RESTRUCTURED CURRICULUM PHASE IV EFFECTIVE FROM 2012-13

M.Sc., Biomedical Instrumentation Science

SEMESTER-I

S.No	TITLE OF THE PAPER	Cont Hrs	Credits
	MAJOR CORE (MC)PAPERS		
1	Tools and Techniques in Cell Biology	5	4
2	Tools and Techniques in Medical Biochemistry	5	4
3	Principles and Practice of Hematology	5	4
4	Diagnostic Microbiology	5	4
5	Hematology and Cell Biology- Lab course	5	2
6	Medical Biochemistry and Microbiology - Lab course	5	2
	LEAP	Outside	
		class hrs	
	TOTAL CONTACT HOURS AND CREDITS	30	20

SEMESTER ---II

S.No	TITLE OF THE PAPER	Cont Hrs	Credits
	MAJOR CORE (MC)PAPERS		
1	Stem cell Technology	5	4
2	Separation techniques for Bio molecules	5	4
3	r-DNA technology	5	4
4	Separation Techniques for biomolecules - Lab course	5	4
5	r-DNA technology - Lab course	4	4
	ELECTIVE SUBJECTS(ES) PAPER		
	Applied Electronics in instrumentation Science/	4	3
	Therapeutic drug monitor		
	(Not more than 2 papers at a time)		
	LIFE SKILLS TRAINING(LST)	2(inside)	2
		+2(outside)	
	LEAP	Outside	3
		class hours	
	Total credits	30+2	25+3=28

BI 1814 - TOOLS AND TECHNIQUES IN CELL BIOLOGY

SEMESTER: I CATEGOR: MC

CREDIT : 04 NO. OF HOURS / WEEK : 05

Objectives: To study the techniques of Cell and Molecular biology and describe their implications in Biomedical Sciences.

UNIT I: MICROSCOPY

Principles and application Light, Phase contrast, Fluorescence, Scanning and Transmission electron microscopes.Micrometry, Micro techniques, Fixation, Staining-Staining methods-Vital staining-Histochemical Staining.

UNIT II: CELL STRUCTURE

Structure of Prokaryotic and Eukaryoticcells- Plasma membrane-ultra structure,models and functions-Intracellular components-Cytoskeleton- Mitochondria -structure and respiratory chain complexes; Structure and function of peroxisome; Nucleolus and biosynthesis of ribosome;nucleus- structure and organization of chromatin. Cell cycle. Cytology of cancer, Characteristics of cancer cells, Carcinogens and carcinogenesis.

UNIT III: CYTOCHEMICAL TECHNIQUES

Cell fractionation, Homogenization, Isolation of cellular components, Sedimentation and Ultra centrifugation (Velocity and buoyant density). Chromosomal detection techniques-cytogenetic techniques, mitosis and meiosis-metaphase chromosomes preparations, karyotyping, identification of chromosomal abnormalities, silver staining techniques.

UNIT IV: CYTOPHOTOMETRY AND FLOW CYTOMETRY

Cell cytometry, Florescence activated cell sorting (FACS), Flow cytometry. Cell surface analysis of proteins using fluorescent dyes. Stem cell technique.

UNIT V: DNA DIAGNOSTIC SYSTEMS

Hybridization probes, PCR, DNA fingerprinting, DNA Microarray, FISH Technique, Molecular diagnosis of genetic diseases. Biothesiometric technique, Auto analyzer, LASER.

REFERENCES:

1. De Robertis EDP and EMF De Robertis (2000), Cell and Molecular Biology- Sounders CollegePhiladelphia.

2. Ajoy Paul 2007 Text BOOK OF Cell and Molecular Biology ArunabhaSen Books and Allied (P) Ltd Kolkata.

3. Murray-Moo-Young (1989) Animal Biotechnology-PergamonPress,Oxford.

4. Spier R.E and J.B.Griffiths (1988) Animal cell Biotechnology, New york.

5. LesleCromwell, FredJ. Weibell and Erich. A. Pfeiffer (2009) Biomedical Instrumentation and Measurements, II Edition. PHI Learning Pvt Limited

6. SatinderAheja(2000) Handbook of bioseperations. Vol.2. Academy Press Newyork.

7. Ghai.C.L. (1999). A Text book of Practical Physiology 5TH Edn.Jaypee Publ.(P)Ltd.

BI 1815 - TOOLS AND TECHNIQUES IN MEDICAL BIOCHEMISTRY

SEMESTER: I CATEGORY: MC

CREDIT : 04 NO. OF HOURS / WEEK : 05

Objectives: To allow the students to get acquainted with the tasks and work of clinical biochemical laboratories and the uses of biochemical methods for the diagnosis and monitoring of pathological status condition.

Unit I

Automation and practices of clinical biochemistry: Laboratory safety – toxic chemicals and biohazards, Automation in clinical laboratory- Analyzers. Computers in clinical laboratory. Precision, reliability, reproducibility and other factors in quality control.Normal values in health and diseases, Specimen collection and processing (blood, urine feaces and CSF), storage of specimens.

Unit IIBlood Gases, pH (acid base balance) and Buffer systems, Electrolytes.Osmolarity.

Biotrasformations of Xenobiotics-Detoxification, Lipid peroxidation, free radicals and antioxidants, Nitric oxide formation & its metabolism and its role in Medicine.Biochemical detection of ischemic myocardium-Hypoxia and ischemia - changes of metabolism (glycolysis, transamination, degradation of nucleotides, lactate- pyruvate) - LDH a CK isoforms, cardiac markers, myoglobins, biochemical demodulation of cardiac muscle (proteins and phospholipids - congenital heart disease).Tumour markers.

Unit III

Endocrinology- mechanism of hormonal action, classification of hormones, Biochemistry of inflammation- Mediators of inflammation .Disorders of carbohydrate metabolism:Carbohydrate metabolism - Disorders of fructose, and galactose metabolism, Regulation of blood glucose and its disorders, Mucopolysaccharidoses.

UNIT IV:

Disorders of Amino Acid Metabolism: Metabolic disorders of amino acids, Congenital AA disease - basic knowledge and possible treatmentPlasma lipids and lipoprotein abnormalities: hypercholesterolemia- lipidosis and hypolipoproteinemias, Taysach s and Niemann picks diseases. Dyslipoproteinaemia,

Vitamins (fat soluble and water soluble and their deficiency disorders),

Disorders of erythrocyte metabolism- Hemoglobin and Myoglobin - hemoglobinopathies, thalassemias and anemias.

Disorders of nucleic acid metabolism-hypo and hyperuricemia, gout.orotaciduria. aminoacidurias, organic acidurias.

Paediatric clinical chemistry- diseases of the newborn and the complications.

Porphyrins, Porphyrias,

Unit V

Renal function tests, Liver function tests, Gastrointestinal function tests, Pancreatic function test, Thyroid function tests.

REFERENCES:

- 1. David L.Nelson& Cox, 2000.Lehninger Principles of Biochemistry, Blackwell, London.
- 2. RanaShinde&M.N.Chatterjee, 2005.Textbook of Medical Biochemistry, Jaypee Brothers, New Delhi.
- 3. Zubay, Principles of Biochemistry, 1998. WMC Brown Publishers, New York
- 4. Voet&Voet, 1999. Fundamentals of Biochemistry, John Wiley & Sons, New York
- 5. Geoffrey. L. Zubay, 1999.Biochemistry- 4th Edition, WMC Brown Publishers, New York.
- 6. Deb, A.C.1999. Fundamentals of Biochemistry.Chand Publications, New Delhi.
- 7. Hames& Hooper, 2003. Instant Notes Biochemistry, 2nd Ed, Bios Scientific Publishers, Oxford.
- 8. Michael L Bishop, Edward P Fody, Larry E Schoeff. 2009. Clinical Chemistry: Principles, Procedures, Correlations, Wolters Kluwer (India) Pvt Ltd.
- 9. Carl A. Burtis and Edward R. Ashwood.2008. Tietz Fundamentals of Clinical Chemistry, Elsevier, Philadelphia.

10. Carl A. Burtis and Edward R. Ashwood.2006. Tietz Textbook of Clinical Chemistry and Molecular Diagnosis. Fourth edition, Elsevier

11. Robert K.Murray, DarnylK.Granner, Peter A.Mayes and Victor W. Rodwell. Harpers Illustrated Biochemistry. 2003. 26th Edition, McGraw Hill

BI 1816 - PRINCIPLES AND PRACTICE OF HEMATOLOGY

SEMESTER : I CATEGORY : MC CREDITS : 04 NO. OF HOURS / WEEK : 05

Objectives:To understand the mechanism of blood formation and their abnormalities in various types of disorders.

UNIT I:Components of the blood

Blood coponenet preparation & storage -plasma and cellular elements and their functions- haemopoetic system of the body - Leucopoiesis, Erythropoiesis and Thrombopoiesis.Study of morphology of RBC & WBC. Human Blood Group system-Collection and processing of blood for transfusion (blood bank)&Transfusion Reactions-Hemolytic disease of the new born. Blood volume - Body fluid - Plasma protein.

UNIT II:Red cell Disorder

Haemostasis – disorders and regulation- types of Anemia- deficiency of iron, B12 and Folic acid, Haemolytic, Aplastic and Megaloplastic genetic disorders, bleeding disorders of man. Diagnosis of Anemia using MCH, MCV & MCHC.Autoanalizer, Flowcytometry - fragility of Red bloods cells -Tissue fluid of Edema and Iron metabolism

UNIT III:Coagulation system

Clinical Hematological features of the various sickle diseases-screening for sickle cell anemia time and thrombin time, Bleeding time (Duke's Method), clotting time (Lee-White Method, Capillary Method), Clot Retraction and lysis time, Prothrombin time, Plasma Recalcification time, Protamine Sulfate test, Fibrinogen determination. Mechanism of coagulation of blood.

UNIT IV:Hemogram

Determination of hemoglobin by Cyanmethenoglobin method and Sahli's method, Determination of PCV by Microhematocrit method and Macrohematocrit method, ESR (Wintrobe method, Westergren's method, Landau method) RBC, WBC count, Total and differential count, Platelet Count-inherited platelet function disorder- Reticulocyte count, Absolute Eosinophil Count.

UNIT V:Special hematological tests

Osmotic fragility test- Quantitation of HbF-Estimation of red cell folate- serum folateserum cobalamine-G6PD-Heinz body preparation- blood parasites- screening of blood parasite test –Lupus Erythrematosis (LE) cell preparation,Quality control and Quality assessment - Preparation of Haemin crystals -hemolytic agents on Red blood corpuscles.

REFERENCES:

- 1. Praful B & Godkar P, 2003. Textbook of Medical Laboratory Technology, 2nd Edition.
- 2. Mukherjee L. 1999, Medical Laboratory Technology, Volume I, Tata McGraw Hill, New Delhi.
- 3. Ochei J, Kolhatkar A.2000. Medical Laboratory Science. Theory and Practice, Tata McGraw Hill, New Delhi.
- 4. SabitriSanyal, . 2000.Clinical Pathology, BI Churchill Livingstone [P] Itd. New Delhi.
- 5. Emmanuel C et al., 2003. Hematology, Harwal Publishers, Pensylvannia.

- 6. RamnikSood, 2005, Medical Laboratory Methods, Jaypee brothers, New Delhi.
- 7. Robert H.Carman, Medical Laboratory Technology, 1999, CMAI, Canada.
- 8. Guyton and Hall, 2002. Textbook of Medical Physiology, 10th Edition Elsevier, New Delhi.
- 9. Sembulingam, 2000. Essential of Medical Physiology, 2nd Edition laypee, New Delhi.

10. Handian. R.I etal., 1995. Blood: Principles and practice of hematology. Philadephia: Lippincott.

BI 1817- DIAGNOSTIC MICROBIOLOGY

SEMESTER: 1	CREDITS	: 04
CATEGORY: MC	NO. OF HOURS/WEEKS	: 05

Objectives:Diagnostic microbiology is a specialty in the sciences which focuses on applying microbiology to medical diagnosis. The students gain knowledge which allows them access to a variety of equipment which they can use to identify and study the organisms they encounter, handle diagnostic testing for hospitals and also work in research and development, helping to develop new diagnostic techniques and treatments for microbial infection.

UNIT I. Basic Medical Microbiology - Microbial Taxonomy- Bacterial Genetics, Metabolism, and Structure- Host-Microorganism Interactions-Innate defenses of the body-transmission- parasite survival strategies and infection. Infective syndromes.

UNIT II: General Principles in Clinical Microbiology : Safety & Specimen Management, Approaches to Diagnosis of Infectious Diseases- Role of Microscopy- Traditional Cultivation and Identification-Nucleic Acid-Based Analytic Methods For Microbial Identification And Characterization-Immunochemical Methods Used for Organism Detection- Serologic Diagnosis of Infectious Diseases

UNIT III: Antimicrobial Activity and chemotherapy: Selective toxicity-discovery and design of antimicrobial agents-Principles of Antimicrobial Action & Resistance-classification- Laboratory Methods and Strategies for Antimicrobial Susceptibility Testing- uses and abuses(case studies)

UNIT VI: Vaccination: types, strategies. Community based control vaccination- factors affecting the success of vaccination- passive immunization with antibody- non-specific cellular immunostimulation-Correction of host immunodeficiency

UNIT V: Clinical Laboratory Management –common nosocomial infection-causes-sources and routes of transmission- Laboratory Physical Design, Management, and Organization- Quality in the Clinical Microbiology Laboratory- Infection Control- Sentinel Laboratory Response to Bioterrorism

REFERENCES:-

- 1. Manual of clinical microbiology.8th Edition. Patrick.R.Murrayet al.ASM Press. Washington DC.
- 2. Bailey & Scott's Diagnostic Microbiology,12TH Edition, Elsevier- Mosby Publication.
- 3. Medical microbiology- a guide to microbial infection, pathogensis, immunity, Laboratory diagnosis and control. Edited by David Greenwood et al. International Edition (16 th edition) Churchill Living ston Publication.

 Color Atlas and Textbook of Diagnostic Microbiology Elmer W. Koneman, Stephen D. Allen ,William M. Janda, Paul C. Schreckenberger ,Washington C. Winn . Lippincott Williams & Wilkins; 5th edition (March 28, 1997)

BI 1818 - HEMATOLOGY AND CELL BIOLOGY- LAB COURSE

SEMESTER :I CATEGORY :MC

CREDIT: 02 NO. OF HOURS / WEEK : 05

Objectives:To provide a detailed understanding of clinical features and laboratory diagnosis hematological diseases

To enable students acquire diagnostic skills in recent developments in cell biology

UNIT I: HAEMOGRAM

Clotting time, Bleeding time, Hemoglobin estimation, Erythrocyte Sedimentation Rate, Packed cell volume, MCV.

UNIT II: COMPLETE BLOOD COUNT

Prothrombin time, Differential count, Total Red Blood cell count, Total white blood cell, Platelet count, Eosinophilic count, Reticulocyte count, Specific gravity of blood & plasma.

UNIT III: SPECIAL INVESTIGATIONS:

Osmotic fragility, Heinz body preparation, Sickle cell preparation, Estimation of glycosylated heamoglobin, Cell preparation and Cytochemical tests.

UNIT IV: CYTOGENETIC TECHNIQUES

Lencocyte culture, Metaphase Chromosomes - Preparation from human blood, Banding techniques, Karyotyping - Identification of Chromosome abnormalities - Silver staining techniques

Karyotyping of Chromosomes

Cell Viability Count- Tryphan Blue Dye Exclusion Assay

UNIT V: Demonstration

Hybridization probes,- FISHtechnique-, flow cytometry and cell sorting REFERENCE:

- 1. Praful B & Godkar P, 2003. Textbook of Medical Laboratory Technology, 2nd Edition.
- 2. RamnikSood, 2005,Medical Laboratory Methods, Jaypee brothers, New Delhi.
- 3. Robert H.Carman, Medical Laboratory Technology, 1999, CMAI, Canada
- 4. Ghair.C.L. (1999). A Text book of Practical Physoviology 5TH Edn.Jaypee Publ. (P)Ltd.

5.Schancover. 2000, Molecular Cloning Protocols.Vol 1-3 Blackwell Publishers.New York. 6.Marimuthu P. 1995, Practical Genelies IBMS.

7. Janarthanan& Vincent Practical biotechnology. 2006, Unic Press, New Delhi.

BI 1819- MEDICAL BIOCHEMISTRY AND MICROBIOLOGY - LAB COURSE

SEMESTER : I CATEGORY : MC CREDIT: 02 NO. OF HOURS / WEEK : 05

Objectives: To allow the students to get acquainted with medical laboratories and the uses of biochemical methods for the diagnosis and monitoring of pathological status condition.

To impart skills on the important microbiological techniques used in clinical diagnosis

COLLECTION OF SAMPLES

Capillary blood, venous blood, saliva, urine. Laboratory visits

UNIT I: SERUM ANALYSIS I

Estimation of Blood Sugar – GOD-POD METHOD Estimation of Total Protein – Lowry's Method & Biuret's Method Estimation of Total Cholesterol – CHOD Method Estimation of Urea in blood – Berthelot Method

UNIT II: ENZYME ASSAYS

Assay of the activity of Serum Glutamate Oxaloacetate transaminase (kinetic method) Assay of the activity of Serum glutamate Pyruvate transaminase (kinetic method) Assay of the activity Lactate Dehydrogenase Assay of the activity of Cholinesterase

UNIT III: (I) HORMONES AND URINE ANALYSIS

TSH

Estimation of Creatinine in Urine- Alkaline Picrate Method.

(ii) Biochemical Preparations

Cytochrome C, Urease from horse gram. Casein and lactalbumin from milk

UNIT IV: STAINING AND CULTURE TECHNIQUES

Preparation of media and reagents- Sterilization, Serial dilution Method, Media preparation; Plating Techniques - Pour plate, Spread Plate and Streak Plate. Simple staining and Gram's staining.

UNIT V: IDENTIFICATION AND ISOLATION OF MICROORGANISMS

Isolation of microorganisms from clinically important specimens.

Isolation and identification of bacteria and fungi. Antibiotic sensitivty test-Antimicrobial assay-MIC

REFERENCES:

1. Gowenlock, 2001. Varley's Practical Clinical Biochemistry, CBS Press, New Delhi.

2. Mukherjee L. 1996. Medical Laboratory Technology, Volume I, Tata McGraw Hill, New Delhi.

3. Mary vijaya, T, Mini, M.L., Sunitha kumara, K., Asha, K.R.T. 2003. Practical clinical biochemistry manual. Rishi publications. Kaliakkavilai.

4. Sadasivam, S and Manikam, A. 1992. Biochemical methods for agricultural sciences. Wiley Eastern Limited.

5. Gunesekaran, P, 1996. LaboratoryManuelinMicrobiology, NewAge international, India.

6. Fischbach, F.T., Dunning, M.B, 2002. A Manuel of Laboratory and Diagnostic Tests.LippinocottWilliamsandWilkins, Baltimore.

BI 2812- STEM CELL TECHNOLOGY

SEMESTER : II CATEGORY : MC

CREDITS : 04 NO. OF HOURS / WEEK : 05

Objective-To provide knowledge on the recent developments in stem cell technology to meet the present needs and demands.

UNIT I: The nature of stem cells, adult stem cells, fetal tissue stem cells ,nuclear transfer stem cells, embryonic stem cells - human cloning. The dividing cells - the cell cycle, stimulating cell division-molecular biology of cell division.

UNIT II: Egg specific functions-structure of the human egg, egg growth,oocyte meiosis-Molecular mei biology of oocyte meiosis. Assisted reproductive technologies-IVM,IVF, METHODS-ICST, GIFT, and ZIFT. The activated egg-Spontaneous egg activation-artificial egg activation-egg activation by sperm-egg activation in IN VITRO fertilization-egg activation following nuclear transplantation- molecular biology of egg activation-Cleavage of human eggs.

UNIT III: The zygote, blastomeric cleavage,the first,secondand fragmented cleavages,the third,fourth,&Fifth cleavages-Development of tissue culture media,molecular biology of blastomeric cleavage-Blastocyst and inner cell mass cells.Organogenesis.Parthenotes - androgenotes,gynogenotes,haplodand diploidparthenotes.Basic nuclear transfertechnology -

transfer of nuclei into frog eggs. Development potential of transplanted nuclei – Transcription, gene expression and translation reprogramming a nucleus.

UNIT IV: -Tissue engineering-biomaterials.scaffolds-for skin graft,bone graft -human and pig.Stemcell engineering-division of stem cells-properties of stem cells-growing ESCS in laboratories.Esc,-Differentiation of adult cells-*C. elegance*, Zebra fish and frog. Potential therapeutic applications of stem cells.

UNIT V: Stem cell therapies – neurodegenerative diseases. Parkinson. Alzheimer, and other brain syndromes-spinal cord injuries,tissue system failures,diabetes, cardiomymopathy, kidney failure, Liver failure, cancer, haemophiliaand muscular dystrophy-cell replace therapy - regenerative medicine.Human embryonic cells and society-The religious,legal,ethical and scientific debate.

References

1.Keissling .A &Anderson(2003)Human embryonic stem cells .An introduction to science andTherapeutic potential.JonesandBarlett Publishers.

2.Andrew Read and Dian DONNAI (2007) New clinical Genetics, Scion Publishing Ltd.UK.

3.RicidLevis (2003) Human Genetics .Concepts and applications.Wiley Publications,USA

4.Ramawat K.G.&ShailyGoyal (2009)Comprehensive Biotechnology-4th Edition Chand&company.

5.Brown T.A 1998.Gene cloning and DNA AnalysisBlackwell science Oxford.

6.Scott F.Gilbert(2007).Developmental Biology.8THEditin.AndrewDsinavar Associates Publisher USA.

BI 2813 - SEPARATION TECHNIQUES FOR BIOMOLECULES

SEMESTER : II Category : MC

CREDITS : 04 NO. OF HOURS / WEEK : 05

Objective:To impart knowledge on the different techniques involved in the separation of biomolecules whereby the students can apply it in clinical research.

UNIT I: Basic principles and concepts

General principles of Chromatography, Recent advances in separation techniques based on size, surface properties, ionic properties and other special characteristics of substances, Process, concept, Theory and equipment by different techniques and various Detectors – Applications –Distillation- Crystallization.

UNIT II: Chromatographic techniques

Analytical techniques for biomolecule separation:Paper Chromatography(PC),Thin Layer Chromatography(TLC), Ion Exchange Chromatography, Gel Exclusion Chromatography(GLC),Affinity Chromatography, Gas liquid chromatography(GLC), High Performance Liquid Chromatography(HPLC) & detectors, Fast performance Liquid Chromatography (FPLC) –Supercritical Fluid Chromatography(SFC), Instrumentation and application.

UNIT III: Electrophoretic techniques

General Principles of Electrophoresis – SDS PAGE- Isoelectric focusing- 2D gel electrophoresis- Immuno electrophoresis & types of immune electrophoresis, Densitometry & its applications,- PCR- Western blotting - Adsorption spectrophotometer - Fluorescence Spectrophotometer.

UNIT IV:Separation of Nucleic acids by Electrophoretic techniques (southern & northern blotting) Agarose gel electrophoresis, Pulse field gel Electrophoresis, Capillary Electrophoresis. Southern and northern Blotting -Nuclear Magnetic resonance- Atomic absorption spectroscopy: Instrumentation, Principle and applications Spectroscopy-crystallography. Photometry: Basic principles and applications of colorimetry-UV-visiblespectrophotometry and IR-Spectrophotometry

UNIT V: Centrifugation techniques

Centrifugation:General Principle, techniques working mechanism, preparative, analytical and ultracentrifuges, applications of centrifugation different methods of centrifugation techniques (zonal, differential, density gradient and isopycnic centrifugation). ultracentrifugation. Types of rotors.Differential centrifugation and density gradient centrifugation.

REFERENCES:

- 1. Wilson K and J.Walker, 2005, Practical Biochemistry, CambridgeUniversity Press. 5th Edition.
- 2. Robards, K. Haddad, P.R and Jackson P.E 1994. Principles and practice of modern chromatographic methods. Academic press. London.
- 3. Andrews A. 2000. Electrophoresis. Theory, techniques and biochemical and clinical applications. Oxford University Press. Oxford.
- 4. Gerald D. Fashion 1990. Practical Handbook of Biochemistry and molecular biology.CRC Press.
- 5. Gowenlock, 2001. Varley's Practical clinical biochemistry, 6thEd, CBS Press, New Delhi.
- 6. Rodney Boyer, 2001. Modern experimental biochemistry, 3rd Ed. Addision Wesley Longman, New Delhi.

BI 2814 - RECOMBINANT DNA TECHNOLOGY

SEMESTER : II Category : MC CREDITS : 04 NO. OF HOURS / WEEK : 05

Objective: To provide updated information on the tools and techniques involved in Genetic Engineering giving detailed knowledge on its applications in the field of Life sciences and to give an insight to molecular techniques involved in Medical diagnostics and therapy.

UNIT I : Introduction to Genetic engineering: Restriction Endonucleases - properties and functions-DNA ligase-Alkaline Phosphates -polynucleotide kinase –Transferase – Reverse transcriptase -Nuclease-linkers-Adapters. Uses of enzymes in genetic engineering. Hybridization techniques: Plaque, subtractive and Colony hybridization, *In-situ* hybridization (Southern, Northern and Western blotting).

UNIT II: Plasmids: structure and function, organization-Replication, stringent, relaxed plasmids. Plasmids of Gram-positive bacteria, gram-negative bacteria-construction.Transformation and selection of recombination. Lambda phage vectors, M13 bacteriophage, Cosmid vectors, shuttle vectors, Animal viral vectors: Adeno, Baculo, SV-40.

UNIT III : Cloning Methodologies-Insertion of Foreign DNA into Host Cells; Transformation ;Construction of libraries; Isolation of mRNA and total RNA; cDNA and genomic libraries; cDNA and genomic cloning; Expression cloning; Jumping and hopping libraries; Phage display; Principles in maximizing gene expression

Unit IV: PCR and Its Applications-Primer design; Fidelity of thermo stable enzymes; Types of PCR – PCR in gene recombination ;Site specific mutagenesis; PCR in molecular diagnostics; Viral and bacterial detection. DNA profiling in forensic science, DNA footprinting, Reporter Genes, Selectable markers.Human Genome Project.

Unit V: DNA Sequencing methods;RNA sequencing; Chemical Synthesis of oligonucleotides; Restriction mapping and Gene mapping. Introduction of DNA into mammalian cells; Transfection techniques; Recombinant Therapeutic proteins; Gene silencing techniques; Gene knockouts and Gene Therapy; Disease model; Somatic and germ-line therapy- in vivo and exvivo;; Gene replacement; Gene targeting; Transgenics; cDNA and intragenic arrays. Bioethics – GMOs, Biotechnology and Biosafety- IPR, IPP.

REFERENCES:

- 1. Old R W, and S.B Primrose 2003, Molecular Biotechnology, Blackwell Publishers, London, 6th edition
- Old, R W and Primrose, S.B 2000, Principles of Gene manipulation: & Introduction to genetic engineering. Blackwell science. Oxford.
- 3. Watson, JD; Gilman, M; Witkowski, J and Zoller, M. 1998. Recombinant DNA, 2nd Edition, Scientific American Books, New York.
- 4. Kornberg A and Baker T A 1992. DNA replication N Y
- 5. Brown T A. 1998 Gene cloning and DNA analysis. Blackwell science. Oxford.
- 6. Sambrook, J. and D.W. Russel; Molecular Cloning: A Laboratory Manual, Vols 1-3, CSHL, 2001
- 7. Grifith, Wessler, Gelbart, S uzuki, Miller,2008. Introduction to Genetic Analysis-.8th Edition.Freeman&co.England.
- 8.. Leland H.Hartwell,LeroyLood,MichaelL.Goldhery,Anne.E.Reynolds,et.,al(2007) ,Genetics .Tata MacGrawHill .inc.
- 9. Benjamin Lewin, Genes IX. Edition-ix. Jones and Bartlett.2008.Sudbury, Massachusetts.
- 10. Gupta, P.K..Priciples of Genetics.2003-2004.Rastogi Publications.Meerut. INDIA
- 11. SandhyaMitra 2000. Genetic Engineering: Principles and Practice. Macmillan Publishers India
- 12. SmitaRastogi and NeelamPathak 2009. Genetic Engineering, Oxford university press

BI 2815 - SEPARATION TECHNIQUES FOR BIOMOLECULES LAB COURSE

SEMESTER : II CATEGORY : MC(P)

CREDITS : 04 NO. OF HOURS / WEEK : 05

Objective:To enable the students to develop basic techniques involved in analysis of biomolecules.

UNIT I: PAPER CHROMATOGRAPHY & THIN LAYER CHROMATOGRAPHY

One Dimensional Chromatography (Separation of amino acids) Separation of Phenolic compounds by TLC.

UNIT II: COLUMN CHROMATOGRAPHY

Separation of Plant pigments using column Chromatography. Gel Filtration Chromatography Affinity Chromatography. Ion exchange chromatography (IgG separation)

UNIT III: SPECTROPHOTOMETRY

Estimation of Chlorophyll. Estimation of EPS Spectrophotometric quantification of nucleic acids.

UNIT IV: PROTEIN STUDIES

Serum Protein Electrophoresis. Protein Isolation from Animal Tissues and purification techniques- SDS PAGE ELISA Western Blotting

UNIT V: DEMONSTRATION-:

High Performance Liquid Chromatography Gas Chromatography, Separation of Cell Organelles- Differential Centrifugation

REFERENCES:

- 1. Sawney, B.S. 1998, Chromatographic Techniques. Chand Publications, New Delhi.
- 2. Gowenlock, 2001, Varley's Practical Clinical Biochemistry, 6th Ed. CBS Press, New Delhi.
- 3. Wilson & Walker, (2003) Principles of Practical Biochemistry 5thEdt. Oxford Press, London.

BI 2816 -R-DNA TECHNOLOGYLAB COURSE

SEMESTER	:11	CREDITS	:	04
CATEGORY	:MC (P)	NO. OF HOURS / WEEK	:	04

Objective: To enable the student to acquire the technical skill in the field of rDNA technology.

UNIT I: ISOLATION TECHNIQUES

Isolation of DNA from Liver tissues RNA isolation from Human blood Isolation of plasmid DNA from bacteria

UNIT II: SEPARATION AND QUANTIFICATION TECHNIQUES

Agarose Gel Electrophoresis- EtBr Staining Restriction Digestion Quantification of DNA and RNA

UNIT III: MOLECULAR TECHNIQUES

DNA Mutagenesis RFLP Reverse Transcriptase PCR (RTPCR)

UNIT IV: PCR

PCR Amplification RAPD

UNIT V: DNA FINGERPRINTING

Human DNA fingerprinting –VNTR/Alu typing Human sex determination-PCR method

REFERENCES:

- 1. Schancover. 2000, Molecular Cloning Protocols.Vol 1-3 Blackwell Publishers.New York.
- 2. Marimuthu P. 1995, Practical Genelies IBMS.
- 3. Janarthanan& Vincent Practical biotechnology. 2006, Unic Press, New Delhi.

BI 2955 - APLLIED ELECTRONICS IN INSTRUMENTATION SCIENCE

SEMESTER: II CREDITS : 03

CATEGORY: ES NO. OF HOURS/ WEEKS : 04

Objectives: The subject deals with Electrical transducers, Electronic instrumentation for signal condition of processing, Micro-processors and Micro-controllers, PC based instrumentation systems, Power Electronics and Data transmission, Bio-instrumentation, Process control and Intelligent instrumentation . The students are provided and in-depth knowledge of AE & I to meet the present and future demands for the market of professionals.

UNIT I: ELECTRONICS

Passive circuit components, series and parallel circuits, circuit theory, power supplies, amplifiers, emitter-followers, oscillators and basic digital circuits. Basis Measurement Techniques for Analog and Digital Measurements Units and standards of physical quantities. Documentation standards. Block diagram of Instrumentation schemes – Static and Dynamic.

UNIT II:Transducers and Electrodes: Different types of transducers and their selection for Biomedical applications, Electrode theory, different types of electrodes Hydrogen Calomel, Ag-AgCI, pH, PO2 Pco2 electrodes, selection criteria of electrodes. Cardiovascular measurement: The heart and other cardio systems, Measurement of Blood Pressure, Blood flow, Cardiac output and Cardiac rate, Electrocardiography, Phonocardiography, Ballistocardiography, Plethysmorgaphy, Magnet – Cardiography, Cardiac pace-maker, computer applications.

UNIT III: INSTRUMENTATION IN DRUG ANALYSIS

Qualitative testing, titrimetric analysis.Beer and Lambert's law. Basis and working principle of colorimeter, ultraviolet, atomic absorption spectrometers, Fluorescence spectroscopy, NMR and Mass Spectroscopy.Basics of Chromatography. Partition, adsorption and ionexchange chromatography. Column chromatography, thin layer chromatography, paper chromatography, immunoabsorbant chromatography, high performance thin layer chromatography, high performance liquid chromatography and gas

UNIT IV: APPLIED INSTRUMENTATION-I: Measurement of Electrical Activities in Muscles and Brain: electromyography, Electroencephalograph and their interpretation. Respiratory System Measurement: Respiratory mechanism, Measurement of pH value of blood, ESR measurements, Haemoglobin measurement, oxygen and carbon dioxide concentration in blood, GSR measurement, polarographic measurements, computer applications.

Medical Imaging: Ultrasound imaging, Radiography and applications. Biotelemetry: Transmission and Reception aspects of Biological signals via long distances. Absence of Patient Care Monitoring.

UNIT V: APPLIED INSTRUMENTATION-II: Analytical methods of measurement -pH, conductivity, viscosity, density, humidity and moisture.Industrial gas analysis such as oxygen, carbon dioxide, methane, carbon monoxide Zircoxia probe oxygenanalyser, paramagnetic oxygen analyzer.

Recorders- Moving coil, Magnetic tape, U-V recorder, X-Y recorder, Digital recorder

References:

- 1. Murty -Transducers & Instrumentation, Dr. S.PHI, Delhi'85.
- 2. Patranabis D- Principles of Industrial Instrumentation –, TMH.
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BI 2956 - THERAPEUTIC DRUG MONITORING

SEMESTER : II CATEGORY : ES CREDITS : 03 NO. OF HOURS / WEEK : 04

Objectives: To make the student understand the use of serum drug measurements as an aid to the management of patients receiving drugs, which is important for the optimization of therapy of drugs whose desired (or toxic) effect cannot be assessed clinically. The students get exposed to the various techniques involved in TDM and the various instruments used in the process.

UNIT I: PRINCIPLES OF THERAPEUTIC DRUG MONITORING

Introduction to drugs and poisons. Pharmacodynamics: site and mechanism of Drug action. Pharmokinetics.Administration and absorption of drugs.Distribution and Elimination.Xenobiotics- Theory of Sherwin, Berczeller and Quick.Mechanism of detoxication.

Guidelines for routine therapeutic monitoring.

UNIT II: RATIONALE OF THERAPEUTIC DRUG MONITORING

Individual adjustment of doses.Individual variability in human drug Metabolism. Genetic factors that cause variability in human drug metabolism. Development and ageing as sources of variability in drug metabolism. Calibration of Instruments for the quantitation of drugs in body fluids.Sampling Techniques. Components of materials used in specimen collection influence of specimen collection in Toxicology. Preparation of serum standards, Quality assurance.Units of drug concentration.

UNIT III: DETERMINATION & INTERPRETATION OF PLASMA CONCENTRATION OF DRUGS

Bio-availability of drugs- Antiasthmatics- Theophylline, Antibiotics, Anticonvulsants-Carbamezepine, Phenobarbitone, Antidepressants- Lithium, Cardioactive drugs-Digoxin; Controlling therapy by measurement of plasma concentrations.

UNIT IV: ACUTE POISONING AND EMERGENCY METHODS

Organizational considerations, Analysis and screening.Screening test for Alcohol, Analgesics- Aspirin, Carbon monoxide, Acute Iron Poisoning.Overview on Toxicology.Antidotes and Applications.Preclinical and clinical phases of drug trials.

UNIT V: DRUGS OF ABUSE

Drug dependence, Principal effects, Classification of drugs of abuse, stimulants, Depressants, Hallucinogens, Rationale of Drug abuse screening, Analysis and Screening techniques.

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2. Carl A. Burtis and Edward R. Ashwood.2006. Tietz Textbook of Clinical Chemistry and Molecular Diagnosis. Fourth edition, Elsevier

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