MB 201: MEDICAL & DIAGNOSTICMICROBIOLOGY

Unit - I


Unit - II

Cocci and their clinical importance. General characters, pathogenicity and prophylaxis of Streptococcus, Staphylococcus, Neisseria, Corynebacteriumdiphtheriae and Clostridiumtetani. Bacilli of medical importance - gram positive and negative bacilli, endospore-forming aerobic bacilli, acid fast bacilli, Mycobacteriumtuberculosis and M. leprae.

Antimicrobial chemotherapy, mechanisms of action of clinically used antimicrobial drugs. Antimicrobial drugs for systemic administration - penicillins, cephalospirins, tetracyclins, erythromycins, anti-tubercle drugs.

Unit - III


Unit - IV

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II SEMESTER (CHOICE BASED CREDIT SYSTEM)

MB 201: MEDICAL & DIAGNOSTIC MICROBIOLOGY

Recommended Books:

1. Reviews of Medical Microbiology by JAWETZ, MELNICK & ADEBERY
2. Medical Microbiology by CRUICKSHANK Vol. I and II
3. A text book of Microbiology (6th edition) by ANANTANARAYAN
4. Clinical diagnosis and management – Laboratory methods by JOHN BERNARD HENRY
5. Zinser Microbiology by JOKLIK, WILLE, AMOS & WILFERT
8. Bailey and Scott’s Diagnostic microbiology by MOSBY
MB 202: Open Elective (Microbes in Human Welfare)

Unit - I
Microorganisms in the service of man in past, present and future

Basics of microbiology: Microbial diversity & types of microorganisms - Viruses, fungi, bacteria, algae, protozoa

Cultivation of microbes - Sterilisation of media and glass wares, growth of microbes on culture media, fermentors/bioreactors/flasks

Traditional microbial technologies – Curdling of milk, yoghurt, cheese, probiotics. Bread and wine making, alcohol and alcoholic beverages, other traditional foods of India

Unit – II

Production of pharmaceutically and commercially important products – antibiotics, enzymes, vitamins, monoclonal antibodies, vaccines

Alternate sources of energy - Bio-fuel methane, hydrogen and alcohol. Current status and prospects of commercial production of microbial fuels

Biodegradable polymers and surfactants from microorganisms - polylactate and polyhydroxyalkaonoates.

Unit – III

Single cell proteins & single cell organisms, mush room cultivation

Genetically engineered organisms – applications in health, industries, agriculture and environment.

Unit - IV

Bio-catalysis for steroidal transformation

Role of Microorganisms in Sustainable agriculture: Biocontrol agents/biopesticides – Bacterial, fungi and viruses. Biofertilisers production, formulations and applications

Microbial Standards for water and food. Quality control
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II SEMESTER (CHOICE BASED CREDIT SYSTEM)

MB 202: Open Elective (Microbes in Human Welfare)

Recommended Books:
1. Principles of fermentation technology (2nd edition) by STANBURY, WHITAKER & HALL.
2. Biotechnology: A Text Book of Industrial microbiology 2nd edition by CRUEGER & CRUEGER.
3. Microbial Technology Vol I by PEPPLER & PEARLMAN (Editors).
4. Microbial Technology Vol II by PEPPLER & PEARLMAN (Editors).
5. Microbial enzymes and bioconversions by ROSE.
7. Prescott & Dunn’s Industrial Microbiology 4th edition Editor REED.
8. Biotechnology Vol III. DELLWEG (Editor).
9. Concepts in Biotechnology by BALASUBRAMANIAN, BRYCE, DHARMALINGAM, GREEN & JAYARAMAN.
10. Immobilized cells: Principles and Application by TAMPION & TAMPION.
11. Industrial Microbiology by THOMA.
12. Methods in Food and Dairy Microbiology by DILIELLO.
13. Industrial Microbiology by CASIDA.
14. Industrial Microbiology by MILLER & LITSKY.
15. Brock Biology of Microorganism (9th edition) by MADIGAN, MARTINKO & PARKER.
Unit - I


Unit - II


Unit - III


Unit - IV

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MB 203: MOLECULAR BIOLOGY

Recommended Books:

2. Molecular Biology – A Comprehensive Introduction to Prokaryotes and Eukaryotes – D. Freifelder (Jones and Bartlett, USA)
MB 204: BIOSTATISTICS AND BIOINFORMATICS

Unit - I


Unit - II


Unit - III


Genome projects - General introduction to genome projects (rice genome project and Mycobacterium tuberculosis genome project). Special emphasis on Human Genome Project (HGP) – Science behind HGP, benefits of HGP, ELSI of HGP in use of genetic information, genetic testing standard, quality and commercialization.

Biological database - Introduction of database (DB), need, organization, search of DB. An over view of biological databases - NCBI, EMBL, DDBJ, SWISS-PROT, PDB, and KEGG.

Unit - IV

Database querying with NCBI using key words, sequences (proteins and genes), finding similarities, identifying genes and proteins from different organisms.

Sequence alignment - Introduction, significance of sequence alignments and use of dot matrices. Pair wise and multiple sequence alignment (MSA) using Clustal programs.

Sequence analysis - concepts of sequence analysis and their importance. BLAST – blastn, blastp, blastx, tblastx, output analysis matrix BLOSSUM, PAM, e-value.

Proteomics - Introduction, principle, technique, 2-D database. Gel analysis software, post gel analysis, MALDI-TOF. Significance and applications of proteomics in modern biology.
MB 204: BIOSTATISTICS AND BIOINFORMATICS

Recommended Books:

1. Statistical methods. S.P. Gupta
2. Fundamentals of mathematical statistics. S.C Gupta & Kapoor
P 201: MEDICAL & DIAGNOSTIC MICROBIOLOGY

Identification of pathogenic bacteria using Gram stain and acid-fast staining techniques.

Collection and culture of nosocomial microorganisms.

Bacterial examination of blood, urine and pus.

Examination of blood smears for malaria.

Blood hemoglobin estimation.

Erythrocyte sedimentation rate.

Liver function test for hepatitis virus.

Slide observations: Candida albicans, Mycobacterium leprae, bacterial spores, Corynebacterium sp., Clostridium tetani, Aspergillus fumigatus

Differential count

RBC
P 202: MOLECULAR BIOLOGY AND BIOINFORMATICS

Determination of log phase during culturing of *E. coli*
Demonstration of β-galactosidase induction in *E. coli* lac*+* strains.
Estimation of DNA by diphenylamine method.
Determination of purity and quantity of DNA by UV absorption method.
Determination of melting temperature (Tm) of DNA
Estimation of RNA by orcinol method.
PAGE electrophoresis of proteins.
Problems related to molecular genetics.
Southern and western blotting.
Electro-elution of DNA.
Restriction digestion of DNA.
Separation of RE-digested fragments by gel electrophoresis.
Restriction mapping of a plasmid.
Cloning of foreign DNA insert into a plasmid followed by transformation.
Polymerase chain reaction.

Familiarization with Windows, UNIX and Internet
Database searching (Give name of the gene/protein search sequence with key words, download the sequence, locate related literature references)
Use of tools at NCBI, EMBL and SWISSPORT
BLAST analysis and FASTA analysis
Pair wise and multiple sequence alignment (CLUSTAWX/W)
Finding composition of sequence, open reading frames
Detecting signals, Mptots and repeats in sequence
Secondary structure prediction of protein sequence
Phylogenetic tree construction
Design of PCR primer
Unit I
Genetic engineering – Scope and milestones of genetic engineering. Restriction and modification enzymes – Classification, nomenclature and importance of restriction endonucleases. DNA ligases, polynucleotide kinase, alkaline phosphatases, S1 nuclease, terminal transferase, Bal 31 nuclease. Cloning Vectors – Characteristics of a cloning vector, disadvantages of natural plasmids in gene cloning. Artificial plasmids as cloning vectors – Construction of pBR322, vectors used for cloning genes in E. coli (plasmids, bacteriophage derivatives, cosmids BACs) yeast (YACS, shuttle vectors), higher plants (Ti plasmid derivatives, caulimovirus) and animal cells (constructs of SV40 and retroviruses). DNA and RNA probes – Synthesis and their applications. Bacterial strains used for cloning (E. coli JM101, strain 109, strain C43 (DE3)).

Unit II

Unit III

Unit IV
MB 301: GENETIC ENGINEERING
Recommended Books:
2. DNA Cloning: a Practical Approach, DM Glover and BD Hames, IRL Press
10. Molecular Biotechnology – Glick
11. Concepts of Biotechnology D. Balasubramanian
12. Principles of Gene Manipulation by Old and Primrose, Blackwell

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III SEMESTER(CHOICE BASED CREDIT SYSTEM)

MB 302: OPEN ELECTIVE (IMMUNITY & HUMAN HEALTH)
Unit – I
History and evolution of immunology, Humoral and cellular immunity, Primary body defence mechanisms, Innate immune systems – Skin, Tears, Saliva and gastric enzymes, cells of immune system B and T lymphocytes, NK cells, antigen presenting cells, phagocytic cells, phagocytosis. Primary and secondary lymphoid organs, antigen recognition by T cells, antigen processing and presentation pathways of exogenous and
endogenous antigens, Major classes of antigens, functions of antigens, structure and functions of antibodies, Protection, Immune responses to different infections Upregulation of immune system against popular and communicable diseases, Applications of immune-based and serological tests in diagnosis of diseases

Unit – II
Cancer Biology and Immunology: Cancer, types of cancers (Carcinoma, Sarcoma, Lymphoma and Myeloma, & leukemia, germ cell tumours ) Pathologicllocal symptomslsystemic symptoms and metastasis, Benign tumours and malignant tumours, immune system of tumors & cancers, Immuno-surveillance, immunoediting, viruses in development of cancers, cancer therapy

Unit - III

Unit - IV
Sanitary Microbiology – Faecal and sewage contamination, outbreaks of diseases during natural calamities and floods, microbiological hazards, Microbiological monitoring of indicator microorganisms (bacteriological standards) in water and food, applications of novel technology for microbiological analysis of water and food

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M.Sc. DEGREE COURSE IN MICROBIOLOGY

III SEMESTER(CHOICE BASED CREDIT SYSTEM)

MB 302: OPEN ELECTIVE ( IMMUNITY &HUMAN HEALTH )

Recommended Books:
1. Immunobiology - The immune system in Health and disease by JANEWAY & TRAVERS.
2. Immunology - An Introduction by TIZARD.
3. Text Book of Immunology by UNANI & BENACERRAF.
4. Fundamentals of Immunology by PAUL.
5. Immunology by KUBY.
6. Immunology - A short course by BENZAINI, SUNSHINE & LESROWITZ.
7. Basic and clinical immunology by STITES, TERR& PARSLow.
8. Antibodies: A Laboratory Manual by HARLOW & LANE.
9. Practical Immunology by HUDSON & HAY.
10. Manual of Clinical Immunology by ROSE& FRIEDMAN.
11. Immunochemistry in Practice by JOHNSTONE & THROPE.
12. Hand Book of Experimental Immunology, Vol I & II by WEIR.
13. Immunology by ROIT
15. Food microbiology by William C Frazer & Dennis Westhoff
Enzymes - Classification, nomenclature, chemical nature of enzymes. Assay of enzymes. Kinetics of enzyme-catalyzed reactions – Michaelis-Menten equation, determination of Vmax, Km, Kcat and their significance. Effect of pH, temperature, concentration of enzyme and concentration of substrate on rate of enzyme-catalyzed reactions.

Unit - II

Enzyme inhibition of active site and identifying functional groups essential for catalysis, factors contributing to the catalytic efficiency such as proximity and orientation steric hindrance, covalent catalysis, general acid-base catalysis, factors of strain in enzyme catalysis. Mechanism of action of enzymes, lysozyme, chymotrypsin, RNase. Regulatory enzymes – noncovalently-regulated enzyme (allosteric enzymes), covalently-regulated enzymes, isozymes. Ribozymes and abzymes.

Unit - III


Unit - IV

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III SEMESTER(CHOICE BASED CREDIT SYSTEM)

MB 303: ENZYMEOLOGY AND BIOENERGETICS

Recommended Books:
1. Biochemistry (2nd edition) by VOET & VOET.
2. Outlines of Biochemistry (5th edition) CONN, STUMPF, BRUENING & DOI.
3. Biochemistry (3rd edition) by STRYER.
4. Biochemistry by ZUBAY.
5. Principles of Biochemistry by LEHNINGER, NELSON & COX.
7. Biochemistry Vol. III by DAS GUPTA.
8. Biochemistry by GARRET & GRISHAM.
10. An Introduction to Practical Biochemistry by PLUMMER.
11. Principles of Biochemistry: General aspects by SMITH, HILL, LEHMAN, LEFKOWITZ, HANDLE & WHITE.

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III SEMESTER(CHOICE BASED CREDIT SYSTEM)

MB 304: MICROBIAL GENETICS

Unit – I
Unit – II

Unit – III

Unit – IV
Genetic mapping – Map units, mapping by recombination analysis and mapping of circular chromosomes. Mapping of bacterial chromosomes by interrupted mating and transduction. Recombination in bacteriophages. Benzer’s studies on r-II locus of T4 bacteriophage to establish the units recon, muton and cistron. Eukaryotic viral genetics – Recombination, reassortment, genetic drift and shift, transcapsidation. Mutagenesis – Mutagens (physical, chemical and biological), types of mutations, molecular mechanism of mutation. Isolation and analysis of mutants. Site-directed mutagenesis and their applications

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M. Sc. COURSE IN MICROBIOLOGY
III SEMESTER(CHOICE BASED CREDIT SYSTEM)

MB 304: MICROBIAL GENETICS
Recommended Books:

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M.Sc. DEGREE COURSE IN MICROBIOLOGY

III SEMESTER (CHOICE BASED CREDIT SYSTEM)

P 301: GENETIC ENGINEERING
Bacterial culture and antibiotic selection media. Preparation of competent cells.
Isolation of lambda phage DNA
Agarose gel electrophoresis and restriction mapping of DNA
Construction of restriction map of plasmid DNA
Cloning in plasmid/phagemid vectors – Selection of positive clones using blue/white colours.
Preparation of helper phage and its titration using M13 mp18/19 vectors.
Preparation of single stranded DNA template
DNA sequencing
Gene expression in E.coli and analysis of gene product
PCR
Reporter gene assay (Gus/CAT/b-GAL)
RFLP
RAPD

Handling of laboratory animals, routes of immunization, bleeding of animals and preparation of serum.
Animal surgery, identification of spleen, lymph nodes and thymus.
Isolation and separation of adherent and non-adherent cells.
Lymphocyte viability test (Trypan blue dye exclusion test).
Mitogen activity on lymphocytes.
Differential action and measurement of soluble and particulate antigen.
Serum electrophoresis and separation of serum proteins.
Precipitation test, immunodiffusion, radial immunodiffusion.
Agglutination reactions.
Differential count and identification of immune cells.
IIISEMESTER (CHOICE BASED CREDIT SYSTEM)

P 302: ENZYMOLOGY & MICROBIAL GENETICS

Assay of chymotrypsin and trypsin.
Isolation and partial purification of enzymes, amylases and cellulases.
Determination of characteristics of enzyme-catalyzed reaction (Vmax and Km).
Effect of temperature and pH on the rate of enzyme catalysed reaction.
Immobilization of enzymes.
Characterisation of immobilised enzymes.

Preparation of cytological slides for mitosis using root tips.
Preparation of cytological slides for meiosis-I using flower buds; chiasma frequency
Identification of different stages of mitosis and meiosis.
 Demonstration of chromosomal (structural and numerical) aberrations
 Study of polytene chromosomes.
 Karyotypic study.
 Demonstration of Mendelian laws using color marbles or beads
 Evaluation of segregation and random assortment using Chi square test or test of fitness.
 Construction of genetic maps based on Problems in two and three factor crosses