery of vaccines, Active and passive prophylactive measures.

General account on: -

Exaltation & attenuation, Subunit vaccines, DNA vaccines, Vaccines additives and adjuvants

UNIT-II: -

Conventional vaccines

Contents and immunization schedule
BCG
Hepatitis vaccine
Influenza vaccine
Polio vaccine (Inactivated, live attenuated)
DPT
MMR

UNIT-III: -

Advanced vaccines

Vaccines in development.
Malaria vaccines
Epstain Barr virus vaccines
Cytomegalo virus vaccines
HIV vaccines, Herpes simplex viral vaccines

UNIT-IV: -Designing & delivery system.

Drug designing
Non-automated in vitro drug susceptibility testing.
Rapid tests for susceptibility testing, and antibiotic assay in body fluid
Drugs &vaccines delivery system.

SEMESTER-IV
DICIPLINE SPECIFIC ELECTIVE (DSE) – 4

Microbial Diversity, Ecology and Evolution (MDEE) II
PMB645T

Course outcomes:
After successfully completing this course, students will be able to:

- Understand in detailabout concepts of Microbial Ecosystems, Population, communities, homeostasis, Diversity indices, dominance indices, information statistics indices, Shannon index, Brillouin Index, Learn about genetic structure of population & Hardy-Weinberg Law
- Learn about different microbial interactions like Competition, coexistence, syntrophy, commensalism, Mutualism, predation, parasitism, antagonism.
- Understand the concept of sustainable development.

UNIT-I: - Microbial Ecosystems
Population, guilds, communities, homeostasis, Environment and microenvironment.
Biofilms. Terrestrial environment, deep surface microbiology. Fresh water environment, lake and river microbiology. Marine Microbiology and Hydrothermal vents.

UNIT-II: -Diversity, stability and succession
Diversity indices, dominance indices, information statistics indices, Shannon index, Brillouin Index, Rank abundance diagrams, community similarity analysis, Jaccard Coefficient, Sorensen coefficient, cluster analysis. Community stability, stability hypothesis, Intermediate-disturbance hypothesis.
Meaning of succession: Tolerance and inhibition patterns of succession, theories of succession.

UNIT-III: -Ecology and Genetics
Genetic structure of population: -Genotype frequency, allele frequencies.
Hardy-Weinberg Law: -Assumptions, predictions, derivation, extension and natural selection. Measuring genetic variation at protein level, measuring genetic variation at DNA level.
Factors effecting gene frequencies: -Mutation, Random genetic drift, migration, Hardy-Weinberg natural selection, Assortative mating, Inbreeding.

UNIT-IV: -Interactions and Ecosystem Management
Microbial Interactions: Competition and coexistence, Gause hypothesis, syntrophy, commensalism and Mutualism, predation, parasitism, and antagonism, Interaction with plants and animals.
Concept of sustainable development: microbial technology and sustainable development. Management and improvement of waste land/barren land. Oil spills, damage and management petroleum and oil shore management.

SEMESTER-IV
DICIPLINE SPECIFIC ELECTIVE (DSE) – 4

Bioinformatics (BIF)-II
PMB645T

Course outcomes:

After successfully completing this course, students will be able to:

- Learn the important aspects Data Mining, data mining problems,cluster analysis, data mining techniques and tools, data mining methods.
- Learn the structure of proteins, protein motifs and folding, protein folding modeling, protein structure prediction**.**
- Understand the structure of RNA, types of RNA, RNA structure prediction**.**

UNIT-I: -
Data Mining-Definition, data mining problems, cluster analysis, data mining techniques and tools, data mining methods.

UNIT-II: -
Structure of proteins-primary, secondary, tertiary, quaternary. Protein motifs and folding, protein folding modeling, protein structure prediction**.**

UNIT-III: -
Structure of RNA, secondary structure of RNA, types of RNA, RNA structure prediction- free energy minimization

UNIT-IV:-
Computer aided drug designing, in silico inhibitors designing, empirical methods of ligand screening, prediction techniques,
post translational modification predicti

SEMESTER-IV

PRACTICAL-VI

DICIPLINE SPECIFIC ELECTIVE (DSE) – 4

PMB644P

Course outcomes:

After successfully completing this course, students will be able to:

- Learn how to isolate viruses from water sources.
- Learn how to carry out microbiological examinations of food samples.
- Understand the production of penicillin in the lab and its estimation.
- Understand Determination of microbial reaction kinetics in a fed batch system.
- Learn about how to immobilize Enzymes.

1) Isolation of viruses from water sources.
2) Microbiological examination of foods.
3) Production of penicillin in lab and its estimation.
4) Determination of microbial reaction kinetics for an inhibitory substrate in a fed batch system.
5) Determination of the parameters of oxygen transfer.
6) Immobilization of cells/Enzymes.
7) Establishment of sterilization cycle
8) Calculation of oxygen transfer kinetics

SEMESTER-IV

RESEARCH PROJECT
RP

PMP648P

Course outcomes:

After completion of project work students will able to:

- Learn how to do literature survey and to plan
- Understand how to locate a problem
- Perform research work on various topics that will impart deeper knowledge of facts & methods in Microbiology / life science.
- Capable of contributing to research and development work.
- Plan and use adequate methods to conduct qualified tasks in given frameworks
- Present and discuss the conclusions as well as the knowledge and arguments that form the basis for these findings.
- Evaluate their work.

List of recommended books

- The Biochemistry of copperBy:JackPeisach,PhillipAisen.
- Biochemistry:- By Rex Montgomery.
- Lehninger Principles of BiochemistryBy:-David L. Nelson and Cox
- Metabolic Pathways By:-David M.Greenberg.
- Harper's BiochemistryBy:RobertK.Myrray.
- Enzymes: By Trevor Palmer.
- Enzyme structure and mechanism By:AlanFersht.
- Methods in Enzymology By: S.Berger,A.Kimmel.
- Fundamentals of Enzymology By;N.Price,L.stevens.
- Immobilization of Enzymes and cells By:Gordon Bickerstaff.
- Industrial MicrobiologyBy:A.H.Patel
- Industrial MicrobiologyBy:L.E.Casida.
- Food Microbiology.By:WilliamC.Frazier,DennisC.Westhaff.
- Prescott and Dunns Industrial microbiology.By;Gerald Reed.
- Basic Food Microbiology.By:Georgej.banwart.
- Medical Microbiology.By:G.F.Brooks,J.S.Butel,S.A.morse.
- Text book of Microbiology.By:Ananthanarayan and Panikar.
- Medical Microbiology.By:B.S.Nagoba and A.Pichare.
- Clinical Microbiology and Infection control.By;Elaine Larson.
- Bacterial Pathogenesis;Molecular and cellular mechanism.By;CamilaLocht and Michel Simonet.
- Medical Microbiology.By:David Greenwood.
- Medical Microbiology.By:J.P.Dugaid.
- Small Dnatumorviruses.By:Kevin Gaston.
- Viruses and Interferon;currentresearch.By:KarenMossam
- Lentiviruses and Macrophages:Molecular and Cellular intereactions.By:MoiraDesporf.
- The Biology of Animal viruses.By;C.A.mims.
- Animal virology.By:DavidBaltimore,A.Huang,c.fox
- Oncogenic viruses and host cell genes.By:E.Kurstak,KarlMaramorosch.
- Bacterial and Bacteriophage Genetics.By:EdwardA.Birge.
- Molecular Genetics of Bacteria.By:J.W.Dale.
- Molecular Biology of the gene.By:J.D.Watson,N.h.Hoppkins,J.W.Roberts,J.A.Steitz&A.M.Weiner.
- Microbial Genetics.By:Maloy{T.A}.Jones and Bartlett publications.
- Mobile DNA.By;NancyCraig,MartinGelletallan,lambowitz.
- Methods of General and Molecular biotechnology.By:Philip Gerhardt ASM publication.
- Recombinant DNA.By;Watson J.D. Essentials of Molecular Biology.By:Malcimski.
- Molecular genetics of Bacteria.By:Larry,Synder and Wendy Champness.
- Molecular biology.By;F.Weaver.WCB/MCGraw Hill.

- Molecular Biology of Gene.Watson et al,Benjamin-cumminas,USA.
- Molecular Biotechnology.Glick-1994.
- Genetic EngineeringBy:SandyaMitra.
- Environmental MicrobiologyBy:RalphMitchell,John Wiley and Sops.Inc.
- Environmental BiotechnologyBy:C.F.Froster and D.A.JohnWase,ElisHorwood.
- Biocatalysis and Biodegradation: Microbial Transformation of organic compounds. 31 y:Lawrencep.Wacekett.
- A manual of environment Microbiology.By:ChristonJ.hurst,ASM publication.
- Biodegradation and bioremediation Academic pressBY:San Diego.
- Biotechnology in the sustainable environment,Plenumpress,NY
- Basic principles of Geomicrobiology. By:A.D.Agate.
- Environmental MicrobiologyBy:R.M.Maier,I.C.Papper and C>P>Gerba.
- Methods in Microbiology:Lynch and Hobbie.
- Experimental Microbial Ecology.By:Arosison Academic Press.
- Advances in Applied microbiology.By:D.Pearlman academic press.
- Microbiology of Extreme environments,edited by Clive Edward,Open University press,Milton Keynes.
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