



Dr. M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
 (Decl. U/S 3 of the UGC Act 1956)
DEPARTMENT OF BIOTECHNOLOGY

M.Tech – Medical Biotechnology (Full Time)
Curriculum and Syllabus
2013 Regulation

I SEMESTER						
S.No	Sub. Code	Title of Subjects	L	T	P	C
1	MBT 13M001	Human Physiology and Immunology	3	0	0	3
2	MBT 13M002	Medical Microbiology	3	0	0	3
3	MBT 13M003	Recombinant DNA Technology	3	0	0	3
4	MBT 13M004	Molecular Biology	3	1	0	4
5	MBT 13M005	Clinical Biochemistry	3	0	0	3
6	MBT 13ML01	Clinical Biochemistry and Immunology Lab	0	0	6	2
7	MBT 13ML02	Medical Microbiology and Recombinant DNA Lab	0	0	6	2
TOTAL			15	1	12	20

II SEMESTER						
S.No	Sub. Code	Title of Subjects	L	T	P	C
1.	MBT 13M006	Pharmacology	3	1	0	4
2.	MBT 13M007	Bioinformatics	3	0	0	3
3.	MBT 13M008	Genomics	3	0	0	3
4.	MBT 13M009	Stem cell Biology	3	0	0	3
5.	MBT 13M010	Immuno technology	3	0	0	3
6	MBT 13ML03	Bioinformatics Lab	0	0	6	2
7.	MBT 13ML04	Molecular Genetic Analysis Lab	0	0	6	2
TOTAL			15	1	12	20

III SEMESTER						
S.No	Sub. Code	Title of Subjects	L	T	P	C
1.	MBT 13M011	Proteomics	3	1	0	4
2.	MBT 13M012	Animal Tissue Culture	3	0	0	3
3.	MBT 13M013	Intellectual Property Rights, Biosafety, Bioethics	3	0	0	3
4.	MMA130023	Research methodology and statistical analysis	3	1	0	4
5.	MMA130XXX	ELECTIVE-1	3	0	0	3
6.	MBT 13ML05	Animal Tissue culture Lab	0	0	6	2
7.	MBT 13ML06	Project Literature Review and Project Proposal	0	0	3	1
TOTAL			15	2	9	20



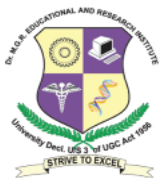
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IV SEMESTER						
S.No	Sub. Code	Title of Subjects	L	T	P	C
1.	MBT13ML07	Project Report and Viva voce	0	0	24	15
TOTAL			0	0	24	15

Credit Distribution

SEMESTER	CREDITS
I	20
II	20
III	20
IV	15
TOTAL	75

ELECTIVES						
S.No	Sub. Code	Title of Subjects	L	T	P	C
1	MBT 13ME01	Herbal drug technology	3	0	0	3
2	MBT 13ME02	Clinical Research	3	0	0	3
3	MBT 13ME03	Cancer Biology	3	0	0	3



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MBT13M001 HUMAN PHYSIOLOGY AND IMMUNOLOGY 3 0 0 3

OBJECTIVES:

- To explain the gross morphology and functional organization of the cell.
- To impart knowledge on the importance of principles of clinical biochemistry to the students.
- To discuss the fundamental mechanisms underlying protective immune responses, and discuss the recent advances and emerging themes in immunology research.

UNIT I: INTRODUCTION AND PHYSIOLOGY OF CELLS 9Hrs

Foundations of Physiology – Functional Organization of the cell – Physiology of Membranes – Signal Transduction – Electrophysiology of the Cell Membrane – Electrical Excitability and Action Potentials – Synaptic Transmission and the Neuromuscular Junction – Cellular Physiology of Skeletal, Cardiac and Smooth Muscle, Arteries Veins and Microcirculation – Heart pump – regulation of arterial pressure and cardiac output

UNIT II: RESPIRATORY, URINARY AND GASTROINTESTINAL SYSTEMS 9Hrs

Organization of Respiratory system – Transport of Oxygen and Carbon dioxide in the Blood – Gas Exchange in the Lungs – Ventilation and Perfusion of the lungs, Organization of Urinary System – Glomerular filtration and Renal Blood flow – Transport of salts, organic solutes and acids and bases – Urine Concentration and Dilution – Organisation of Gastrointestinal system – Gastric function – Pancreatic and salivary glands – Nutrient digestion and Absorption.

UNIT III: ENDOCRINE AND REPRODUCTIVE SYSTEMS 9 Hrs

Organization of Endocrine control – Endocrine regulation and growth – Thyroid, Adrenal, Pancreas and Parathyroid glands – Sexual differentiation – Male and Female Reproductive systems – Fertilization – Pregnancy and Lactation

UNIT IV: MOLECULAR IMMUNOLOGY 9 Hrs

Cells of immune system; innate and acquired immunity, Development, maturation, activation and differentiation of T-cells and B-cells; TCR; antibodies: structure and functions; antibodies: genes and generation of diversity; antigen-antibody reactions; monoclonal antibodies: principles and applications; antigen presenting cells; major histocompatibility complex; antigen processing and presentation; regulation of T-cell and B-cell responses.

UNIT V : INFECTION, IMMUNITY AND TRANSPLANTATION 9 Hrs

Properties of Cytokines, cytokine secretion by Th1 and Th2 subsets, Complement activation, Inflammation, Acute phase response, Immune response to infectious diseases, Hypersensitivity, genetics of transplantation, Autoimmune diseases.

Total No. of Hrs: 45

TEXT BOOK

1. Sarada Subramanyam, K.Madhavan Kutty and Singh HD, (1996) '*Human Physiology*' (5th Ed) S.Chand & Company Ltd
2. Sujit K.Chaudhuri (1997) *Concise Medical Physiology*, New Central Book agency.
3. Goldsby RA, Kindt TJ. Osborne BA (2000) *Kuby immunology* (4th Ed) W.H. Freeman & Co Ltd.
4. Ivan Riot (1988). *Essentials of immunology* (6th Ed) Blakswell scientific publications, Oxford.

REFERENCE BOOKS

1. Arthur.C.Guyton (2010) *Medical Physiology* (12th Ed) Prism Book private Ltd.
2. Cyril A, Keele Eric Neil and Neil Norman Joels Samson Wrigths (2009) *Applied Physiology* (13th Ed) Oxford University Press.
3. Paul W. E. (1988) *Fundamentals of immunology* (Eds.) Raven press, New York.



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MBT13M002 **MEDICAL MICROBIOLOGY** **3 0 0 3**
OBJECTIVES:

- To discuss the host-microbe interactions and investigation, diagnosis, and treatment by various microbes
- To create an awareness and improving the detection of emerging viral infections.

UNIT I : HOST-PATHOGEN INTERACTION **9 Hrs**

Normal microbial flora of human body, host-microbe interactions. Infection and infectious process, routes of transmission of microbes in the body. Microbial toxins, Enteric pathogens: Cholera, *Shigella* spp, *Salmonella* spp and *E.coli*. Extracellular pathogens: *Staphylococcus* spp, *Streptococcus* spp.

UNIT II : INTRACELLULAR PATHOGENS AND PATHOGENIC ANAEROBES **9 Hrs**

Facultative intracellular pathogens –Mycobacterium; Obligate intracellular pathogens –Chlamydia, Rickettsia; Accidental pathogens – *Pseudomonas* spp; Chronic pathogens – *Helicobacter pylori*. Pathogenic anaerobes, Tetanus, Clostridia, Corynebacteria, Spirochaetes.

UNIT III FUNGI AND PROTOZOA **9 Hrs**

Fungal pathogens; Description and pathology of diseases caused by Protozoa: Leishmania donavani, Trypanosoma gambiense, Entamoeba histolytica, Malarial parasites, Helminthes: Ascaris lumbricoides and Filarial parasites.

UNIT IV: BIOLOGY OF VIRUSES **9 Hrs**

Classification and Replication, DNA virus Replication strategies, RNA virus replication strategies, Viral genetics, Viruses transmitted via air: Influenza, Rhinovirus, SARS; Respiratory and Adeno Viruses : Measles, Mumps, Rubella, Enteroviruses and other Picornaviruses, Viruses transmitted via food or water: Rotavirus, Polio, Hepatitis A, Coxsackie virus; Oncogenic viruses: Human Papilloma virus, KSHV, HTLV; Viruses transmitted via sex, needles, or blood: Hepatitis C and HIV.

UNIT V: EMERGING VIRUSES **9 Hrs**

Emerging viruses: Chikungunya, Influenza A virus (H1N1), Bioterrorism – Anthrax. Sexually transmitted diseases : Gonorrhoea, Syphilis; Zoonoses – Borrelia burgdorferi; Antibiotics and antibiotic resistance, Antiviral and anti-parasitic drugs.

Total No. of Hrs : 45

TEXT BOOKS :

1. Betty Forbes, Daniel Sahm, Alice Weinfeld, Bailey (2007) *Scott's Diagnostic Microbiology* (12th Ed), Mosby.
2. Gerald Collee J, Andrew G Fraser, Barrie P Marmion, (2006) *Mackie and McCartney's Practical Medical Microbiology*, Elsevier.

REFERENCE BOOKS

1. Elmer W Koneman et al., (2005) *Koneman's Color Atlas and Text Book of Diagnostic Microbiology* (6th Ed), Lippincott Williams and Wilkins.
2. R Ananthanarayan, C.K.J Paniker (2009) *Textbook of Microbiology* (8th Ed) Orient Blackswan.
3. Geo.F.Brooks, Karen C.carroll, Janet.S, Stephen A.Mose (2007) *Medical Microbiology* (24 Ed) McGraw-Hill Medical.



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MBT13M003
OBJECTIVES:

RECOMBINANT DNA TECHNOLOGY

3 0 0 3

- To understand the basic concept steps in the cloning such as Restriction enzymes, Vectors and screening techniques.
- Utilize the knowledge on creation of a genomic library and detection of desire gene and analysis of gene function.

UNIT I: BASIC CONCEPTS IN RECOMBINANT DNA TECHNOLOGY

9 Hrs

Overview of nucleic acid extraction and purification methods, detection and quantitation, gel electrophoresis; Restriction Endonucleases, DNA modifying enzymes, Klenow enzyme, Cohesive and blunt end ligation, linkers and adaptors, homopolymer tailing, double digestion, TA cloning, labeling of DNA probes: Nick translation, Random priming, Radioactive and non-radioactive probes. Hybridization techniques: Northern, Southern and Colony Hybridization.

UNIT II: PROPERTIES OF CLONING VECTORS

9 Hrs

Plasmid Vectors : PBR 322, PUC19 vectors, Methods for introducing DNA into cells, Transformation, Selection of recombinants, alpha complementation, replica plating. Bacteriophage vectors : Insertion and replacement vectors, Cosmids, M13 Vectors, yeast vectors, shuttle vectors, Artificial chromosome vectors: YAC and BAC, Constitutive and Inducible Promoters, Expression vectors, GST vector, Animal Virus derived vectors-SV-40; vaccinia/baculo & retroviral vectors.

UNIT III: GENOMIC LIBRARIES

9 Hrs

Construction and Evaluation of Genomic libraries, growing and storing libraries, cDNA libraries, screening libraries with gene probes, screening expression libraries with antibodies, characterization of plasmid clones. Primer design; Fidelity of thermostable enzymes; DNA polymerases; Types of PCR – multiplex, nested, reverse transcriptase, real time PCR, touchdown PCR, hot start PCR, colony PCR, cloning of PCR products, rapid amplification of cDNA ends (RACE), applications of PCR.

UNIT IV: PCR AND SEQUENCING

9 Hrs

Principles of DNA Sequencing: Sanger's method, Maxam and Gilbert method, Automated DNA sequencing, pyrosequencing, next generation sequencing, Analysis of Sequence Data: ORF identification, exon/intron boundaries, expression signals, protein motif and domain, Databank entries and annotation.

UNIT V: ANALYSIS OF GENE FUNCTION

9 Hrs

Analysis of Gene Function –methods for studying the promoter, transposon mutagenesis, allelic replacement and gene knockouts, complementation, protein interaction through two hybrid screening and phage display. Factors affecting expression of cloned genes, expression of cloned genes in bacteria, yeast systems, expression in insect cells-baculovirus systems, mammalian systems, adding tags and signals, in vitro mutagenesis.

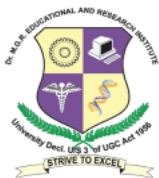
Total No. of Hrs:45

TEXT BOOKS:

1. Jeremy Dale, Malcome Schantz, and Nick Plant (2011) *From Genes to Genomes Concepts and Applications of DNA technology* (3rd Ed), Wiley Blackwell Press.
2. T.A. Brown (2010) *Gene Cloning and DNA analysis* (6th Ed)Wiley.

REFERENCE BOOKS

1. S.B. Primrose, R.M. Twyman and R.W.Old (2001) *Principles of Gene Manipulation* (6th Ed) S.B.University Press.
2. Joseph Sambrook, David W. Russell (2001) *Molecular cloning : A laboratory Manual*(3rd Ed)CSHL Press.
3. Watson, Caudy, Myers, Witowski (2007) *Recombinant DNA: Genes to Genomes* (3rd Ed)Cold Spring Harbor Laboratory Press



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MBT13M004

MOLECULAR BIOLOGY

3 1 0 4

OBJECTIVES:

- To understand the basic concept of genome organization and replication process and its error and repair mechanism. Understand the mechanism of replication, transcription and translation.
- To deeply learn the molecules involved in synthesis of DNA, RNA and proteins.

UNIT I: GENOME ORGANIZATION AND DNA REPLICATION

12 Hr

Structure of DNA - A-,B-, Z- and triplex DNA , Organization of the bacterial genome, organization of eukaryotic chromosome, Role of nuclear matrix in chromosome organization, DNA reassociation kinetics (Cot curve analysis), Replication initiation, elongation and termination in prokaryotes and eukaryotes; Enzymes and accessory proteins; End replication problem, Role of telomerase

UNIT II: MUTATION, REPAIR AND RECOMBINATION

12 Hrs

Replication errors and their repair, proofreading, mismatch repair, Mutagens, repair of DNA damage – photoreactivation, base excision repair, SOS repair, homologous recombination, holliday model, recBCD pathway, role of recA, homologous recombination in eukaryotes, site specific recombination.

UNIT III: TRANSCRIPTION:

12 Hrs

Prokaryotic Transcription; Transcription unit; Promoters-Constitutive and Inducible; Operators; Regulatory elements; Initiation; Attenuation; Termination-Rho-dependent and independent; Anti-termination; Transcriptional regulation-Positive and negative; Operon concept- lac, trp, ara, and gal operons; Processing of tRNA and rRNA. Eucaryotic transcription and regulation; RNA polymerase structure and assembly; RNA polymerase I, II, III; Eukaryotic promoters and enhancers; General Transcription factors; TATA binding proteins (TBP) and TBP associated factors (TAF); Activators and repressors. Inhibitors of transcription

UNIT IV: POST TRANSCRIPTIONAL MODIFICATIONS, TRANSLATION AND TRANSPORT

12 Hrs

Processing of hnRNA, tRNA, rRNA; 5'-Cap formation; 3'-end processing and polyadenylation; Mechanism of splicing, spliceosome, self-splicing, alternative splicing, exon shuffling, RNA editing, mRNA transport, Catalytic RNA. **Translation & Transport** Translation machinery; Ribosomes; Composition and assembly; Universal genetic code; Degeneracy of genetic code; Termination codons; Wobble hypothesis; Mechanism of initiation, elongation and termination; Co- and post-translational modifications;

UNIT V: GENE REGULATION:

12Hrs

Prokaryotes – activators and repressors, DNA looping, Eukaryotes – Homeodomain proteins, Zn containing DNA-binding domains, leucine zipper motifs, helix – loop helix proteins, gene silencing - DNAmethylation, histone modifications, mechanism of siRNA and microRNAs.

Total No. of Hrs: 60

TEXT BOOK

1. Watson et al (2004) *Molecular Biology of the Gene*, (5thEd) Pearson Education.
2. David Freifelder (1987) *Molecular biology* (2nd Ed) Jones and Bartlett publishers international.

REFERENCE BOOKS

1. Harvey Lodish David Baltimore and Arnold Berk (1995) *Molecular biology* (3rd Ed) W H Freeman & Co.
2. Benjamin Lewin (2003) *Genes VIII* (1st Ed) Benjamin Cummings.
3. Bruce Alberts, Alexander Johnson, Julian Lewis (2007) *Molecular Biology of the Cell* (4thEd) Garland science.



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MBT13M005

CLINICAL BIOCHEMISTRY

3 0 0 3

OBJECTIVES:

- To explain various chemical tests performed in the biological fluids to identify disease conditions
- To analyze the results of the biochemical tests and able to interpret with the pathological conditions
- To know how perform various organ functional tests and using the results obtained the learner should have ability to correlate with normal or abnormal physiology

UNIT I: COLLECTION, PRESERVATION OF BIOLOGICAL SPECIMENS

9 Hrs

Collection, preservation of biological specimens such as blood, urine, CSF, bile, saliva and faeces, automation in clinical biochemistry, Disorders of blood – blood dyscrasias, agranulocytosis, thrombocytopenia, aplastic, hemolytic anemia, methemoglobin, hematuria, hemoglobinopathies, homeostasis and thrombosis, extrinsic and intrinsic pathways of blood clotting mechanism and disorders. Laboratory test and measure coagulation and anticoagulants.

UNIT II: PRENATAL DETECTION OF IN BORN – DISORDERS OF METABOLISM

9 Hrs

Prenatal detection of in born – disorders of metabolism and in the fetus and heterozygous carriers by enzyme assays in amniotic fluid plasma cells and biopsy samples, phenylketonuria, alkaptonuria, phenylalaninemia, homocystinuria and tyrosinemia and related disorders of amino acids, Hartnup's disease, Hypo and hyper uricemia and gout.

UNIT III :DISORDERS OF CARBOHYDRATE METABOLISM

9 Hrs

Disorders of carbohydrate metabolism – blood sugar level, diabetes mellitus, metabolic complications. Various types of glucose tolerance test, assay of insulin, glycosylated hemoglobin, glycogen storage diseases, galactosemia, lactose intolerance, fructosuria, pentosuria, mucopolysaccharidosis, ketone bodies, plasma lipids, lipoproteins, abnormalities, hypo and hyper cholesterolemia, lipidosis. Clinical inter-relationship of lipids (sphingolipidosis, multiple sclerosis), lipoproteins and apo lipoproteins. Diagnostic tests of lipoprotein. HDL – cholesterol, LDL – cholesterol and triglyceride disorders.

UNIT IV:CLINICAL ENZYMOLOGY

9 Hrs

Clinical enzymology – plasma enzymes in diagnosis and prognosis – amino transferases, aldolase, amylase, phosphatases, lipase, elastase, Gamma – glutamyl transferase, 5' nucleotidase. Iso enzymes of ALP and LDH, clinical application of plasma enzyme assays in myocardial infarction, liver diseases and muscle contraction.

UNIT V: EVALUATION OF ORGAN FUNCTION TEST

9 Hrs

Evaluation of organ function test – assessment and clinical manifestation of renal (clearance and tubular function tests), hepatic (proteins, carbohydrates, lipids, pigment metabolism, detoxification, excretion), pancreatic, gastric (FTM, pentagastrin test, insulin stimulation tests) and intestinal functions (malabsorption syndrome, disaccharidoses deficiency)

Total No. of Hrs: 45

TEXT BOOKS

1. H. Varley, A. H. Gowenlock, and M. Bell (2006) *Practical Clinical Biochemistry* (6th Ed) London: Heinemann Medical Books, New Delhi (India) : CBS

REFERENCE BOOKS

1. Ramakrishnan(2001) *Clinical biochemistry*(3rd Ed) Orient Longman private Ltd.



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MBT13ML01

CLINICAL BIOCHEMISTRY AND IMMUNOLOGY LAB

0 0 6 2

OBJECTIVES:

- To know how perform various organ functional tests and using the results obtained the learner should have ability to correlate with normal or abnormal physiology

 1. Estimation of common parameters in urine
 2. Liver profile analysis
 3. Kidney profile analysis
 4. Cholesterol (HDL, LDL) analysis
 5. Detection of C-reactive protein and HBsAg using latex slide test
 6. Peripheral smear staining by Leishman's stain. Interpretation of peripheral smear. Differential count.
 7. Antibody assays a) Immunodiffusion b) Immuno-electrophoresis
 8. Detection of syphilis using VDRL test
 9. Detection of HIV
 10. Sandwich ELISA
 11. Western blotting
 12. Flowcytometer : Analysis of cell surface antigens (demonstration)

REFERENCES/TEXT BOOKS

1. H. Varley, A. H. Gowenlock, and M.Bell (2006) *Practical Clinical Biochemistry* (6th Ed) London: Heinemann Medical Books, New Delhi (India) : CBS



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MBT13ML02

MEDICAL MICROBIOLOGY AND RECOMBINANT DNA LAB

0 0 6 2

OBJECTIVES:

- To understand the practical knowledge of various biochemical phenomena by demonstrate the experiment, their applications and interpret the results.
 - To utilize the knowledge gained in molecular biology, gene manipulation techniques, and cloning vectors in the construction of genomic or cDNA library
1. Gram staining, spore staining, capsule staining
 2. Hanging drop method-motility
 3. Acid fast staining
 4. Biochemical Test-A. Indole test, MR-VP test, Citrate test, TSI test.
B. Catalase ,Oxidase,Coagulase test.
 5. LPCP mount
 6. Plaque assay using bacteriophage.
 7. Haemagglutination test.
 8. Preparation of Competent cells
 9. Transformation
 10. TA cloning
 11. Plasmid mini preps, Plasmid large scale preparation
 12. Restriction mapping
 13. Mutagenesis by chemical agents or UV

REFERENCES/TEXT BOOKS

1. James Cappuccino , Natalie Sherman (2013) *Microbiology : A laboratory manual* (10th Ed) Benjamin Cummings



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MBT13M006

PHARMACOLOGY

3 1 0 4

OBJECTIVES:

- To understand the general pharmacology including pharmacokinetic and pharmacodynamic properties
- To study the mechanism of action of drugs acting on different organ systems

UNIT I: GENERAL PHARMACOLOGY

12Hrs

Introduction to pharmacology, Routes of administration of drugs, their advantages and disadvantages. Various processes of absorption of drugs and the factors affecting them. Metabolism, distribution and excretion of drugs. General mechanism of drugs action and their factors which modify drugs action.

UNITII:DRUGS ACTING ON THE CENTRAL NERVOUS SYSTEM

12Hrs

General anaesthetics- adjunction to anaesthesia, intravenous anaesthetics. Analgesic antipyretics and non-steroidal Anti-inflammatory drugs- Narcotic analgesics. Local anesthetics. Drugs acting on autonomic nervous system. Cholinergic drugs, Anticholinergic drugs, anticholinesterase drugs. Adrenergic drugs and adrenergic receptor blockers. Neurone blockers and ganglion blockers. Neuromuscular blockers,

UNITIII:DRUGS ACTING ON RESPIRATORY SYSTEM

12Hrs

Respiratory stimulants, Bronchodilators, Nasal decongestants, Expectorants and Antitussive agents. Autocoids: physiological role of histamine and serotonin, Histamine and Antihistamines, prostaglandins.

UNITIV:CARDIOVASCULAR DRUGS AND DRUGS ACTING ON DIGESTIVE SYSTEM

12Hrs

Cardiotonics, Antiarrhythmic agents, Anti-anginal agents, Antihypertensive agents, peripheral Vasodilators and drugs used in atherosclerosis. Diuretics and anti-diuretics. Drugs acting on digestive system-carminatives, digestants, Bitters, Antacids and drugs used in peptic ulcer, purgatives ,and laxatives, Antidiarrhoeals, Emetics, Anti-emetics, Antispasmodics.

UNIT V: CHEMOTHERAPY OF MICROBIAL DISEASES:

12Hrs

Antibacterials, Antifungal agents, antiviral drugs, Chemotherapy of protozoal diseases, Anthelmintic drugs. Chemotherapy of cancer.

Total no of Hours: 60

TEXT BOOK

1. B.S sathoskar (2005) *Pharmacology and pharmacotherapeutics* (19th Ed) popular Prakasham.

REFERENCE BOOK

1. Gareth Thomas (2007) *Medicinal Chemistry : An Introduction* (2nd Ed) John Wiley.



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MBT13M007

BIOINFORMATICS

3 0 0 3

OBJECTIVES:

- To learn nucleotide, protein and genome databases and know about the file formats .
- To understand pairwise and multiple sequence alignment and the principle.
- To gain knowledge on approaches for gene prediction methods in prokaryotes and eukaryotes

UNIT I:SEQUENCE DATABASES AND INFORMATION RETRIEVAL

9 Hrs

Sequence Databases and Information Retrieval: Nucleotide Sequence Databases; GenBank, EMBL, DDBJ, all as part of INSDC; accession numbers & annotations, Medical Databases

UNIT II:PAIRWISE SEQUENCE COMPARISONS

9 Hrs

Pairwise Sequence Comparisons: biology of homology, PAM & BLOSSUM scoring matrices, global & local alignment algorithms, statistical significance of pairwise alignments.

UNIT III:BLAST, FASTA AND ADVANCED BLAST

9 Hrs

BLAST, FASTA and Advanced BLAST: Database searching, FASTA algorithm, BLAST ALGORITHM, PSI BLAST, STATISTICAL SIGNIFICANCE OF DATABASE SEARCHES

UNIT IV:PROTEIN SEQUENCE AND STRUCTURE ANALYSES

9 Hrs

Protein Sequence and Structure Analyses : 4 essential perspectives on proteins: (1) domains motifs, (2) physical properties, (3) protein localization, (4) protein function. Gene Ontology for these perspectives in action; proteomics - methods, practices, databases introduction to protein structure and structural genomics; principles of protein structure & protein folding - X-ray crystallography and NMR - the PDB, RCSB, SCOP, CATH, DALI, FSSP & others.

UNIT V:MSA'S OR MULTIPLE SEQUENCE ALIGNMENTS

9 Hrs

MSA's or Multiple Sequence Alignments: Hierarchical and non-hierarchical Methods -MSAs by PSI-BLAST , Tools for MSAs, 3D-PSSM Protein Fold Recognition (Threading) Server: Introduction to Molecular Evolution, Tree nomenclature and structure; the 4 stages of Phylogenetic Analysis, tree-building methods, NJ, MP, ML, tree-evaluation methods, the Bootstrap, Phylogenetics: Introduction to the basics, Models, Assumptions, & Interpretations, How to construct a Tree in 4 steps; the differences, between Parsimony, Distance, and Likelihood.

Total no of Hours: 45

TEXTBOOKS

1. Jonathan Pevsner (2009) *Bioinformatics and Functional Genomics* (2nd Ed) Wiley-Liss
2. Bioinfbook.org - Website dedicated to the text with updated URLs

REFERENCE BOOK

1. Jones NC & Pevzner PA(2004) *An Introduction to Bioinformatics Algorithms*(1st Ed) MIT Press
2. Barry G(2004)*Hall Phylogenetic Trees Made Easy: A How-To Manual* (2nd Ed) Sinauer Associates, Inc.
3. Paul G.Higgs and Teresa K. Attwood (2005) *Bioinformatics and Molecular Evolution* (1stEd)Blackwell Publishers
4. Baxevanis & Oulette (2005)*Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins* (3rd Ed)Wiley-Interscience
5. D.E. Krane & M.L. Raymer (2003)*Fundamental Concepts ofBioinformatics*. Benjamin Cummings



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MBT13M008

GENOMICS

3 0 0 3

OBJECTIVES:

- To study the Structure and organization of prokaryotic and eukaryotic genome
- To give a background idea about Human genome project
- To introduce pharmacogenetics and epigenetics

UNIT I: INTRODUCTION TO GENOMICS

9 Hrs

Introduction – Structure and organization of prokaryotic and eukaryotic genome; Genome size and C value paradox; Repetitive DNA sequences in genome, Tools for genome analysis-RFLP, DNA fingerprinting, RAPD-PCR. Analysis of sequence data : Gene identification, Open Reading Frame (ORF), Exon-intron boundary, Gene prediction methods in prokaryotes and eukaryotes.

UNIT II: GENOME ANALYSIS

9 Hrs

Background of Human genome project, Physical mapping, Markers for physical mapping: Cytogenetic map, STS map, EST map, Radiation hybrid map; Genetic mapping and Linkage analysis; Whole genome sequencing methods – Clone by clone method and shotgun sequencing; Chromosome walking and chromosome jumping; Metagenomics, 16S rRNA typing.

UNIT III: ANALYSIS OF GENE EXPRESSION

9 Hrs

Introduction to gene expression, Methods for gene expression analysis: RNase protection assay, Real-time RT-PCR, SAGE; Comparing transcriptome : Differential Display, Subtractive hybridization; Microarrays – principle, types and methodology of cDNA arrays and Oligonucleotide arrays; Applications of microarrays; Analysis of microarray data.

UNIT IV: PHARMACOGENETICS

9 Hrs

Single nucleotide polymorphisms (SNPs) and types, Techniques for detection of SNPs : RFLP, Allele specific PCR, Allelic discrimination assay; CYP enzymes involved in drug metabolism; Polymorphism in drug metabolizing enzymes and its effects; Process of drug discovery; Phases of clinical trials; High throughput screening for drug discovery.

UNIT V: EPIGENETICS

9 Hrs

DNA methylation, DNA methyl transferases, CpG island methylation, Mechanism of transcriptional repression by methylation, Methods for detection of DNA methylation: Restriction analysis, Bisulfite PCR;

Total no of Hours: 45

TEXT BOOK

1. Campbell AM & Heyer LJ (2007) *Discovering Genomics, Proteomics and Bioinformatics*, (2nd Ed) Benjamin Cummings

REFERENCE BOOK

1. Brown TA(2006) *Genomes* (3rd Ed) Garland Science.
2. Sahai S (1999) *Genomics and Proteomics, Functional and Computational Aspects*. Plenum Publication,.



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MBT13M009

STEM CELL BIOLOGY

3 0 0 3

OBJECTIVES:

- To study the principles of developmental biology in the early embryonic development.
- To study the stem cell processing and its therapeutic applications.

UNIT I : INTRODUCTION TO EMBRYONIC DEVELOPMENT AND STEM CELLS

9 Hrs

Embryonic development, Blastocyst and inner cell mass, Development of differentiated tissues from embryonic germ layers, Function of placenta, amniotic fluid and umbilical chord; Stem cells : Definition, Classification and Properties; Properties and application of Embryonic stem cells.

UNIT II : HEMATOPOIETIC STEM CELLS

9 Hrs

Hematopoiesis – Hierarchy, Properties of Hematopoietic Stem Cells(HSCs), HSCs, Types of HSCs : Long term HSCs, Short term HSCs; Hematopoietic and Stromal cell differentiation; characteristics of Bone marrow stromal cells; Cell surface Markers for HSCs.

UNIT III : STEM CELL PROCESSING AND TRANSPLANTATION

9 Hrs

Sources of stem cells; Cell types for transplantation: Bone marrow, Peripheral stem cells, cord blood stem cells; Types of transplants; Methods of obtaining bone marrow and peripheral blood for transplant, Stem cell processing and storage; HLA matching; Advantages and drawbacks of autologous and allogeneic transplants.

UNIT IV : ADULT STEM CELLS

9 Hrs

Adult stem cell plasticity, Comparison of adult stem cells vs embryonic stem cells, myogenesis; Skeletal muscle stem cells; Epidermal stem cells, Liver stem cells, Stem cell therapies in animal models: Their outcome and possible benefits in humans

UNIT V : STEM CELLS AND THERAPY

9 Hrs

Normal stem cells vs. Cancer stem cells, Clinical uses of hematopoietic stem cells in leukemia, lymphoma and inherited blood disorders; Use of stem cells in diabetes, myocardial infarction, Parkinsons disease.

Total no of Hours: 45

TEXT BOOKS:

1. Robert Lonza(2009)*Essentials of Stem CellBiology* (2nd Ed) Academic Press.
2. Anthony Atala, Robert Lonza, James A.Thomson, Robert Nerem (2011)*Principles of Regenerative Medicine* (2nd Ed)Academic Press

REFERENCE BOOKS

1. Dov Zipori (2009)*Biology of Stem cells and the Molecular basis of the Stem State*. Humana Press.
2. StemBook Cambridge (MA): Harvard Stem Cell Institute; 2008.



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MBT13M010

IMMUNOTECHNOLOGY

3 0 0 3

OBJECTIVES:

- To understand the consequences of immune response
- To study the new generation antibody related immune response
- To study the quantification related techniques of immune response

UNIT I : INTRODUCTION TO IMMUNOTECHNOLOGY

9 Hrs

Kinetics of immune response, memory; Principles of Immunization; Techniques for analysis of Immune response

UNIT II: ANTIBODY RELATED TECHNIQUES

9 Hrs

Immuno-chemistry of Antigens - Immunogenicity, Antigenicity, haptens, Toxins-Toxioids, Hapten-carrier system; Genetic bases of immune response – Heterogeneity; Role and properties of adjuvants, Immune modulators; B cell epitopes; Hybridoma Rabbit, human; Antigen – Antibody interaction, affinity, cross reactivity, specificity, epitope mapping; Immuno assays RIA, ELISA, Western blotting, ELISPOT assay, immunofluorescence, Surface plasma resonance, Biosensor assays for assessing ligand – receptor interaction.

UNIT III: NEW GENERATION ANTIBODIES

9 Hrs

Multigene organization of immunoglobulin genes, Ab diversity; Antibody engineering; Phage display libraries; Antibodies as in vitro and in vivo probes

UNIT IV: CMI AND IMAGING TECHNIQUES

9 Hrs

CD nomenclature, Identification of immune Cells; Principle of Immunofluorescence Microscopy, Fluorochromes; Staining techniques for live cell imaging and fixed cells; Flow cytometry, Instrumentation, Applications; Cell Functional Assays – lymphoproliferation, Cell Cytotoxicity, mixed lymphocyte reaction, Apoptosis, Cytokine expression; Cell cloning, Reporter Assays, In-situ gene expression techniques; Cell imaging Techniques- *In vitro* and *In vivo*; Immuno-electron microscopy; *In vivo* cell tracking techniques; Microarrays; Transgenic mice, gene knock outs

UNIT V: VACCINE TECHNOLOGY

9 Hrs

Rationale vaccine design based on clinical requirements: Hypersensitivity, Immunity to Infection, Autoimmunity, Transplantation, Tumor immunology, immunodeficiency; Active immunization, live, killed, attenuated, Sub unit vaccines; Recombinant DNA and protein based vaccines, plant-based vaccines and reverse vaccinology; Peptide vaccines, conjugate vaccines; Passive Immunization; Antibody, Transfusion of immunocompetent cells, Stem cell therapy; Cell based vaccines

Total no of Hours: 45

TEXT BOOKS :

1. Hay FC, Westwood OMR (2002). Practical Immunology (4th Ed) Blackwell Publishing

REFERENCE BOOKS

1. S. Hockfield, S. Carlson, C. Evans, P. Levitt, J. Pintar, L. Silberstein (1993) *Selected Methods for Antibody and Nucleic Acid probes*, Volume 1, Cold Spring Harbor Laboratory Press.
2. Harlow ED, David Lane (1988) *Antibodies Laboratory Manual*, (2nd Ed) Cold Spring Harbor Laboratory Press.



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MBT13ML03

BIOINFORMATICS LAB

0 0 6 2

OBJECTIVES:

- To demonstrate the protein/DNA sequence search methods and sequence alignment databases.
- To understand and hands-on-training on the genome sequence analysis and annotation.
- To analyze the comparative genomics.
- To use various computational tools for expression analysis to identify open reading frames, mutations, conserved region

Lecture 1: Demonstration of Entrez and SRS`

Lecture 2 : Database Searches with BLAST and FASTA

Practical 1: Simple Sequence Formats- Sequin

Practical 2: Protein secondary structure prediction and tour of protein structure database

Practical 3: Pairwise Sequence Alignment

Practical 4 : Multiple sequence alignment

Practical 5: Gene prediction –eukaryotic

Practical 6: Identification of promoter and transcription factor binding sites

Practical 7: Genome analysis and Annotation

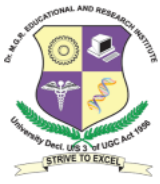
Practical 8: Applications of comparative genomics

Practical 9: computational tools for expression analysis

Practical 10: cluster analysis.

REFERENCES

1. David W. Mount (2004)*Bioinformatics – Sequence and Genome Analysis*(2nd Ed)CSHL press.
2. Andreas E.Baxeavanis, Francis OulletteBF (2001)*Bioinformatics - A practical guide to the analysis of genes and proteins*(2nd Ed)John Wiley.



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MBT13ML04 MOLECULAR GENETIC ANALYSIS LAB

0 0 6 2

OBJECTIVES:

- To learn the principle and methods used in cytogenetics
 - To learn different techniques for chromosome analysis using probes and hybridization
 - To gain knowledge on application of cytogenetic techniques in clinical diagnostics
-
1. Processing of blood samples for DNA, RNA and protein isolation
 2. Genomic DNA isolation by Phenol-Chloroform method and spin column
 3. PCR amplification of mutation and polymorphic region
 4. PCR-RFLP for the detection of SNPs
 5. DNA fingerprinting using RAPD technique
 6. SSCP analysis for the detection of mutations
 7. Diagnosis of bacterial, viral and parasitic diseases using PCR
 8. Southern hybridization
 9. Isolation of RNA from tumor cells or tissue
 10. Reverse Transcriptase PCR (RT-PCR) for studying gene expression/the detection of chromosomal abnormalities
 11. Automated DNA sequencing (demonstration)
 12. Analysis of automated sequencing data



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MBT13M011

PROTEOMICS

3 1 0 4

OBJECTIVES:

- To recapitulate the knowledge on protein structure and its properties.
- To learn different methods in characterizing proteins and protein structure determination.
- To learn protein structure prediction and modeling and mechanism of protein folding and misfolding

UNIT I INTRODUCTION AND SCOPE OF PROTEOMICS

12Hrs

Introduction and scope of proteomics, Protein separation techniques - ion-exchange, size exclusion and affinity chromatography techniques

UNITII:ANALYSISOFPROTEOMES

12Hrs

Analysis of proteomes- Two-dimensional polyacrylamide gel electrophoresis- Sample preparation- Solubilization, Reduction, Resolution- Reproducibility of 2-DE- Image analysis of 2-DE gels.

UNITIII:MASSSPECTROSCOPY

12Hrs

Mass spectrometry - ion source (MALDI, spray sources); analyzer (ToF, quadrupole, quadrupole ion trap) and detector; LC/MS for identification of proteins and modified proteins, *De novo* sequencing using mass spectrometric data, Tryptic digestion of protein and peptide fingerprinting.

UNITIVPULL-DOWNASSAYS

12Hrs

Pull-down assays (using GST-tagged protein), far western analysis, Yeast two hybrid system, Glycobiology and proteomics, Immunomics, Clinical proteomics and disease biomarkers, Protein arrays, Application of proteome analysis in drug development and toxicology.

UNITV:MINIG-PROTEOMICS

12Hrs

Mining proteomics - Protein expression profiling – Identifying protein-protein interaction and protein complexes – Mapping protein modification – New approaches in proteomics.

Total no of Hours: 60

TEXT BOOK

1. John M Walker(2009)*The Protein Protocols Handbook* (3rd Ed) Springer.
2. Robert K Scopes(1994) *Protein Purification* (3rd Ed)Springer.

REFERENCE BOOK

1. Pennington & Dunn (2000)*Proteomics from protein sequence to function* (1st Ed) Garland Science.
2. Richard J Simpson (2009) *Basic Methods in Protein Purification and Analysis* (1st Ed) CSLH Press
3. Campbell AM & Heyer LJ (2006) *Discovering Genomics, Proteomics and Bioinformatics* (2nd Ed)CSLH and Benjamin Cummings.



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MBT13M012

ANIMAL TISSUE CULTURE

3 0 0 3

OBJECTIVES:

- To study the requirements of laboratory design, media and equipments for animal tissue culture
- To make understand the different types of cell culture and its applications including scale up process

UNIT I : CELL CULTURE LABORATORY DESIGN & EQUIPMENTS

9 Hrs

Cell culture lab Layout; Sterile handling area; Incubation; Hot room; Air circulation; Service bench; Laminar flow; Sterilizer; Incubator; CO₂ incubator; Refrigerators and freezers; Centrifuge; Inverted stage microscope; Magnetic stirrer; Liquid nitrogen freezers; Slow cooling system for cell freezing; Washing, packing and sterilization of different materials used in animal cell culture; Aseptic concepts; Maintenance of sterility; Cell culture vessels.

UNIT II: MEDIA AND REAGENTS

9 Hrs

Types of cell culture media; Ingredients of media; Physiochemical properties; CO₂ and bicarbonates; Buffering; Oxygen; Osmolarity; Temperature; Surface tension and foaming; Balance salt solutions; Antibiotics growth supplements; Fetal bovine serum; Serum free media; Trypsin solution; Selection of medium and serum; Conditioned media; Other cell culture reagents; Preparation and sterilization of cell culture media, serum and other reagents.

UNIT III: DIFFERENT TYPES OF CELL CULTURES

9 Hrs

History of animal cell culture; Different tissue culture techniques; Types of primary culture; Chicken embryo fibroblast culture; Chicken liver and kidney culture; Secondary culture; Trypsinization; Cell separation; Continuous cell lines; Suspension culture; Organ culture etc.; Behavior of cells in culture conditions: division, growth pattern, metabolism of estimation of cell number; Development of cell lines; Characterization and maintenance of cell lines, stem cells; Cryopreservation; Common cell culture contaminants.

UNIT IV: APPLICATIONS

9 Hrs

Cell cloning and selection; Transfection and transformation of cells; Commercial scale production of animal cells, stem cells and their application; Application of animal cell culture for *in vitro* testing of drugs; Testing of toxicity of environmental pollutants in cell culture; Application of cell culture technology in production of human and animal viral vaccines and pharmaceutical proteins.

UNIT V: SCALE-UP

9 Hrs

Cell culture reactors; Scale-up in suspension; Scale and complexity; Mixing and aeration; Rotating chambers; Perfused suspension cultures; Fluidized bed reactors for suspension culture; Scale-up in monolayers; Multisurface propagators; Multiarray disks, spirals and tubes; Roller culture; Microcarriers; Perfused monolayer cultures; Membrane perfusion; Hollow fiber perfusion; Matrix perfusion; Microencapsulation; Growth monitoring

Total no of Hours: 45

TEXT BOOK

1. Freshney R I(2005) Culture of Animal Cells, (5th Ed) Wiley-Liss.

REFERENCE BOOKS:

1. John R.W. Masters (2000) *Animal Cell Culture: Practical Approach* (3rdEd) Oxford.
2. Clynes M, (1998) *Animal Cell Culture Techniques* (1st Ed) Springer.



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MBT13M013 INTELLECTUAL PROPERTY RIGHTS, BIOSAFETY, BIOETHICS 3 0 0 3

OBJECTIVES:

- To learn the importance of IPR
- To learn the process involved in patenting and claims
- To understand the requirements of disclosure and patent litigation

UNIT I:INTRODUCTION TO INTELLECTUAL PROPERTY 9 Hrs

Types of IP: Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications, Protection of New GMOs; International framework for the protection of IP, IP as a factor in R&D; IPs of relevance to Biotechnology and few Case Studies; Introduction to History of GATT, WTO, WIPO and TRIPS

UNIT II: CONCEPT OF ‘PRIOR ART’ 9 Hrs

Invention in context of “prior art”; Patent databases; Searching International Databases; Country-wise patent searches (USPTO, EPO, India etc.); Analysis and report formation Basics of Patents -types of patents; Indian Patent Act 1970; Recent Amendments; Filing of a patent application; Precautions before patenting disclosure/non-disclosure; WIPO Treaties; Budapest Treaty; PCT and Implications; Role of a Country Patent Office; Procedure for filing a PCT application

UNIT III:PATENT FILING AND INFRINGEMENT 9 Hrs

Patent application- forms and guidelines, fee structure, time frames; Types of patent applications: provisional and complete specifications; PCT and convention patent applications; International patenting-requirement, procedures and costs; Financial assistance for patenting-introduction to existing schemes; financial incentives Patent infringement-meaning, scope, litigation, case studies and examples; Case studies

UNIT IV: BIOSAFETY 9 Hrs

Introduction; Historical Background; Introduction to Biological Safety Cabinets; Primary Containment for Biohazards; Biosafety Levels; Biosafety Levels of Specific Microorganisms; Recommended Biosafety Levels for Infectious Agents and Infected Animals; Biosafety guidelines - Government of India; Definition of GMOs & LMOs; Roles of Institutional Biosafety Committee, GMO applications in food and agriculture; Environmental release of GMOs; Risk Analysis; Risk Assessment; Risk management and communication; Overview of National Regulations and relevant International Agreements including Cartagena Protocol.

UNIT V: BIOETHICS 9 Hrs

Concepts and principles relevance to Biotechnology; Ethics and the Law Issues: Genetic Engineering, Stem Cells, Cloning, Medical techniques, Bioweapons; Research concerns - Animal Rights, Ethics of Human Cloning, Reproduction and Stem Cell Research; Emerging issues: Biotechnology's Impact on Society.

Total no of Hours: 45

TEXTS/REFERENCES:

1. BAREACT, Indian Patent Act 1970 Acts & Rules(2007) Universal LawPublishing Co. Pvt. Ltd.
2. Kankanala C(2007) *Genetic Patent Law & Strategy* (1st Ed)Manupatra Information Solution Pvt. Ltd.

IMPORTANT LINKS:

- <http://www.w3.org/IPR/>
<http://www.wipo.int/portal/index.html.en>
http://www.ipr.co.uk/IP_conventions/patent_cooperation_treaty.html
www.patentoffice.nic.in/www.iprlawindia.org/ - 31k - Cached - Similar page



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MMA130023 RESEARCH METHODOLOGY AND STATISTICAL ANALYSIS

3 1 0 4

OBJECTIVES:

- To identify the research problem and to design the experiment
- To measure the statistical significance of the designed experiments
- To learn how to prepare the thesis or manuscript for publication

UNIT I: IDENTIFICATION OF RESEARCH PROBLEM & EXPERIMENTAL DESIGN

12Hrs

Classification of research, Definition & Identification of research problem, Steps in research process, Experimental design, Literature search, Different systems of citing references, Components of a research report, Formulation of research objectives, Hypotheses, Variables & types, Types of Study: Non-intervention studies & Intervention studies.

UNIT II: SAMPLING TECHNIQUES AND MEASURES OF CENTRAL TENDENCY & DISPERSION

12Hrs

Sampling techniques, Measures of central tendency: mean, median and mode; Measures of dispersion: Range, Standard deviation and Coefficient of variation; Measures of skewness; Probability, Types of Distributions – Normal, Binomial, Poisson.

UNIT III: TESTING OF HYPOTHESIS

12Hrs

Testing of hypothesis; Null and alternative hypothesis; Type I and type II errors; Level of significance; P value; Tests of significance of single and two sample means: F-test, Fisher's exact test, independent t test, paired t test, Chi square test.

UNIT IV : CORRELATION, REGRESSION & ANALYSIS OF VARIANCE

12Hrs

Correlation analysis – Types, Pearson's correlation coefficient and Spearman's rank correlation; Regression analysis & Types. Analysis of variance (ANOVA) – definition – assumptions – model; One way analysis of variance with equal and unequal replications; Two way analysis of variance; Non parametric tests – Mann Whitney 'U' test & Kruskal Wallis test.

UNIT V: ANIMAL ETHICS GUIDELINES AND PREPARATION OF MANUSCRIPT & THESIS FOR SUBMISSION

12Hrs

Animal ethics guidelines & handling animal models (Mice, Rat and Rabbit), Writing a manuscript, Submission of manuscript in a journal, submission of abstract in a conference, Writing a thesis, Citation index, h-index, Impact factor of journals, Citation of references in a manuscript using online tools, Presentation of data (tables/figures): 1-D and 2-D bar charts, pie diagrams, graphs (using computer software packages).

Total no of Hours: 60

TEXT BOOKS

1. Vijayalakshmi G and Sivaparagasam C(2009)*Research Methods – Tips and techniques*(5th Ed) MJP Publishers.
2. Sundar Rao PSS, Richard PH, Richard J (2003) *An introduction to Biostatistics* (4th Ed) Prentice Hall of India(P) Ltd., New Delhi.

REFERENCE BOOKS

1. Kothari CR (2004) *Research Methodology-Methods and techniques* (2nd Ed) New age international Limited publishers, New Delhi.
2. Suresh C. Sinha and Anil K. Dhiman (2002) *Research Methodology* (1st Ed)New Delhi, 2 volumes, 860 p.
3. Gupta SP(2005) *Statistical Methods* (6th Ed) Sultan Chand & Sons, New Delhi.
4. Jerrold H. Zar (2003)*Bio Statistical Analysis* .Tan Prints(I) Pvt. Ltd., New Delhi.



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MBT13ML05

ANIMAL TISSUE CULTURE LAB

0 0 6 2

OBJECTIVES:

- To be aware of tissue culture laboratory practices and maintaining sterility in lab
 - To learn the composition and preparation of plant and animal tissue culture medium
 - To apply the concepts learned in biochemistry and microbiology for understanding the role of medium in animal cell culture
-
1. Preparation of tissue culture medium and Tissue culture lab practices
 2. Preparation primary cell cultures from various organs (Liver, kidney, spleen)
 3. Suspension culture
 4. Culture of adherent cells
 5. Cell scraping and enzymatic digestion of breaking cell adherence to the flask and cell passaging
 6. Enumeration of cell number and cell viability.
 7. Cell counting
 8. Cell cytotoxicity assay: MTT assay
 9. Cryopreservation of cells
 10. Revival and subculture of frozen cells
 11. Leukocyte culture
 12. Organ culture

REFERENCES

1. Clynes M, (1998) *Animal Cell Culture Techniques* (1st Ed) Springer.



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MBT13ML06 PROJECT LITERATURE REVIEW AND PROJECT PROPOSAL 0 0 3 1

The student is expected to choose a research project and collect relevant literature regarding previous work and give an outline of the research proposal. Feasibility of the methodology, plan of experiments and future applications must also be given.

The student will be graded by a committee.



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MBT13ME01 **HERBAL DRUG TECHNOLOGY** **3 0 0 3**

OBJECTIVES:

- To explain the concept of phytochemical technology and various methods of its extraction.
- The objective also includes the analysis of plant drugs and standardization of herbal drugs.

UNIT I :INTRODUCTION TO MEDICINAL PLANTS **9Hrs**

Introduction to Medicinal Plants, Classification of secondary metabolites, Medicinal importance of secondary metabolites like Flavonoids, Phenols, Alkaloids, Tannins Terpenes and Saponins.

UNIT II: EXTRACTION OF PHYTO PHARMACEUTICALS **9Hrs**

Extraction of Phyto pharmaceuticals – Infusion, Decoction, Digestion, Maceration, Percolation, Successive Solvent Extraction, Super Critical Fluid Extraction

UNIT III:EXTRACTION OF PHYTO PHARMACEUTICALS **9Hrs**

Steam Distillation, Headspace Techniques, Sepbox, Selection of Suitable Extraction Process, Carbohydrates, Proteins, Alkaloids, Glycosides.

UNIT IV:APPLICATION OF CHROMOTOGRAPHY AND SPECTROSCOPY IN PLANT DRUG ANALYSIS **9Hrs**

Application of Chromatography and Spectroscopy in Plant Drug Analysis – Infrared Spectroscopy, NMR Spectroscopy, Mass Spectroscopy.

UNITV:STANDARDIZATION OF HERBAL DRUGS **9Hrs**

Standardization of Herbal Drugs – Importance of Standardization and Problems Involved in the Standardization of Herbs, Standardization of Single Drugs and Compound Formulations, WHO Guidelines for Quality Standardized Herbal Formulation, Estimation of Parameter Limits used for Standardization, Herbal Extracts.

Total no of Hours: 45

REFERENCE BOOK

1. S.S. Agarwal, M.Paridhavi (2013) *Herbal Drug Technology* (2nd Ed) Orient Blackswan.



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MBT13ME02

CLINICAL RESEARCH

3 0 0 3

OBJECTIVES:

- To explain the basics of clinical research including New drug discovery process
- To explain the fundamentals of clinical research
- To explain the ethics and regulatory affairs of the clinical trials

UNIT I: BASICS OF CLINICAL RESEARCH

9 Hrs

Basic pharmacology and clinical research, New drug discovery process, Pre clinical toxicology: Carcinogenicity, Mutagenicity, Teratogenicity, Single dose and repeat dose toxicity studies, Reproductive toxicity, Basic terminology used in clinical research.

UNIT II : ETHICS IN CLINICAL RESEARCH

9Hrs

Ethical Theories and Foundations, Ethics Review Committee and Informed Consent Process, Integrity & Misconduct in Clinical Research, Conflicts of Interest, Ethical issues.

UNIT III : FUNDAMENTALS OF CLINICAL TRIALS

9Hrs

Fundamental principles of comparative clinical trials in investigating effectiveness, efficacy and safety of treatments; Types of clinical trials, Design and organization of phase-I, phase-II, phase-III, phase-IV trials, various regulatory requirements in clinical trials, Schedule Y, ICMR guidelines, etc.

UNIT IV:4 BASIC STATISTICS FOR CLINICAL TRIALS

9Hrs

Basic statistical methods used in clinical trials. To select and apply appropriate statistical methods to analyse data from clinical trials, presenting, interpreting and discussing the analyses, basic data analyses from clinical trials using the computer-based 'Stata' software package.

UNIT V :REGULATORY AFFAIRS, GOOD CLINICAL PRACTICE

9Hrs

Regulatory legislation and associated approvals and permissions required to conduct high-quality single-centre, national and international clinical trials. Good Clinical Practice (GCP), ways of implementing GCP including risk assessment and trial monitoring.

Total no of Hours: 45

TEXT BOOK

1. Gupta SK (2007) *Basic Principles of Clinical Research and Methodology* (1st Ed) JPB.

REFERENCE BOOKS:

2. John I. Gallin, Frederick P Ognibene (2012) *Principles and Practice of Clinical Research* (3rd Ed) Academic Press.
3. Dr.Arun Bhatt . *Good trial and good clinical practice*. Career publication.



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MBT13ME03

CANCER BIOLOGY

3 0 0 3

OBJECTIVES:

- To understand the fundamentals of cancer biology regarding cell cycle, mutational changes in signaling molecules, types of cancer, early detection methods and cancer screening methods, etc.

UNIT I : FUNDAMENTALS OF CANCER BIOLOGY

9Hrs

Regulation of cell cycle, mutations that cause changes in signal molecules, effects on receptor, signal switches, tumor suppressor genes, modulation of cell cycle in cancer, different forms of cancers, diet and cancer. Cancer screening and early detection, Detection using biochemical assays, tumor markers, molecular tools for early diagnosis of cancer.

UNIT II : PRINCIPLES OF CARCINOGENESIS

9Hrs

Theory of carcinogenesis, Chemical carcinogenesis, metabolism of carcinogenesis, principles of physical carcinogenesis, x-ray radiation-mechanisms of radiation carcinogenesis.

UNIT III : PRINCIPLES OF MOLECULAR CELL BIOLOGY OF CANCER

9Hrs

Signal targets and cancer, activation of kinases; Oncogenes, identification of oncogenes,retroviruses and oncogenes, detection of oncogenes. Oncogenes/proto oncogene activity. Growth factors related to transformation. Telomerases.

UNIT IV : PRINCIPLES OF CANCER METASTASIS

9Hrs

Clinical significances of invasion, heterogeneity of metastatic phenotype, metastatic cascade, basement membrane disruption, three step theory of invasion, proteinases and tumour cell invasion.

UNIT V : CANCER THERAPY

9Hrs

Phases of clinical trials, clinical research ICMR guidelines in brief, Different forms of therapy, chemotherapy, radiation therapy, detection of cancers, prediction of aggressiveness of cancer, advances in cancer detection. Use of signal targets towards therapy of cancer; Gene therapy,

Total Hours:45

TEXT BOOK:

1. Franks LM. Teich NM. (1991) *An Introduction To Cellular And Molecular Biology Of Cancer* , Oxford Medical Publications.

REFERENCE BOOKS:

1. Maly BWJ 1987 *Virology A Practical Approach* , IRLI Press, Oxford.
2. Dunmock NJ And Primrose SB,(1988) *Introduction To Modern Virology* , Blackwell Scientific Publications, Oxford.



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MBT13L07

PROJECT REPORT AND VIVA VOCE

0 0 24 15

Individual student was expected to choose a research problem and execute it with proper data. He/ She will explain their research project to a committee of faculty members