

Integrated M.Sc. Biotechnology

I-SEMESTER

Course Code	Course Name	Credit Hr.	
MAS-303	BASIC MATHEMATICS-I	3	(3-0-0)
PHY-309	BASIC PHYSICS	3	(3-0-0)
CHEM-310	ORGANIC CHEMISTRY	3	(2-0-1)
CHEM-312	PHYSICAL CHEMISTRY	3	(2-0-1)
COMP-302	COMPUTER APPLICATION	2	(1-0-1)
GPT-301	MORAL & VALUE EDUCATION	2	(2-0-0)
CHEM-311	INORGANIC CHEMISTRY	3	(2-0-1)
		<u>3</u>	
		19	

II-SEMESTER

MAS-331	FUNDAMENTAL STATISTICS	3	(2-0-1)
BIOL-403	LIFE SCIENCE I (BOTANY)	3	(2-0-1)
BIOL-404	LIFE SCIENCE II (ZOOLOGY)	3	(2-0-1)
MAS-304	BASIC MATHEMATICS II	3	(3-0-0)
MCE-301	CELL BIOLOGY	3	(2-0-1)
MCE-303	INTRODUCTORY BIOTECHNOLOGY	3	(3-0-0)
PHY-308	BIOPHYSICS	3	(3-0-0)
		<u>3</u>	
		21	

III-SEMESTER

CHEM-330	ANALYTICAL CHEMISTRY	3	(2-0-1)
BCBT-401	BIOCHEMISTRY-I	3	(2-0-1)
MCE-302	MOLECULAR BIOLOGY	3	(3-0-0)
SES-415	ENVIRONMENTAL STUDIES-I	2	(2-0-0)
MBFT-351	MICROBIOLOGY-I	3	(2-0-1)
BIOL-545	ANIMAL PHYSIOLOGY	3	(2-0-1)
BIOL-546	PLANT PHYSIOLOGY	3	(2-0-1)
		<u>3</u>	
		20	

IV-SEMESTER

SES-416	ENVIRONMENTAL STUDIES-II	2	(2-0-0)
BCBT-403	BIOCHEMISTRY-II	3	(2-0-1)
GPB-412	GENETICS	3	(2-0-1)
MBFT-401	MICROBIOLOGY-II	3	(2-0-1)
MCE-401	BASICS OF MOLECULAR GENETICS	3	(2-0-1)
BCBT-408	CHEMICAL THERMODYNAMICS	3	(3-0-0)
CBBI-501	APPLICATION OF BIOINFORMATICS	2	(1-0-1)
		<u>2</u>	
		19	

V-SEMESTER

MCE-406	MOLECULAR BIOLOGY TECHNIQUES & INSTRUMENTATION	3	(2-0-1)
BCBT-405	ENZYMOLGY & ENZYME TECHNOLOGY	3	(2-0-1)
BCBT-406	BASIC IMMUNOLOGY	3	(2-0-1)
LNG-304	PROFESSIONAL COMMUNICATION & TECHNICAL WRITING	3	(3-0-0)
MAS-531	BIOSTATISTICS	3	(2-0-1)
MCE-402	INTRODUCTION TO PLANT BIOTECHNOLOGY	3	(2-0-1)
MCE-404	INTRODUCTION TO ANIMAL BIOTECHNOLOGY	3	(2-0-1)
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VI-SEMESTER

MBFT-502	INDUSTRIAL MICROBIOLOGY	3	(2-0-1)
MCE-501	BIOSAFETY, BIOETHICS & IPR ISSUES	3	(3-0-0)
TE-451	FUNDAMENTAL TISSUE CULTURE	3	(2-0-1)
BCBT-502	INDUSTRIAL BIOTECHNOLOGY	3	(2-0-1)
BCBT-505	PLANT BIOCHEMISTRY	3	(2-0-1)
BCBT-506	ANIMAL BIOCHEMISTRY	3	(2-0-1)
MCE-403	INTRODUCTION TO ENVIRONMENTAL BIOTECHNOLOGY	3	(2-0-1)
JSBB-488	SEMINAR-I	1	(0-0-1)
			22

VII-SEMESTER

MCE-503	BASIC NANOTECHNOLOGY	2	(2-0-0)
BCBT-605	IMMUNOTOXIN & DRUG DESIGNING	3	(3-0-0)
BAM-502	MARKETING & MANAGEMENT OF BIOTECHNOLOGICAL PRODUCTS	3	(3-0-0)
BCBT-501	BIOCHEMICAL ENGINEERING	3	(2-0-1)
MCE-603	GENETICALLY MODIFIED FOODS	2	(2-0-0)
MBFT-605	MICROBIAL TECHNOLOGY IN FOOD INDUSTRY	3	(2-0-1)
JSBB-589	SEMINAR-II	1	(0-0-1)
			17

VIII-SEMESTER

MCE-702	ADVANCED MOLECULAR BIOLOGY TECHNIQUES & INSTRUMENTATION	3	(2-0-1)
MAS-711	STATISTICS-I	3	(2-0-1)
COMP-705	COMPUTER ORIENTATION	3	(2-0-1)
MCE-701	MOLECULAR CELL BIOLOGY	3	(2-0-1)
MCE-804	MEDICAL BIOTECHNOLOGY	3	(3-0-0)
CBBI-801	BIOINFORMATICS	3	(2-0-1)
MCE-805	NANOBIOTECHNOLOGY	2	(2-0-0)
		<u>18</u>	

IX-SEMESTER

MBFT-814	MICROBIAL BIOTECHNOLOGY	3	(2-0-1)
MCE-806	GENETIC ENGINEERING	3	(2-0-1)
CBBI-708	BIOMOLECULAR MODELING	3	(2-0-1)
TE-802	ANLMAL TISSUE CULTURE TECHNOLOGY	3	(2-0-1)
MAS-715	STATISTICS-II	3	(2-0-1)
BCBT - 843	ENZYME TECHNOLOGY	3	(2-0-1)
MCE-782	SEMINAR-III	1	(0-0-1)
		<u>19</u>	

X-SEMESTER

MCE - 899	DISSERTATION	15	(0-0-15)
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I-SEMESTER

MAS 303

BASIC MATHEMATICS I

3(3-0-0)

Algebra

Theory of quadratic, Binomial-Theorem (for +ve index), Use of natural & common logarithms, exponential series, partial-fractions, Determinants of order 3, Theory of Matrices, addition, subtraction, multiplication, transpose, elementary ideas on ad joint & inverse. Solution of linear equations, inequalities, permutation & combination.

Trigonometry

Trigonometrical- functions, addition & subtraction formula, double & half angle formula laws of sines & cosines, solutions of triangles, height & distance, real & complex-numbers, hyperbolic trigonometric functions. De-Movire's Theorem.

Coordinate-Geometry: Distance between two points, Area of triangle, Straight-lines

PHY-309

BASIC PHYSICS

3(3-0-0)

Units and measurements, dimensions and dimensional analysis

Speed ,velocity, acceleration, momentum, impulse, torque, kinematics in one, two and three dimensions .

Newtons law of motion, conservation of energy and linear momentum, weight and mass of body ,Newtons law of universal gravitation , satellite and weightlessness, keplers law of planetary motion , types of force in nature .

Equilibrium and elasticity, stress, strain, hookes law elastic limit

Machines and their principle, efficiency, mechanical advantage, velocity ratio, relationship between efficiency, mechanical advantage and velocity ratio , levers and their kinds .

Pressure in fluids and their laws, Pascals law, atmospheric pressure, gauge press, measurement of press, simple barometer, buoyancy and Archimedes principle, principle of floatation and it has applications. hydrometer and lactometer . Surface tension, capillary, equation of continuity, bernoullis equation, viscosity.

Thermometry, relationship between the scales of temperature, absolute scale of temperature and clinical thermometer, specific heat, latent, conduction, convection, radiation

Rectilinear propagation and reflection of light, formation of image of a point object by a plane mirrors, colours

Sound, pitch, frequency, wavelength, velocity of sound echoes

Electricity, simple cell, relation ship between current charge, potential, oms law resistance, series and parellel combination

Electrical power, watt and KWH, household electricity.

CHEM-310

ORGANIC CHEMISTRY

3(2-0-1)

UNIT I: chemistry of carbohydrates

UNIT II: amino acid and protein

UNIT III: Benzene and its homologous, structure of benzene, aroma, nomenclature and aromatic compounds

UNITIV: General introduction of alkaloids

UNITV: General introduction of terpenes

UNIT VI: introduction to analytical chemistry and its branches

UNITVII: General principles of analytical chemistry, volumetric analysis, concept of gram equivalents and method of expressing concentration of solution, preparation of primary and secondary standard solutions. Neutralization (acid – base), titration permagnometry, gravimetric analysis: principles of methodology estimate of calcium

UNIT VIII thermometric analysis the gravimetric analysis, types, instrumentation, application

UNIT IX Polarimetry

UNIT X Potentiometric titration, electrode system, ion selective membrane electrodes, application of potentiometric titrations

PRACTICALS

1. Qualitative analysis of organic compounds
2. Volumetric determination of Fe by KMnO_4 solution
3. Polarimetric analysis
4. Estimation of protein by kjeldal method
5. Estimation of calcium volumetrically.

CHEM-312

PHYSICAL CHEMISTRY

3(2-0-1)

Ionic equilibrium: concepts of acids and their related strength, buffer solution and its ph, hydrolysis of salts, acids –base indicators oswalds and quinonoides theory, solubility product

Chemical kinetics: order and molecularity, differential rate laws and integrated rate laws equations for zero, 1st, 2nd and 3rd reactions (derivations included) significance of rate constant and its evaluation, time for definite fractional change of reaction, determination of order

Electro chemistry: reversible and irreversible cells, EMF of a cell and free energy, nernst equation, equilibrium constant, standard electrode potential, types of reversible electrodes, applications of EMF measurements, determination of

Some life issues – love, sex and marriage, men and money – value of time, meaning of work, human communication, human suffering, addition, ecology, women issues

Understanding ones neighbor, neighborhood groups: their structure and their functions patterns of social interactions of group dynamics. Preparation for a career, choice of vocation, motivation of study and research, and the present educational system: curriculum and syllabus, teaching methods, examination and work experience

Definition of value education, moral and ethics, laws and morale based on ten commandments and two great commandments

Discovery of self, self – awareness, growth of intellect – mans spiritual life emotions, will respect the rights of life, liberty, property, truth reputation

Sin, origin of sin, manifestation of sin, the result of sin, the remedy of sin, sin as an act, sin as a state, sin as a nature.

CHEM 311 INORGANIC CHEMISTRY 3(2-0-1)

Periodic table: Mendleef periodic table, modern periodic table and table. Long and extended form of periodic table, its main features, merits and demerits.

Periodic properties:

Atomic and ionic radii: classification of atomic radii (1) covalent radii (2) metallic radii (3) vander-waal radii, ionic radii. classification of ionic radii (1) size of anions, size of cations, crystal coordination number, radius ratio, size of anions, factors influencing magnitude of ionic radii. Periodic variation of atomic and ionic radii.

Ionization energy: introduction, successive ionization energies. Factors influencing ionization energy (nuclear charge, size of atom, ion. shielding effective nuclear charge, principal quantum number, half and full filled orbitals) trend of ionization energy in the periodic table

Electronic affinity: first and second electron affinity. Factors effecting magnitude of electron affinity. Periodic variation

Radioactivity: introduction of radioactivity, radioactive emmision (alpha ,beta and gamma rays). Half-life period, average life period, radioactive equilibrium. Group displacement law, atomic and induced radioactivity.

Nuclear chemistry: nuclear fussion and nuclear fission reactions. Mass defect, binding energy.

II-SEMESTER

MAS 331

FUNDAMENTAL STATISTICS

3 (2-0-1)

Definition & applications of Statistics, Testing of Hypothesis: Concept of Hypothesis, Degrees of freedom, Level of significance Measures of central – tendency, Measures of dispersion, standard error of mean. Coefficient of variation Probability: Definition & applications, numerical- problems.

Simple-correlation between two variables (definition, properties & numericals).

Regression- Lines : Definition & uses, Method of least square, Concept of regression- coefficient.

BIOL- 403

LIFE SCIENCE-I

3(2-0-1)

1. Origin of Life: History of earth, theories of origin of life nature of the earliest organism.

2. Varieties of Life: Classification, Five kingdoms, viruses (TMV, HIV, bacteriophage), Prokaryotes (Bacteria-cell structure, nutrition, reproduction), Protista, fungi, Plantae and animalia.

3. Chemicals of life: (Biomolecules)-Carbohydrates, lipids amino acids, proteins, nucleic acids, identification of biomolecules in tissues.

4. Histology: Meristems (apical, intercalary, lateral) and their function simple tissues (parenchyma, collenchyma, sclerenchyma) Complex tissue(xylem and phloem); Tissue systems (epidermal, ground, vascular); primary body and growth(root,stem and leaf); secondary growth. Animal Epithelial tissue, connective tissue, muscle tissue and nervous tissue and their function in body.

5. Nutrition: Autotrophic(photosynthesis) Pigment systems, Chloroplast, light absorption by chlorophyll and transfer of energy, two pigment systems, photosynthetic unit, phosphorylation and electron transfer system, Calvin-Benson Cycle(C3), Hatch Slack Pathway(C4), Crassulacan Acid Metabolism(CAM), factors affecting photosynthesis; Mineral nutrition in plants. Heterotrophic-Forms of heterotrophic nutrition, elementary canal in Humans, nervous and hormonal control of digestive systems, fate of absorbed food materials; Nutrition in humans, Reference values.

6. Energy Utilization: (Respiration) –Structure of mitochondria, cellular respiration, relationship of carbohydrate metabolism to other compounds, Glycolysis, fermentation, formation of acetyl co-A, Krebs cycle, Electron Transport System and Oxidative Phosphorylation, ATP, factors affecting respiration.

7.Transport : Plant water relationship Properties of water diffusion, osmosis, imbibitions movement of water in flowering plants, uptake of water by roots, ascent of water in xylem. Apoplast, symplast theory, transpiration structure of leaf and stomata in plants opening and closing mechanism of stomata factors affecting transpiration, significance of transpiration, general characteristics of blood vascular system, development of blood systems in animals, composition of blood, circulation in blood vessel, formation of tissue fluids, the heart, function of mammalian blood, the immune system

BIOL-404

LIFE SCIENCE-II (ZOOLOGY)

3(2-0-1)

Coordination and control: Plant movement (tactic, tropic and Nastic) , Plant growth substances(auxins, cytokinins, gibberellin, ABA and Ethylene) , Phytochrome and effect of light on plant development , vernalization and flowering. Nervous system , parts of nervous system, sensory receptors, structure and function of receptors, endocrine system, role of hormones in growth and development in humans.

Homeostasis: Control system in biology, control of blood glucose level, temperature regulation in endothermic animals, the liver and its importance.

Reproduction: Asexual reproduction - apomixis and other means of natural vegetative reproduction (bulb, corm, rhizome, stolon, runner, tuber, tap root ,tillers), advantage and disadvantage of natural asexual reproduction. Artificial propagation- cutting , grafting budding , layering, micro propagation through tissue culture ,advantage and disadvantage of micro propagation .

Sexual reproduction-life cycle of flowering plants, the parts of a flower(dicot and monocot), microsporogenesis, in vitro pollen culture, microgametogenesis, isolation of sperms, palynology, scope of palynology, development of ovule, types of ovule, megasporogenesis, megagametogenesis, embryo sac, seed formation, structure of seed and its importance. Review of sexual reproduction in vertebrates, human intervention in reproduction.

Continuity in Life: Chromosomes, cell cycle, mitosis, meiosis, techniques to study mitosis and meiosis.

III-SEMESTER

CHEM-330

ANALYTICAL CHEMISTRY

3(2-0-1)

Introduction to Analytical chemistry and its branches.

General principle of analytical chemistry: Volumetric analysis.

Concept of gram equivalents and method of expressing , Concentration of solution preparation of primary and secondary, Standard solution Neutralized (Acid-Base), Titration, Permagnometry. Gravimetric analysis & methodology. Estimate of calcium.

Thermometric analysis: The gravimetric Analysis – types, Instrumentation, Application.

Polarimetry.

Potentiometer titration: Electrode system, Ion selective membrane

Electrodes, Application of potentiometer titrations

BCBT- 401

Biochemistry- I

Credits: 3(2-0-1)

Unit I : Chemical structure of proteins and their properties, cellular membrane and transport phenomenon.

Unit II: Intermediary metabolism- concept of anabolism and catabolism, metabolism of carbohydrates, lipids and amino acids and their interrelationship.

Unit III: Biological oxidation, electron transport system, oxidative phosphorylation, free energy changes in biochemical reactions, energy changes in biochemical reactions, energy rich compounds.

Unit IV: Metabolism of nucleic acids and proteins.

Unit V: Hormones: regulation of metabolism by various hormones.

Practicals :

1. Specific group tests for carbohydrates
2. Specific group tests for amino acids.
3. Specific tests for lipids.
4. Determination of mil protein, fat and lactose.
5. Determination of acidity in sample.

MCE 302

MOLECULAR BIOLOGY

3 (3-0-0)

Unit 1: Introduction: Development of molecular biology. Historical perspectives. Concepts in molecular biology.

Unit 2: Structure and properties of nucleic acids: Structure of nucleotides, DNA double helix, helical conformations and DNA topology. Types of DNA and RNA- A, B, Z forms of DNA, mRNA, tRNA, rRNA, hnRNA, snRNA. Physical and chemical properties of DNA.

Unit 3: DNA protein interaction: Molecular aspects of protein-nucleic acid binding. DNA binding motifs in proteins- Helix- turn - helix, Zinc finger motifs, Leucine zipper, HMG box, etc.

Unit 4: Gene organization: Gene structure and architecture, gene clusters, split genes, overlapping genes, pseudogenes, operon, open reading frames, transposons, oncogenes. Range of genome size. C value and gene numbers. Reassociation kinetics, Repetitive DNA - satellite DNA.

SES-415

Environmental Studies I

2(2-0-0)

Unit-I The Multidisciplinary Nature of Environmental Studies

Definition, Scope and importance: Need for public awareness

Unit-II Ecosystem

Concept of an ecosystem, Structure and function of an ecosystem, Procedures, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Introduction types, characteristics features, structure and function of the following ecosystem:

- (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem
(d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit-III Social Issue and the Environment

From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain harvesting, watershed management, Resettlement and rehabilitation of people its problems and concerns. Case studies, Environmental ethics: Issues and possible solutions. Wasteland reclamation: Consumerism and waste products: Environment ethics, issues and possible solutions, Wasteland reclamation, Consumerism and waste products, Environment Protection Act. Air (Prevention and Control of Pollution) Act: Water (Prevention and Control of Pollution) Act: Wildlife protection Act.

Forest Conservation Act: Issues involved in enforcement of environmental legislation:
(Public awareness).

MBFT -351 **Microbiology I** **3(2-0-1)**

History, scope and development of microbiology
Concept of eukaryotic and prokaryotic cells
General characteristics, structure and reproduction of bacteria, actinomycetes ,
algae, fungi, protozoa , mycoplasma , rickettsiae , chlamydiae and viruses .
Preservation of microorganisms
Control of microorganisms by physical and chemical agents
Practical
Preparation of media and reagents, their sterilization
Culture techniques
Staining techniques (simple, differential, special) in bacteria
Preservation of microbial cells

BIOL 545 **Animal Physiology** **3 (2-0-1)**

Unit 1: Physiological process in animals with special reference to man. Functional anatomy of the digestive & respiratory systems. Physiology of digestion, gland in the alimentary canal & their secretions. Physiology of respiration, mechanism of breathing.

Unit 2: Physiology of blood circulation The blood, plasma & tissue fluid, blood corpuscles, hemoglobin, Blood groups & clotting of blood.

Unit 3: Physiology of Nervous System. Link between environment & central nervous systems. Nerve Impulse & reflex action.

Unit 4: Endocrine system of various glands & their secretions.

Practical

1. Study of frog/human blood film.
2. Haemolysis: effect of isotonic, hypotonic & hypertonic solution on
3. Erythrocyte.
4. Preparation of haemin crystals.
5. Study of blood group.
6. Study of secretions of pituitary, thyroid, adrenal, pancreas, testes & ovary
7. From prepared slides.

BIOL 546 **Plant Physiology** **3 (2-0-1)**

Unit 1: Water relation-Movement of water across membranes Ascent of sap, Transpiration, Translocation of organic substances

Unit 2: Study of macro & microelements nutrition. Mechanism of photosynthesis, factors regulating photosynthesis. Carbon fixation in C_3 , C_4 plants. CAM, structure & function of chloroplast.

Unit 3: Mechanism of respiration, respiratory substrates & ETC (electron transport chain). ATP synthesis & utilization, structure of mitochondria as the power house of cell.

Unit 4: Nitrogen metabolism & assimilation. Vernalisation & Photoperiodism. Elementary knowledge of stress physiology.

Practical

1. Demonstration of osmosis
2. Demonstration of osmotic potential of a cell
3. Stomatal studies
4. Measurement of rate of transpiration
5. Nutrients deficiency symptoms in plants
6. Measurement of rate of photosynthesis in an aquatic plant
7. To demonstrate that light and CO_2 are essential for photosynthesis
8. To demonstrate that O_2 is consuming during respiration
9. To demonstrate that CO_2 is liberated during respiration
10. Seed viability test
11. Test for starch and sugar

IV-SEMESTER

SES-416

ENVIRONMENTAL STUDIES II

2(2-0-0)

Defining Environment, atmosphere model: Troposphere, stratosphere, mesosphere, thermosphere, comparison of clear and dry air Hydrological cycle, components of hydrologic cycle, role of water in pollutant cycle in soils.

Pollutants: Definition and classification, air, water and soil pollution

Soil and water pollution due to NO_3 , phosphates and heavy metals, NO_3 pollution due to organic matter decomposition, mineralization, nitrogen cycle, negative environmental effects of NO_3 , PO_4^{3-} and other metal ions on human health; phosphate loading to surface water bodies through characteristic overland flow, sediment delivery ratio, runoff ratio/coefficient, enrichment ratio, water quality index, water quality standard, sewage treatment, water purification and management water quality index, water quality standard, sewage treatment, water purification and management strategies

Air pollution: concept, air pollution problem in India, present status Type and sources of urban and industrial pollutant Responses of crops to important phytotoxic air pollutants (SO , NO , Ozone, HF etc).

Acid rain: causes and consequences with special references to crops. Nuclear pollution and consequences. Air pollution control and alternate strategies. Risk assessment and warning

BCBT- 403

Biochemistry – II

3 (2-0-1)

Unit I: Protein Chemistry: Structure of proteins, methods for determining the 3D structure of a protein – X-ray diffraction, NMR, Mass spectrometry, protein homology among species, protein denaturation and folding, assisted folding, edman degradation, glycoprotein, lipoproteins, proteoglycans, phosphor proteins, chromoprotein, bacterial and viral protein (HIV, HBV, toxins, etc.)

Unit II: Biomembranes: Molecular constituents of membranes, movement of molecules through membranes, energetics of membrane transport system, biosignalling, voltage gated ion channels, transporters and group translocation with examples.

Unit III: Sensory systems: Olfaction, taste, vision, hearing and touch with their biochemical mechanisms.

Unit IV: Physiochemical properties of nucleic acids: Hydrogen bonding, bond length, tautomerism and its significance in nitrogen bases, DNA denaturation, and factors responsible for hypochromicity. Renaturation of DNA, annealing, Waldo's rule, hybridization, ionization, enzymatic of nucleic acids, effect of acids and alkalis on nucleic acids, DNA super coiling and nucleic acid mutations.

Practicals:

1. Fractionation of egg proteins.
2. Detection of alpha – amylase activity in saliva.
3. Determination of sugar/glucose in urine (Benedict's Trinitometric method).
4. Identification of blood constitution.
5. Extraction of total nucleic acid from plant tissues.
6. Extraction of RNA from yeast.
7. Assay of protein by Biuret's method.

GPB-412

GENETICS

3(2-0-1)

Mendel's law of heritability, mono, di hybrids ratios

Linkage: types, linkage maps, linkage groups, coefficient of coincidence, coefficient of interference

Crossing over, cytological basis of crossing over, factors effecting crossing over, estimation of recombination frequency from f₂ data.

Practicals:

Simple and compound microscope, cell culture. Monohybrid and dihybrid ratios, test cross, back cross, epistatic interactions, practice of mitotic and meiotic cell division, study of special chromosomes, probability, chi square and crossing over, two point test, cross linkage analysis, three point test, cross linkage analysis.

MBFT -401

Microbiology II

3(2-0-1)

Diversity and importance of microorganisms in the environment, soil, water, air-borne, metabolic diversification and biogeochemical cycles.

Microbial interaction: microbe-microbe, microbe-plant and microbe-animal interactions.

Common pathogenic microbes in plants and animals

Environmental microbiology, Bioremediation, aromatic organic pollutants, metal immobilization, Bio-augmentation, Waste and water treatment.

Industrial microbiology and fermentations, Modern developments, Microbes and biotechnology

Microbes in human welfare, biofertilizers, pesticide, waste treatment.

Introduction to microbial genetics: transformation, Conjugation, Mutation and plasmids.

Practical:

Isolation of agriculturally important microorganisms, *Rhizobium*, *Azotobacter* etc.

Microbial analysis of soil water and air

Microbial analysis of fresh foods, fermented foods and vegetables

Antibiotic sensitivity tests

MCE 401 BASICS OF MOLECULAR GENETICS 3 (2-0-1)

Unit 1. Introduction: Basic concepts in molecular genetics. Prokaryotic and Eukaryotic genome. Concept of gene and central dogma.

Unit 2. Transcription: Mechanism of transcription in prokaryotes and eukaryotes. Transcription of protein coding genes- mRNA. Post transcriptional modifications - 5' capping, poly A tailing and mRNA splicing in eukaryotes.

Unit 3. Translation: Introduction to protein synthesis. The nature of genetic code. Mechanism of translation in prokaryotes and eukaryotes. Post translational modification of proteins.

Unit 4. Regulation of gene expression: Gene regulation in prokaryotes - *lac* and *trp* operons as model systems. Gene regulation in eukaryotes – Transcriptional level control, RNA processing level control, translational level control, post translational level control.

Unit 5. Gene mutation: Mutagenesis. Causes of mutation – spontaneous and induced. Types of mutagens - physical and chemical. Classification of mutations. Molecular basis of gene mutation.

Practicals

Structural elucidation of nucleotides and nucleic acids.

Study of DNA and RNA models

Extraction of proteins from plant tissues

Estimation of proteins by Lowry and Bradford methods

Introduction To Thermodynamics Terms (System, surrounding, boundaries etc.) open and closed loop systems, isolated systems, thermodynamic variables, extensive and intensive properties.

Thermodynamic process- lost thermal, adiabatic process, isobaric, isochoric, cyclic and irreversible processes.

Laws of thermodynamics- thermal equilibrium, zero law, first law, second law of thermodynamics, energy concept, law of conservation of energy, concept of enthalpy, entropy.

Reactive systems, degree of reaction, reaction equilibrium, laws of mass action, Gibbs functional change heat of reaction, fugacity + reactivity, construction, enthalpy of formation, laws for reaction systems.

Air cycle, Otto cycle, work done in cycles, thermal efficiency.

Refrigeration- Introduction to principles of vapors compression cycle.

Unit 1

Bioinformatics and Internet: Internet Basics, FTP, www, connecting to Internet, Electronic mail, internet resources.

Unit 2

The NCBI data model: Introduction, Seq-id, Sequence, collection of sequence, annotation of sequence, describing sequence.

Unit 3

GenBank Sequence Database: Introduction to structure, Primary and secondary database,

Unit 4

Sequence Alignment And Database Searching : FASTA , BLAST ,

Unit 5

Multiple Sequence Alignment

Unit 6

Phylogenetic Analysis: Fundamental of Phylogenetic model, Tree interpretation, Tree building and tree evaluation, Phylogenetic software.

Unit 7

Introduction to Structure , PDB , MMDB , Structure file format , visualizing structure information , Structure viewers , structure similarity searching , Advanced structure modeling.

Unit 8

Comparative Genome Analysis: Introduction, application, genome analysis and annotation.

Practicals:

1. Understanding Linux Operating System and Commands.
2. Introduction to NCBI.
3. Using Entrez to search Literature Databases.
4. Retrieving DNA sequence from GenBank and analyzing various formats of the data stored.
5. Retrieving Protein sequence from GenPept (NCBI) and Expasy.
6. Analyzing Protein Sequences.
7. Analyzing DNA sequence.
8. Sequence alignment using BLAST (Basic Local Alignment Search Tool).
9. Sequence alignment using FASTA.
10. Multiple sequence alignment using ClustalW.

V-SEMESTER

MCE 406 MOLECULAR BIOLOGY TECHNIQUES AND TRUMENTATION

3 (2-0-1)

Unit 1. Molecular biology techniques: Cell fractionation. Isolation and purification of genomic DNA. Polymerase Chain Reaction. Nucleic acid blotting. DNA sequencing techniques.

Unit 2. Instrumentation in biotechnology: Working principles, instrumentation and applications of pH meter, centrifuge, colorimeter, spectrophotometer, autoclave, distillation unit, lyophilizer, flame photometer.

Unit 3. Methods for separation of macromolecules: Chromatography- column, thin layer, paper, ion exchange, gel filtration, affinity. Electrophoresis- agarose gel electrophoresis and poly acrilamide gel electrophoresis.

UNIT 4. Microscopy: Principles and applications of microscopy - simple, compound, phase contrast and electron microscopy. Yeast-2 Hybrid system, MS, tandem MS and MS imaging

Practicals

Measurement of hydrogen ion concentration of a given solution
Separation techniques-centrifugation and electrophoresis
Study of working principles and operation of some important equipments used in biotechnology laboratory viz., spectrophotometer, pH meter, centrifuge, electrophoresis apparatus (AGE and PAGE), PCR machine, Distillation unit, autoclaves etc.

BCBT-405

Enzymology and Enzyme Technology

3(2-0-1)

Unit1: Introduction of enzymes: General properties and significance, classification and nomenclature. Terms and definition in enzymology: enzyme activity, specific activity, turnover number, active site, isoenzyme, marker enzyme Multienzyme complex, extracellular enzymes, extremozymes, abzymes, ribozymes, induced enzyme etc

Unit 2: Factor affecting enzyme activity: pH, Temperature, substrate concentration etc. Isolation, purification and localization of enzyme, techniques involved in enzyme assays.

Unit 3: Enzyme kinetics: steady rate kinetics, Derivation of Michaelis-Menten equation using steady state/equilibrium kinetics, plots of Lineweaver- Bruke etc. machanism of substrate and multi-substrate enzyme catalyzed reaction.

Unit 4: Regulation of enzyme activity: Covalent modification, enzyme inhibition and kinetics. Allosteaic enzyme: feed back inhibition, allosteaic model concerted and sequential, co-operativity.

Unit 5: Mechanism of enzyme action and concept of active site: Vis-a-vis lysozyme, chymotrypsin, alcohol dehydrogenase, glyceraldehyde 3 phosphate dehydrogenase, proteases.

Unit 6: Enzyme Technology: Commercial production of enzymes, preference of extracted enzymes over whole organism, immobilization of enzymes, example of enzyme engineering, application of enzyme (therapeutic uses, analytical uses, manipulated uses etc.), uses of enzyme in solutions, enzyme reactors, biphasic system, Bi and poly functional enzymes, solvent engineering.

Practical:

1. Determination of protein
2. Determination of salivary amylase
3. Activity of effect of salt on salivary amylase
4. Detection of effect of pH on enzyme activity
5. Determination of Acid/Alkaline phosphatase
6. Determination of enzyme kinetics
7. Separation of protein by PAGE
8. Identification

BCBT- 406

BASIC IMMUNOLOGY

3(2-0-1)

Unit I: Basic terminology: Infection, pathogen, antigen, antibody, bacterial and viral antigens, haptens, adjuvants, immunogens interferons, epitopes, paratopes, lymphokines

Specific and non-specific immune response: cellular basis of immunity, humoral and cell mediated immunity, biochemistry of immunoglobulins (structure, types, property and function),

cells of immune system: cells involved in adaptive immune response i.e. B and T cells, cells involved in innate immune response- macrophages, dendritic cells, phagocytes, mast cells granulocytes, etc.

Unit II: Organs of immune system: primary lymphoid and secondary lymphoid organs, their structure and function. Major Histo Compatibility complex (MHC class I and class II), their structure and function. Chemistry of antigen-antibody interactions, precipitation and agglutination.

Unit III: Structure of T-cell receptors and their comparison with analogous antibody molecule. Natural Killer cell, Their structure and function. Superantigens and Antibody dependent cell mediated cytotoxicity (ADCC).

Unit IV: Immunodeficiency diseases: Primary B and T cell deficiency diseases, Autoimmunity, Hypersensitivity. Principles of RIA, ELISA and immunoelectrophoresis (Rocket immunoelectrophoresis), use of monoclonal antibodies in immunodiagnosis and immunotherapy.

Practical:

1. To prepare blood smear.
2. Separation of serum and plasma from blood.
3. Qualitative tests of important constituents of plasma and serum.
4. Separation of plasma proteins (i.e. Fibrinogen, globulin, and albumin).
5. Determination of E.S.R. of any blood sample.
6. Preparation of antigen from blood.
7. Determination of the blood group.
8. Determination of the haematocrit value of the blood sample.
9. Use of widal kit for rapid quantitative slide test.
10. Determination of density of blood.
11. Determination of bleeding and clotting time of blood.
12. Preparation of haematin crystals.

LNG-304 Professional Communication and Technical Writing 3(3-0-0)**Language:**

1. Concerned (Subject, Verb Agreement)
2. Antecedents (Noun, Pronoun Agreement)
3. Modifiers (Adjectives, Adverbs, Participle)
4. Prepositions (Usage)
5. Inflection (Noun, Verb)
6. Determiners (General, Specific)
7. Word enrichment (Antonyms, Synonyms, Homonyms, Acronyms, Orthography)
8. Voice

Communications:

1. Kinds
2. Different Speeches (Welcome Speech, Voice of thanks)

Technical Writing:

1. Importance
2. Objectives
3. Audience
4. Methods
5. Essentials (Documentation, Visuals, Sentences, Punctuation)
6. Process
7. Curriculum Vitae
8. Interview
9. Letter (Components, Format, 5 Kinds)
10. Memos (Administrative, Business)

11. Report (Format, Style, Periodical and Miscellaneous Reports)

Speech:

1. Stress
2. Intonation
3. Accent
4. Rhythm

MCE 402 INTRODUCTION TO PLANT BIOTECHNOLOGY 3 (2-0-1)

Unit 1. Introduction to plant biotechnology: Definition. History and development of plant biotechnology. Modern trends in plant biotechnology.

Unit 2. Gene transfer in plants using *Agrobacterium*: Ti plasmids, transfer of T-DNA, construction of binary and co-integrate vector systems. *Agrobacterium* mediated leaf disc transformation.

Unit 3. Direct gene transfer in plants: Physical (Particle gun delivery, electroporation, microinjection, macroinjection, electroinjection, fiber mediated DNA delivery, Laser induced DNA uptake, Sonication) and Chemical methods of gene transfer (Poly ethylene glycol, Poly vinyl alcohol, Calcium phosphate)

Unit 4. Applications of plant biotechnology: Improving agronomic traits - genetic manipulation of plants for salt resistance, herbicide resistance, fungi and virus resistance, insect and other pest resistance. Modification of production traits - delayed fruit ripening, improving seed storage proteins.

Practicals

Safety aspects and precautions to be taken in Biotechnology Laboratory
Preparation of reagents, stock solutions and buffers for plant DNA isolation.
Study of Labwares used for isolation of DNA
Isolation of genomic DNA from plant tissues by CTAB method.
Purification of crude DNA samples.

MCE 404 INTRODUCTION TO ANIMAL BIOTECHNOLOGY 3 (2-0-1)

Unit 1. Introduction to animal biotechnology: Definition, history, importance and scope of animal biotechnology. Applications of animal biotechnology.

Unit 2. Gene manipulation of animals: Animal viral genome, animal cloning vectors. Gene transfer methods in eukaryotic systems - retroviral vector method, DNA microinjection method, engineered embryonic stem cell method. Selection of clones by using different methods.

Unit 3. Transgenic animals: Production of transgenic mice, rabbits, fish, sheep, goat, cattle, pig,

etc.

Unit 4. Application of animal biotechnology: Transgenic animals as bioreactors- recombinant proteins produced by animal bioreactors. Transgenic animals as models of human diseases. Xenotransplantation. Embryo transfer technologies in cattle and its application.

Practicals

Handling of laboratory animals - mice, rabbits etc.

Isolation and purification of DNA from blood samples

Isolation and enumeration of bacterial population from meat samples

Development of Cell Lines from Egg Embryo

Screening of UV mutation in *E. coli*

Application of biotechnology in pharmaceutical, food & beverages, leather, paper, textile, detergent and chemical industries.

Biotechnology industry and medicine: Antibiotics, therapeutic application, Developing recombinant proteins for medical and therapeutic use, drug designing, new drug targets and vaccine development- Insulin, anti-haemophilic factor, human serum albumin, engineered enzymes.

Food and beverage industry: Xylanase, emulsifiers, high intensity sweetener, edible mushrooms, foods from microbes, role of biotechnology to improve food quality and food production.

Fermentation, cultures of microorganisms, solid or semisolid cultures, batch culture, continuous culture, fedbatch culture. Metabolic pathways in microorganisms, glycolysis or EMP pathways, entner-doudoroff pathways, the pentose phosphate pathways.

Practical:

1. Estimation of casein protein in milk.
2. Qualitative determination of different constituents of baking powder.
3. Estimation of glucose by anthron method.
4. Determination of vitamin-C in sample.
5. Estimation of lipid.
6. Determination of colour and pigments.
7. Methylene blue reduction test of milk.

BCBT- 505

PLANT BIOCHEMISTRY

3(2-0-1)

Unit I: Metabolism of carbohydrates: metabolism of carbohydrate in plants, plant acid, plant respiration.

Unit II: chloroplast and pigments: Chloroplast morphology, structure and biochemical anatomy of chloroplast, chlorophyll and photosynthetic pigments.

Unit III: Photosynthesis: photosynthesis in plants, including bacterial photosynthesis, C3 and C4 pathways, CAM photomorphylation, photosystems, cheiosmoticncoupling, etc. photorespiration, relationship between photosynthesis, photorespiration, and crop productivity, photoperiodism, photomorphogenesis. Environmental and agricultural aspects of photosynthesis.

Unit IV: Nitrogen metabolism: Metabolism of N-compounds in plants(seedlings and leaves), nitrogen cycle, nitrate and nitrite reduction, denitrification, symbiotic and non symbiotic nitrogen fixation, nitrogen organization, function and regulation, assimilation of fixed nitrogen by plants, nitrification.

Unit V: Plant microbe interaction: Chemo autotrophy in rhizobia, nitrify bacterial, metabolism of lipids in plants, phosphorous solubilising bacteria, biochemical changes in infected plants.

Unit VI: Plant nutrients: Biochemical roles of inorganic ions in plants (both macro and micronutrients), symptoms of nutrient deficiency in plants, assimilation of (P, S, Ca) their metabolism, stress physiology, uptake of nutrients in stress condition, transport phenomenon in plants.

Practical:

1. Analysis of plants and plant product for various constituents.
2. Extraction and identification of sugars from plants fruits and vegetables.
3. Extraction and determination of amino acid and protein.
4. Determination of lipids, phospholipids, cholesterol in food, fruits and vegetables.
5. Determination of various plants nutrients

BCBT-506

ANIMAL BIOCHEMISTRY

3(2-0-1)

Unit:1 Biochemistry of Blood and Body fluids-Biochemical composition of blood groups, path way of blood clotting, physiological function of blood, buffering action of blood, kinds other body fluids and their chemistry.

Unit: 2 Biochemistry of Body tissue-Connective tissue, collagen, elastin muscle protein, muscle construction,

Unit: 3 Biochemistry of Fat in adipose tissue , steroids-structure and biochemical function cholesterol-Structure and biochemical synthesis, plasma lipids, transport of lipids, lipo-protein, chylomicrons, VLDL, HDL, LDL, and Lp(a), free fatty acids, nonesterified fatty acids.

Unit: 4 Anti-oxidant-Generation of free radicals, damage produced by reactive-oxygen species (ROS), free-radicals, and scavenging enzyme system.

Unit: 5 Animal Hormones-Origin, site of action, biochemical mechanism of hormone action, feed-back mechanism of hormonal secretion.

Practical:

1. Identification of blood constituents.
2. Action of salivary amylase.
3. Action of digestive enzymes on proteins.
4. Determination of constituents of milk protein, fat, lactose.
5. Determination of sugar in urine and blood.
6. Determination of cholesterol in blood and biological sample.

MCE 403 INTRODUCTION TO ENVIRONMENTAL BIOTECHNOLOGY

3 (3-0-0)

Unit 1. Introduction to environmental biotechnology: Importance of biotechnology in environmental protection. Biodiversity, ecosystem and population diversity. Environmental hazards.

Unit 2. Biomass utilization: Bioremediation, bioleaching, biodegradation, biostimulation, bioaccumulation, bioaugmentation, biomagnification.

Unit 3. Biotechnological methods of pollution detection: Bioassay, biosensors and biological indicators. Sewage and soil waste management.

Unit 4. Global environment issues: Ozone depletion, green house effect, acid rain, sea level rise, global warming.

JSBB-488

SEMINAR I

1(0-0-1)

VII-SEMESTER

MCE 503 FUNDAMENTALS OF NANOTECHNOLOGY 2 (2-0-0)

Nanotechnology: an overview

Nanomaterial, their chemistry and synthesis

Carbon nano tube and their applications

Study of analyzing tools for nanostructures (STM, TEM, AFM)

Applications of nanotechnology in semi conductors, composites, ceramics, catalysis and photocatalysis, biosensor development, drug delivery and gene therapy, NEMS and MEMS, environmental biotechnology

Health and safety issue, ethical, legal and societal implications

BCBT-605 IMMUNOTOXIN & DRUG DESIGNING 3(3-0-0)

Unit1: History of drug discovery & Molecular biology for drug:-early and recent history of drug discovery, enzymes/receptor as drug target. molecular biology for drug discovery(recombinant proteins and monoclonal antibodies as drug). Molecular basis of disease processes. Target identification and validation.

Unit2: Organic synthesis for drug discovery:-target oriented organic synthesis and retro synthetic analysis. diversity oriented organic synthesis and evolving synthetic analysis, solid phase synthesis for drug discovery (parallel is split pool strategy) combinatorial chemistry and high through put screening(HTS).

Unit3: Combinatorial chemistry for drug discovery:-combinatorial biocatalysis for drug discovery, synthesis of Bergen in derivatives. Drug discovery in cancer research/new target based drugs in clinical trials.

Unit4:Introduction of pharmacogenomics:-microbial genomics for new antibiotics, immunotoxin drug(eg ricin, a plant toxin).drug designing for blocking enzyme activity through blocking hormones receptor through inhibition of nucleic acid synthesis against heterogenous target.

Department of Biochemistry and Biochemical technology

BAM-502 MARKETING & MANAGEMENT OF BIOTECHNOLOGY PRODUCTS 3(3-0-0)

Concept of Marketing

Customer Satisfaction and Buyer Behavior.

Marketing Mix

Analyzing Consumer Markets of Biotechnological products.

Pricing-strategies and methods of pricing of Biotechnological products

Identifying Markets Segments and Selecting Target Markets for Biotechnological products.

Positioning the Market Offering Through the Product Life Cycle

Distribution Channel

Promotion of Biotechnological Products.

BCBT- 501 BIOCHEMICAL ENGINEERING 3(2-0-1)

Unit-1: Bioreactors definition, classification of chemical reactors, residence time, bioreactors design and their functions, types of bioreactors. Application of bioreactors in bio-fertilizer production, alcohol production, antibiotic production, plant cell culture, animal cell culture, waste management.

Unit-2Control of bioprocess parameters in bioreactors, temperature, pressure, oxygen supply, agitation, nutritional, on/off control, PID control, control of heating of bioreactors, flow measurement control, chemical and electrical methods of foam control, off-line control parameters (measurement of properties analysis of cell population and composition), use of computer technology in bioprocess control system.

Unit-3 Engineering principles: transport phenomenon in bioprocess, mass transfer principles, mass transfer coefficient in gasses and liquids, heat transfer principles, coefficient of heat transfer, applied enzyme catalysis, biomass production in cell cultures.

Unit-4 Upstream and downstream processing: media formulation, sterilization of equipments, gas compressor types and principles of compression, air filtration, solid and liquid handling. Industrially fermented broth (filtration and ultra-filtration), centrifugation, solvent extraction, chromatographic separation, liquid extraction of biopolymers and antibiotics ion exchange recovery of antibiotics and proteins.

Practical:

1. To estimate dimensionless mixing time in a batch reactor.
2. To study the pH control system of bioreactor.
3. To understand the functioning of bioreactor and to carry out its blank sterilization.
4. To study the operation of a bioreactor.

MCE 603 GENETICALLY MODIFIED FOODS 3 (3-0-0)

Unit 1. Introduction to GM foods: History and development of GM food / crops. Currently existing GM foods/ crops.

Unit 2. Cultivation of GM crops: Growing of GM food crops. Countries cultivating GM food crops.

Unit 3. Debate on GM foods around the world. Criticisms against GM foods. Biosafety concerns and regulators of GM foods. GM food criteria in India. GM food labelling and GM labelling. Consumer acceptance and market forces.

Unit 4. Economical and political effects of GM foods. Future developments.

MBMT 605 Microbial Technology in Food Industry 3(2-0-1)

- Food as a substrate for microorganisms
- Primary Sources of Microorganisms in Foods
- General principles underlying spoilage of foods and different methods of preservation of foods
- Starter Cultures
- Fermented milk product and other food: types, production and defects.
- Fermented beverages: Brewing, malting, mashing, hops & primary and secondary fermentation
- New protein foods – SCP, mushroom, food yeasts, algal proteins
- Quality and safety assurance in food and dairy industry

Practical:

- Familiarity with bacteria and fungi important in food industry
- Evaluation of milk sample by Direct Microscopic Count
- Starter Activity test
- Microbiological analysis of Dahi
- Isolation and identification of microorganisms involved in food spoilage (vegetable, fruit)
- Enumeration of microorganisms in different food products (fruit juice, sugar etc)

JSBB-589

SEMINAR II

1(0-0-1)

VIII-SEMESTER

ADVANCED MOLECULAR BIOLOGY TECHNIQUES AND INSTRUMENTATION

MCE 702

3 (2-0-1)

Unit 1. Molecular biology techniques: Isolation and purification of DNA, RNA and Plasmids. DNA finger printing, polymerase chain reaction (PCR), Southern blotting, Northern blotting, dot blot and slot blot. DNA sequencing techniques.

Unit 2. Chromatographic techniques: Principles, instrumentation and applications of adsorption, partition, exclusion, ion exchange, affinity, column chromatography, chromatofocussing, TLC, HPLC, FPLC and GLC.

Unit 3. Electrophoretic techniques: Principles, instrumentation and applications of gel electrophoresis (AGE and PAGE), Pulse field gel electrophoresis (PFGE).

Unit 4. Centrifugation techniques: Principles, instrumentation and applications of differential, zonal, density gradient and ultra centrifugations.

Unit 5. Principles, instrumentation and applications of colorimetry, spectrophotometry, atomic absorption photometry, mass spectroscopy. Detection and measurement of radio active isotopes (GM counter and Scintillation counter), autoradiography.

Practicals

Estimation of chlorophyll pigments using colorimetry

Separation of cell organelles by centrifugation

Separation of nucleic acids by agarose gel electrophoresis

Qualitative and quantitative determination of DNA by UV spectroscopy.

Study of pipetting techniques

MCE 701 MOLECULAR CELL BIOLOGY

3 (2-0-1)

Unit 1. Macromolecules: Biochemical and molecular aspects of living cells, Carbohydrates, Proteins and Nucleic acids. Cell fractionation procedure.

Unit 2. Cell organelles: Molecular organization of cell organelles (structure and function), cell wall, plasma membrane (various models), endoplasmic reticulum, mitochondria, chloroplast, nucleus, etc.

Unit 3. Cytoskeleton and Extra Cellular Matrix: Microtubules, intermediate filaments and micro filaments. ECM- definition, significance and biomolecules involved in ECM.

Unit 4. Cell growth and division: Cell cycle, mitosis, meiosis, DNA replication, apoptosis,

cancer.

Unit 5. Cell signaling and cell- cell interactions: signal transduction, endocrine, paracrine and autocrine signalling, surface receptor mediated transduction, chemistry and function of signaling molecules.

Practicals

Mitosis of Onion Root Tips
Tissue Types in Dicot Stem
Tissue Types in Monocot Stem
Tissue Types in Dicot Root
Tissue Types in Monocot Root
Gram Staining of Bacteria

MCE 804 MEDICAL BIOTECHNOLOGY 3 (2-0-1)

Unit 1. Introduction: History and scope of medical biotechnology, current status and future prospects.

Unit 2. Disease diagnostics and Immunotechnology: Detection of genetic diseases. Molecular Diagnosis- genetic markers, DNA diagnostics, PCR based diagnostics, array-based diagnostics and nucleotide polymorphisms. Antigen-antibody interaction- complement fixation, agglutination, immunoelectrophoresis, immunofluorescence, enzyme-linked immunosorbant assay (ELISA) and radioimmunoassay (RIA).

Unit 3. Monoclonal antibodies: Hybridoma technology and monoclonal antibody production, applications of monoclonal antibody.

Unit 4. Drug development and gene therapy: Molecular drug designing- disease targets, methods of drug delivery, designing of drug delivery system for biotechnological products,; Mode of action of antibiotics and antivirals; molecular mechanism of drug resistance (MDR). Germ line gene therapy, Somatic gene therapy, cellular targets for somatic gene therapy, gene targeting and delivery.

Unit 5. Animal health care and biotechnology: Methods of immunization, preparation of vaccines, type of vaccines, DNA vaccines, Viral vaccines (conventional: killed/attenuated) peptide vaccines and recombinant proteins.

Unit 6. Applications of gene profiling, microarray techniques and DNA fingerprinting in medical science. Stem cell technology and their potential applications

Practicals

Determination of Blood groups
Agglutination Test – The Widal Test
Determination of Blood Glucose by Hagedorn- Jenson method
Identification of pathogen using double diffusion method of Antigens and Antibodies

Isolation and characterization of bacterial pathogens from provided samples.
In-silico drug designing; enzyme and inhibitor action and docking protocol.

CBBI-801

BIOINFORMATICS

3 (2-0-1)

Unit 1

Introduction to Bioinformatics, philosophical, directional and application oriented background of bioinformatics.

Unit 2

HGP – influence area in Bioinformatics, Application in different industries, and its Indian scenario, as a business, problem and future aspects.

Unit 3

Information network – Internet, web Browser and address (NCBI, EBI etc).

Unit 4

Databases – information resources for Proteins and Genomics.

Unit 5

SRS, Algorithms, Alignment.

Unit 6

Phylogenetic Analysis: Fundamental of Phylogenetic model, Tree interpretation – Paralogues and orthologues, Tree building and tree evaluation, Phylogenetic software.

Unit 7 Comparative Genome Analysis: Introduction, application, genome analysis and annotation.

Unit 8

Molecular structure Prediction and visualization (X-ray crystallography/NMR/Bioinformatics).

Unit 9

Micro array data analysis.

Unit 10

Different analysis packages and other Miscellaneous Tools etc.

MCE 805

NANOBIOTECHNOLOGY

3 (3-0-0)

Unit 1. Introduction, History and basic concepts of Nanotechnology; Man made and natural nano-materials; future scopes of nanotechnology

Unit 2. Solid state physics; crystal structure; quantum mechanics and nanostructure analysis

Unit 3. Methods of measuring properties; Atomic structure, particle size determination, surface structure, Microscopy (TEM, SEM and Field Ion), Spectroscopy (IR, Raman and X-ray)

Unit 4. Nanomaterials, Metal nanocluster, Semiconducting nanoparticles. Molecular clusters; DNA nanowires; Methods for synthesis

Unit 5. Carbon nanocluster; Nanotube; Mechanism and applications

Unit 6. Nanobiotechnology- Catalysis: Nanocrystals; Biological building blocks; Nucleic acids; Biological nanostructures

Unit 7. Nanomachines and Nano devices; NEMS; NEM (Fabrications) supermolecular switches

Unit 8. Nano-medicine; synthesis; drug delivery; application

IX-SEMESTER

MBFT 814

MICROBIAL BIOTECHNOLOGY

3(2-0-1)

History and scope of Biotechnology. Bioreactors: Types of Bioreactors e.g. packed bed, bubble column, air lift, fluidized bed bioreactor, membrane/hollow fiber, photo-bioreactor etc.

Industrial production of alcohol, glycerol, solvents (acetone, butanol, isopropyl alcohol), vinegar, acids (lactic, citric, gluconic acid), vitamins (Riboflavin, B12), antibiotic (penicillin, streptomycin, tetracycline, griseofulvin) by micro-organisms.

Concept of various types of fermentation: Batch, continuous, semisolid and solid state etc.

Methods of enzyme production, their immobilization and application in therapeutic, analytical manipulation and industrial uses.

Use of microbes in producing SCP, substrates used in producing SCP, their nutritional value.

Biotransformation

Practical

Study of fermentor and fermentor operation.

Isolation and purification of important microbial enzymes.

Production of lipase by submerged fermentation.

Production of lipase by semisolid fermentation.

Effect of pH and temperature on enzyme production.

Isolation of yeast from fruit juice and rice flour.

Quantitative estimation of ethanol produced during yeast fermentation.

Production of wine from grapes by using yeast

Citric acid production by solid state fermentation

Preparation of fungal spore in large scale by bread culture method.

Immobilization of cell on sodium alginate gel

MCE 806

GENETIC ENGINEERING

3 (2-0-1)

Unit 1. Biology of cloning vectors and enzymes used in genetic engineering: Plasmids, cosmids, phagemids, *Agrobacterium tumifaciens* based vectors (binary and cointegrate vector strategy) and artificial chromosomes (BAC, YAC). Enzymes used in genetic engineering: exonucleases, endonucleases- S1 nucleases, restriction endonucleases, ligases, polymerases, reverse transcriptase, terminal deoxynucleotidyl transferase, kinases and alkaline phosphatases.

Unit 2. Principles of recombinant DNA technology: Construction of recombinant DNA, construction of genomic and cDNA libraries, selection and screening of desired clones by hybridization method, genetic method and immunological method.

Unit 3. Recombinant DNA expression: Requirements of gene expression vectors, transient

vs stable expression, expression of heterologous gene in bacteria (*E. coli*), detection of expression of foreign genes, maximizing the expression of recombinant DNA.

Unit 4. Marker genes: Selectable and screenable marker genes (reporter genes)- luciferase, β galactosidase, chloramphenicol acetyl transferase. Transfection methods – electroporation, microinjection, particle gun bombardment.

Practicals

Restriction Digestion of DNA with Restriction Endonuclease
Ligation of Restriction Digested Fragments using Ligase Enzyme
Preparation of Competent Cells
Transformation of Competent Cells
Selection of Recombinants using Blue-White Screening

CBBI-708

BIMOLECULAR MODELING

3 (2-0-1)

Unit 1

Concepts of Molecular Modeling, Simulation of molecular mechanics and dynamics, Empirical representation of molecular energies, Simulations of Free Energy changes, Force fields, Use of Force Fields. A Energy minimization of small molecules, Local and global energy minima. Molecular Mechanics methods, Techniques in Molecular Dynamics, Monte Carlo Simulation for conformational analysis and semi-empirical methods, Application of molecular graphics.

Unit 2

Methods for Prediction of Secondary and Tertiary structures of Proteins - Knowledge-based structure prediction, Principles of Protein Folding, Fold recognition, Methods for comparison of 3D structures of proteins; Methods to predict three dimensional structures of nucleic acids.

Unit 3

Analysis of structures and correctness of structures, Submission of data to PDB: atomic coordinates and electron density maps; Anatomy of Proteins - Ramachandran plot. Evaluation of stereo-chemical properties of protein structures.

Unit 4

Internal and external co-ordinate system; Generation of co-ordinates of biopolymers in Cartesian and cylindrical polar co-ordinate system; Methods of single crystal X-ray diffraction of macromolecules: molecular replacement method and direct method - Fiber diffraction. Structural data banks - Protein Data Bank, Cambridge small molecular crystal structure data bank.

TE - 802 ANIMAL TISSUE CULTURE TECHNOLOGY 3 (2-0-1)

UNIT1: Biology of cells in culture: Origin and characterization of different cell types, Subculture, selection of medium, Chemically defined and serum free media, Development of serum free media Advantages and disadvantages of serum free media

UNIT 2: Cultured cells-Biology and characterization: Characteristics of cultured cells, Cell bank, Measurement of growth parameters of cultured cells, Cell adhesion, Cell proliferation and differentiation, Identification of specific cell lines

UNIT 3: Genetic engineering of mammalian cells: Mammalian cell lines, Mammalian cell expression system, Gene transfer techniques in mammalian cells, Sexing of embryos, Somatic cell nuclear transfer and transgenic animals.

Unit 4: Hybridomas and cell transformation: The basis of hybridoma technology, Storage of hybridoma cells, Monoclonal antibodies and their commercial production, Commercial production of monoclonal antibodies and their use for mankind.

Practicals

- Maintenance of Animal Cell Culture Laboratory.
- To develop cell lines from egg embryo.
- Maintenance of cell lines and to check their viability by Haemocytometer.
- To check % cell viability by MTT assay.
- To check the effect of Pesticides on Cell lines.

BCBT-813 ENZYME TECHNOLOGY (2-0-1)

Unit1: Introduction of enzymes:General properties and significance, classification and nomenclature. Terms and definition in enzymology, co-factors, coenzymes, active site concept, isoenzymes, allosteric enzymes, marker enzymes, multienzyme complex, ribozyme, abzyme, synzyme, extremozyme, therapeutic enzymes and immobilized enzymes etc.

Unit 2: Enzyme kinetics:steady rate kinetics, Derivation of Michaelis-menten equation using steady state/equilibrium kinetics, plots of lineweaver- Bruke, Hanes, Eadie- Hofster etc. Mechanism of bisubstrate and multisubstrate enzyme catalyzed reaction, Enzyme inhibitors, mechanism of enzyme action-lysozyme, chymotrypsin, alcohol DH.

Unit 3: Regulation of enzyme activity: Covalent modification, allosteric model concerted and sequential, cooperativity. Feedback inhibition.

Unit 4:Enzyme Technology: Commercial production of enzymes, immobilization of enzymes, example of enzyme engineering, application of enzyme(therapeutic uses, analytical uses, manipulated uses etc.), uses of enzyme reactors.

Unit 5: Isolation, purification and localization of enzymes. Various methods to estimate the enzyme activity.

Practical:

1. Effect of temperature, pH, substrate concentration and enzyme concentration and enzyme concentration on enzyme activity.
2. Action of salivary amylase on starch.
3. Determination of acid phosphatase activity in sample.
4. Determination of alkaline phosphatase activity in sample.
5. Determination of SGOT in serum.
6. Determination of SGPT in serum.
7. Determination of urease in plant sample.
8. Assay of protein by lowry method.
9. Assay of catalase in vegetables.
10. Hydrolysis of egg protein by pepsin.

JSBB-782

SEMINAR

1(0-0-1)

X-SEMESTER

MCE-899

DISSERTATION

15(0-015)