

B.Tech. Biotechnology (Molecular & Cellular Engineering)

Course Code	Course Title	Credits	L-T-P
SEMESTER – I			
ME-304	WORKSHOP PRACTICE & TECHNOLOGY	4	2-0-1
PHY-313	APPLIED PHYSICS	3	3-0-0
CHEM-310	ORGANIC CHEMISTRY	3	2-0-1
CHEM-311	INORGANIC CHEMISTRY	3	2-0-1
GPT-301	MORAL AND VALUE EDUCATION	3	3-0-0
BIOL-403	LIFE SCIENCE-I (BOTANY)	3	2-0-1
SES-415	ENVIRONMENTAL STUDIES-I	2	<u>2-0-0</u>
		Total	21
DEFICIENCY			
MAS-313	ELEMENTARY MATHEMATICS	4	4-0-0
or			
BIOL-201	ELEMENTARY BIOLOGY	2	2-0-0
SEMESTER – II			
ME-301	ENGINEERING GRAPHICS	3	0-0-3
PHY-308	BIOPHYSICS	3	3-0-0
MAS-408	TECHNICAL MATHEMATICS-I	4	3-1-0
COMP-410	COMPUTER AND LANGUAGES	4	2-1-1
CHEM-312	PHYSICAL CHEMISTRY	3	2-0-1
BCBT-401	BIOCHEMISTRY-I	3	2-0-1
BIOL-404	LIFE SCIENCE-II (ZOOLOGY)	3	2-0-1
SES-416	ENVIRONMENTAL STUDIES-II	2	2-0-0
MBFT-349	INTRODUCTORY MICROBIOLOGY	3	2-0-1
		Total	29
SEMESTER – III			
ME-305	FLUID MECHANICS & TRANSPORT PROCESS	3	3-0-0
MAS-488	TECHNICAL MATHEMATICS-II	4	3-1-0
MAS-511	STATISTICAL METHODS	3	2-0-1
CHEM-330	ANALYTICAL CHEMISTRY	3	2-0-1
BCBT-403	BIOCHEMISTRY-II	3	2-0-1
MCE-302	MOLECULAR BIOLOGY	3	2-0-1
MCE-401	BACICS MOLECULAR GENETICS	3	2-0-1
MCE-303	INTRODUCTORY BIOTECHNOLOGY	3	<u>3-0-0</u>
		Total	25
SEMESTER – IV			
ME-420	INTRODUCTION TO HEAT & MASS TRANSFER	3	3-0-0

EEE-301	ELECTRICAL ENGINEERING	4	2-1-1
COMP-510	FOUNDATION OF INFORMATION TECHNOLOGY	4	2-1-1
BCBT 408	CHEMICAL THERMODYNAMICS	3	3-0-0
BCBT-404	ENZYMOLGY & ENZYME TECHNOLOGY	3	2-0-1
GPB-412	GENETICS	3	2-0-1
MCE-406	MOLECULAR BIOLOGY TECHNIQUES & INSTRUMENTATION	3	2-0-1
MCE-402	INTRODUCTION TO PLANT BIOTECHNOLOGY	3	<u>2-0-1</u>
		Total	26

JSBB-400	TRAINING-I	1	0-0-2
----------	------------	---	-------

SEMESTER – V

ECE-430	ELECTRONIC MEASUREMENT & INSTRUMENTATION	3	2-0-1
CBBI-502	CONCEPTS OF BIOINFORMATICS	3	2-0-1
BCBT-407	CHEMICAL ENGINEERING	3	3-0-0
LNG-304	PROFESSIONAL COMMUNICATION & TECHNICAL WRITING	3	3-0-0
BCBT-405	BASIC IMMUNOLOGY	3	2-0-1
MCE-403	INTRODUCTION TO ENVIRONMENTAL BIOTECHNOLOGY	3	2-0-1
MBFT-452	MICROBIAL METABOLISM	2	2-0-0
MBFT-453	PRINCIPLES OF MICROBIAL GENETICS	2	2-0-0
JSBB -400	TRAINING-I EVALUATION	1	<u>0-0-1</u>
		Total	23

SEMESTER – VI

BAM-502	MARKETING & MANAGEMENT OF BIOTECHNOLOGY PRODUCTS	3	3-0-0
TIEG-503	CONCEPTS OF IN VITRO CULTURE	3	2-0-1
MCE-404	INTRODUCTION TO ANIMAL BIOTECHNOLOGY	3	2-0-1
MCE-501	BIOSAFETY, BIOETHICS & IPR ISSUES	3	3-0-0
MCE-502	RECOMBINANT DNA TECHNOLOGY [MCE]	3	2-0-1
JSBB-488	SEMINAR-I	1	<u>0-0-1</u>
		Total	16

JSBB-500	TRAINING-II	1	0-0-2
----------	-------------	---	-------

SEMESTER – VII

MOLECULAR & CELLULAR ENGINEERING (MCE)

MCE-601	MOLECULAR BREEDING	3	2-0-1
MCE-602	GENOMICS	3	3-0-0
MCE-603	GENETICALLY MODIFIED FOODS	3	3-0-0

MCE-604	GENE CLONING AND GENE THERAPY	2	2-0-0
CBBI-601	STRUCTURAL BIOINFORMATICS	2	1-0-1
JSBB-589	SEMINAR-II	1	0-0-1
JSBB-500	TRAINING-II EVALUATION	1	<u>0-0-1</u>
			Total 15

SEMESTER – VIII

JSBB-699	PROJECT (GE/MT/BT)	9	0-0-18
----------	--------------------	---	--------

1st Semester

ME-304 WORKSHOP PRACTICE & TECHNOLOGY 4(2-0-2)

Introduction to engineering materials and its classification, metals and its classification – ferrous and non-ferrous metals and its alloys, cast iron steel and alloy steel

Brief introduction – description and uses of hand tools used in carpentry shop, fitting shop, sheet metal work, smithy shop, plumbing shop, welding shop.
Welding –introduction to welding and its classification, gas welding, electric welding, soldering and brasing

Various types of fasteners and fastening devices, threads, terminology of threads, various forms of threads. Properties of engineering materials- mechanical properties – strength elasticity, stiffness, plasticity, malleability, ductility, brittleness, toughness, hardness, impact strength , fatigue and creep

Practical

1. Carpentry shop, - simple job on vertical and horizontal sawing , planning and slot making in wood , (ii) to make t- lap joint
2. Smithy shop – to make o- ring from a given rod (ii) to prepare s- hook
3. Fitting shop –(i) simple exercise on filing, v- groove and vertical sawing (ii) to make square from given piece of mild steel by filing and hack sawing
4. Welding shop –(i) to make butt weld of two given mild steel pieces (ii) to make lap weld of two given pieces (iii) soldering and brazing practices
5. Sheet metal shop –(i) to make book stand from given piece of sheet metal of 18 SWG
6. Introduction of lathe machine showing various parts.

PHY-313

APPLIED 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.

Newton's law of motion, conservation of energy and linear momentum, weight and mass of body, Newton's law of universal gravitation, satellite and weightlessness, Kepler's law of planetary motion, types of force in nature.

Equilibrium and elasticity, stress, strain, Hooke's 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, Pascal's law, atmospheric pressure, gauge pressure, measurement of pressure, simple barometer, buoyancy and Archimedes principle, principle of flotation and its applications. hydrometer and lactometer.

Surface tension, capillary, equation of continuity, Bernoulli's 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

UNITIX 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-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 influenzing magnitude of ionic radii. Periodic variation of atomic and ionic radii.

Ionization energy: introduction, successive ionization energies. Factors influenzing 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 emission (alpha ,beta and gamma rays). Half-life period, average life period, radioactive equilibrium. Group displacement law, atomic and induced radioactivity.

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

GPT-301 MORAL AND VALUE EDUCATION 3(3-0-0)

My country and my people, the many Indians, being and becoming Indian, nationalism and internationalism

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.

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

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) Aqatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit-III Social Issue and the Environment

Form 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).

MAS-313

Elementary Maths-I

4(4-0-0)

Algebra: Theory of Quadratic equations, Partial fractions, Binomial theorem (for positive index), Exponential and Logarithmic series, Elementary concepts of Permutation and Combination.

Trigonometry: Elementary concepts of Complex numbers, De-Moivre's theorem and its application.

Co-ordinate Geometry: Equation of standard curves and their identification.

Differential Calculus: Function, Limit, Continuity and Differentiability, Differentiation of standard functions, Method of Differentiation, Tangent and Normal, Maxima and Minima.

Integral Calculus: Indefinite integration of standard functions, Integration by substitution, by parts, by partial fraction.

Vector Analysis: Scalar and Vectors, sum and Difference of Vectors, Dot and Cross product. (double, triple).

BIOL-201 **ELEMENTARY BIOLOGY** **2(2-0-0)**

LIFE: Living and non-living

Origin of life: Oparin abiotic theory

Evolution: unicellularity, multicellularity, complex tissue system

Introduction to various systems of biology

Introduction to botany: history of botany, brief introduction of branches of botany, morphology, anatomy, taxonomy, physiology, paleobotany.

Introduction to lower botany: Algae, fungi, lichen, bacteria, virus, bryophytes, pteridophytes, gymnosperms.

Introduction to zoology: Classification of animal kingdom, adaptation of animals. External morphology of frog, internal anatomy of frog – internal organs, different internal systems.

Scope: application of biology

Differential Calculus: Partial Differentiation, Euler theorem, Total differential coefficient, Partial higher order derivatives, Application of partial differentiation, Maxima-Minima of function of two variables, Jacobians.

Integral Calculus: Definite integrals and their properties, Application of determining are length, area, surface and volume. Simpson's rule for approximate integration, Mean values, Root mean square values.

Differential Equations: Ordinary differential equations their order, degree and formation, Solution of the equation of the first order, first degree, Homogenous differential equations, Linear differential equations, Exact differential equations, Linear differential equations of second order with constant coefficient, Homogenous linear equations, Applications.

COMP-410 COMPUTER AND LANGUAGES 4(2-1-1)

Introduction to computers: Computer organization and peripherals. Hardware, software concepts, terminology. Introduction to DOS – DOS external commands, DOS internal commands. Introduction to windows- Start menu and accessories, windows explorer, my computer. Introduction to networking of computers. Program development using BASIC- Algorithms and flow charts, variables, constants, relational logical operators, library functions, hierarchy rules for operators and evaluations of expressions, LET, INPUT, READ..... DATA, control statements, GOTO, IF---THEN, FOR---NEXT, Introduction to array and DIM statement, Introduction to searching, sorting, introduction to functions and subroutines. Steps in development of applications. Introduction to information management- Data storage, retrieval, data manipulation, validation and security

of data, presentation of data and report generation. Introduction to MS-Office.

Introduction to RDBMS.

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 solubility product, ph, dissociation constant of acids, hydrolysis constant solubility, soluble salts

Practicals:

Analysis of inorganic mixture, redox and acid base titration. Preparation and standardization of primary and secondary standard solution, ph, buffers, chemical kinetics and partition coefficient.

BCBT- 401 **Biochemistry- I** **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 milk protein, fat and lactose.
5. Determination of acidity in sample.

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.

Hereditary and Variation: Mendel's work, chromosomal basis of inheritance, modified dihybrid ratio, gene interaction, Linkage, gene mapping, sex determination, cytoplasmic inheritance, variation and mutation.

Economical Importance Plants: Cereals (wheat, rice, maize), Beverages (tea, coffee, cocoa), Fibers (jute, linen, cotton), wood (pines, cedar, teak, sisam), rubber (Para rubber), spices (turmeric, black pepper, cloves, coriander), medicinal plants (Ephedra, Taxus, Cinchona, Fox glove, Belladonna, Ravolfia, neem, Hemp).

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 indeed, 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

MBFT 349 Introductory Microbiology 3(2-0-1)

- Definition, Scope and History of Microbiology
 - Cellular organization of prokaryotic and eukaryotic cells
 - Difference between prokaryotic and eukaryotic cells
 - General characteristics and nature of Bacteria, Mycoplasma, Rickettsiae, Chlamydiae, Actinomycetes, Protozoa, Fungi, Algae & Viruses

Practical

- Familiarity with equipment to be used in Microbiology Laboratory.
- Cleaning, washing and sterilization of glass wares
- Observation of permanent slides to study the structural characteristics of common bacteria , fungi, algae & protozoa

3rd Semester

ME-305 FLUID MECHANICS & TRANSPORT PROCESS 3(3-0-0)

Introduction to principles of engineering and units: classification of unit operation and transport process and basic system of units, methods of expressing temperature and composition gas law and vapour pressure, conservation of mass and material balances, energy and heat unit, conservation of heat energy and heat balances

Principles of momentum transfer: introduction, fluid statics, and viscosity of fluids, mass energy and momentum balances, and non-Newtonian fluids

Principles of steady state heat transfer: Introduction and mechanism of heat transfer, conduction, conduction through solid in series, forced convection heat transfer in fluids, natural convection heat transfer and heat transfer of non-Newtonian fluids

Principle of mass transfer: Introduction the mass transfer and diffusion, molecular diffusion in gas and liquid biological solution and cells, mass transfer in cellular systems

MAS-488 TECHNICAL MATHEMATICS-II 4(3-1-0)

Differential calculus: partial differentiation, Euler theorem, total differential coefficient, partial higher order derivatives, application of partial differentiation approximation problems, error determination, maxima – minima functions of two variables, Jacobians

Integral calculus: definite integrals and their properties, their application in determining arc length and surface area, Simpson rule for approximation, integration, mean values and root mean square values. Multiple integrals – double and triple integrals, their application in determining area and volume

Differential equations : Ordinary differential equations, their order degree and formation, solution of the equations of the first order and first degree. Homogenous and differential equations, linear differential equations, exact differential equations, linear differential equation of second order with constant equations, homogenous linear equations.

Vector calculus: vector differentiation, gradient, divergence and curl, their physical interpretation directional and normal derivatives vector integration, line surface and volume integrals, green theorem, gauss theorem and stoke s theorem

Fourier series: periodic functions, fouriers series fourier series and their coefficients and their determination (euler formula) ,change of interval , half range sine and cosine series.

MAS-511

STATISTICAL METHODS

3(2-0-1)

Definition and application of statistics, geographical representation of frequency distribution, measures of central tendency, measures of dispersion, standard error of mean, coefficient of variation

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

Unit IV: Physicochemical properties of nucleic acids: Hydrogen bonding, bond length, tautomerism and its significance in nitrogen bases, DNA denomination, and factor responsible for hypochromicity. Renaturation of DNA, annealing, walloce'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 I urine (Benedict's Tritrimetric 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.

MBGE-302

MOLECULAR BIOLOGY

3(2-0-1)

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.

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

MCE 303 INTRODUCTORY BIOTECHNOLOGY 3 (3-0-0)

Unit 1. Introduction: Historical development of biotechnology. Basic concepts of biotechnology. Definition and descriptions of some important terminology in biotechnology.

Unit 2. Branches of biotechnology: Study of various branches of Biotechnology including Plant, Animal, Medical, Industrial, Environmental, Marine Biotechnology, Bioinformatics, etc.

Unit 3. Biotechnology in India: Biotechnology and developing world- concerns and consequences. Role of biotechnology in Indian industry. Impact on agricultural sector.

Unit 4. Biotechnology and other disciplines: Biotechnology- an interdisciplinary pursuit, a three component central core, product safety. New trends in biotechnology.

Unit 5. Applications and scope of biotechnology: Practice of biotechnology in medicine, industry, agriculture, live stock improvement and environment. Future perspectives.

4th Semester

ME-420 INTRODUCTION TO HEAT AND MASS TRANSFER 3(3-0-0)

Mass Transfer Operation: Classification of mass transfer operation, choice of operation method, methods of conducting the mass transfer operation, unit systems

Diffusion in solids: Ficks law diffusion, types of solid diffusion Equipment for gas liquid operations: L.gas dispersed –sparged vessel (bubble columns), mechanically agitated vessels, mechanical agitation of single phase liquids, gas liquid contract, tray tower, liquid dispersed –venturi scrubbers, wetted wall tower, spray tower and spray chamber, packed tower. Concurrent tower gas and liquid, end effect and artificial and tray mixing, tray tower vs. packed towers.

Humidification operations

Distillation: Vapors liquid equilibria, single stage operation (flash vaporization) differential or simple distillation, continuous rectification (binary system) multistage tray towers, continuous contact equipment (packed towers) multicomponent systems, low-pressure distillation.

Drying: Drying operation, batch drying, mechanism of batch drying, continuous drying, leeching.

EEE-301 ELECTRICAL ENGINEERING 4(2-1-2)

UNIT I: Electrical circuits and circuit parameters, voltage, current, power energy, basic circuit components – resistance, inductance, capacitance, ohms law, series and parallel combination of resistance, voltage and current division in series and parallel circuits, voltage and current sources in series and parallel circuits, voltage and current sources, source transformation, kirchoffs current law, electrical circuit analysis using KVL & KCL.

UNITII: Fundamental of ac circuits: impedance admittance reactance and complex power real reactive power analysis of circuits using Maxwell's loop, current method and Maxwell nodal method of voltage, average, rms, form factor of sinusoidal wave form.

UNITIII: network theorems a) thevenins theorem b) Norton theorem c) superposition theorem d) maximum power transfer theorem.

UNIT IV: polyphase system three-phase system line phase line voltage. Phase current, phase voltage of three phase star or delta connected systems relation between the current and phase current and line voltage and phase voltage in three phase star and delta connected system, balanced and unbalanced three phase system. Three phase electrical power measurement using two-watt meter method.

UNIT V: Measurement and measuring instruments. Measurement of electric current voltage power energy construction and working principles of ammeter voltmeter wattmeter energy meter

Magnetic circuit and transformer b-h curves magneto motive force (MMF) flux reluctance in a magnetic circuit relation between electric and magnetic circuits, basic principle of a single phase transformer EMF equation, transformation ratio and equivalent circuit of transformer, open circuit test and short circuit test in a single phase transformer, losses and efficiency.

UNIT VI: electric machines dc machines – construction and working of dc generator, dc series, dc shunt and dc compound generators and motors, the internal characteristics of dc generators, characteristic of dc motors, working and constructions, application of dc motors in field of biotechnology. AC machines – induction motor, working and construction, equivalent circuit, slip, synchronous speed. Single phase and three phase induction motor. Synchronous machine – introduction to construction and working, application in field of biotechnology.

UNITVIII: Introduction to power system, power system components, protection of power system, per unit system, safety device fuse.

COMP-510 FOUNDATION OF INFORMATION TECHNOLOGY 4(2-1-2)

Introduction to windows: Start menu and accessories, windows explorer, my computer. Introduction to networking of computers.

Internet-internet, TCP/IP, IP address, Basic C and C++,Oracle.

Information networks: Internet, world wide web, web browsers, HTTP, HTML and URLs, EMB.

BCBT-408 CHEMICAL THERMODYNAMICS 3(3-0-0)

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 cycl

BCBT-404 ENZYMOLOGY & 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 of extra cellular enzymes like protease, oxidase, urease, catalase and

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.

MCE-406 MOLECULAR BIOLOGY TECHNIQUES AND INSTRUMENTATION
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.

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.

JSBB 400

TRAINING I

I (0-0-1)

5th Semester

ECE-430 ELECTRONIC MEASUREMENT & INSTRUMENTATION 3(2-0-1)

Semiconductors: energy band theory of solids, concept of solids, concept of forbidden gaps, insulators and semiconductors. Transport phenomenon in semiconductors, intrinsic, and extrinsic semiconductors

Junction diode p-n junction diode vi characteristics, diode application as a rectifier (half wave and full wave) breakdown mechanism –avalanche and Avalanche characteristics, zener diode and its applications LED and its applications

Bijunction transistor, CE, CB Configuration, characteristics, curves, requirement of biasing, stability, small signal equivalent ckt, h- parameter model, transistor as an amplifier, frequency response of amplifiers, negative feed back, gain band width product, oscillators and condition for oscillation

Other semiconductor devices: introduction of JFET, MOSFET, and CMOS

Switching theory and logic gates number systems, Boolean algebra, logic gates, flip flop and ICS

A/D and D/A converters introduction, methods of conversion A/D, D/A

Quantities of measurements: introduction, performance characteristics, static characteristic, error in measurement, types of error, and source of error, dynamic characteristic

Electronic instruments: ammeter, voltmeter, ohm meter, VOM, Q meter

CRO block diagram and working

Transducers and measurements of electrical and non electric quantities: measurement of liquid level, flow temperature, strain, pressure, force, torque, power, displacement, vibration, acceleration due to transducers. Measurement of resistance, inductance, capacitance using DC (Wheatstone bridge) and AC (MAXWELL Bridge, WEINBRIDGE) bridges.

List of Practicals:

Study of diode characteristics

Study of half wave and full wave rectifier with and without capacitor filter and determine ripple factor.

CBBI-502 Concepts of Bioinformatics 3 (2-0-1)

Unit 1

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

Unit 2

Information Retrieval from Biological Databases: Integrated information Retrieval (Entrez System), Retrieving database entries.

Unit 3

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

Unit 4

GenBank Sequence Database: Introduction to structure, Primary and secondary database, Format vs Content: Computer vs. Human, Databases, Genbank Flat file, GCG.

Unit 5 Sequence Alignment And Database Searching : Introduction , Evolutionary Basis of Sequence Alignment, Optimal alignment method , Substitution Score and Gap Penalty , Statistical Significance of Alignment, Database similarity searching , FASTA , BLAST , Database searching Artifacts , Position Specific Scoring Matrices.

Unit 6

Multiple Sequence Alignment: What is MSA, Structural or Evolutionary Alignment, how to align Sequences, Tools.

Unit 7

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

Unit 8

Predictive Method using Nucleotide Sequence: Introduction, Marking repetitive DNA, Database search, Codon bias detection, detecting functional site in DNA.

Unit 9

Predictive Method using Protein Sequence : Protein identification based on composition , Physical properties based on sequence , Motif and pattern ,

Secondary structure and folding classes, specialized structure or features ,
Tertiary structures.

Unit 10

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

Unit 11

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.
11. Introduction to the structure database PDB.
12. Visualization of the protein structure using VMD.
13. Secondary structure prediction using GOR algorithm.

BCBT- 407

CHEMICAL ENGINEERING

3(3-0-0)

Mixing : Types of agitator, flow pattern and power consumption

Steady state conduction: Fourier's laws, concept of resistance to heat transfer, critical insulation thickness, conduction with heat generation.

Convection : Film theory and concept of heat transfer coefficient. Heat transfer in Laminar and turbulent flows.

Heat exchanger: Sizing of shell and tube heat exchanger. Heat transfer in agitated vessel.

Boiling and condensation: Heat transfer to boiling liquids and from condensing vapors.
Fundamentals of mass transfer: Molecular diffusion in fluids and solids, concept of mass transfer coefficient. Equilibrium stage, Multistage and continuous contractors with application to gas absorption, calculation of NTU, HTU and no. of stages. Psychrometric chart and its application.

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

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

MCE 403 INTRODUCTION TO ENVIRONMENTAL 3 (3-0-0) **BIOTECHNOLOGY**

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.

MBFT 452 MICROBIAL METABOLISM 2(2-0-0)

Bacterial Enzymes: Classification, Properties, Factors affecting enzyme activity, Inhibition of enzyme action, Regulation of enzymes.

Carbohydrate metabolism: Anabolism- Photosynthesis (oxygenic and anoxygenic). Catabolism- EMP pathway, Pentose pathway, Krebs' cycle, Fermentation Electron transport system, ATP production

Metabolism of proteins: Metabolic pathways of nitrogen utilization, Urea cycle, Protein synthesis.

Catabolism of lipids.

MBFT 451 PRINCIPLES OF MICROBIAL GENETICS 3(2-0-1)

History-Experiments of Hershey Chase and Griffith; DNA as genetic material; Discovery of DNA structure, RNA as genetic material, Genetic code.

Organization and function of genetic material-Bacterial and Viral

Brief account of plasmids-Structure and types.

Replication of DNA- Rolling circle model; Replication of RNA- Reverse transcriptase.

Concept of genes-Lac operon, Tryptophan operon; Attenuation control-Promoters- Repressors- Gene Expression and control.

Gene transfer mechanisms- Conjugation, Transformation, Transduction.

Mutagenesis-Mutation, Mutants, IS elements, Transposons, Repair mechanisms

Distribution Channel

Promotion of Biotechnological Products.

TE- 503

Concepts of *In vitro* Culture

3 (2-0-1)

UNIT 1: Introduction to Plant Tissue Culture: Historic view, organization of tissue culture laboratory, aspectic techniques, media formulation, clonal propagation vs tissue culture, totipotency.

Unit 2: Animal Tissue Culture: Basic techniques, media formulation for animal cell, initiation of cell culture, evolution & maintenance of cell lines, suspension culture & immobilized culture.

UNIT 3: Types of *in vitro* cultures: Axillary bud proliferation, Organogenesis, Embryogenesis, organ culture, anther culture, suspension culture.

UNIT 4: Applications of tissue culture techniques: Somaclonal and gametoclonal variation, protoplast fusion and somatic hybridization, haploid and monoplod production, cybridizaiton, preservation of genetic resources, cryporeseration.

Practicals:

- Media preparation for animal & plant tissue culture
- Sterilization techniques of different explants
- Callus induction
- Determination of Growth Curve in Suspension Culture
- Development of cell lines from chicken embryo

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*

MCE 501 BIOSAFETY, BIOETHICS AND INTELLECTUAL PROPERTY RIGHTS IN BIOTECHNOLOGY 3 (3-0-0)

Unit 1. The legal and socioeconomic impact of biotechnology, public education of the process of biotechnology involved in generating new forms of life for informed decision making, biosafety regulation and national and international guidelines, r-DNA guidelines, experimental protocol approvals, levels of containment, regulatory bodies in biotechnology, biosafety committee.

Unit 2. Ethical issues, moral values on experimental animals, ethical implications of biotechnological products and techniques.

Unit 3. Intellectual property rights, WTO, TRIPS, International conventions, patents and copy rights, patent claims, methods of applications of patents.

Unit 4. Legal implications, biodiversity and farmers right. Beneficial application and development of research focus to the need of the poor, identification of directions for yield effect in agriculture, aquaculture etc.

MCE 502 RECOMBINANT DNA TECHNOLOGY 3 (3-0-0)

Unit 1. Biology of cloning vectors: Plasmids, lambda bacteriophage, cosmids, M13 bacteriophage, phagemid, *Agrobacterium tumifaciens*- binary and cointegration vector strategy.

Unit 2. Enzymes used in genetic engineering: Exonucleases, endonucleases - S1 nuclease, restriction endonucleases; ligases, polymerases, reverse transcriptase, terminal deoxy nucleotidyl transferases, kinases, alkaline phosphatase.

Unit 3. Principles of recombinant DNA technology: Construction of recombinant DNA, rDNA expression, genomic and complimentary DNA (cDNA) libraries, detecting expression

of foreign genes.

Unit 4. Application of r-DNA technology: Medicine, industry, agriculture, live stock improvement, environmental protection, etc.

JSBB-488

SEMINAR

1(0-0-2)

JSBB 500

TRAINING II

I (0-0-2)

7th Semester

MCE 601 MOLECULAR BREEDING 3 (2-0-2)

Unit 1. Introduction to markers: Different kinds of markers- morphological, biochemical and molecular markers.

Unit 2. Molecular marker systems: PCR based approaches - RAPD, SSR, AFLP, AP-PCR; targeted PCR, STS, SCAR; and non-PCR based approach (RFLP).

Unit 3. Marker assisted selection (MAS): Development of markers, generation of mapping population, bulk segregate analysis, use of NILS for tagging genes, selection of QTLS for MAS.

Unit 4. Molecular markers in plant breeding: Uses of molecular markers- resistance breeding, gene intergression, gene pyramiding, antibiotic resistance, improvement of qualitative characters, fertility restorer genes and hybrid vigour.

Practicals

Extraction of proteins from plant tissues
Protein profiling of crop plants by Polyacrylamide gel electrophoresis
Study of Labwares used in PCR analysis
PCR amplification of DNA samples
Electrophoretic separation of PCR products
Staining, visualization and scoring of PCR products

MCE 602 GENOMICS 3 (3 - 0- 0)

Unit 1. Introduction: Basic concepts of genomics. Structural and functional genomics. Proteomics, transcriptomics, metabolomics and phenomics.

Unit 2. Genome: Physico-chemical properties of genome, genome size and sequence components, gene structure and higher order genome organization.

Unit 3. Genome analysis: DNA sequencing, DNA Micro array, gene finding, genome databases and data mining. Structural, functional and comparative genomics.

Unit 4. Genome mapping: Basic concepts, model organisms, genome projects, genetic and linkage map, cytogenetic maps, physical maps, comparative genome mapping.

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.

MCE 604 GENE CLONING AND GENE THARAPY 3 (2-0-2)

Unit: 1 Gene cloning: Introduction to gene cloning, basic events of gene cloning, selection strategies for a clone of a specific gene.

Unit: 2 Expression of cloned gene: Expression of cloned genes in cultured cells, production of proteins from cloned genes, production of recombinant pharmaceuticals - insulin, human growth hormone, hepatitis B virus vaccine, tissue plasminogen activator (tPA).

Unit: 3 Gene therapy: Introduction and approaches to gene therapy. Types of gene therapy – germline gene therapy, somatic cell gene therapy, augmentation therapy, *ex vivo* gene therapy, *in vivo* gene therapy. Viral gene delivery systems – retrovirus and adenovirus vector systems.

Unit: 4 Applications of gene therapy: Correction of gene defects and disorders, Cystic fibrosis, Human adenosine deaminase deficiency, Duchenne muscular dystrophy. Ethical issues raised by gene therapy.

Practicals

Preparation of Buffers for Genomic and Plasmid DNA Isolation
Isolation of Bacterial Genomic DNA
Estimation of DNA by Diphenylamine Method
Restriction Digestion of λ DNA with *Eco* R1 Restriction Enzyme
Ligation of λ *Eco* R1 Digest using T4 DNA Ligase

CBBI-601 Structural Bioinformatics 2 (1-0-1)

Unit 1

Introduction: Definition of BioMolecular modeling, Protein Structure – Primary, Secondary and tertiary, Structure of RNA, Nucleotide, amino acids.

Unit 2

Biological Databases: Types of databases and their introduction. Primary, Secondary, Structure, Ligand Databases.

Unit 3

Protein Structure determining methods: X-Ray, NMR, RNA Structure Prediction.

Unit 4

In silico methods of protein structure prediction: Threading, Ab-initio, homology Modeling.

Unit 5

Evaluation of modeled protein structure: Ramachandran plot, What Check, ProCheck, Verify 3-D.

Unit 6

Modeling Protein interaction: Protein – Protein Interaction, Protein – Ligand Interaction, Software.

Unit 7

Application of BioMolecular modeling.

Practicals:

1. Introduction to the structure database PDB.
2. Visualization of the protein structure using VMD.
3. Secondary structure prediction using GOR algorithm.
4. Tertiary structure prediction using SWISS-MODEL, ModWeb and Geno3D.
5. Using Modeller for homology modeling.
6. Protein Structure validation using SAVS server.
7. Protein active site prediction using CastP and Pocket Finder.
8. Chemical file format conversion using Open Babel.
9. Automated docking using PATCH DOCK webserver.
10. Structural alignment using DaliLite and SSAP.

JSBB-589

SEMINAR

1(0-0-1)

JSBB-500

TRAINING II EVALUATION

1(0-0-1)

B. Tech. Biotechnology (MCE/IM/BPT)- 8th Semester

JSBB PROJECT (MCE/IM/BPT) 9(0-0-18)