SCOPE

This course provides an overview of the macromolecules that are key to all living systems.

OBJECTIVE

This course enables the students to understand about higher order structure of biomolecules i.e. Polysaccharides, proteins, lipids and nucleic acids.

UNIT I

Polysaccharides: Occurrence, structure and biological functions of cellulose, chitin, starch and glycogen. Fructans, arabins and galactans (brief account). Occurrence, structure, and biological functions of bacterial cell wall polysaccharides and blood group antigens. Structure and significance of glycoconjugates - Glycosaminoglycans – structure and biological role of hyaluronic acid, chondroitin sulfate and heparin, sialic acid; glycoproteins and glycolipids.

UNIT II


UNIT III


UNIT IV

UNIT V
Nucleic acid interaction with proteins: DNA binding motifs in proteins – the basic helix loop helix (bHLH) motif, zinc finger, the leucine zipper, helix-loop helix and homeo domain. RNA binding motifs in proteins. Molecular aspects of protein-nucleic acid binding – direct interactions. Techniques characterizing nucleic acid-protein complex – gel retardation assay, DNase I footprinting.

REFERENCES
Nucleic acid structure and recognition. Neidle, Oxford University Press, 2002
SCOPE
Enzyme and microbial technology is a rapidly growing field due to its higher applications in disease diagnosis, industries and production of desired products from microorganisms.

OBJECTIVES
This paper provides impact knowledge about the structural organization of proteins, kinetics of enzymes, production, purification, characterization and immobilization of enzymes. It also gives knowledge about the application of enzymes and to produce desired products and strains from microorganisms.

UNIT I
Proteins: Enzymes - Nomenclature and classification of Enzymes with examples; coenzymes and cofactors. Active site rule: catalytic triad; Mechanism of enzyme action - Lock and key model, Induced fit model. Factors affecting enzyme activity. Isolation, purification and characterization of enzymes.

UNIT II

UNIT III

UNIT IV
Microbial Growth: Balanced and Unbalanced microbial growth; Measurement of growth; Principles of microbial growth and culture systems-batch culture, fed batch culture, semi-continuous culture and continuous culture. Isolation and screening of industrially important microbes. Important strains for better yield. Design of a fermenter. Types of bioreactor-Continuous stirred tank, Bubble column, Airlift, Fluidized bed, Packed bed and Photobioreactor.

Solid substrate fermentation and Media fermentation. Examples of bioprocess for the

UNIT V
Production of fermented products and downstream processing: Production of alcohol and alcoholic beverages. Microbial production of Organic acids: Source, recovery and uses of Citric acid, Lactic acid, Acetic acid and L-ascorbic acid. Production of antibiotics: Penicillin and Tetracyclin. Bioinsecticides: Production of Bacterial and fungal polysaccharides, commercial production of Xanthan gum and pullulan. Production of edible mushroom and SCP. Biofertilizers (Phosphobcterium and Rhizobium sp.,- Basics only).

TEXT BOOKS


REFERENCES


SCOPE
The goal of the paper will ensure the instrumentation techniques.

OBJECTIVE
This paper given an insight knowledge about the emerging themes and provides an in-depth analysis of instrumentation and its applications in various fields.

UNIT I

UNIT II

UNIT III
Chromatography: Principles, Types – paper chromatography, thin layer chromatography and HPTLC, Column chromatography - Ion exchange chromatography, affinity chromatography, gel filtration chromatography, Low pressure liquid chromatography (LPLC) and High Performance Liquid Chromatography (HPLC)- Normal and Reverse Phase Gas -liquid chromatography Mass spectroscopy (GC – MS), MALDI-TOF. Application of Chromatography.

UNIT IV
Electrophoresis: Principle, instrumentation and applications of agarose gel electrophoresis, sodium dodecyl sulphate – polyacrylamide gel electrophoresis (SDS-PAGE), native PAGE, isoelectric focusing, immunoelectrophoresis, 2D gel electrophoresis. Pulse field gel electrophoresis, capillary electrophoresis, gel documentation – Applications.

UNIT V
Flowcytometry: Principles and applications.
TEXT BOOKS


REFERENCES


SCOPE

To develop an understanding of the fundamentals of cell biology, structure and function of living organisms, their life processes and Biochemical basis of motility, membrane and organelle biogenesis, cell-cell interaction, cell-cell signaling, Cancer and cell cycle.

OBJECTIVES

Understanding of the molecules within cells. Interactions between cells that allow construction of multi cellular organisms and Understanding the structural and functional aspects of the cell provides the student with a strong foundation in the molecular mechanisms underlying cellular function.

UNIT I

Membrane: Membrane bilayer- models, Membrane lipids- fluidity, asymmetry, phase transition, Liposomes.
solubilisation of proteins, lipid anchored proteins, Carbohydrates – cell surface carbohydrates – Lectins and selectins.

UNIT II

Membrane transport: Passive diffusion, facilitated diffusion in erythrocytes, Carriers and ion channels, Ion concentration gradients.
Uniporter Catalyzed transport, active transport systems. Transport process driven by ATP-Ion pumps: Calcium ATP ase; Na⁺ K⁺ ATPase; Mechanism, Gastric H⁺ K⁺ ATPase, ABC superfamily – ATPases that transport peptides and drugs (MDR proteins).
Co-transport by Symporters and antiporters, Group translocation.
Osmosis and receptor mediated endocytosis.

UNIT III

Mitochondria – Reduction potential, electron transport chain – Complexes, Q-cycle, Cyt C oxidase complex, Translocation of protons and the establishment of a proton motive force, machinery for ATP formation and chemi-osmotic mechanism, ATP synthase – Experiments, inhibitors and uncouplers of oxidative phosphorylation.

UNIT IV

Cell – Matrix interaction: Cell – Cell interaction: Extra cellular matrix; Collagen, hyaluronan and proteoglycans, laminin, integrins and fibronectins.
Cell – Cell signaling – Signalling molecules and their receptors; functions of cell surface receptors, pathways of intracellular signal transduction, second messengers, G-protein coupled receptors, receptor tyrosine kinases, Ras, MAP kinases.

UNIT V
Cell cycle and cancer: Cell cycle and its control, Cell cycle control in mammalian cells, checkpoints in cell cycle regulation.
Cancer: Properties of tumour cells and genetic basis and onset of cancer.
Tumour viruses – DNA & RNA Viruses as transforming agents – mechanism.

TEXT BOOKS


REFERENCES


SCOPE

To provide sufficient knowledge about plant cells and its organelles, various metabolic pathways and its applications in plant productivity, Plant growth substances, plant secondary metabolites and its production, technical advantages in plant tissue culture and gene transfer technology to increase production of plant secondary metabolites.

OBJECTIVES

Understanding of the plant cell organelles and their functions, understanding the functions and regulations of major biosynthetic pathways of plants, plant growth substances, obtaining knowledge on tissue culture techniques and metabolic engineering to increase the production of plant secondary metabolites and to become familiar with the exciting topics in plant biology research.

UNIT I

Plant cell: Structure of plant cell – cell wall, vacuoles, plastids, mitochondria, peroxisomes and Golgi complex. Overview of photosynthesis: photosynthetic apparatus, reaction center, photosystems I and II, mechanism of photosynthesis-cyclic and non cyclic photophosphorylation; evidences in support of light and dark reactions.

UNIT II


UNIT III


UNIT IV


UNIT V

secondary metabolites.

TEXT BOOKS


REFERENCES


Colorimetry
1. Isolation and estimation of starch from potato (Anthrone method)
2. Isolation and estimation of glycogen from liver (Anthrone method)
3. Estimation of Total carotenoids (Spectroscopic method)
4. Estimation of fructose in fruits (Resorcinol method)
5. Estimation of ascorbic acid (DNPH method)
6. Estimation of Vitamin E (Dipyrridyl method)

Fluorimetry
7. Estimation of thiamine from cereals or fruits
8. Estimation of riboflavin

Titrimetry
9. Estimation of lactose in milk
10. Estimation of calcium in milk

Separation techniques
12. Separation of plant pigments by TLC.
13. Separation of plant pigments by column chromatography.

Cell biology:
15. Preparation of standard buffer and determination of pH of buffers.
16. Subcellular fractionation by differential centrifugation and purity assessment with marker enzymes (Group Experiment).
17. Salting out of proteins using ammonium sulphate precipitation

REFERENCES
Plant Biochemistry
1. Phytochemical screening of any one selected medicinal plant
2. Estimation of Tannins
3. Estimation of Flavonoids
4. Estimation of Chlorophyll
5. Estimation of Phenols

MICROBIOLOGY
6. Isolation of pure culture – serial dilution, pour plate, spread plate, streak plate methods.
7. Colony morphology – colony counting.
8. Staining techniques- simple, differential, spore, and fungal staining.
9. Antibiotic resistance / sensitivity test (Disc method)
11. Identification of microorganisms – biochemical tests (IMVIC test)(Group Experiment)
12. Microbiology of potable water
13. Isolation, characterization and purification of ANY one of the following microbial enzymes
   a) Amylase
   b) Protease
15. Assay of antifungal activity of ANY ONE selected medicinal plant by Disc or Well diffusion.

PLANT TISSUE CULTURE (Group experiment)
16. Preparation of tissue culture media
17. Surface sterilization
18. Induction of meristem culture
20. Regeneration of shoot and root from callus culture.

REFERENCES


Sadasivam S and A. Manickam , 2009. Biochemical Methods, New Age International
Publishers, New Delhi.


SCOPE
To explain generation and transformation of energy in metabolic pathways, maintenance of homeostatis of metabolites by intrinsic and extrinsic control mechanism.

OBJECTIVES
To explain the metabolic pathways of carbohydrates, lipids, amino acids, nucleic acid metabolism and their regulation with various metabolic conditions with special reference to control of enzyme activity.

UNIT I
Introduction to control of enzyme activity: Allosteric interaction; Reversible covalent modification; proteolytic action; control of amount of enzyme; control of rates of enzyme degradation; feed back inhibition; feed forward stimulation. Role of compartmentation. Elucidation of Metabolic pathways- Single-and Multi-step pathways. Experimental approaches to study the metabolism- using metabolic inhibitors and isotopes.

UNIT II
Carbohydrate Metabolism: An overview of Glycolysis and Gluconeogenesis. Regulation of Glycolysis and Gluconeogenesis-Reciprocal control of Glycolysis and Gluconeogenesis, TCA cycle- steps, regulation at branch points; Glycogen Metabolism: Overview of glycogenesis and glycogenolysis. Reciprocal control of glycogenesis and glycogenolysis. Hormonal regulation of fuel metabolism; Metabolic disorders-Diabetes mellitus.

UNIT III
Lipid metabolism: An overview of fatty acid synthesis and degradation, Regulation of fatty acid synthesis- control of acetyl CoA carboxylase and fatty acid synthetase complex; Reciprocal control of fatty acid synthesis and degradation. Biosynthesis of triacyl glycerol, phoshpatidyl choline, phosphotidyl ethanolamine and sphingomyelin and their regulation. Synthesis and degradation of cholesterol and its regulation. Obesity and regulation of body mass. Metabolic disorders- Atherosclerosis, Hyper and hypo lipoproteinemia.

UNIT IV

UNIT V
Muscle, Liver and Adipose tissue. Integration of metabolism. Metabolic disorders- Gout, SCID.

TEXT BOOKS


REFERENCES


SCOPE
To shed light on the structure, function and relationship between the macromolecule DNA and protein.

OBJECTIVES
To explain gene structure, replication, transcription, translation recombination mechanism of DNA in both Prokaryotic and eukaryotic system.

UNIT I
**Molecular structure of genes:** Molecular definition of gene, chromosomal organization of genes and non-coding DNA, protein coding genes, tandemly repeated genes, single sequence DNA. Structural organization of eukaryotic chromosomes- histone proteins, chromatin, functional elements. Mobile DNA elements- bacterial IS elements, transposons, viral transposons and non- viral transposons. Mutation- types.

UNIT II
**DNA replication and repair:** General features of chromosomal replication. Enzymology of DNA replication, DNA replication machinery. Replication in prokaryotes and eukaryotes- Initiation, elongation and termination. DNA damage-types. Repair mechanism of DNA damage-all types.

UNIT III
**Transcription:** prokaryotic gene transcription- Initiation, elongation and termination. Eukaryotic gene transcription- transcription unit, RNA polymerases- types, Transcription and processing of mRNA, tRNA and rRNA. Regulatory sequences in protein coding genes- TATA box, initiators, CpG island, promoter-proximal element, activators and repressors of transcription, Multiple transcription control elements. Regulation of transcription factor activity by lipid-soluble hormones.

UNIT IV
**Translation:** Deciphering genetic code, features. Wobble hypothesis. Initiation, elongation and termination of prokaryotic and eukaryotic translation. Fidelity of translation. Post translational modifications-all types; Protein targeting-Targeting protein to nucleus, ER, Golgi complex. Protein degradation- ubiquitin mediated degradation.

UNIT V

**Eukaryotic gene regulation:** Transcriptionally active chromatin, chromatin
remodeling, DNA binding transactivators and coactivators. Regulation of gene expression by intracellular and intercellular signal, RNAi.

**TEXT BOOKS**


**REFERENCES**


SCOPE
The scope of this paper is to introduce the main principles of bioinformatics the coverage will include biological data base, sequence alignment and structure prediction.

OBJECTIVES
Understand the genomic data acquisitions and analysis comparative and predictive analysis of DNA and Protein sequence.

UNIT I
**Definition, concepts of Bioinformatics:** Objectives, History of Bioinformatics, Milestones, Genome sequencing projects, Human Genome Project- Science, applications and ELSI.
**Introduction to Biological databases:** Types of databases, sequence databases-nucleic acid sequence databases, GenBank, protein sequence database, Swiss-Prot, PIR, motif database-PROSITE, structural databases, bibliographic databases and organism specific databases-GMOD- Searching and retrieval of data-Entrez and SRS.

UNIT II
**Introduction to sequence Alignment:** Pairwise and multiple sequence alignment, substitution matrices, Similarity searching programs, BLAST, FASTA, Multiple sequence alignment – CLUSTAL, Phylogenetic analysis-PHYLIP theory of phylogeny, tree building methods.

UNIT III
**Protein prediction strategies and programs:** Protein Secondary Structure Prediction, three dimensional structure prediction-Comparative modeling, threading, protein folding and visualization of molecules – Visualization tools-RasMol, Deep View.

UNIT IV
**Gene Identification and Prediction:** Gene Mark, Gene Scan, Pattern Recognition, Global gene expression studies-DNA Micro array.

UNIT V
Applications of Bioinformatics-Molecular medicine, biotechnology, agricultural, Computer Aided Drug Designing- Lead molecules, properties, ADME profiles, QSAR, receptors, docking.

REFERENCES


SCOPE

To make the student to understand the concept of gene manipulation and gene transfer technologies.

OBJECTIVES

To understand the manipulation of genes, transfer techniques, expression systems and genetically modified foods.

UNIT I


UNIT II


UNIT III

Isolation and characterization of gene transcripts: Introduction, Converting mRNA transcripts into cDNA, Screening representative cDNA libraries, Functional sequencing of cDNA expression libraries. Expressed cDNAs compared with computer databases. Characterization of recombinant proteins- Processing, purification and refolding and stabilization-Insulin, hGH, tPA.

UNIT IV

Mutagenesis: Site-directed mutagenesis, In vitro mutagenesis-Linkers, synthetic oligonucleotides and transposons, Role of Tagging in gene analysis, Identification and isolation of genes through T-DNA or transposons.

Gene therapy- Different strategies for gene therapy, therapeutics based on targeted exhibition of gene expression and mutation correction in vivo, Gene therapy for inherited diseases, ADA, FH, Cystic fibrosis.

UNIT V

Transgenics: Gene transfer techniques- Microinjection, biolistic methods, vector based transfer.

Transgenic plants: Agrobacterium & Ti plasmids. Methods of engineering herbicide resistance plants, Stress resistance plants and modification of plant nutritional content.
(amino acids, β- carotene) Plants as bioreactors: edible vaccines.

Transgenic animals: Method of Engineering transgenic mice, transgenic cattle- applications
Biosafety- regularities and concerns. Societal impact of genetically modified food.

REFERENCES


SCOPE
The student enable to under the basics of quality control, maintenance of records and quality assurance.

OBJECTIVES
To inculcate good laboratory practice which enable the student to perform better in clinical laboratory.

UNIT I

UNIT II
Quality Control: Quality control laboratory: Responsibilities, routine controls, instruments, protocols, non-clinical testing, controls on animal house, data generation and storage, quality control documents, retention samples, records, audits of quality control facilities.

UNIT III

UNIT IV
Inspections, Quality Audit and Quality System Reviews: Inspections of pharmaceutical manufacturers, role of quality audit, role of inspectors, methods of inspection- routine, concise, follow-up and special inspections, frequency and duration of inspections, preparations for inspections, conduct, report and regulatory actions. Loan License Auditing – Concepts, Auditing, role of quality circle in quality assurance.

UNIT V
Laboratory Regulations and Safety: List of Regulations to be followed. Laboratory safety procedure- glass ware, equipment safety, hands protection, precaution to be undertaken to prevent accident and contamination.

TEXT BOOKS


REFERENCES


SCOPE
To understand the basics about the mechanism of microbial growth, kinetics, bioreactor design and types, purification of fermented products and its application.

OBJECTIVE
Students completing this paper are able to know the fermenter concepts.

Unit I:
**Introduction of fermentation technology:** History of fermentation. Fermentation process. Microbial culture, Screening and selection for fermentation processes. Preservation and improvement of industrially important microorganisms. Inoculum production for bacterial and fungal processes. Strain improvement

Unit II:
**Bioreactor Design:** Fermentor functions, construction and maintenance of aseptic conditions. Control of various parameters: temperature control; Aeration and agitation system (Non-Newdonian fermentations), baffles; types of fermentors, computer applications in fermentation technology. Sterilization of fermentor, aseptic inoculation and sampling methods, Specialized bioreactors: tubular bioreactors, membrane bioreactors, tower bioreactors, fluidized bed bioreactors, Immobilized system and packed bed reactors and Photobioreactor.

Unit III:
**Fermentation kinetics:** Fermentation growth kinetics. Simple unstructured kinetic model for microbial growth of bacterial, fungal, animal and plant systems. Kinetic of substrate utilization, biomass growth and product formation in continuous system, batch and fed batch cultures, total cell retention cultivation, inhibition on cell growth and product formation.

Unit IV:
**Downstream process:** Basic concepts of bio-separation technology, separation characteristics of proteins and enzymes—size, stability properties; purification methodologies characteristics of bio enzymes products; Flocculation and conditioning of broth, overview of reaction processes involved in separation. Centrifugation as a tool for downstream processing.

Unit V:
**Bioreactor Products:** Production of fermented dairy products, Fermented foods and beverages; Types of fermentation processes and their advantages and disadvantages; production of penicillin, recombinant insulin. Propagation of animal and plant cell using bioreactors for production of pharmaceuticals, therapeutic proteins and monoclonal antibodies.
TEXT BOOKS
Microbiology; Pelczar, Chan and Krieg; Tata McGraw Hill, New Delhi

REFERENCES
SCOPE
This course has been intended to provide the student in the emerging areas plant tissue culture and their importance, which plays an essential role in present, future use and applications of plant biology.

OBJECTIVES
Students get an idea about aseptic condition, plant hormones, various transformation methods and application.

UNIT I
Growth and Development:

UNIT II
Introduction to plant tissue culture: Totipotency, Tissue culture Media (Composition and preparation). Nutritional components of tissue culture media. Plant Hormones- Types, structures, biosynthesis & metabolism. Basic concepts of aseptic cultures and its uses. Different areas and applications of plant tissue culture.

UNIT III
Basic techniques in tissue culture: Design & lab setup of Tissue Culture laboratory. Types of culture, Initiation of callus and suspension cultures, Micro propagation (Organogenesis, Somatic Embryogenesis, Shoot tip culture, Rapid clonal propagation, Embryo Culture and Pollen culture). Production of haploids and their application, Storage of plant genetic resources and Cryopreservation.

UNIT IV
Plant transformation technology: Ti &Ri Plasmid and their transfer mechanisms, Use of Ti &Ri as vectors, Binary vectors, Use of 35s & other promoters genetic markers- methods of nuclear transformation, viral vectors & their applications, Use of reporter gene, Particle bombardment, electroperoration, Microinjection, Chloroplast transformation- transplastomics, Transformation of monocots, Transgene stability & gene silencing in Plant transformation.
UNIT V


TEXT BOOKS

REFERENCES
SCOPE
The paper provides basic knowledge diet for acute and chronic disease.

OBJECTIVES
To understand the role of diet in the management of disease

UNIT I
Nutrition- Foods for normal nutrition. Diets in gastrointestinal diseases-Acute gastrointestinal conditions, chronic and non-acute disorders of the upper gastrointestinal tract, lower gastrointestinal conditions, pancreatitis, liver diseases, gall stones, appendicitis, cholelithiasis. Diet for hepatitis


UNIT II
Diet for diabetes mellitus- Nutrition recommendations for patient with diabetes, Meal planning, Exchange list of different food groups, Diabetic diets based on exchange list, Diabetic diets menu wise.
Diets in Renal disease- Acute renal failure, Proteinuria, Indoor diet charts for renal patients.

UNIT III
Diet for Cardiovascular Diseases- Risk Factors, Hypertension, Atherosclerosis, Stroke and other peripheral diseases, Cardiomyopathy and cardiac failure, Rheumatic heart disease, dietary management, general guidelines for coronary heart disease, Dietary recommendations of WHO.
Diet for Acute cardiac diseases
Obesity- Body fat distribution, Health risks of obesity, Weight reduction, Factors contributing to obesity.

UNIT IV
Cancer and diet therapy- Influence of diet on carcinogenesis, Dietary risk factors and cancers at various sites in the human body, diet therapy, eating well during cancer treatment, managing eating problems during treatment.
Diet for inborn errors of metabolism- phenylketonuria, Galactosaemia, Celiac disease.

UNIT V
Nutrition related bone disease- osteoporosis.
Dietary factors in dental disease- Starch & dental cavities, protective factor in food
Blood- Nutrition deficiency affecting hematopoiesis.
REFERENCES


SCOPE

To enable the students to know more about effect of pollution on eco systems, bioremediation processing and recent techniques as an appreciation of their impact on society.

OBJECTIVE

On completion of the subject, students will be able to apply their knowledge on eco system, recalcitrant in various contaminants, and also advantages, limitations and applications of bioremediation.

UNIT I


UNIT II

Bioremediation: Introduction of Bioremediation, general perspectives, constraints and priorities of bioremediation, Advantages, limitations and applications. Factors affecting process of biodegradation. Contaminant availability for biodegradation. Microbial interactions with inorganic pollutants, Microbial metal resistance, Microbial transformation, accumulation and concentration of heavy metals.

UNIT III


UNIT IV

UNIT V


TEXT BOOKS


REFERENCES


MOLECULAR BIOLOGY
1. Isolation of DNA and RNA from liver
2. Estimation of DNA and RNA - UV method
3. Estimation of DNA by Diphenylamine method
4. Estimation of RNA by Orcinol method
5. Estimation of Protein by Lowry’s method
6. Culturing and Isolation of Plasmid DNA
7. Agarose gel electrophoresis of DNA
8. Restriction digestion analysis of DNA (Demonstration)
9. Preparation of competent *E. coli*- transformation (demonstration)
10. Determination of Molecular weight of polypeptides by SDS PAGE (group)
11. Polymerase Chain Reaction for amplification of DNA (demonstration)
12. Ligation of DNA
13. Southern Blot Analysis (Demonstration)
14. Western Blotting (Demonstration)

ANIMAL TISSUE CULTURE (Demonstration)
15. Preparation and Sterilization of media
16. Cell lines and maintenance - Trypsinisation, Passaging, Staging
17. Cell counting and cell staining

REFERENCES


Kannan N., 2003; Laboratory Manual in Microbiology, Panima Publishing Corporation, Bangalore.


1. Biological Databanks Sequence databases, Structure Databases, Specialized databases
2. Data base file formats.
3. Data retrieval tools and methods (PUBMED, ENTREZ, SRS)
4. Sequence Similarity searching (NCBI- BLAST, FASTA)
5. Protein sequence analysis (ExPASY proteomics tools)
6. Multiple sequence alignment (Clustal-W)
7. Gene structure and function prediction (Using ORF Finder, Genscan, GeneMark)
8. Molecular Phylogeny (PHYLIP)
9. Sequence Analysis using EMBOSS
10. Protein structure visualization – RASMOL (Menu function and Command line entries), Deep View.

REFERENCES:


SCOPE
To provide knowledge with various aspects of immunology like immune system and its response to invading antigens, derangement of immune system and immunotherapy.

OBJECTIVES
To expose the students with humoral and cell mediated immune system, antigen antibody interaction, over and under response of immune system in diseased conditions, immunotherapy and immunotechniques. (Clinical immunology, diagnostic immunology)

UNIT I

UNIT II
Antigen: Epitope, B cell and T cell epitope, haptens, viral and bacterial antigens; factors influencing adjuvant technology. Immunoglobulins-domains, B cell receptors, antigenic determinants on immunoglobulins, Immunoglobulin super family. Immunoglobulin genes: multigene family; Immunoglobulin rearrangement- antibody diversity.

UNIT III
Hyper sensitivity: Type I, II, III, IV, V and VI. Complement-definition, classical and alternate pathway, MHC: organization, MHC molecules and genes, MHC and immune responsiveness, Transplantation and rejection.

UNIT IV
Immunity to infection: Definition and types of immunity, Primary and secondary immunodeficiency diseases. Auto-immune diseases, Tumor immunology Vaccines: Active and passive immunization, Types of vaccines with example. Monoclonal Antibodies- Production and Applications.

UNIT V
Immuno Techniques: Antigen-Antibody interactions- precipitation reaction, agglutination tests- haemagglutination; Complement fixation test. Direct and indirect immunofluorescence, RIA, ELISA, CLIA, ECLIA, Immunoblotting, effector cell assay, Heamolytic plaque assay and Elispot assay.
TEXT BOOK


REFERENCES


Geoffrey Zubay, 2009. Immunology, W.B. Saunders and company, Philadelphia, United States.


SCOPE
A career in diagnostic laboratory or in research laboratory is available. To provide sufficient knowledge about the hormones and its importance.

OBJECTIVES
Understanding the bases of life processes and their role in human being and their deficiency diseases.

UNIT I

UNIT II

UNIT III
Clinical Parameters: Myocardial infarctions, hepatobiliary disease. General principles of hormone assay and clinical significance of steroid, protein and thyroid hormone (experimental details are not required). Oncology- oncogenes and cell cycle, Cancer Markers; Free radical induced lipid peroxidation. Free radical scavengers. Antioxidants in disease prevention.

UNIT IV
Overview of important endocrine glands and their hormones: Chemistry, synthesis, control, physiological role and pathophysiology of hypothalamus, pituitary, thyroid and parathyroid hormones.

UNIT V
Chemistry, synthesis, control, physiological role and pathophysiology of pancreas, adrenal medulla, adrenal cortex, male and female reproductive hormones. Endocrinology of pregnancy, parturition and lactation.
REFERENCES


SCOPE
To provide sufficient knowledge about natural products and its applications.

OBJECTIVE
To make the students to gain knowledge on extraction, isolation and identification of natural products from various sources like plants, microbes and marine organism as therapeutic agents.

UNIT I
Methods of plant analysis- Extraction- sequential and percolation techniques. Separation techniques-Column chromatography, TLC, GLC and HPLC. Methods of identification-UV, IR, NMR and MS; Analysis of results- Qualitative and quantitative methods.

UNIT II
Natural products from plant sources: Chemistry, distribution and techniques for anthocyanins, phenolics, flavonol and flavones, tannin and quinines (General discussion only).

UNIT III
Natural products from plant sources: Chemistry, distribution and techniques for triterpenoids, essential oils, steroids, carotenoids and alkaloids (General discussion only).

UNIT IV
Natural products from microbes: Sample collection; Screening tests- antiviral, antibacterial, anticancer, antihypercholesterolemic. Commercial production of microbial enzymes - Invertase and beta galactosidase.

UNIT V
Marine organism and animals: Secondary metabolite from marine algae, bacteria, fungi and vertebrates. Separation and isolation techniques- Desalting, ion exchange and reverse phase column chromatography; Bio assay directed fractionation. Isolation of simple peptides. Drugs from animal sources – hormones, carbohydrate and proteins.

TEXT BOOKS

REFERENCES


SCOPE

The goal of the paper will ensure the widespread visibility and high impact of Drugs, thereby promoting on emerging research, pointing the way for the establishment of new medicines – from the identification of targets, through to the synthesis and evaluation of putative therapeutic entities.

OBJECTIVE

This paper gives an insight knowledge about the emerging themes, and provides an in depth analysis of specific drug classes, its metabolism and therapeutic approaches.

UNIT I


UNIT II


UNIT III

Genetically engineered protein and peptide agents as drugs, Novel drug delivery systems, anti-AIDS drug development, oncogenes as targets for drugs, multidrug resistance phenotypes, production of secondary metabolites by plant tissue culture. Genome based medicine.

UNIT IV

Mechanism of action of drugs used in therapy of Respiratory system – cough, bronchial asthma, pulmonary tuberculosis. Antimicrobial drugs – sulphonamides, trimethoprim, penicillins, aminoglycosides and bacterial resistance, Cancer chemotherapy. Thyroid and antithyroid drugs, insulin and oral antidiabetic drugs, antifertility and ovulation inducing drugs. Pharmacotherapy of gout and rheumatoid arthritis, Immuno therapy – Immunosuppressants and immunostimulants, Enzymes in therapy.

UNIT V

Brain – Neurotransmitters, encephalins and endorphins; general function of autonomic and somatic nervous system; cholinergic transmission and receptors; adrenergic transmission and receptors; muscarinic receptors. Non steroid and anti inflammatory drugs; adrenergic blocking drugs; cholinergic blocking drugs; muscarinic blocking drugs; parkinson’s

TEXTBOOKS


REFERENCES


SCOPE
This course has been intended to provide the student insights into helpful areas of statistics and research methodology.

OBJECTIVE
Students get an idea about collection, interpretation and presentation of statistical data and identify the research problem.

UNIT I

UNIT II

UNIT III
Test of significance: Tests based on Means only-Both Large sample and Small sample tests – Student’s t test, Chi square test - goodness of fit. Analysis of variance – one way and two way classification. CRD, RBD Designs.

UNIT IV

UNIT V

REFERENCES
SCOPE
The paper deals with basic concept of drug discovery, clinical trial and IPR.

OBJECTIVES
Students understand concept of drug discovery, clinical research and IPR.

UNIT I
Drug discovery and Development: Introduction to Pharmaceutical Industry, New drug discovery-Target Identification- Target Prioritization/ validation, Lead identification, Lead optimization ; Preclinical studies - Preclinical technology, Chemistry manufacturing and controls / Pharmaceutics Pharmacology/Toxicology

UNIT II
Basics of Clinical Research: Definition of clinical research and development, History of randomized trial Literature - Finding and Evaluation databases of Scientific Literature; Critiquing of Research Projects, Time management and resource implications

UNIT III
Epidemiology: Experimental Procedures - Controlled Experiments, Sampling Techniques, Questioner Design, Validity and reliability of observations, Primary variables, Acquisition and using secondary data, Randomization and Blinding: Theory and practice

UNIT IV
IPR: Introduction to Copyright - Conceptual Basis, International Protection of Copyright and Related rights- An Overview (International Convention/Treaties on Copyright). Indian Copyright Law -The Copyright Act, 1957 with its amendments, Ownership, transfer and duration of Copyright, Renewal and Termination of Copyright.

UNIT V

TEXT BOOK
REFERENCES


SCOPE

The paper deals with isolation of bioactive compounds from medicinal plants and testing their efficacy.

OBJECTIVES

The students can understand the techniques of isolation and characterization secondary metabolites from plants and their biological activity.

UNIT I


UNIT II

General extraction and isolation techniques for compounds from plants. Techniques involved in extraction of phytochemicals – Perculation, Soxhlet extraction, Supercritical Fluid extraction, Pilot scale extraction, reflux and other methods. Factors affecting extraction.

UNIT III

Isolation and purification techniques – Thin layer and Column chromatography. Chemical fingerprinting – HPLC, HPTLC, FTIR, NMR and GC-MS.

UNIT IV

Biotechnology of medicinal plants: Production of secondary metabolites from plant culture. Indian Standard Specifications (ISI) laid down for sampling and testing of various drugs in finished form by the Bureau of Indian Standards. Toxicity testing in drugs and Safety.

UNIT V


REFERENCES


SCOPE

This course is designed to provide students with the basic skills needed to manipulate mammalian cells in culture. Laboratory skills in cell growth, cell passage, gene transfection, and enzyme assays will be acquired. Since this is a upper level course, the student should be familiar with common biological terms.

OBJECTIVE

Understanding the principles of animal cell culture and its application.

UNIT I

Introduction, importance, history of cell culture development, different tissue culture techniques including primary and secondary culture, continuous cell lines, suspension culture, organ culture, advantages and limitations medical/pharmaceutical products of animal cell culture-genetic engineering of animal cells and their applications. Risks in a tissue culture laboratory and safety - biohazards.

UNIT II

Different types of cell culture media, growth supplements, serum free media, balanced salt solution, other cell culture reagents, culture of different tissues and its application. Facilities for animal cell culture-infrastructure, equipment, culture vessels. Biology and characterization of cultured cells-cell adhesion, proliferation, differentiation, morphology of cells and identification.

UNIT III

Primary cell culture techniques - mechanical disaggregation, enzymatic disaggregation, separation of viable and non-viable cells. Mass culture of cells - manipulation of cell line selection - types of cell lines -maintenance of cell lines - immobilization of cells and its application - synchronization of cell cultures and cell division - production of secondary metabolites - biotransformation - Induction of cell line mutants and mutations - cryopreservation – germplasm conservation and establishment of gene banks.

UNIT IV

Animal cell culture scale up: Scale up in suspension - stirrer culture, continuous flow culture, air-lift fermentor culture; Scale up in monolayer - Roller bottle culture, multi surface culture, multi array disks, spirals and tubes - monitoring of cell growth. Organ culture - whole embryo culture - specialized culture techniques - measurement of cell death.

UNIT V

Tissue engineering: Design and engineering of tissues - tissue modeling. Embryonic stem cell engineering - ES cell culture to produce differential cells - Human embryonic stem cell research. Transgenic animals-transgenic animals in xenotransplantation
TEXT BOOKS


REFERENCES


SCOPE
To understand the emerging trends in genomics and proteomics.

OBJECTIVES
To make the students to acquire knowledge in the applications of genomics and proteomics tools and to address the modern biological issues.

UNIT I
Genome Sequencing: Introduction to Genes, Genome organization –prokaryotes and eukaryotes, Genetic markers- RFLP, Mini and Micro satellite, STS, EST, SSCP, RAPD, RFLP, SNP and SSR. Human Genome and Genomic analysis: Size, features, composition and characteristics of human genome – Sequence repeats, transposable elements, gene structure and pseudogenes.

UNIT II
Sequencing Genomes- methodology, chain termination method, chemical degradation method, shotgun sequencing and assembly of contiguous DNA sequence. cDNA and genomic library construction. Genomic Mapping: Different types of Genome maps and their uses, Genetic and Physical mapping techniques. Map resources. Practical uses of genome maps, NGS

UNIT III

UNIT IV

UNIT V
Experimental Proteomics: Proteome analysis- 2D gel electrophoresis: general strategy, immobilized pH gradients, sample preparation, isoelectric focusing, second dimension PAGE, staining, transfer of proteins from 2D gels, image acquisition and analysis of 2D gels. 2DE databases.
TEXT BOOKS


REFERENCES


ENZYMEOLOGY

1. Determination of the activity of the following serum enzymes:
   a. LDH
   b. Acid phosphatase
   c. Alkaline phosphatase
   d. Aspartate amino transferase
   e. Alanine amino transferase
   f. 5’ nucleotidase
   g. Sodium potassium ATPase
   h. Ceruloplasmin

IMMUNOLOGY (DEMONSTRATION)

2. Raising of antibodies- single soluble and particulate antigen
3. Immunodiffusion- single radial and double diffusion.
4. Immuno-electrophoresis.
5. Rocket immunoelectrophoresis
6. ELISA

Case study-Report

7. Serum enzyme in liver disease
8. Serum enzyme in cardiac disease
9. Serum enzyme in cancer disease
10. Glucose Tolerance Test

REFERENCES


Clinical analysis

1. Estimation of glucose in serum
2. Estimation of cholesterol in serum
3. Estimation of urea in the urine and serum
4. Estimation of chloride in the urine and serum
5. Estimation of calcium in the urine and serum
6. Estimation of magnesium in the urine and serum
7. Analysis of urinary calculi
8. Estimation of Bilirubin in serum (Kit method)
9. Estimation of triglyceride in serum (Kit method)
10. Estimation of HDL in serum (Kit method)

ANIMAL STUDIES (Group experiment)

11. Handling of animals
12. Methods of injection
13. Induction of liver toxicity

REFERENCES


SCOPE
To understand structural features of clinical data management.

OBJECTIVE
Since the emerging trends are numerous the goals of the course is to introduce the student to the current trends in database management for clinical research.

UNIT I
Drug Development Process
Review FDA approved process for development and approval of a drug, role of key player in drug development. Key events in history that have impacted human subject rights, review informed consent process and describe regulatory requirements.

UNIT II
GCP Regulation and Guidelines
Key concept in regulatory application such as GCP, regulation guidance and ICH guidelines. Review mandatory regulations of FDA that apply to sponsor investigator and IRB. Review the regulatory documents which must be collected and maintained, discuss the role of these regulatory documents, and identify strategies to ensure their accurate completion, review management of study files.

UNIT III
Database Management Systems (DBMS) for Clinical Research
The concept of a multi-table relational database and data normalization. Rows as entities, columns as attributes. Primary and foreign keys. One-to-One, One-to-Many and Many-to-Many relationships. The basic tables in a clinical research study: subjects, measurements, and examiners.
Creating a table in design or “data dictionary” view. Field names, types, and descriptions; validation rules, primary and foreign keys, lookup tables, and relationships between tables. Creating data entry forms/subforms.

UNIT IV
Queries and Reports, Importing Data
Filtering by form. Writing select queries and reports for monitoring study progress. Importing data and appending and updating records.

UNIT V
Queries and Exporting Data
More sophisticated queries, including totals (“group by”) queries. Exporting data for statistical analysis. SAS Programming

TEXT BOOKS


REFERENCES


SCOPE
This paper encodes information on drug designing, drug discovery and drug metabolism.

OBJECTIVE
To assist the students to know the actual path of drug mechanism of action and drug discovery.

UNIT I
Introduction to drugs, classification of drugs, passage of drugs across biological membrane; absorption and distribution of drugs; Drug metabolism and elimination- methods of study of drug metabolism, microsomal drug metabolism, binding of drugs to plasma proteins, Introduction and receptor concept-. Types of receptors, receptor theories, isolation of receptors. consequences of drug receptor interaction

UNIT II
Monte Carlo Simulation Methods, Conformational analysis, Ab initio, dft and semi empirical methods, Use of molecular modeling to discover and design new molecules. Techniques of molecular dynamics, Molecular Dynamics Simulation Methods - molecular dynamics using simple models, molecular dynamics with continuous potential-setting up and running a molecular dynamic simulation, constraint dynamics.

UNIT III
Recent advances in drug design methodologies- Biomolecular structure, Structure activity relationship, Pharmacokinetics, Pharmacophoric pattern, ADME Properties, quantitative structure activity relationship, Use of genetic algorithms and principle component analysis in the QSAR equations.

UNIT IV
Ion channels- Structure, function and Pharmacology, Enzymes and enzyme inhibitors, - Enzyme Inhibition strategies.- Enzyme inhibition as a tool for drug development – Examples. Finding new drug targets to treat disease- strategies for target identification and lead design- Use of Genomics and Proteomics for understanding diseases at molecular level- - new targets for anti-cancer drugs, Lipinski’s rule.

UNIT V
Principles and methods of docking, docking problem, structure based drug design, induced fit docking. 3D database search approaches. Screening technology and Informatics for natural products drug discovery. The drug development process, the practice and limitations of Computer assisted drug discovery process, Commercial analysis of docking software’s.
**TEXT BOOKS**

**REFERENCE BOOKS**