AMITY UNIVERSITY
RAJASTHAN

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Amity Institute of Biotechnology -Minutes of Board of Studies

2018-2019

Meeting of the Board of Studies in Biotechnology to be held on 05-04-2019 in Director Sir's office at 10.30 a.m.

Agenda

1. Reshuffling of Food Microbiology course (Domain Elective) of B.Tech. (BTB233)and B.Tech + M.Tech (Dual degree) Biotechnology II semester(UMT233) with Food and nutrition –BTB-433 (Domain elective) of B.Tech. and B.Tech +M.Tech(Dual degree) Biotechnology (UMT433) semester IV. (**Justification:** Preliminary knowledge of microbiology is required for food microbiology whereas no prerequisites are needed for Food and nutrition.)

2. Change in course content of Protein engineering- BTB 732 (Domain elective) –Course content has been updated as per the demand of subject.

3. Change in course content of Introduction to dynamical system for neuroscience- ICN 703 and Psychology of Mind- ICN 702.

4. Incorporation of one additional course as domain elective namely computational biology- BTB 634(3 Credit course) in B.Tech Biotech. VI Semester.

5. Replacement of course BTB 703-JAVA-II in B.Tech Biotech. VII Semester with a new course Principles of management and entrepreneurship, in accordance with recommendations of the Industry Advisory Board of AIB. (Justification: The JAVA II is advanced java which is not required to B.Tech Biotech students since they are not from core mathematics while Entrepreneurship skills shall prove useful for them in developing entrepreneurship abilities.

6. Removal of JAVA –II Lab BTB 723 from B.Tech. Biotech. VII semester also need approval. (Justification: The JAVA-II lab is taught with JAVA –II theory course only which has been proposed for removal and replacement therefore Lab course will not be feasible as well.

7. Change in evaluation of 6 month project in final semesters of B.Tech (BTB860) and MTech and MSc (MSB/MTB460)programs

Existing Assessment Pattern:

External Assessment 100%			
Sr No	**Assessment task**	**Weightage**	**Marks**
1	Project report	50%	50
2	Viva Voce	50%	50

AMITY UNIVERSITY RAJASTHAN
Amity Institute of Biotechnology
Suggestions/Changes in the existing course syllabus

Program & Semester	**B.Tech Biotechnology, VII Semester** + Dual Degree
Course Code	**BTB732** / UMT 732
Course Title	**PROTEIN ENGINEERING**
Existing Content	**Course Contents:** **Module I** Dynamics and Structural Evolution Protein Engineering: Study of molecular interaction forces (Hydrogen, Ionic, covalent, van- der walls and others), Structure andchemical properties of the building blocks of biological materials (amino acids, sugars, nucleic acids). **Module II** Protein structure and folding; Mechanism of folding; Principles of protein secondary structures, alpha-helix, beta-helix, beta-sheet, beta-turns, random coils, coiled coils, and others and case studies with Keratin, collagen and green fluorescence protein. Methods and tools used tocharacterize the molecular structures of biological materials (Circular dichroism, NMR, X-ray diffraction, FTIR, scanning electron microscopy and others). **Module III** Protein dynamics, Protein Folding (10,20,30 & 40), Proteins design and engineering, Random and site directed mutagenesis; Strategies to alter catalytic efficiency;structure prediction and modeling proteins; Molecular graphics in protein engineering; Dynamics and mechanics; Signal transduction. **Module IV** Receptors and hormones; antigen-antibody relationship; Drug-protein interactions and Design applications of engineered proteins. Molecular chaperons, Heat shock protein, case study of misfolded prions; Drugs-protein interactions and Design; Protein engineering benefits inindustry and medicine; Engineering of antibodies.

Ravneet

Plz enclose external expert comments copy, if applicable

Proposed Content	**Course Content:** **Module 1:** Introduction to protein engineering, structure and properties of amino acids, primary, secondary, tertiary and quaternary structure of proteins Engineering of Macromolecules, Basics of protein engineering, Rationale, Assumptions for protein engineering, Key biocatalyst properties. Mutational effects on protein folding: methodology, application and interpretation. Protein engineering for stability. **Module 2:** Methods in Protein Engineering, library construction methods. Rational design, Evolutionary protein design, Use of genetic engineering to protein engineering, Site-specific and multiple amino acid substitutions, Functional and structural consequences and limitations, DNA shuffling, Error prone PCR. Phage display, cell surface display and cell-free display methods for screening the engineered protein candidates. **Module 3:** De novo design of catalysts & artificial proteins: Approaches used in designing and constructing novel proteins. **Module 4:** Structure – function relationships of proteins, Structure and function of an antibody; structure of hemoglobin, muscle proteins, G Protein, Protein structure and folding; Mechanism of folding; Molecular chaperons, Heat shock protein, case study of misfolded prions. **Module 5:** Drugs-protein interactions and Design, Rational structure-based drug design. Protein engineered biomaterials, Protein-DNA interactions; drug-DNA interactions; Databases of sequences and structure for protein and DNA, public domain softwares for visualizing and modeling biomolecules. Protein engineering benefits in industry and medicine.
Justification	Course content has been restructures in five modules and course content has been updated as per the demand of the subject.

Name of Subject Expert: Dr Sanket Kaushik

Plz enclose external expert comments copy, if applicable

Introduction to dynamical system for neuroscience

Course Code ICN703 **Credits: 03**

Course Objectives: This course will help the students to understand relationship between structure and function of brain, dynamical systems and Electrophysiology of Neurons. It will also give a clear understanding of various neurological and psychiatric conditions.

Module I: Overview of brain systems and general principles of their functional organization: From cortical maps and subcortical loops to the micro-structure of brain circuits and their interconnections. Methodologies used to study brain systems: Basic assumptions and approaches. Measuring neural activity (electrophysiology and imaging); shutting down neural activity (lesions, pharmacological inactivation, optogenetics); perturbing of neural activity (micro stimulation and opto-stimulation); opening the loop at the behavioral and neural levels.

Module II: The Peripheral Nervous System, Autonomic Nervous System, Sympathetic Nervous System, Parasympathetic Nervous System, Sensory-Somatic Nervous System, Cranial Nerves, Spinal Nerves. Brain, Brain Lobes, Midbrain and Brain Stem, structure and function of the spinal cord the Cerebral Cortex, corpus calosum, somatosensation, gyrus, sulcus.

Module III: Neurons, Parts of a Neuron, Types of Neurons, types of glia, and specific functions, role in supporting neuron function. Nerve Impulse Transmission within a Neuron: Resting Potential, Neuronal Charged Membranes, Resting Membrane Potential, Nerve Impulse Transmission within a Neuron: Action Potential, Depolarization and the Action Potential, Hyperpolarization and Return to Resting Potential, Myelin and Propagation of the Action Potential Synaptic Transmission, Chemical Synapse, Signal Summation, Synaptic Plasticity.

Module IV: Introduction to Sensation, Reception, Encoding and Transmission of Sensory Information, Integration of Signals from Mechanoreceptors, Density of Mechanoreceptors, Thermoreceptor, Capsule Receptors, Free Nerve Endings, Umami, olfactory, receptor. Hearing and Vestibular Sensation, amplitude and frequency of sound waves to transduction and the inertia on receptive cells in the vestibular system. Anatomy of the Eye, visual information coding in the brain., various Pathways for Visual signals are processed in the brain through several different pathways.

Module V Alzheimer's Disease, Parkinson's Disease, Neurodevelopmental Disorders, Autism and ADHD, Attention Deficit Hyperactivity Disorder (ADHD) and Mental Illness, Schizophrenia, Epilepsy, Stroke Tumors, Seizure Disorders, Cerebrovascular accidents, Disorders of development, Degenerative disorders.

Psychology of Mind

Course Code : ICN 702 **Credits 03**

Course Objective:
This course will help the students to understand the basic concepts of individual psychology from affective, behavioural and cognitive perspectives.

Course Contents:

Module I: The Science of Psychology

Definitions and goals, modern perspectives: Psychodynamic, Behavioural, Humanistic, Cognitive, Socio-cultural, Evolutionary Personality: Definition, Theories, Measurement.

Module II Sensation, Attention and Perception:

Sensation: concepts of threshold, absolute and difference thresholds, signal-detection and vigilance; Factors influencing attention including set and characteristics of stimulus; Definition and concept of perception, biological factors in perception; Perceptual organization-influence of past experiences, perceptual defence-factors influencing space and depth perception, size estimation and perceptual readiness; The plasticity of perception; Extrasensory perception; Culture and perception, Subliminal perception.

Module III: Learning and Memory

Learning and synaptic plasticity, Perceptual learning, classical conditioning, instrumental conditioning, relational learning

Module IV: Psychological wellbeing and Mental Disorders:

Concept of health-ill health; Positive health, well-being; Causal factors in mental disorders (anxiety disorders, mood disorders, schizophrenia and delusional disorders; personality disorders, substance abuse disorders); Factors influencing positive health, well-being, life style and quality of life; Happiness disposition.

Module V: Therapeutic Approaches:

Psychodynamic therapies; Behaviour therapies; Client cantered therapy; Cognitive therapies; Indigenous therapies, Bio-feedback therapy; Prevention and rehabilitation of the mentally ill; Fostering mental health.

Meeting of The Board of Studies in Biotechnology on 19-11-2018

Agenda

1. To approve revised syllabus of all courses in all semesters of all Programs as per uniform module distribution according to credits.

   All courses with 3 credits to have 5 modules
   All courses with 2 credits to have 3 modules

2. To approve changes in course content of Integrated M.Tech. in Converging Technologies ICT 101- Properties of Matter, Thermal Physics and Optics.
3. To approve changes in course content of Integrated M.Tech. in Converging Technologies ICT 105- Foundation Course in Mathematics.
4. To approve programme structure and syllabus of all courses in Sem VIII, Integrated M.Tech. in Converging Technologies .
5. To approve modification in programme structure of 7th semester of Cognitive neuroscience specialization.
6. To approve Changes in course content of following M. Sc./M.Tech Biotech
   - **MSB/MTB101:** BIOCHEMISTRY AND METABOLIC REGULATION- Syllabus updated by Dr Vijay Kr Srivastava
   - **MSB/MTB103:** BIOINFORMATICS- Syllabus updated by Dr Vijay Kr Srivastava
   - **MSB/MTB122-** ADVANCED MICROBIAL TECHNOLOGY –Lab- By Dr Neelam Jain, suggested to increase the credit from 1 (2hrs) to 2 (4hrs)
   - **MSB/MTB231:** MEDICAL BIOTECHNOLOGY- Syllabus updated by Dr D D Singh
   - **MSB/MTB 202:** ADVANCED ANIMAL BIOTECHNOLOGY- Syllabus updated by Dr Anupam Jyoti
   - **MSB301:** BIOPROCESS AND INDUSTRIAL BIOTECHNOLOGY- Syllabus updated by Dr Shruti Mathur (Downstream Processing contents added)
   - **MSB/MTB332:** Drug Discovery and Development- Syllabus updated by Dr Vikram Yadav
7. To approve Domain elective courses BSB 130 Term Paper to be substituted with 'Biochemical Basis of Desease'
8. Any other item with approval of the chair.

Course Name	Course Code	L:T:P	Credit	Semester
BIOCHEMISTRY AND METABOLIC REGULATION	MTB101	3:0:0	3	1

A. COURSE LEARNING OUTCOMES (CLO)

CLO 1	aware of the metabolic pathways
CLO 2	able to identify and solve problems related to biochemical disorders
CLO 3	Able to understand cell metabolism and its applications in various sectors.
CLO 4	N/A

B. SYLLABUS

Module I
Structure of Biomolecules, Metabolism of Carbohydrates, Lipids, Proteins, Amino acids and Nucleic acids.

Module II
Photosynthesis in Microorganisms; Role of chlorophylls, carotenoids and phycobilins; Calvin cycle; Chemolithotrophy; hydrogen- iron-nitrite-oxidizing bacteria; nitrate and sulfate reduction; methanogenesis and acetogenesis; Bacterial fermentations.

Module III: Modes of Regulation
Different levels of regulation - protein synthesis/degradation, allosteric regulation, reversible covalent modification, proteolytic processing, Requirements for ATP in synthesis and degradation cycle, Reversibility of the different methods of regulation, Consequences of misregulation

Module IV: Regulation of metabolic pathways
Glycolysis/glycogenolysis, Phosphogluconate/Citric Acid Cycle, Oxidative Phosphorylation, Fatty acid oxidation, Fatty Acid Biosynthesis, Amino Acid Oxidation.

Module V:
Regulation of Metabolism for the production of Primary and Secondary Metabolites with case studies.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Lehninger, A. (2013). Principles of Biochemistry, 6th Ed., Nelson and Cox.
- Mathews, Van Holde & (2012).Ahern Biochemistry. 4th Edition.

References:

- Smith, E. L., Hill, R. L. Lehman, I. R. Lefkowitz, R. J. Handler, P. & White, A. (1983). Biochemistry 7th Ed. McGraw-Hill Book Company.
- Berg, J. M., Tymoczco, J. L. & Stryer, L. (1990). Biochemistry, 3rd Ed., W.H. Freeman and Company.
- Voet, D. V. & Voet, J. G. (2010). Biochemistry, 4th Ed. Wiley
- Conn, E. E. & Stumph, P. K. (1987).Outlines of Biochemistry, John Wiley & Sons.

Course Name	Course Code	L:T:P	Credit	Semester
BIOINFORMATICS	MTB103	3:0:0	3	1

A. COURSE LEARNING OUTCOMES (CLO)

CLO 1	Investigate about various publicly available biological datasets at various database and will understand the data attributes with information stored in it.
CLO 2	Create new projects by applying various tools to correct the existing data interpretation issues by applying computational methods.
CLO 3	Apply these data sources and software for investigation of novel biological problems
CLO 4	Develop new protocols and methods for biological discoveries.

B. SYLLABUS

Module I: Basics of Bioinformatics

Introduction to Bioinformatics; Computers in Biology to understand Biological System; Basic commands of Windows, Unix and Linux operating systems; Concept of open resources in Bioinformatics.

Module II

Biological databases -

Database concepts; Introduction to Data types and source; Protein Sequence and Structural Databases; Nucleic acid databases; Genome databases; Specialized Databases; Protein databases- UniProt, Protein Data Bank. Clinically relevant drug-drug interactions databases; Information retrieval from Biological databases: Entrez system, TCGA data bases, Bioportal.

Module III

Sequence Analysis

Biological background for sequence analysis; Sequence alignment: Global, Local, Pairwise and Multiple sequence analysis; Algorithm for alignments; Database Searching; Tools for Sequence alignment.

Module IV

Introduction to Modeling and Visualization tools

Introduction to RASMOL, PyMoL SWISS-PDB Viewer.

Module V

Insilico Structure prediction of protein and docking

Protein identification, physical properties, motifs and patterns, structure, folding classes, structure classification; Structure databases– PDB and MMDB, visualizing structural information, Docking of Molecules, structure prediction in proteins, prediction of buried residues in proteins, RNA secondary structure – minimum free-energy structures.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Sensen, C.W. (2002). Essentials of Genomics and Bioinformatics, John Wiley and Sons.
- Mount, D.W. (2004). Bioinformatics: Sequence and Genome Analysis. 2nd Ed., Cold Spring Harbor Laboratory Press.
- Baxevanis, A.D. and Ouellette, B.F.F (2009). Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Wiley – Interscience

References:

- Gusfield, D. (1997). Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology, Cambridge University Press
- Heijne, G. Von and Heijne, G. Von (1987). Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit by Academic Press.
- Pevzner, P.A. (2000). Computational Molecular Biology: An Algorithmic Approach by MIT Press
- Doolittle, R.F., Abelson, J.N, & Simon, M.I. (1996). Computer Methods for Macromolecular Sequence Analysis, Academic press
- Waterman, M. (1995). Introduction to Computational Biology: Maps, Sequences and Genomes, 1st Ed,

Course Name	Course Code	L:T:P	Credit	Semester
BIOPROCESS AND FERMENTATION TECHNOLOGY	MTB202	3:0:0	3	2

A. COURSE LEARNING OUTCOMES (CLO)

CLO 1	Function at a technically competent level in Biotechnology industries
CLO 2	Design and develop biological processes and products required to become an entrepreneur
CLO 3	Critically analyse lacunae in bioprocesses and solve problems of bioprocesses in industry
CLO 4	N/A

B. SYLLABUS

Module I

Advantage of bioprocess over chemical process. Basic principle in bioprocess technology. Media formulation sterilization, thermal death kinetics, batch and continuous sterilization system. Sterilization of Industrial Media, Air and Fermenter

Module II

Transport phenomena in bioprocess – Mass transfer, mass transfer co-efficient for gases and liquids. Rate of oxygen transfer. Determination of oxygen transfer coefficient. Rheological properties of intermedium. Biological heat transfer, Heat transfer coefficients.

Bioprocess control and monitoring variables such as temperature, agitation, pressure etc.

Module III

Kinetics of microbial growth, substrate utilization and product formation Batch, Fed-batch, CSTR types of reactors – CSTR, tower, airlift, bubble column, packed bed, immobilized cells, Control and monitoring, online and off-line control, Computers in bioprocess control systems.

Module IV

Industrial production of enzymes: cellulase, amylase, protease; organic acids: citric acid, acetic acid, lactic acid; ethanol, biomass, antibiotics: classification, penicillins, tetracyclins, chloramphenicol; vitamins: B_{12}, riboflavin, fermented dairy products.

Ethanol: Production by batch, continuous and cell recycle adopted by various technologies practiced in Indian distilleries using molasses and grains computation of fermentation efficiency, distillation efficiency and overall efficiency of ethanol production, recovery, uses, glucose effect etc. po wer alcohol – definition, uses, merits and demerits of various technologies for its production.

Antibiotics: Classification, penicillin, tetracycline, streptomycin, cephalosporin. Various penicillin as precursor and 'R' – side chain, penicillianase, 6-APA, pencillin production, harvest and recovery, uses of various forms etc.

Streptomycin: Chemical structure, production, harvest and recovery, uses by-product of streptomycin fermentation etc.

Module V Biomass: Bakers and distillers yeast production using various raw materials, "bio" factors for growth, Crabtree effect, harvesting, different forms and uses.

What are mushroom, different forms of common mushroom production from agro based raw materials and uses.

Examination Scheme:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Text & References:

Text:

- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Text Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International
- Industrial Microbiology, Prescott and Dunn, C.B.S. Publishers

References:

- Biochemical Engineering, Bailley and Ollis.

Course Name	Course Code	L:T:P	Credit	Semester
MEDICAL BIOTECHNOLOGY	MTB231	3:0:0	3	2

A. COURSE LEARNING OUTCOMES (CLO)

CLO 1	Develop the theoretical and empirical concepts of disease diagnosis for a successful career in Biotechnology and allied industries.
CLO 2	Demonstrate the principles and applications of diseases therapy to solve the problems of society
CLO 3	Apply the concepts & techniques for the identification of diseases and associated risks and make progress efficiently towards solutions for real world problems
CLO 4	Develop the research skills in preparation for a career in the biosciences industry or academic research from Biotechnology and thereby produce recommendations for sustainable development

B. SYLLABUS

Module I

Clinical significance of biochemical tests and their role in the diagnosis and monitoring of disease, Clinical characteristic of disease. Role of pharmacological testing in clinical management of disease. Role of clinical biochemistry in detection, diagnosis and therapy of genetically inherited diseases and cancer.

Module II

Genetic disease, type of inheritance, single-gene and multifactorial inheritance, example of genetic diseases.Therapeutic intervention in blood disorder by stem cell transplantation/gene therapy.

Module III

Clinically important taxonomic grouping of bacteria, Staphylococci, Streptococci etc. Isolation and identification strategies of bacteria. Etiology-identification of disease agents and their source, transmission, portals of entry, nosocomial infections. Anti- microbial chemotherapy. Modes of action of major groups of antibiotics.

Module IV

Current topics in animal and cellular and molecular biology- cellular and molecular mechanism of human diseases,(cancer /diabetts) transgenesis-animal models of human diseases, animals for pharmaceutical protein production.

Manipulation of reproduction and development for application in medicine, agriculture, aquaculture and conservation.

Module V Epidemiology-epidemics, pandemics and endemics disease. Control measure of microbial diseases-public health control methods.Hygiene regulations, population screening for disease. Management of Clinical Data.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Marshall, W J, Clinical Chemistry, 3rd edition, Mosby, 1997.
- Harper's Biochemistry K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw Hill/ Appleton and Lange

References:

- Sudbery, P. Human molecular genetics. Addison Wesley Longman (1998)
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox. , Worth Publishing
- Principles of Physical Biochemistry, K.E. Van Holde, W.C. Johnson, Prentice Hall
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner
- Biochemistry (Fifth Edition), Lubert Stryer
- Physical Biochemistry, David Freifeider
- Annual Review of Biochemistry (1995-2004)
- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience
- Industrial Enzymes & their applications, H. Uhlig., John Wiley and Sons Inc.

Course Name	Course Code	L:T:P	Credit	Semester
BIOPROCESS PLANT DESIGN	MTB 301	3:0:0	3	3

A. COURSE LEARNING OUTCOMES (CLO)

CLO 1	To understand the application of chemical engineering principles
CLO 2	To understand the unit operation to bioprocess system
CLO 3	To understand the principles of disciplines of mechanical, electrical and industrial engineering to design a completely economically optimal process using living or subcomponent of cells
CLO 4	N/A

B. SYLLABUS

Module I
Introduction; General design information; Mass and energy balance; Flow sheeting; Piping and instrumentation.

Module II
Materials of construction for bioprocess plants; Mechanical design of process equipment; Vessels for biotechnology application.

Module III
Design of bioreactors; Design considerations for maintaining sterility of process streams processing equipment; Selection and specification of equipment for handling fluids and solids; Selection, specification design of heat and mass transfer equipment used in bioprocess industries

Module IV
Design of facilities for cleaning of process equipment used in biochemical industries; Utilities for biotechnology
production plants; Process economics

Module V
Bioprocess validation; Safety Considerations; Case studies.

Examination Scheme:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Text & References:

Text:
- Process Plan Layout and Piping Design, E. Bausbacher, R. Hunt, Prentice Hall PTR.
- Chemical Engineering, R.K. Sinnott, J.M. Coulson and J.F. Richardsons, Butterworth-Heinemann.
- Applied Process design for Chemical and Petrochemical Plants, E. E. Ludwig, Butterworth- Heinemann.

References:
- Chemical Engineers Handbook, R.H. Perry and D.W. Green, McGraw- Hill.
- Plant Design and Economics for Chemical Engineers, M. Peters and K. Timmerhaus.

Course Name	Course Code	L:T:P	Credit	Semester
DRUG DISCOVERY & DEVELOPMENT	MTB 332	3:0:0	3	3

A. COURSE LEARNING OUTCOMES (CLO)

CLO 1	Understand of Drug discovery & development general process
CLO 2	Understand of Drug development considerations
CLO 3	Understand of Drug Receptor theories in relation to drug development
CLO 4	Understanding of Rational Drug Design in Drug discovery and development process

B. SYLLABUS

Module: I

Drug discovery & development:

General Introduction of drug design and development, Strategies for Target Identification and validation, Lead Identification and Optimization, Pre-Clinical Research and Clinical Research & Pharmacovigilance.

Module: II

Drug development considerations:

Introduction to Pharmacology, Sources of drugs, Dosage forms and routes of administration, mechanism of action, Combined effect of drugs, Factors modifying drug action, tolerance and dependence, Pharmacogenetics.

Module: III

Pharmacokinetics:

Pharmacokinetic, Pharmacodynamic and Toxicological considerations in drug development, Physiochemical properties of drugs in relations to their biological activity, Rout of drugs administrations, Various types of dosage formulations, Stability of drugs.

Module: IV

Drug Receptor Theories:

Principles of drug action, Mechanisms of drug action, Drug-receptor interactions, Types of drug targets, G-Protein coupled receptor, Ion Channels, Ligand Gated Ion Channels, Enzymatic drug receptor and Transducer mechanisms, Dose response relationship, Factors modifying drug action.

Module: V

Rational Drug Design:

Introduction, Types of drugs design: Legand based, Structure based, Rational drug discovery, Computer Aided drug design, De novo drug design methodologies.

Structure activity relationships in drug design, Statistical techniques behind QSAR, Molecular descriptors 3D QSAR and COMFA, Molecular modeling, Molecular docking and dynamics.

Examination Scheme:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Suggested Books:

- New Drug Development: Design, Methodology, and Analysis, by J. Rick Turner, Published by John Wiley & Sons, 2007.
- Essentials of Medical Pharmacology by K D Tripathi, Published by JAYPEE Brothers Medical Publishers (P) Ltd. 7th Edition 2010.
- Biopharmaceutics & Pharmacokinetics by DM Brahmankar & SB Jaiswal, Published by Vallabh Prakashan; 3rd Edition 2012.
- Drug Discovery and Clinical Research, by S.K Gupta, Published by JAYPEE Brothers Medical Publishers (P) Ltd

Course Name	Course Code	L:T:P	Credit	Semester
Biochemistry And Metabolic Regulation	MSB101	3:0:0	3	1

A. COURSE LEARNING OUTCOMES (CLO)

CLO 1	Biochemistry majors will be able to demonstrate an understanding of fundamental biochemical principles, such as the structure/function of biomolecules, metabolic pathways, and the regulation of chemical and molecular processes that occur in and between cells.
CLO 2	Biochemistry majors will gain proficiency in basic laboratory techniques in both chemistry and biology, and be able to create the scientific method to the processes of experimentation and hypothesis testing.
CLO 3	Students in the Biochemistry major will be able to apply and effectively communicate scientific reasoning and data analysis in both written and oral forums.
CLO 4	Develop your research skills in preparation for a career in the biosciences industry or academic research.

B. SYLLABUS

Module I
Structure of Biomolecules, Metabolism of Carbohydrates, Lipids, Proteins, Amino acids and Nucleic acids.

Module II
Photosynthesis in Microorganisms; Role of chlorophylls, carotenoids and phycobilins; Calvin cycle; Chemolithotrophy; hydrogen- iron-nitrite-oxidizing bacteria; nitrate and sulfate reduction; methanogenesis and acetogenesis; Bacterial fermentations.

Module III: Modes of Regulation
Different levels of regulation - protein synthesis/degradation, allosteric regulation, reversible covalent modification, proteolytic processing, Requirements for ATP in synthesis and degradation cycle, Reversibility of the different methods of regulation, Consequences of misregulation

Module IV: Regulation of metabolic pathways
Glycolysis/glycogenolysis, Phosphogluconate/Citric Acid Cycle, Oxidative Phosphorylation, Fatty acid oxidation, Fatty Acid Biosynthesis, Amino Acid Oxidation.

Module V:
Regulation of Metabolism for the production of Primary and Secondary Metabolites with case studies.

Examination Scheme:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Text & References:

Text:

- Lehninger, A. (2013). Principles of Biochemistry, 6th Ed., Nelson and Cox.
- Mathews, Van Holde & (2012).Ahern Biochemistry. 4th Edition.

References:

- Smith, E. L., Hill, R. L. Lehman, I. R. Lefkowitz, R. J. Handler, P. & White, A. (1983). Biochemistry 7th Ed. McGraw-Hill Book Company.
- Berg, J. M., Tymoczco, J. L. & Stryer, L. (1990). Biochemistry, 3rd Ed., W.H. Freeman and Company.
- Voet, D. V. & Voet, J. G. (2010). Biochemistry, 4th Ed. Wiley
- Conn, E. E. & Stumph, P. K. (1987).Outlines of Biochemistry, John Wiley & Sons.

Course Name	Course Code	L:T:P	Credit	Semester
BIOINFORMATICS	MSB103	3:0:0	3	1

A. COURSE LEARNING OUTCOMES (CLO)

CLO 1	Investigate about various publicly available biological datasets at various database and will understand the data attributes with information stored in it.
CLO 2	Create new projects by applying various tools to correct the existing data interpretation issues by applying computational methods.
CLO 3	Apply these data sources and software for investigation of novel biological problems
CLO 4	Develop new protocols and methods for biological discoveries.

B. SYLLABUS

Module I: Basics of Bioinformatics

Introduction to Bioinformatics; Computers in Biology to understand Biological System; Basic commands of Windows, Unix and Linux operating systems; Concept of open resources in Bioinformatics.

Module II

Biological databases -

Database concepts; Introduction to Data types and source; Protein Sequence and Structural Databases; Nucleic acid databases; Genome databases; Specialized Databases; Protein databases- UniProt, Protein Data Bank. Clinically relevant drug-drug interactions databases; Information retrieval from Biological databases: Entrez system, TCGA data bases, Bioportal.

Module III

Sequence Analysis

Biological background for sequence analysis; Sequence alignment: Global, Local, Pairwise and Multiple sequence analysis; Algorithm for alignments; Database Searching; Tools for Sequence alignment.

Module IV

Introduction to Modeling and Visualization tools

Introduction to RASMOL, PyMoL SWISS-PDB Viewer.

Module V

Insilico Structure prediction of protein and docking

Protein identification, physical properties, motifs and patterns, structure, folding classes, structure classification; Structure databases– PDB and MMDB, visualizing structural information, Docking of Molecules, structure prediction in proteins, prediction of buried residues in proteins, RNA secondary structure – minimum free-energy structures.

Examination Scheme:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Text & References:

Text:

- Sensen, C.W. (2002). Essentials of Genomics and Bioinformatics, John Wiley and Sons.
- Mount, D.W. (2004). Bioinformatics: Sequence and Genome Analysis. 2nd Ed., Cold Spring Harbor Laboratory Press.
- Baxevanis, A.D. and Ouellette, B.F.F (2009). Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Wiley – Interscience

References:

- Gusfield, D. (1997). Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology, Cambridge University Press
- Heijne, G. Von and Heijne, G. Von (1987). Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit by Academic Press.
- Pevzner, P.A. (2000). Computational Molecular Biology: An Algorithmic Approach by MIT Press
- Doolittle, R.F., Abelson, J.N, & Simon, M.I. (1996). Computer Methods for Macromolecular Sequence Analysis, Academic press

...Computational Biology: Maps, Sequences and Genomes, 1st Ed,

Course Name	Course Code	L:T:P	Credit	Semester
MEDICAL BIOTECHNOLOGY	MSB231	3:0:0	3	2

A. COURSE LEARNING OUTCOMES (CLO)

CLO 1	Develop the theoretical and empirical concepts of disease diagnosis for a successful career in Biotechnology and allied industries.
CLO 2	Demonstrate the principles and applications of diseases therapy to solve the problems of society
CLO 3	Apply the concepts & techniques for the identification of diseases and associated risks and make progress efficiently towards solutions for real world problems
CLO 4	Develop the research skills in preparation for a career in the biosciences industry or academic research from Biotechnology and thereby produce recommendations for sustainable development

B. SYLLABUS

Module I

Clinical significance of biochemical tests and their role in the diagnosis and monitoring of disease, Clinical characteristic of disease. Role of pharmacological testing in clinical management of disease. Role of clinical biochemistry in detection, diagnosis and therapy of genetically inherited diseases and cancer.

Module II

Genetic disease, type of inheritance, single-gene and multifactorial inheritance, example of genetic diseases.Therapeutic intervention in blood disorder by stem cell transplantation/gene therapy.

Module III

Clinically important taxonomic grouping of bacteria, Staphylococci, Streptococci etc. Isolation and identification strategies of bacteria. Etiology-identification of disease agents and their source, transmission, portals of entry, nosocomial infections. Anti- microbial chemotherapy. Modes of action of major groups of antibiotics.

Module IV

Current topics in animal and cellular and molecular biology- cellular and molecular mechanism of human diseases,(cancer /diabetts) transgenesis-animal models of human diseases, animals for pharmaceutical protein production.

Manipulation of reproduction and development for application in medicine, agriculture, aquaculture and conservation.

Module V Epidemiology-epidemics, pandemics and endemics disease. Control measure of microbial diseases-public health control methods.Hygiene regulations, population screening for disease. Management of Clinical Data.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:

Text:

- Marshall, W J, Clinical Chemistry, 3rd edition, Mosby, 1997.
- Harper's Biochemistry K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw Hill/ Appleton and Lange

References:

- Sudbery, P. Human molecular genetics. Addison Wesley Longman (1998)
- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox. , Worth Publishing
- Principles of Physical Biochemistry, K.E. Van Holde, W.C. Johnson, Prentice Hall
- Tools of Biochemistry, T.G. Cooper, John Wiley and Sons Inc.
- Enzymes Biochemistry, Biotechnology, Clinical Chemistry, Trevor Palner
- Biochemistry (Fifth Edition), Lubert Stryer
- Physical Biochemistry, David Freifeider
- Annual Review of Biochemistry (1995-2004)
- Enzyme Kinetics: Behaviour and Analysis of Rapid Equilibrium and Steady State Enzyme Systems, I.H. Segel, Wiley-Interscience
- Industrial Enzymes & their applications, H. Uhlig., John Wiley and Sons Inc.

Course Name	Course Code	L:T:P	Credit	Semester
ADVANCED ANIMAL BIOTECHNOLOGY	MSB202	3:0:0	3	2

A. COURSE LEARNING OUTCOMES (CLO)

CLO 1	Develop a practical approach of the basic concepts of cell culture and investigate the newer applications of cell culture
CLO 2	Develop the principles and applications of hybridoma technology, IVF-ET, animal cloning and vaccine development
CLO 3	Apply the concepts & techniques for the applications of transgenic animals with reference to animal models and discuss the public and ethical concerns over the use of animal biotechnology.
CLO 4	Develop the research skills in preparation for a career in the biosciences industry or academic research.

B. SYLLABUS

Module I

Culture media – Natural and defined media, Primary culture – Steps, Mechanical and enzymatic disaggregation, Cell lines – Maintenance of cell line, Tissue and organ culture, Cell growth kinetics; Cryopreservation, Contamination

Module II

Polyclonal and monoclonal antibodies, Advantages and disadvantages of monoclonal antibodies, Production strategy, Use of monoclonal antibodies, Therapeutic monoclonal antibodies.

Module III

Vaccines; Types of vaccines - First generation vaccine, Second generation vaccine, Recombinant subunit vaccine, Peptide vaccine, Nucleic acid vaccines.

Module IV

In vitro fertilization–steps, Embryo transfer –Steps, Advantages and disadvantages of IVF-ET; Gene transfer methods – Viral and non viral methods, Expression vector systems,

Module V

Biopharming - transgenic animals as bioreactors for producing pharmaceutically important compounds and therapeutic proteins; Bioethical issues related to animal biotechnology

Examination Scheme

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Text books:

1. Ramdass, P. (2014). Animal Biotechnology Recent concepts and developments. MJP publishers
2. Masters, J. R. (Ed.). (2000). Animal cell culture: a practical approach (pp. 3-10). New York: Oxford University Press.

Reference Books:

1. Freshney, R. I. (Ed.). (1986). Animal cell culture: a practical approach (Vol. 8). Oxford: IRL press.

Course Name	Course Code	L:T:P	Credit	Semester
BIOPROCESS AND INDUSTRIAL BIOTECHNOLOGY	MSB 301	3:0:0	3	3

A. COURSE LEARNING OUTCOMES (CLO)

CLO 1	Aware of the bioenergetics and metabolic pathways
CLO 2	Able to identify and solve problems related to biochemical engineering
CLO 3	Able to understand cell engineering and its applications in various sectors.
CLO 4	N/A

B. SYLLABUS

Module I

Advantage of bioprocess over chemical process. Basic principle in bioprocess technology. Media formulation sterilization, thermal death kinetics, batch and continuous sterilization system. Sterilization of Industrial Media, Air and Fermenter

Module II

Transport phenomena in bioprocess – Mass transfer, mass transfer co-efficient for gases and liquids. Rate of oxygen transfer. Determination of oxygen transfer coefficient. Rheological properties of medium. Biological heat transfer, Heat transfer coefficients.

Bioprocess control and monitoring variables such as temperature, agitation, pressure etc.

Module III

Kinetics of microbial growth, substrate utilization and product formation Batch, Fed-batch, types of reactors – CSTR, tower, airlift, bubble column, packed bed, immobilized cells, Control and monitoring, online and off-line control, Computers in bioprocess control systems.

Module IV

Downstream Processing

Aqueous - two-phase extraction; Adsorption-desorption processes; Membrane based separation: Dialysis, Electro dialysis, Micro filtration, Ultra filtration.

Chromatographic methods of separation based on size, charge, reverse phase, hydrophobic interactions, and biological affinity, HPLC, FPLC, MS-LC, Gas chromatography.

Electrophoresis, principle, types on the basis of support media, 1D, 2D gel electrophoresis, continuous and capillary electrophoresis.

Crystallization, Drying, Case studies.

Biomass: Bakers and distillers yeast production using various raw materials, "bio" factors for growth, Crabtree effect, harvesting, mushroom production from agro based raw materials and uses.

Module V

Industrial production of enzymes: cellulase, amylase, protease; organic acids: citric acid, acetic acid, lactic acid; ethanol, biomass, antibiotics: classification, penicillins, tetracyclins, chloramphenicol; vitamins: B_{12}, riboflavin, fermented dairy products.

Ethanol: Production by batch, continuous and cell recycle adopted by various technologies practiced in Indian distilleries using molasses and grains computation of fermentation efficiency, distillation efficiency and overall efficiency of ethanol production, recovery, uses, glucose effect etc. po wer alcohol – definition, uses, merits and demerits of various technologies for its production.

Antibiotics: Various penicillin as precursor and 'R' – side chain, penicillianase, 6-APA, pencillin production, harvest and recovery, **Streptomycin:** Chemical structure, production, harvest and recovery, uses by-product of streptomycin fermentation.

Examination Scheme:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Text References:

***Text*:**

- Principles of Fermentation Technology, Salisbury, Whitaker and Hall, Aditya Text Pvt. Ltd.
- Industrial Microbiology, Casida, New Age International
- Industrial Microbiology, Prescott and Dunn, C.B.S. Publishers

***References*:**

- Biochemical Engineering, Bailley and Ollis.

Course Name	Course Code	L:T:P	Credit	Semester
DRUG DISCOVERY & DEVELOPMENT	MSB 332	3:0:0	3	3

A. COURSE LEARNING OUTCOMES (CLO)

CLO 1	Understand of Drug discovery & development general process
CLO 2	Understand of Drug development considerations
CLO 3	Understand of Drug Receptor theories in relation to drug development
CLO 4	Understanding of Rational Drug Design in Drug discovery and development process

B. SYLLABUS

Module: I

Drug discovery & development:

General Introduction of drug design and development, Strategies for Target Identification and validation, Lead Identification and Optimization, Pre-Clinical Research and Clinical Research & Pharmacovigilance.

Module: II

Drug development considerations:

Introduction to Pharmacology, Sources of drugs, Dosage forms and routes of administration, mechanism of action, Combined effect of drugs, Factors modifying drug action, tolerance and dependence, Pharmacogenetics.

Module: III

Pharmacokinetics:

Pharmacokinetic, Pharmacodynamic and Toxicological considerations in drug development, Physiochemical properties of drugs in relations to their biological activity, Rout of drugs administrations, Various types of dosage formulations, Stability of drugs.

Module: IV

Drug Receptor Theories:

Principles of drug action, Mechanisms of drug action, Drug-receptor interactions, Types of drug targets, G-Protein coupled receptor, Ion Channels, Ligand Gated Ion Channels, Enzymatic drug receptor and Transducer mechanisms, Dose response relationship, Factors modifying drug action.

Module: V

Rational Drug Design:

Introduction, Types of drugs design: Legand based, Structure based, Rational drug discovery, Computer Aided drug design, De novo drug design methodologies.

Structure activity relationships in drug design, Statistical techniques behind QSAR, Molecular descriptors 3D QSAR and COMFA, Molecular modeling, Molecular docking and dynamics.

Examination Scheme:

Components	Mid Term	Attendance	Assignment/ Project/Seminar/Quiz	Class Test	Viva	EE
Weightage (%)	15	5	10	10	10	50

Suggested Books:

- New Drug Development: Design, Methodology, and Analysis, by J. Rick Turner, Published by John Wiley & Sons, 2007.
- Essentials of Medical Pharmacology by K D Tripathi, Published by JAYPEE Brothers Medical Publishers (P) Ltd. 7th Edition 2010.
- Biopharmaceutics & Pharmacokinetics by DM Brahmankar & SB Jaiswal, Published by Vallabh Prakashan; 3rd Edition 2012.
- Drug Discovery and Clinical Research, by S.K Gupta, Published by JAYPEE Brothers Medical Publishers (P) Ltd

Properties of Matter, Thermal Physics and Optics

Course Code: ICT101 **L:3,T:1,P:2, C:5**

Course Objective:

Aim of this course is to introduce the students to fundamentals of graduate level physics, which form the basis of all applied science and engineering.

Course Contents:

Module I: Properties of Matter:

Elasticity: Hook's Law, Young's Modulus, Bulk Modulus, Shear Modulus, Poisson's ratio, Relations between elastic constants. Twisting couple on a Cylindrical Rod, Bending of Beams, Bending moments, Cantilever.

Viscosity: Viscosity, Critical velocity, Flow of a Liquid through a Capillary Tube, Poiseuille's equation, Capillaries in series and parallel, Stoke's Formula.

Surface Tension: Molecular Forces, Surface energy, Shape of drops, Pressure difference across a Curved Surface, Expression for Excess Pressure on a curved surface, Film of Water between two Glass plates, Shape of liquid meniscus in a capillary tube, Capillary action, Rise of liquid in a conical Capillary tube, Vapor pressure and Surface tension.

Module II: Thermal Physics:

Concept of thermodynamic state, the first law of thermodynamics: heat and work, internal energy. second law of thermodynamics: concept of entropy and temperature, principle of increase of entropy. thermodynamic variables: enthalpy, Helmholtz potential, Gibbs free energy, Phase transformations: first order and second order, Clausius-Clapeyron equation. Production of low temperature: Joule-Thomson experiment, regenerative cooling, cooling by adiabatic demagnetization.

Module III: Optics:

Diffraction of light: Fresnel's half period zones, explanation of rectilinear propagation of light, zone plate, Fresnel's diffraction at a straight edge, Fresnel's diffraction at a circular aperture, Fraunhoffer diffraction.

Resolving Power: Geometrical and spectral resolution, distinction between magnification and resolution, Rayleigh's criterion for the limit of resolution, resolving power of plane diffraction grating, resolving power of a prism.

Polarization of light: Concept of polarization, polarization by reflection, Brewster's law, polarization by refraction, pile of plates, double refraction, Huygens explanation of double refraction through uniaxial crystals, Nicol prism, phase retardation plates, elliptically and circularly polarized light, detection of plane, elliptically and circularly polarized light and optical rotation - laws of rotation of plane of polarization.

Laser system: Spontaneous & stimulated emission, absorption, Einstein coefficients (only definitions), population inversion, optical &electrical pumping , cavity resonators, properties of lasers, Ruby laser, Helium- Neon laser, uses of laser, idea of holography (qualitative treatment only).

Optical fibers: Structure and types of fibers, fiber optic communication system.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE

Foundation Course in Mathematics

Course Code: ICT105 **L:3,T:0,P:0,**
C:3

Course Objective:
The knowledge of Mathematics is necessary for a better understanding of almost all disciples. Here our intention is to make the students acquainted with the concept of basic topics from Mathematics.

Course Contents:

Module 1: Complex Numbers **(4)**
Definition, real and imaginary parts, complex conjugate, representation of a complex number in a plane, modules and argument of a complex number, algebra of a complex numbers, cube root of unity.

Module 2: Sequences and Series **(6)**

Sequences, series (finite and infinite) 4^{th} term, arithmetical progression (A.P.) sum of n terms of an A.P. arithmetic mean (A.M.), Geometric progression (G.P) sum of n terms and infinite terms of a G.P., Geometric mean (G.M.), Harmonic progression (H.P.) Harmonic Mean (H.M.) Relation between A.M., G.H, H.M, series representation of exponential functions, logarithmic functions, $\log_e (1 + x)$ and $\log_e (1-x)$.

Module 3: Permutation and Combination **(5)**
Fundamental principle of counting, Factorial rotation, Permutation as an arrangement, meaning of P (n,r). Combination-meaning of C (n,r), Applications of permutation and combinations.

Module 4: Binomial Theorem **(4)**

Statement and proof of Binomial theorem of positive integral exponent. General and middle terms in Binomial expansions. Properties of Binomial coefficients.

Module 5: Matrices and Determinants **(6)**

multiplication of matrices, rank of matrix, elementary row and column transformation, inverse of a matrix, solution of linear equations in two or three variables using inverse of a matrix; Determinants of a square matrix, properties of determinates

Module 6: Co-ordinate Geometry of two-dimensional **(5)**

Point: definition, Cartesian system of coordinates in a place, distance and section formula, condition for collinearity of three points in a place, equation of a straight line slope form, intercept form, two point form, general form: parallel and perpendicular line, intercept of a line, angle between two lines.
Standard and general forms of circle, equation of a circle when and points of a diameters points of intersection of a line and a circle, condition of tangency of a line and a circle, conic section: definition, focus, directrix, eccentrity, equations of parabola, ellipse and hyperbola.

Examination Scheme:

Components	A	CT	HA/ S/V/Q	EE
Weightage (%)	5	15	10	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Text & References:

- H. K. Das, Higher Enginering Mathematics, S. Chand Publishing.
- Erwin Kreyszig, Advanced Engineering Mathematics, Wiley.
- B. V. Ramana, Higher Engineering Mathematics, Tata Mc.Graw Hill Edu.
- Mathematics, text book for XI, NCERT.
- Mathematics-I and II text book for XII, NCERT.

OLD Syllabus

Biocomputing Methods of Bioinformatics

Course Code BTF 632 **Credit: 03**

Course Objective:

The objective of the course is to provide detail explanation of various mathematical models or biomodels used in bioinformatics

Module I

Molecular modeling methods: Semi-empirical methods, Empirical methods.

Module II

Molecular Mechanics, Conformations: global vs. local Force fields: expressions for stretch, bond, torsion, etc. Description of various force fields: MM3, Dreiding, AMBER, CHARMM Mechanics of Bio-macromolecules.

Module III

Molecular Dynamics, Newton's equations for many particles Verlet and related algorithms Types of dynamics simulations: adiabatic, constant T, simulated annealing, etc. Conformational searching using MD and other methods Free energy calculations Dynamics of Bio-macromolecules Electrostatics of biomolecules.

Module IV

Energy Minimization, Golden section, derivative based method (SD, CG, Newton-Raphson) Docking simulations, Rigid docking, Flexible docking, Different Scoring schemes

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

References

1. Höltje Hans-Dieter, Sippl Wolfgang, Rognan Didier, Folkers Gerd. Molecular Modeling: Basic Principles and Applications. Publisher: New York, Wiley-VCH.2003. ISBN: 3527305890.
2. Friesner Richard A. Computational Methods for Protein Folding:advances in Chemical Physics Volume 120 Kindle Edition. Publisher: New York, John Wiley &Sons. 2002 ISBN: 0471209554
3. Leach, Andrew. Molecular Modelling: Principles and Applications. Publisher:Prentice Hall. 2001. ISBN: 0582239338.
4. Höltje Hans-Dieter, Folkers Gerd. Molecular Modeling: Basic Principles andApplications (Methods and Principles in Medicinal Chemistry) Vol. 5. Publisher:New York, Wiley-VCH , 1997. ISBN: 3527293841.
5. McCammon Andrew J., Harvey Stephen C. Dynamics of Proteins and Nucleic Acids Publisher: New York, Cambridge University Press, 1987. ISBN: 0521356520.

New Syllabus

Biocomputing Methods of Bioinformatics

Course Code BTF 632 **Credit: 03**

Course Objective:

The objective of the course is to provide detail explanation of various mathematical models or bio models used in bioinformatics

Module I

Molecular modeling concepts: Coordinate system, Potential Energy Surface, Molecular graphics and surfaces.

Module II

Molecular Mechanics, Empirical Force fields: expressions for stretch, bond, torsion, etc. Description of various force fields, Force field parameterization.

Module III

Energy Minimization, derivative based method (SD, CG, Newton-Raphson) Applications of Energy Minimization.

Module IV

Molecular dynamic simulation method: simple model, continuous Potential, constraint dynamics, MD at constant temperature and pressure, Monte Carlo Simulation.

Module V

Conformational analysis: systematic methods for exploring conformational space, Model Building Approach, Random Search, Global Energy minimum, Molecular fitting.

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9

ADVANCED COMPUTATIONAL BIOLOGY - II

Course Code : BTF 603 **Credit Units:3**

Module I
Genomics and Metagenomics: Large scale genome sequencing strategies. Metagenomics, basic principles, applications and interpretation of results. Basic concepts on identification of disease genes, role of bioinformatics-OMIM database, reference genome sequence, Genome mapping and types , gene expression profiling; identification of SNPs, SNP database (DbSNP). Role of SNP in Pharmacogenomics, SNP arrays.

Module II
Protein arrays: basic principles. Computational methods for identification of polypeptides from mass spectrometry. Identification of proteins by PMF and MS/MS data; Database search engines for MS data analysis (Mascot, Sequest, and others);

Module III
Proteomics informatics strategies for biomarker discovery, analysis of protein functions and pathways. Applications of proteomics (Disease diagnosis, drug development, and plant biotechnology). Protein-protein interactions: databases such as DIP, PPI server and tools for analysis of protein-protein interactions.

Module IV
Biological networks: Complex Biological Systems, Types of Biological networks, Intra-cellular networks: Gene-regulatory network, Protein-interaction network, Metabolic networks and Signaling network; Inter-cellular networks: Neuronal networks, Network motifs.

Module V
NGS Platforms: Introduction to NGS, Roche/454 FLX, Illumina/Solexa Genome Analyzer, Applied Biosystems SOLiD system, Helicos Heliscope, Pacific Biosciences/single molecule real time (SMRT) sequencing.

Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

Text & References:
1. Simpson R. J."Proteins and Proteomics - A Laboratory Manual". Cold Spring Harbour Laboratory Press, 2002.
2. Pennington S. R. and Dunn M. J. "Proteomics - From Protein Sequence to Function. Viva Books, 2002.
3. Twyman R. M. "Principles of Proteomics". Taylor & Francis. 2004.
4. Principles of Genome Analysis and Genomics (3rd Ed.) by Primrose, S.B. and Twyman, R.M., Blackwell Publishing Company, Oxford, UK. 2003.
5. Bioinformatics: Sequence and Genome Analysis by Mount, D., Cold Spring Harbor Laboratory Press, New York. 2004.

B. Tech. Bioinformatics

Semester I

Code	Course	Category	L	T	P/FW	Credit
BTF 101	Applied Mathematics - I	CC	3	1	-	4
BTF 102	Applied Physics - I	CC	2	-	-	2
BTF 103	Applied Chemistry - I	CC	2	-	-	2
BTF 104	Introduction to Computers	CC	2	-	-	2
BTF 105	Life Sciences	CC	2	-	-	2
BTF 122	Applied Physics - I Lab	CC	-	-	2	1
BTF 123	Applied Chemistry – I Lab	CC	-	-	2	1
BTF 124	Introduction to Computers Lab	CC	-	-	2	1
BTF 125	Engineering Graphics Lab	CC	-	-	2	1
DE Electives: Student has to select 1 course from the list of following DE electives						
BTF 130	Term Paper	DE	3			3
BTF 131	Chemical Biology	DE	3			
BTF 132	Basics in Biotechnology	DE	3			
BTF 133	Introduction to Bioinformatics	DE	3			
BCS 101	English	VA	1	-	-	1
BSS 104	Understanding Self for Effectiveness – I	VA	1	-	-	1
	Foreign Language - I	VA	2	-	-	2
FLT 101	French					
FLG 101	German					
FLS 101	Spanish					
FLC 101	Chinese					
TOTAL						**23**

Semester II						
Code	**Course**	**Category**	**L**	**T**	**P/FW**	**Credit**
BTF 201	Applied Mathematics - II	CC	3	1	-	4
BTF 202	Applied Physics - II	CC	2	-	-	2
BTF 203	Applied Chemistry - II	CC	2	-	-	2
BTF 204	Object Oriented Programming in C++	CC	2	-	-	2
BTF 205	Internet Technologies	CC	2	-	-	2
BTF 222	Applied Physics - II Lab	CC	-	-	2	1
BTF 223	Applied Chemistry – II Lab	CC	-	-	2	1
BTF 224	Object Oriented Programming in C++ Lab	CC	-	-	2	1
BTF 225	Internet Technologies Lab	CC	-	-	2	1
DE Electives: Student has to select 1 course from the list of following DE electives						
BTF 230	Term Paper	DE	3			3
BTF 231	Biological Information and Databases	DE	3			
BTF 232	Computational Biology	DE	3			
BTF 233	Database management System	DE	3			
OE	Open Elective-I	OE				3
BCS 201	English	VA	1	-	-	1
BSS 204	Understanding Self for Effectiveness – II	VA	1			1
	Foreign Language - II	VA	2	-	-	2
FLT 201	French					
FLG 201	German					
FLS 201	Spanish					
FLC 201	Chinese					
Total						**26**

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Semester IV						
Code	**Course**	**Category**	**L**	**T**	**P/FW**	**Credit**
BTF 401	Biochemistry - II	CC	3	-	-	3
BTF 402	Molecular Biology	CC	3	-	-	3
BTF 403	Computers - II	CC	2	-	-	2
BTF 404	Genetics	CC	3	-	-	3
BTF 405	**Statistics for Biology**	**CC**	**3**	-	-	**3**
BTF 421	Biochemistry – II -Lab	CC	-	-	2	1
BTF 422	Molecular Biology-Lab	CC	-	-	2	1
BTF 423	Computers - II-Lab	CC	-	-	2	1
BTF 424	Genetics-Lab	CC	-	-	2	1
DE Electives: Student has to select 1 course from the list of following DE electives						
BTF 430	Term paper	DE	3			3
BTF 431	Proteomics	DE	3			
BTF 432	Basics of PERL programming II & Python	DE	3			
BTF 433	Molecular Structure Visualization	DE	3			
OE	Open Elective-III	OE				3
BCS 401	Communication Skills – II	VA	1	-	-	1
BSS 404	Understanding Self for Effectiveness – IV	VA	1	-	-	1
FLT 401 FLG 401 FLS 401 FLC 401	Foreign Language - IV French German Spanish Chinese	VA	2	-	-	2
Total						28

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9

AMITY UNIVERSITY
RAJASTHAN

AIB/AUR/Agenda-AC/008 Date: 06/12/2018

Meeting of the Academic Council AUR

The following agenda of Amity Institute of Biotechnology may be considered during the Academic Council meeting:

1. To approve various recommendations of the Board of Studies in Biotechnology held on 19-11-2018
2. To approve various recommendations of the Board of Studies in Bioinformatics held on 21-11-2018
3. To approve various recommendations of the Board of Studies in Food Technology held on 29-11-2018

Prof Vinay Sharma
Director – AIB