JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. Biotech.-I Sem

L	T/P/D	C
4	-/-/-	4

(A72319) BIOINFORMATICS

Objectives: This course provides an introduction to biological data analysis using compilation methods. It also provides knowledge on various types of Databases and different tools/softwares which can be used in the biological systems.

Unit I:

Introduction to Bioinformatics

Need of Computers in Biotechnology; History, Scope & Applications of Bioinformatics, Elementary commands and protocols, ftp, telnet, http.

Unit-II:

Data Bases

Primary Data Base Information:

Introduction to Biological databases, Organization and management of databases. Searching and retrieval of information from the World Wide Web. Structure databases - PDB (Protein Data Bank), Molecular Modeling Databases (MMDB). Primary Databases NCBL, EMBL, DDBJ.

Secondary Data Base:Introduction to Secondary Databases Organization and management of databases Swissprot, PIR, KEGG.

Biochemical Data Bases: Introduction to BioChemical databases-organization and Management of databases. KEGG, EXGESCY, BRENDA, ERGO.

Unit III :

Sequencing Alignment and Scoring Matrices

Aligment-Local, Global alignment, pair wise and multiple sequence alignments, Concept of gap penalty and e-value, Alignment algorithms, Dynamic programming in sequence alignment: Neddleman-Wunsch Aligorithm and Smith-Waterman Algorithm, Amino acid substitution Matrices (PAM, BLOSUM). Sequence similarity search with database: BLAST and FASTA.

Unit IV:

Homology and Phylogenetic analysis

Introduction to Homology, Levels of protein structures, Homology modeling of proteins (sequence to structure), Cn3D, RasMol and SPDbV in homology modeling-case studies.

Introduction to phylogenetics, Methods of Phylogenetic analysis, Role of

multiple sequence alignment algorithms in Phylogenetic analysis, Automated Tools for Phylogenetic Analysis, Construction of phylogenetic tree.

Unit V:

Special Topics in Bioinformatics

DNA mapping and sequencing, Map alignment, Large scale sequencing methods: Shotgun and Sanger method. cDNA sequencing; Genome Mapping, Map assembly, Comparative Sequence analysis.

TEXT BOOKS:

1. Bioinformatics. David Mount, 2000. CSH Publications
2. Essential Bioinformatics by Jin Xiong, Cambridge University Press, 2011.

REFERENCES:

1. Bioinformatics: Methods and Applications: Geneomics & Proteomics and Drug Discovery by S.C.Rastogi, Namitha Mendiratta, Parag Rastogi, Prentice –Hall of India Private Limited, 2006
2. Genomics and Proteomics-Functional and Computational aspects. Springer Publications. Editior-Sandor Suhai.
3. Bioinformatics- Methods and Protocols-Human Press. Stephen Misener, Stephen A. Krawetz.
4. Bioinformatics – Principles and Applications – Harshawardhan P.Bal TATA MEGRAW HILL.
5. Bioinformatics Basics. Applications in Biological Science and Medicine by Hooman H. Rashidi and Lukas K.Buehler CAC Press 2000.
6. Bioinformatics – A Practical guide to the Analysis of Genes and Proteins – Andreas D.Baxevanis, B.F. Francis Ouellette. 3rd Edition, 2005, John Wiley & Sons, Inc.

Outcomes: At the end students get familiarized with existing tools and resources for computational analysis of biological data. They develop an awareness of problems which arise in the modeling & analysis of living system.

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(A72328) TRANSPORT PHENOMENA IN BIOPROCESSES

Objectives: This course is designed to provide an understanding of different transport processes that occur during processing of materials and ensure proper distribution of mass and energy throughout the system.

Unit I:

Basics of Transfer Operation

Mechanism of Momentum Transport: Newton's Law of Viscosity, Non-Newtonian fluids, theory of viscosity of liquids, time dependant viscosity, viscosity measurement (cone-and-plate viscometer, coaxial cylinder rotary viscometer, impeller viscometer), use of viscometers with biological reaction fluids, rheological properties of fermentation broth, factors affecting broth viscocity (cell concentration, cell morphology, osmotic pressure, product and substrate concentration), Velocity distribution in laminar flow and turbulent flow

Unit II:

Momentum Transport

Equation of change for isothermal system (equation of continuity, equation of motion, equation of mechanical energy), Navier-Stoke's equation, Euler Equation and their application, Stream function and potential function and their applications. Creeping flow and irrotational flow, boundary layer theory. Interphase transport in isothermal systems (friction factors for flow in tubes and in packed columns) mixing, mixing mechanism, power requirements in ungassed Newtonian and Non Newtonian fluids, gassed fluids, interaction between cell and turbulent Eddies, skin friction, form friction, operating conditions for turbulent shear damage. Macroscopic Balances- mass, momentum and mechanical energy balances.

Unit III:

Energy Transport

Thermal conductivity and the mechanisms of energy transport- measurement of thermal conductivity, Fourier's law, steady state conduction, analogy between heat and momentum transfer. Steady and unsteady state heat transfer, Natural and forced convection, Dimensionless numbers in heat transfer. Calculation of heat transfer coefficient, Overall heat transfer coefficient. Non-isothermal heat transfer, Temperature distribution with more than one independent variables- heating in a semi infinite and finite slab, temperature distribution in turbulent flow- reference to stirred tank reactor, relationship between heat transfer, cell concentrations and stirring conditions

Unit IV:

Mass Transport

Diffusivity, theory of diffusion, analogy between mass, heat and momentum transfer, role of diffusion in bioprocessing, film theory, concentration distribution with more than one independent variable- unsteady diffusion, boundary layer theory, concentration distribution in turbulent flow- Corrsin equation. Definition of binary mass transfer coefficients, transfer coefficients at high mass transfer rates- boundary layer theory, penetration theory. Convective mass transfer, Liquid -solid mass transfer, liquid-liquid mass transfer, gas-liquid mass transfer

Unit V:

Oxygen Transport in Bioprocesses

Oxygen uptake in cell cultures, Factors affecting cellular oxygen demand, oxygen transfer from gas bubbles to aerobic culture, oxygen transfer in fermentors- bubbles, factors affecting oxygen transport- sparging, stirring, medium properties, antifoam agents, temperature, mass transfer correlations, measurements of k a - oxygen balance method, dynamic method. Mixing and impeller design.

Note: In all units relevant basic numerical problems should be practiced

TEXT BOOKS:

1. R.B.Bird, W.E.Stewart, E.N.Lightfoot, Transport Phenomena, John wiley and sons, Singapore ,
2 P.M.Doran, Bioprocess Principles, Academic Press,

REFERENCES:

1. M.L.Shuler and F. Kargi, Bioprocess Engineering: Basic concepts, 2nd edition, Prentice Hall of India, 2003
2. Harvey W. Blanch, Douglas S. Clark Biochemical Engineering, Marcecel, Dekker, 2007.

Outcomes: After completion of the course the students will be able to understand the flow problems, different flow characteristics, laminar and turbulent flow, energy distribution, and will gain ability to calculate enthalpy change under mass flow characteristics.

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IV Year B.Tech. Biotech.-I Sem

L	T/P/D	C
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(A72323) DOWNSTREAM PROCESSING

Objectives: This course is formulated to teach various methods of product separation, isolation and purification.

UNIT I:

OVERVIEW OF BIOSEPARATION AND ITS IMPORTANCE

Role and importance of downstream processing in bioprocess industries; problems and requirements of bioproduct purification. Economics of downstream processing in Biotechnology, cost-cutting strategies, characteristics of biological mixtures, process design criteria for various classes of bioproducts (high volume, low value products and low volume, high value products): Physico-chemical basis of bio-separation processes.

UNIT-II:

PRIMARY SEPARATION AND RECOVERY PROCESS

Cell disruption methods for intracellular products: Bead mill, homogenizer, chemical and enzymatic methods, ultrasonographic method: Removal of insolubles, biomass (and particulate debris) separation techniques, flocculation and sedimentation, centrifugation and filtration methods.

UNIT-III:

PRODUCT ISOLATION AND ENRICHMENT

Precipitation and sedimentation methods (with salts, organic solvents, and polymers, extractive separations, aqueous two-phase extraction, supercritical extraction), Extraction: co-current and counter-current extraction, Chemisorption, Adsorption, Sigle stage absorption, Fixed bed adsorption, Absorption isotherm, Langmuir and Friendlich isotherm, Absorption hysteresis, Break-through curve. Aqueous-two-phase extraction.

UNIT IV:

PRODUCT PURIFICATION

Chromatographic separation, HPLC, FPLC, GC, TLC, Ion-exchange chromatography, gel permeation chromatography, affinity chromatography, chromatofocusing electrophoresis separations, tangential cross flow filtration, membrane filtration, micro and ultrafiltration, holofibre separation, reverse osmosis, membrane separation theory and design. Other separation processes: dialysis, electrodialysis, pervoporation, electrophoresis methods of bioseparations. Recent development in product Isolation (for ex. one step purification, reverse micro cellular extraction on line membrane separation). In-situ product removal, integrated bioprocessing

UNIT V:

CRYSTALLIZATION AND DRYING

Crystallization, theory and principles, various crystallization equipment. **Drying**: Theory and principles of drying, definition of various terms, Drying kinetics, Drying rate terms, Mechanism of batch drying - constant rate and falling rate periods evaluation and diffusivity coefficient; various drying operations, drying equipment, criteria for selection of dryers.

TEXT BOOKS:

1. Wankat PC. Rate controlled separations, Elsevier.
2. Belter PA and Cussler E. Bioseparations, Wiley.

REFERENCES:

1. Product Recovery in Bioprocess Technology, BIOTOL.' Series, VCH.
2. Asenjo J.M. Separation processes in Biotechnology, Marcel Dekkere Inc
3. M.R.Ladisch, Bioseparation engineering: Principles, Practice and Economics, Wiley Interscience.

Outcomes: After completion of this course the students will be skilled in choosing a process of separation for a particular product, they will know how to design the relevant equipment, calculate the yield, and degree of purification.

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L	T/P/D	C
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(A72318) ANIMAL BIOTECHNOLOGY

Objectives: This course is designed to impart students an understanding of primary cell culture and methods of converting them to long term established cultures. They will be exposed to all the requirements and equipments needed for animal cell culture, stem cell technology, organ culture, tissue engineering.

Unit I:

Introduction

Primary and established cells; Equipments & Instrumentation; Characterization of cultured cells: Cell duplication time – examples of slow & rapid growers; Parameters of growth and their measurement; Measurement of viability and toxicity; Introduction to apoptosis and necrosis.

Unit II:

Media & Supplements

Balanced salt solutions and simple growth medium; Physical, chemical and metabolic functions of media constituents; Role of CO_2; Role of serum & supplements.

Unit III:

Basic mammalian cell culture techniques

Disaggregation of tissue and primary cells – enzymatic and non-enzymatic; Maintenance of cell culture- suspension and adherent; Cell separation based on cell density and phenotypic markers.

Higher order cultures

Organ and histotypic cultures; Three dimensional cultures; Mixed cell cultures – eg., study of immune response; Skin grafts.

Unit IV:

Application of Animal cell cultures

Study of biological process- eg., polarized and non-polarized cells; Production of vaccines; Biologicals and therapeutics (monoclonal antibody and recombinant protein).

Unit V:

Tissue Engineering & Stem Cells

Cloning; Micromanipulation; Synchronization; Transformation. Stem cells Definition; Types – pleuripotent v/s totipotent; Embryonic, adult and fetal;

Role of stem cells in tissue engineering; Applications of stem cells.

TEXT BOOKS:

1. Culture of Animal Cells, (3rd Edition), F1. Ian Froshney. Wiley-Liss.
2. Animal Cell Culture – Practical Approach, Ed. John R.W. Masters, OXFORD.

REFERENCES:

1. Cell Culture Lab Fax. Eds. M. Butler & M. Dawson, Bios Scientific Publications Ltd., Oxford.
2. Animal Cell Culture Techniques. Ed. Martin Clynes, Springer.
3. Methods in Cell Biology, Vol. 57, Animal Cell Culture Methods. Ed. Jenni P. Mather and David Barnes. Academic Press.
4. Cell Growth and Division: A Practical Approach. Ed. R. Basega, IRL Press.

Outcomes: After completion of the course students will achieve the expertise to demonstrate the methods for development of primary cell culture. They will develop awareness in interlinking of different fields for the development of biological organs.

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(A72322) CROP IMPROVEMENT

(Elective-II)

Objectives: Students get familiarized with tissue culture and transformation techniques for improvement of crop productivity and quality. To learn different molecular markers for molecular breeding and MAS.

Unit I:

Plant Breeding and Crop Improvement

Conventional Plant Breeding strategies, Hybridization, Inbred lines, Pure lines, Heterosis.

Unit II:

Molecular Markers for Crop Imrovement

RAPD, RFLP, AFLP, SSRs, SSCP, SCAR. QTLs: Marker assisted selection, construction of molecular maps, map based cloning.

Unit III:

Gene Cloning

Discovery, Cloning of Plant genes, Probe based screening, Genomic and proteomic approaches.

Unit IV:

Transgenic Crops I

Secondary Metabolites, Increase in Productivity by manipulation of photosynthesis, Nitrogen fixation, Nutrient uptake efficiency, Post harvest technology.

Unit V:

Transgenic Crops II

Transgenic plants for quality improvement for lipids & Carbohydrate content, Plantibodies, Edible Vaccines, Therapeutic Proteins.

TEXT BOOKS:

1. Biochemistry & Moleuclar Biology of Plants (Buchanan, B.B. Gruissem, W. and Jones, R.L. eds.) 2000.
2. Molecular Plant Breeding, Yunbi Xu, CABI Publishers, 2010.

REFERENCES:

1. Bernard R. Glick and John E. Thompson, Methods in Plant Molecular Biology and Biotechnology, CRC Press,

2. John Hammond, Peter McGarvey, Vidadi Yusibov, Plant Biotechnology: New Products and Applications, Springer Verlag,
3. Plant Molecular Biotechnology by S.Mahesh, New Age International Publishers, 2008.

Outcomes: Students would be able to do transformation of crop plants to increase crop productivity. Students will also gain the ability to apply molecular markers for MAS in breeding.

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(A72327) STRUCTURAL BIOLOGY

(Elective-II)

Objectives: This course aims to familiarize students to the importance of structure of biomolecules with respective functions. They further understand the impact of interaction of biomoleucles such as protein-protein interaction, protein-nucleic acid interaction, receptor-ligand interaction on biological functions.

UNIT I:

MACROMOLECULAR STRUCTURE AND INTERMOLECULAR FORCES

Macromolecular Structure: Levels of structure in biomolecules, size and shape, Molecular chirality and Structural transitions.

Forces that determine Protein and Nucleic acid structure, basic problems. Polypeptide chains; geometric, potential energy calculations, observed values for rotation angles, hydrogen bonding, hydrophobic interactions and structure of water molecule; ionic interactions, disulphide bonds.

UNIT II

STRUCTURE OF NUCLEIC ACIDS

Nucleic acids; general characteristics of nucleic acid structure; geometric, glycosidic bond rotational isomers, backbone rotational isomers and ribose puckering forces stabilizing ordered forms, base pairing; base stacking; tertiary structure of nucleic acids.

UNIT-III

PROTEIN FOLDING AND STRUCTURE

Protein folding: Types of proteins and interactions that govern protein folding, protein structure, The protein globule and hydrophic interactions, organized folds, folding mechanisms, membrane proteins, helix-coil transitions.

Prediction of protein structure; Sequence-structure relationships (fundamentals of bioinformatics: sequence homology),

UNIT IV:

BIOMOLECULAR INTERACTIONS & KINETICS

Molecular recognition, supramolecular interactions, Functional importance of protein-protein and protein-nucleic acid interactions. Specific and non-specific DNA-protein complexes.

Biochemical Kinetics studies, uni-molecular reactions, simple bimolecular multiple intermediates, steady state kinetics, catalytic efficiency relaxation

spectrometry, ribonuclease as an example.

UNIT V:

EXPERIMENTAL METHODS

Size and shape of micro molecules: photons, chromophores, transition dipole moments, absorbance, and concentration. Methods of direct visualization of macromolecules as hydrodynamic particles - macromolecular diffusion, ultra centrifugation, viscometry.

TEXT BOOKS:

1) Introduction to Protein Architecture: The Structural Biology of Protein by A.M. Lesk, Oxford University press (2001).

2) Vijayan. M. Yathindra. N. and Kolaskar A.S. Perspectives in structural Biology. Indian Academy of Sciences.

REFERENCES:

1. Introduction to Protein Structure, by Branden and Tooze

2. Tinoco, I., Jr., Sauer, K., Wang, J. C., & Puglisi, J. D. (2001) Physical Chemistry: Principles and Applications in Biological Sciences, 4th ed. Prentice Hall.

3. Discovering Genomics, Proteomics and Bioinformatics by A. Malcolm Campbell, Laurie J.Heyer, 2nd Edition, Pearson Publications, 2008.

Outcomes: Students would be able to generate and study the importance of structure of biomoleules using x-ray diffraction and related techniques. They could assess the changes of the structure and its effect on the biological function. They will gain the ability to distinguish between the type of interaction and its impact on biological system.

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(A72321) CANCER BIOLOGY

(Elective-II)

Objectives: This course aims to familiarize the students with an understanding of the molecular mechanisms of cancer, its development by factors such as physical, chemical, diet and retroviruses etc., .The effect of mutations involving anti and pro apoptotic genes and defects in DNA repair mechanisms along with strategies for cancer treatment are a part of the objectives.

UNIT I:

FUNDAMENTALS OF CANCER BIOLOGY

Regulation of Cell cycle, mutations that cause changes in signal molecules, effects on receptor, signal switches, Different forms of cancer – Classification: Epidemiology of cancer.

UNIT II:

PRINCIPLES OF CARCINOGENESIS

Principles of Physical Carcinogenesis, X - Ray radiation, UV - mechanism of radiation Carcinogenesis; Chemical Carcinogenesis, Metabolism of Carcinogenesis, Natural History of Carcinogenesis, Targets of Chemical Carcinogenesis, Diet & Cancer.

UNIT III:

MOLECULAR CELL BIOLOGY OF CANCER

Oncogenes, Identification of Oncogenes, Viruses and Cancer, Detection of Oncogenes, Growth Factor and Growth Factor receptors that are Oncogenes. Oncogenes / Proto Oncogene activity. Growth factors related to transformations. Signal transduction and aberrant cell growth.

Principles of cancer metastasis: Clinical significances of invasion, heterogeneity of metastatic phenotype, Metastatic cascade, Basement Membrane disruption, Three-step theory of Invasion, Proteinases and tumour cell invasion.

UNIT IV:

DETECTION OF CANCER

Detection of Cancers, Prediction of aggressiveness of Cancer, Advances in Cancer detection.

UNIT V:

TUMOR SUPPRESSION AND CANCER THERAPY

Tumor suppressor genes, modulation of cell cycle in cancer.

Different forms of therapy, Chemotherapy- new molecules, radiation Therapy, and Immunotherapy: advantages and limitations.

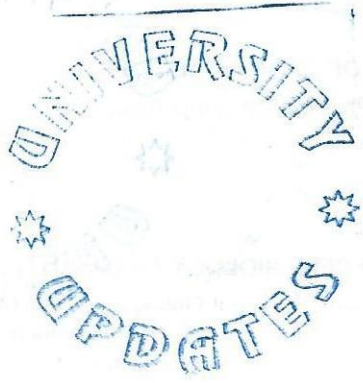
TEXT BOOKS:

1. L.M. Franks, N.M. Teich. An Introduction to Cellular and Molecular Biology of Cancer, New Edition, Oxford Medical publications.
2. Raymond. W. Ruddon, Oxford University press.

REFERENCES:

1. Dunmock N.J and Primrose.S.B., Introduction to modern Virology, Blackwel.

Outcomes: After completion of the course the student will be able to understand the cellular and molecular basis of cancer, its treatment and development of new drugs.



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(A70527) ARTIFICIAL NEURAL NETWORKS
(Elective-II)

UNIT- I

Introduction - what is a neural network? Human Brain, Models of a Neuron, Neural networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks

Learning Process – Error Correction learning, Memory based learning, Hebbian learning, Competitive, Boltzmann learning, Credit Assignment Problem, Memory, Adaption, Statistical nature of the learning process.

UNIT- II

BACK PROPAGATION: back propagation and differentiation, Hessian matrix, Generalization, Cross validation, Network pruning Techniques, Virtues and limitations of back propagation learning, Accelerated convergence, supervised learning.

UNIT- III

SINGLE LAYER PERCEPTRONS: Adaptive filtering problem, Unconstrained Organization Techniques, Linear least square filters, least mean square algorithm, learning curves, Learning rate annealing techniques, perceptron – convergence theorem, Relation between perceptron and Bayes classifier for a Gaussian Environment

Multilayer Perceptron – Back propagation algorithm XOR problem, Heuristics, Output representation and decision rule, Computer experiment, feature detection.

UNIT- IV

SELF ORGANIZATION MAPS: Two basic feature mapping models, Self organization map, SOM algorithm, properties of feature map, computer simulations, learning vector quantization, Adaptive patter classification.

UNIT- V

NEURO DYNAMICS: Dynamical systems, stability of equilibrium states, attractors, neuro dynamical models, manipulation of attractors as a recurrent network paradigm

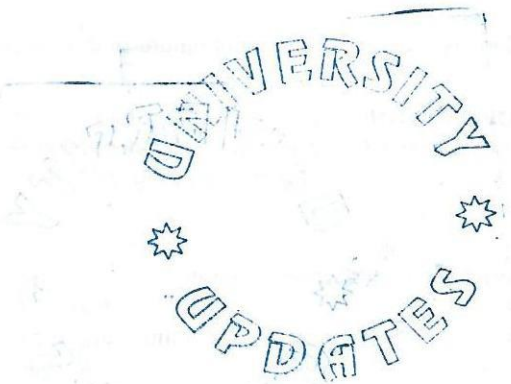
Hopfield Models – Hopfield models, computer experiment

TEXT BOOK:

1. Neural networks: A comprehensive foundation/ Simon Hhaykin/ PHI.

REFERENCES:

1. Artificial neural networks/ B.Vegnanarayana/PHI
2. Neural networks in Computer intelligence/ Li Min Fu/ TMH/2003
3. Neural networks/ James A Freeman David M S kapura/ Pearson education/2004
4. Introduction to Artificial Neural Systems/Jacek M. Zurada/JAICO Publishing House Ed. 2006.



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(A72326) MOLECULAR PATHOGENESIS

(Elective-III)

Objectives: This course is designed to provide students an understanding of pathogenesis of a disease, a consequence of whole organism Vs a molecules of the microbe and its effect on disease development. They will get awareness about resistance, susceptibility and disease epidemiology outcomes of different populations.

UNIT I:

INTRODUCTION

Introduction to pathogenesis, components of microbial pathogenicity. Population genetics of Microbial pathogenesis, methods to detect genetic diversity and structure in natural population, epidemiology.

UNIT II:

HOST DEFENCES

Host defense against pathogens, clinical importance of understanding host defense, components of the host surface defences systems like skin, mucosa, eye, mouth, respiratory tract.

Components of the systemic defense like the tissues and blood.

Modulation of immune response by Pathogens

UNIT III

HOST- PATHOGEN INTERACTION

Virulence and virulence factors, colonising virulence factors, virulence factors damaging the host tissues, virulence genes and regulation of the virulence genes.

Experimental methods to study host-pathogen interaction, selecting the pathogen model, measurement of virulence, identification of potential virulence factors, Viral Pathogenesis.

UNIT IV:

PARADIGMS OF PATHOGENESIS:

Diphtheria disease by colonisation; Disease without colonisation, *Clostridium botulinum* and *Staphylococcus aureus;* Intestinal infections, *Shigella* and *E.coli* infections; *Vibrio cholera, Salmonella* infections; fungal infections.

UNIT V:

FUTURE CHALLENGES

Gastric and duodenal ulcers - are they due to infections? Lyme disease and Syphilis - unsolved mystery. Legionnaires disease-aftermath of comforts.Tuberculosis and other mycobacterial infections reemerging with vengeance. Rheumatic fever and glomerulo nephritis - still a question to be solved, HIV & AiDS, Malaria.

TEXT BOOK:

1) Iglewski B.H. and Clark V.L. Molecular basis of Bacterial pathogenesis, Academic press,

REFERENCES:

1. General Microbiology. Prescott and Dunn Mc Graw Hill Publishers.

2. Biology of Micro organisma. BROCK, Prentice Hall, International Inc.

Outcomes: Students could distinguish between the molecules with the pathogen which could cause disease or induced protection of the host. They get awareness why certain population are resistant vs susceptible based on their genetic background and the methods to resist epidemiology of a disease.

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(A72320) BIOPHARMACEUTICALS

(Elective-III)

Objectives: This course enables students to understand the difference between pharmaceuticals vs biopharmaceuticals, importance of properties of drugs, dose and absorbance rates in hosts (Pharmacokinetics). It also provides an in depth understanding of some biopharmaceuticals which are presently in use.

UNIT I:

INTRODUCTION TO PHARMACEUTICALS

History & Definition of Drugs. Sources of Drugs - Plant, Animals, Microbes and Minerals. Different dosage forms. Routes of drug administration; Biotech drugs in Development, Recent FDA Approvals.

UNIT II:

DRUG DISCOVERY AND DRUG DESIGN

Drug Research based on Computers and Biotechnology, Antibodies in Rational Drug Designing, Classes of Therapeutic Targets in the Living Cell, Drug Development in Past and Role of Biotechnology Today, Drug Designing Softwares (AUTODOCK, ARGUSLAB etc.,)

UNIT III:

PHARMACOKINETICS

Pharmacokinetics- Drug absorption, factors that affect the absorption of drugs, Distribution of drugs, Biotransformation of drugs, Bioavailability of drugs and drug metabolism, Pharmacogenomics.

UNIT IV:

BIOPHARMACEUTICAL PRODUCTS

Production of Therapeutic Proteins, Blood Products, Monoclonal Antibodies, Hormone Therapy, Role of Biopharmaceuticals in treatment of various health disorders

UNIT V:

TRANSGENICS & GENE THERAPY

Transgenic Production of Biopharmaceuticals: Animals of Interest for Transgenesis, Challenges & Issues,Advantages, Transgenic Plants for Production, Human Gene Therapy: Examples; Ethics; Gene transfer with Viral & Non-viral Vectors.

TEXT BOOK:

1. Biopharmaceuticals by S.N.Jogdand, Himalaya Publishing House.

REFERENCES:

1. Biopharmaceuticals: Biochemistry & Biotechnology, Gary Walsh , John Wiley & Sons Ltd.
2. Remington's Pharmaceutical sciences, (Mark Publications & Company eston PA) year .
3. Theory & Practice of Industrial Pharmacy, Leon Lachman, Lea & Febiger .

Outcomes: At the end the students will be able to distinguish between pharma vs biopharma. They will be skilled to assess the properties of drugs & biopharma products and their outcome as a potential molecules.

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(A72324) INTRODUCTION TO BIOMATERIALS

(Elective-III)

Objectives: This course is designed with an objective to provide an understanding of the basic properties required for a material to be biocompatible. They will be imparted awareness in testing & quality assessment of the biomaterials. They will get exposure to latest nano biomaterials and their application for human use.

Unit I.

Introduction

Structure and function of human body: chemical, cellular, tissue, organ and system level.

Biocompatibility of synthetic materials and implants.

Unit II.

Basics of Biomaterials

Characteristics of biomaterials,

Classification of biomaterials,

Impact of biomaterials.

Unit III.

Biomaterials for human use

Metallic biomaterials as implants,

Bioceramics and ceramic biomaterials,

Polymeric biomaterials – classification, natural and synthetic materials; biomedical applications,

Composite biomaterials – classification, biological responses to composite biomaterials, biomedical applications.

Unit IV.

Quality and Testing of Biomaterials

Degradation,

Corrosion,

Deformation,

Fracture,

Brittle to ductile transition,

Fatigue,

Tribology.

Unit V.

Nanobiomaterials

Definition and classes of nanobiomaterials

Polymeric, ceramic and composite nanobiomaterials

Scaffolding, tissue engineering (including stem cells), growth factor delivery with nanobiomaterials

TEXT BOOKS:

1. Biomaterials: A Nano Approach by Sreeram Ramakrishna, Murgan Ramalingam, T.S.Sampath Kumar, Winston.O.Soboyejo, CRC Press
2. D. Byrom, Biomaterials –novel materials from biological sources, Stockton press, New York.

REFERENCE:

1. A. Steinbuechel – Biopolymers.

Outcomes: At the end students will be able to differentiate whether a material has the compatibility with biological system to be used for applications. They will be able to assess the quality of biomaterials, design and generate new biomaterials or modify existing material for enhancement of biocompatibility.

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(A72388) BIOINFORMATICS LAB

Objectives: This course aims to impart in students fundamental knowledge of various biological data bases and tools which can be used for analysis using compilation methods.

1) Information retrieval from Databases
2) FASTA & BLAST
3) Sequence Alignments:
   a) Pairwise sequence Alignment (EMBOSS)
   b) Multiple sequence Alignment (Clustal W)
4) Primer Designing Tools
5) Protein visualization tools (RASMOL, SPDBV)

REFERENCES:

1. Bioinformatics – A Practical guide to the Analysis of Genes and Proteins – Andreas D.Baxevanis, B.F. Francis Ouellette. 3rd Edition, 2005, John Wiley & Sons, Inc.

Outcomes: Students gain an expertise with existing tools and resources for computational analysis of biological data. They develop an awareness of problems which arise in the modeling & analysis of living system.

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(A72389) DOWNSTREAM PROCESSING LAB

Objectives: The lab curriculum is formulated to train students on various methods of product separation, isolation, purification and formulation.

1. **Cell disruption techniques:**

Bead mill, ultrasonication, chemical and enzymatic method, high pressure cell disrupter

2. **Separation of soluble from insolubles:** Filtration, sedimentation, centrifugation,

3. **Product Isolation:** Product enrichment operations, precipitation, ultra filtration, Aqueous two-phase extraction,

4. **Product purification:** Preparative liquid chromatographic techniques (HPLC), GC, Affinity chromatography, Ion-exchange chromatography, TLC, Gel electrophoresis, Ultra filtration, membrane based filtration.

5. **Drying and Crystallization:**

Product crystallization, Freeze drying, Flash drying.

6. **Demonstration of few equipments**

1. Tangential flow filtration unit
2. Ultra filtration membrane
3. Chromatographic apparatus
4. Chromatographic columns
5. UV-Vis spectrophotometer
6. HPLC
7. GC
8. FPLC
9. Lyophilizer

REFERENCES:

1. Product Recovery in Bioprocess Technology, BIOTOL.' Series, VCH.
2. Asenjo J.M. Separation processes in Biotechnology, Marcel Dekkere Inc

Outcomes: The students will be skilled to select a process of separation for a particular product, use the relevant equipment, calculate the yield, and degree of purification for industrial applications.