B.SC. MICROBIOLOGY SEM-V JUNE-2013

MI-501 MOLECULAR BASIS OF MICROBIAL GENETICS **Credit: 03**
Hours: 45

Unit-1: Fundamentals of genetics

1. DNA structure, Genes, Chro mosomes, cell division, prokaryotic genome, Introduction to classical, Molecular & Evolutionary genetics

Unit-2: Replication of DNA

1. DNA replication
   Single replication, bidirectional movement of replication fork -ori c, priming reaction
2. DNA polymerases, DNA synthesis of leading, lagging strand, Okazaki fragments
3. Termination
4. Models for prokaryotic DNA replication.

Unit-3: Gene Expression & Regulation

1. Transcription of Bacterial DNA
2. Structure of typical bacterial promoter
3. Structure of role of RNA polymerase
4. Initiation, elongation & termination – Rho dependants & independents
5. Salient features between prokary otic & eukaryotic transcription
6. Concept of operon positive & negative control of operon – Lac operon –different mutants of lac operon - Arabinose operon – catabolite repression – Tryptophan operon – Attenuation control
7. Genetics code, important, features of the nature of genetics code
8. Prokaryotic translation – structure of mRNA, t-RNA, Ribosomes, & their role in Translation - Initiation, Elongation, Translocation & termination of protein synthesis.

Unit-4: DNA damages & Repair

1. Direct , indirect & post Replication repair of DNA
2. Photo reactivation, excision Repair , Recombination Repair, Mis match Repair.

References:

1. Instant notes in Genetics, second edition 2 HICKEY & FLETCHER, Viva publications.
2. Principles of Genetics: Eight Edition 1991. John Wiley & SONS by Gardner, Simmons , Snustad.
3. Genetics :Analysis and Principles.1999.Benjamin Cummings.

MI-502 TECHNIQUES IN GENE TRANSFER **Credits: 03**

Hours: 45

Unti-1: Principles of Gene transfer

1. Bacterial recombination : General principles
2. Bacterial plasmids- fertility factor
3. Transfer of plasmid DNA – In vitro plasmid transfer – plasmid replication
4. Properties of particular bacterial plasmids, f -plasmids, R- plasmids, colicinogenic plasmid- Agrobacterium plasmid Ti –broad host range plasmid
5. Transposable genetic elements
6. Insertion sequences- detection of transposition in bacteria – types of bacterial transposons, Mechanism of Replication and non Replicative transposition

Unit-2: Transformation

1. Discovery of transformation
2. Biology of transformation
3. Molecular mechanisms of transformation
4. Mapping by transformation
5. Other uses by transformation

Unit-3: Transduction

1. Generalized transduction
2. Co transduction & linkage
3. Mapping by co-transduction
4. Specialized transduction
5. Formation of specialized transducing particles from lam bda lysogen
6. Specialized transduction of a non lysogen
7. Specialized transduction of a lysogen
8. High frequency transuding lysates
9. Specialized transuding phage as a cloning vehicle

Unit-4: Conjugation

1. Insertion of F- into the *E. coli* chromosome HFr trsnsfer
2. Interrupted matting & time of entry mapp ing
3. HFr mapping and HFr collection
4. Mapping " unselected" Recessive markers
5. Chromosomes transfer by F+ cultures
6. Isolation of HFr Strains & F' plasmids
7. Chromosomes transfer mediated by F' plasmids
8. Rec A- protein & its function

References:

1. Principles of Genetics : Eighth Edition. 1991, John Wiley & Sons by GARDNER, Simmons snustand.
2. Microbial Genetics, Second Edition 1994. Stan ely R. Maloy, John E. Cronar, D. Arcid freifelder, Johnes & Barlett publishers.
3. Microbiology: second Edition 1993, Lansing M. Harl ey , Donald A. Klein.Win C. Brown publishers.

MI-503 CLASSICAL GENETICS **Credit: 03**

Hours: 45

Unit-1: INFORMATION TO GENETICS

1. Overview of genetics
2. The relationship between Genes and Traits
3. Fields of Genetics

Unit-2: MENDELIAN PRINCIPLES

1. Principles of inheritance, Relevance of Mendelian laws ,Mendels's Genetics
   a. Segregation of two or more genes
   b. The principles of independent Assortment
   c. Dihybrid test crosses
   d. Mendelian inheritance & Probability
   e. Mutually exclusive events- independent events

Unit-3: GENES & CHROMOSOMES

1. Nature of genetic material, gene structure & function
2. The stability of chromosome complement
3. Mitosis-Meiosis, chromosomes & heredity
4. Determination of X-linked inheritance, sex determination in drosophila

Unit-4: GENETIC LINKAGE AND CHROMOSOME MAPPING

1. Linkage and recombination of genes in a chromosome
2. Genetic mapping – crossing over, crossing over takes place at the four strand stage of meiosis
3. The molecular basis of crossing over , multiple crossing over
4. Genetic mapping for three point –test crosses , double crossing over , genetic mapping and functions- genetic distance and physical distance
5. Mapping by tetrad analysis(introduction)
6. Mitotic recombination – recombination within genes closer look at complementation

References:

1. Genetics : principles and analysis . 4th edition 1998, Denial L. Hartl, Elizabeth tones.
2. Principles of genetics : E.J. Gardner.
3. Genes 9: Benjamin Levin

MI-504 r-DNA TECHNOLOGY **Credits: 03**

Hours: 45

Unit-1: INTRODUCTION AND SCOPE

1. What is genetics engineering
2. Historical perspectives
3. Milestone in biotechnology and recombinant DNA technology

Unit-2: TOOLS OF GENETIC TECHNOLOGY

1. Enzymes – exonuclease, endonuclease
2. Restriction endonuclease- nomenclature examples of some enzymes, S1 nuclease
3. DNA ligase , alkali phosphates , reverse transcriptase ,DNA polymerase, foreign DNA ,cloning vector ,plasmids , bacteriophage , insertion vector recombinan t vector, cosmid, plasmids, c-DNA clone bank
4. Gene bank

Unit-3: TECHNIQUES OF GENETIC ENGINEERING

1. Requirements of molecular biology laboratory
2. Gene cloning in prokaryotes – isolation of DNA to be cloned – insertion of DNA fragments in to vector – use of restriction linkers- use of homo polymer tailes , transfer of recombinant DNA in to bacterial cells.
3. Colony hybridization technique – Immunological test
4. Cloning in eukaryotes in plant cell, yeast, filamentous fungi, Agrobacterium plasmid- plant cell transformation by ultra sonication -liposome mediated- gene transfer
5. Animal cell and animal viruses
6. Electroporation- particle bombardment
7. Microinjection- divert transformation- site directed mutagenesis

Unit-4: APPLICATIONS OF R-DNA TECHNOLOGY

1. Agriculture and environmental applications
    a. In medical applications
    b. In industrial applications

References:

1. Textbook of Biotechnology by R. C. Dubey, Publisher : S. Chand, and Co.
2. Fundamentals of Molecular Biology 2009, Tar ganti K. Pal, Saroj S.
3. Molecular Cell Biology 5th edition by Lodish, Berk, Matsudalia

MI- 505 PRACTICAL

1. **Enzyme induction**
2. **Ultraviolet irradiation survival curve in *E. coli.***
3. **Isolation of Streptomycin resistant mutant of *E. coli* by gradient plate technique.**
4. **Isolation of spontaneous mutant of *E. coli* replica plate technique.**
5. **Isolation of pigment mutant of *Serratia marcescens***
6. **Demonstration: Conjugation in *E. coli***
7. **Isolation of petite mutants of yeast.**
8. **Isolation of Lac^- mutants of *E. coli*.**
9. **Isolation of bacteriophage from sewage.**
10. **Isolation of temperature sensitive mutant.**
11. **Demonstration: AMES test.**

Subjective Elective **Credits: 2**

Hours: 30

BIOINFORMATICS

Unit-1: INTRODUCTION TO BIOINFORMATICS

1. Definition & Scope
2. Basic computing & Development of database

Unit-2: COMPONENTS OF BIOINFORMATICS

1. Sequence Analysis (similarity, identity & homology), BLAST and F ASTA
2. Applications of Bioinformatics

Scheme for Semester End Examination

Semester – V Paper : 501 to 504

EX-1	Microbial growth	Marks 40
Ex-2	Isolation of mutant for _____ from the given sample.	Marks 40
Ex-3	Enzymology	Marks 40
Ex-4	Spotting	Marks 20
Ex-5	Viva	Marks 40
Ex-6	Journal and Slides	Marks 20

B.SC. MICROBIOLOGY SEM-VI JUNE-2013

MI-601 IMMUNOLOGY **Credit: 03**

Hours: 45

UNIT–1. IMMUNITY AND IMMUNE RESPONSE.

1. Types of Immunity: Definition, types of im munity in terms of host defence. Cell mediated and Humoral immunity.
2. Immune response: Definition, types of Immune responses – primary and secondary immune response. Cells and organs of the immune system, molecules of Immune response- Antigen and Antibody.

UNIT–2. ANTIGENS AND ANTIBODIES

1. Antigen, its types, terms: hapten, epitope, isoantigen, heterologous and homologous antigen, Cell-Associated Differentiation Antigens (CD), ABO and Rh antigens, MHC molecules
2. Antibody, its types, related terms, Structure and function, classes of antibodies, specificity, diversity (concept), Mon oclonal and polyclonal antibody

UNIT–3. IMMUNOLOGICAL REACTIONS

1. Agglutination, Complement fixation, ELISA, Immunodiffusion, Immunoprecipitation, Immunoelectrophoresis, Immunoprecipitation, Neutralization, Radio Immunoassay, Serotyping, Flow cytometry, Immuno-blot technique

UNIT–4. IMMUNE DISSORDERS.

1. Hypersensitivity – types I, II, III & IV
2. Autoimmune diseases – Immunotolerance, Autoantigen
3. Transplantation (Tissue) Rejection, types of grafts, mechanism of rejection, Graft versus Host Disease
4. Immunodeficiencies – Congenital and Acquired

REFERENCES:

1. Prescott *et al.*, Microbiology.6th edition.
2. Tortora *et. al*., Microbiology, An Introduction, 4th edition.
3. Madigan *et. al*., Brock Biology of Microorganisms, 8th edition.

ADDITIONAL READING:

1. Kuby *et. al*., Immunology, 5th edition.
2. Roitt *et. al*., Immunology, 6th edition.

MI-602 INDUSTRIAL MICROBIOLOGY **Credit: 03**

Hours: 45

Unit-1: ISOLATION, PRESERVATION AND IMPROVEMENT OF INDUSTRIAL MICROORGANISM

1. Scope of industrial microbiology and biotechnology the range of fermentation processes
2. Isolation criteria ,methods, enrichment and screening
3. Preservation : different methods
4. Improvement of industrially important microorganisms
5. Selection of mutants: natural, induced and DNA recombination
6. Improvement by modifying properties other than yield of product

Unit-2: FERMENTER DESIGN AND MEDIA

1. Basic functions of a typical fermenter
2. Design of an ideal S.T.R and various auxiliary parts
3. Aseptic operation and contaminants
4. Achievement and maintenance of aseptic condition
5. Medium formulations for industry
6. Various media ingredients and the criteria for selection
7. Antifoaming agents
8. Medium sterilization – batch continuous
9. Sterilization of fermenter, feeds and liquid waste
10. Sterilization of air

Unit-3 : DOWNSTREAM PROCESSING

1. Introduction
2. Removal of cells and solids: various methods
3. extraction of intracellular products by cell disruption methods
4. Concentration of extracted products : - methods
5. Purification of products :- chromatographic techniques membrane techniques and ultra filtration
6. drying and crystallization
7. quality assurance –bioassay

Unit-4: TYPICAL FERMENTATION PROCESSE S

1. Fermentative productions of antibiotics –penicillin
2. Fermentative productions of ethanol

3. Fermentative productions of enzyme amylase.
4. Fermentative productions of organic acids –citric acid
5. Fermentative productions of vitamin B_{12}
6. Microbial Biomass

References:

1. Mansi, : Fermentative productions of vitamin B_{12} fermentation microbiology and Biotechnology, Tylor and Francis.
2. Whittaker: Principles of fermentation technology.
3. Crueger and Crueger: Biotechnology,
4. Peppler: Microbial Technology: Fermentation technology
5. Casida: Industrial Microbiology.

MI-603 MEDICAL MICROBIOLOGY. **Credit: 03**

Hours: 45

UNIT–1. MEDICALLY IMPORTANT MICROORGANISMS .

1. Bacterial Diseases of Skin and Eyes, Chicken pox and Herpes.
2. Bacterial Diseases of Nervous System, Rabies and Creutzfeldt-Jakob disease.
3. Bacterial Diseases of Cardiovascular and Lymphatic System, Malaria and Dengue fever.
4. Bacterial Diseases of Respiratory System, Influenza and Common cold.
5. Bacterial Diseases of Digestive System, Hepatitis and Amoe bic dysentery.
6. Bacterial Diseases of Urinary and Reproductive System, Genital Herpes and Candidiasis.

UNIT–2. HOST PARASITE RELATIONSHIP.

1. Normal flora of skin, oral cavity, Gastrointestinal tract, and other body regions,
2. Entry of pathogen into the host, Colonization and growth.
3. Toxins – Endotoxins and Exotoxins.
4. Nonspecific host defences – general, physical, chemical and biological barriers.

UNIT–3. EPIDEMIOLOGY.

1. Definition, Types of diseases - pandemic, epidemic, endemic and sporadic, epizootics and zoonoses.
2. Morbidity rate, Mortality rate, types of carriers, types of transmission – airborne, contact, vector- borne.
3. Control of Epidemics.
4. Recognition of Epidemic, antigenic shift and drift, Herd Immunity.

UNIT–3. PROPHYLAXIS.

1. Definition – Immunization, vaccine, adjuvant, serum, antiserum, anamnesis, toxoids.
2. Types of vaccines –whole organism vaccines, Inactivated, Purified macromolecules as vaccines, Recombinant vector vaccines, DNA vaccines, Multivalent subunit vaccines.
3. Antimicrobial prophylactic therapies – malaria prophylaxis, prophylactic use of immunoglobulins.

REFERENCES:

1. Microbiology By Tortora

MI-604 BIOPROCCESS TECHNOLOGY **Credit: 03**

Hours: 45

Unit-1: OVERVIEW OF MICROBIAL PROCESSES

1. Microbial processes in food – SCP and YEAST
2. Microbial processes in industry :-bioleaching and MEOR
3. Microbial processes in agriculture ;- bio insecticide and bio-fertilizer

Unit-2: EXPLORATION OF MICROBES FOR OVER PRO DUCTION OF METABOLITES

1. Primary metabolites and strain improvement
2. Secondary metabolites and strain improvements
3. Current advances and future prospects

Unit-3: CONTROL PARAMETERS AND SCALE UP

1. Control systems :- manual and automatic , combined method , requirement for control
2. Biosensor
3. Recent trends in fermentation control
4. Scale up of industrial products

Unit-4: BIOPROCESS ECONOMICS

1. Introduction
2. Fermentation economics for isolation , strain improvement and media design
3. Fermentation economics for sterilization , aeration and agitation and effluent treatments

MI-605 Practical

1. Identification of unknown medically important bacteria from mixed population using identification keys : a) *Escherichia coli*, b) *Enterobacter aerogenes*, c) *Proteus vulgaris*, d) *Salmonella* group : *S. typhi, S. paratyphi A, S. paratyphi B*, e) *Shigella dysenteriae*, f) *Pseudomonas aeruginosa*.
2. Isolation, cultivation, identification and study of antibiotic sensitivity (Antibiogram) of Gram negative bacteria.
3. Determination of human blood groups: ABO and Rh system.
4. Estimation of Haemoglobin by Sahli's acid haematin method.
5. Total count of Erythrocytes.
6. Total count of Leucocytes.
7. Differential count of Leucocytes by Field's method.
8. Urine examination : Physical, chemical, microscopic.
9. Estimation of blood glucose by GOD/POD method.
10. Estimation of blood urea by Di-Acetyl Monoxime method.
11. Study of Agglutination reaction: i) Dreyer's technique, ii) Double dilution technique.
12. Primary screening of (a) Amylase, (b) Antibiotic producers, i) crowded plate method, ii) Wilkin's method, (c) Organic acid producers.
13. Bioassay of Penicillin using *Bacillus subtilis*.
14. Fermentative production of Amylase and determination of Amylase activity.
15. Determination of Oxygen Transfer Rate (OTR) under static, sparing and shaking condition by sodium sulphite method.
16. Sterility testing of Pharmaceutical products.

Subjective Elective **Credit: 02**

Haematology & Blood Banking **Hours: 30**

Unit-1 : Blood and its Components

1 Plasma and serum
2 Red blood cells
3 White blood cells
4 Platelets
5

Unit-2 : Blood Transfusion & Transfusion Reactions

1. Collection, Storage and transfusion of blood
2. Blood grouping
3. Minor and Major cross matching
4. Erythroblastosis Foetalis

Scheme for Semester End Examination

Semester VI Paper : 601 - 604

EX-1 Characterization and Identification of medically important bacteria Marks 40

1. *Enterobacter* genus
2. *Salmonella* genus
3. *Shigella* genus
4. *Proteus* genus
5. *Pseudomonas*

Ex-2 Bioassay of antibiotics OR Fermentation exercise Marks 40

Ex-3 Biochemical tests for Blood and/or Urine Marks 40

Ex-4 Spotting Marks 20

Ex-5 Viva Marks 40

Ex-6 Journal and Slides Marks 20