Course Structure of

B. Tech. Biotechnology [from **Batch 2013** onwards]

Course Code	Semester / Course Title	Credits	
	Semester-I		
BIOL-201	Elementary Biology [Deficiency course]	2 (2-0-0)	
MCE-301	Cell Biology	3 (2-0-1)	
GPT-301	Moral and Value Education	3 (2-1-0)	
ME-304	Workshop Practice and Technology	4 (2-0-2)	
PHY-309	Applied Physics	3 (3-0-0)	
CHEM-311	Inorganic Chemistry	3 (2-0-1)	
CHEM-313	Organic Chemistry	3 (2-0-1)	
MAS-313	Elementary Mathematics-I [Deficiency course]	4 (3-1-0)	
BIOL-403	Life Science-I (Botany)	3 (2-0-1)	
ENVS-415	Environmental Studies-I	2 (2-0-0)	**24**
	Semester-II		
ME-301	Engineering Graphics-I	2 (0-0-2)	
PHY-308	Biophysics	3 (3-0-0)	
CHEM-312	Physical Chemistry	3 (2-0-1)	
MBFT-349	Introductory Microbiology	3 (2-0-1)	
BCBE-401	Biochemistry-I	3 (2-0-1)	
CSIT-401	Computer and Languages	4 (2-1-1)	
BIOL-404	Life Science-II (Zoology)	3 (2-0-1)	
MAS-408	Technical Mathematics-I	4 (3-1-0)	
ENVS-416	Environmental Studies-II	2 (2-0-0)	**27**
	Semester-III		
MCE-302	Molecular Biology	3 (3-0-0)	
MCE-303	Introductory Biotechnology	3 (3-0-0)	
ME-306	Fluid Mechanics and Transport Process	3 (3-0-0)	
CHEM-330	Analytical Chemistry	3 (2-0-1)	
MCE-401	Basics of Molecular Genetics	3 (2-0-1)	
BCBE-403	Biochemistry-II	3 (2-0-1)	
MCE-405	Introduction to Food Biotechnology	3 (3-0-0)	
MAS-488	Technical Mathematics-II	4 (3-1-0)	
MAS-511	Statistical Methods	3 (2-0-1)	**28**
	Semester-IV		
EE-301	Electrical Engineering	4 (2-1-1)	
MCE-402	Introduction to Plant Biotechnology	3 (2-0-1)	
BCBE-402	Basic Proteomics	2 (2-0-0)	
BCBE-404	Enzymology and Enzyme Technology	3 (2-0-1)	
MCE-406	Molecular Biology Techniques and Instrumentation	3 (2-0-1)	
BCBE-408	Chemical Thermodynamics	3 (3-0-0)	
GPB-412	Genetics	3 (2-0-1)	
ME-417	Introduction to Heat and Mass Transfer	3 (3-0-0)	
CSIT-501	Application of Information Technology	4 (2-1-1)	**28**
JSBB-400	Training-I (credit will be awarded in Vth Semester)	-	

Course Structure of
B. Tech. Biotechnology [for **Batch 2013** onwards]

Course Code	Semester / Course Title	Credits	
	Semester-V		
LNG-304	Professional Communication and Technical Writing	3 (3-0-0)	
MCE-403	Introduction to Environmental Biotechnology	3 (3-0-0)	
MCE-404	Introduction to Animal Biotechnology	3 (2-0-1)	
ECE-404	Electronic Measurement and Instrumentation	5 (3-1-1)	
BCBE-405	Basic Immunology	3 (2-0-1)	
BCBE-407	Chemical Engineering	3 (3-0-0)	
MBFT-452	Microbial Metabolism	2 (2-0-0)	
CBBI-502	Concept of Bioinformatics	3 (2-0-1)	
MBFT-507	Microbial Biotechnology	3 (2-0-1)	
JSBB-400	Training-I Evaluation	1 (0-0-1)	**29**
	Semester-VI		
MCE-501	Biosafety, Bioethics and IPR Issues	3 (3-0-0)	
BCBE-501	Biochemical Engineering	3 (2-0-1)	
BAM-502	Marketing and Management of Biotechnology Products	3 (3-0-0)	
MBFT-502	Industrial Microbiology	3 (2-0-1)	
MCE-502	Recombinant DNA Technology	3 (3-0-0)	
MCE-503	Fundamentals of Nanotechnology	3 (3-0-0)	
TE-503	Concepts of *in vitro* Culture	3 (2-0-1)	
MCE-601	Molecular Breeding	3 (2-0-1)	
MBFT-601	Fermentation Technology	3 (2-0-1)	
JSBB-488	Seminar-I	1 (0-0-1)	**28**
JSBB-500	Training-II (credit will be awarded in VIIth Semester)	-	
	Semester-VII		
PHA-574	Pharmaceutical Biotechnology	4 (4-0-0)	
CBBI-601	Structural Bioinformatics	3 (2-0-1)	
BCBE-601	Bioprocess Engineering and Downstream Processing	3 (2-0-1)	
MCE-602	Genomics	3 (3-0-0)	
MCE-603	Genetically Modified Foods	3 (2-0-1)	
BCBE-603	Medical and Molecular Diagnostics	3 (2-0-1)	
MCE-604	Gene Cloning and Gene Therapy	3 (2-0-1)	
MBFT-604	Microbial Enzyme Technology	3 (2-0-1)	
MBFT-605	Microbial Technology in Food Industry	3 (3-0-0)	
JSBB-589	Seminar-II	1 (1-0-1)	
JSBB-500	Training-II Evaluation	1 (1-0-1)	**30**
	Semester-VIII		
JSBB-699	Project	12 (0-0-12)	**12**
	Total Credits		**206**

B.Tech. Biotechnology

SEMESTER – I

BIOL-201 : Elementary Biology 2 (2-0-0)

Unit 1. Life: Living and non-living organisms. Origin of life: Oparin's abiotic theory. Evolution: Unicellularity, multicellularity, complex tissue system, Branches of Biology. Cell.

Unit 2. Introduction to Botany: History of botany; Brief introduction of branches of botany; morphology, anatomy, taxonomy, physiology, palaeobotany. Introduction to lower botany: Algae, fungi, bacteria, virus, bryophytes, pteridophytes.

Unit 3. Introduction to Zoology: Classification of animal kingdom; adaption of animals. Morphology of frog. Anatomy of frog: internal organs: different internal systems.

Unit 4. Scope and application of biology.

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MCE-301 : Cell Biology 3 (2-0-1)

Unit 1. An introduction to cell biology: History of cell biology. Development of cell theory. Modern cell biology.

Unit 2. Diversity of cell size and shape: Structure of prokaryotic cells (bacteria, fungi, virus, cyanobacteria, mycoplasma etc.). General organization of eukaryotic cells, cell shape, cell size, cell volume and cell number.

Unit 3. Organization of cell: Cell wall, plasma membrane, their structural organization and functions. Membrane bound cell organelles - nucleus, endoplasmic reticulum, golgi apparatus, mitochondria, chloroplast, lysosomes, peroxisomes and vacuoles. Non-membrane bound cell organelle- ribosome. Cytoskelton- microtubules, intermediate filaments and microfilaments.

Unit 4. Cell growth and division: Cell cycle, kinds of cell division, amitosis, mitosis, meiosis, comparison between mitosis and meiosis, crossing over, significance of cell division.

Practical:

Microscopy- simple and compound microscope Preparation of stains.
Grams staining.
Study of cell division - different stages of mitosis Differential staining of blood cells.
Hanging drop method for motility of bacteria.

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GPT-301 : Moral and Value Education 3 (2-1-0)

Objectives

- To explicitly discuss that is implicitly communicated through Academic disciplines.
- To Inculcate Life affirming values based on 'Fear of God as the beginning of wisdom'.

Section-I. Basics

- Integrating Heart-Head-Hand – Story of Sam Higginbottom.
- 'Contextual-Dialogical-Praxological' character of Value education.
- Different Values: Academic-Economic-Social-Material-Moral-Spiritual.

Section-II. Biblical Foundation

- Proverbs .. Chapter 2-4.
- Ten Commandments .. Exodus 20: 1-17.
- Two Commandments of Jesus .. Mark 12: 29-31.
- Sermon of Mount .. Matthew Chapter 5-7.
- Lord's Prayer .. Matthew 6: 9-13; Luke 11: 1-4.
- Parable of Good Samaritan .. Luke 10: 29-37.
- Parable of Two Brothers .. Luke 15: 11-32.

Section-III. Formation of Character

- Voice of Conscience
- Virtues .. Prudence-Justice-Courage-Discipline-Success-Faith-Hope-Love.
- Values of Life .. Marriage-No same sex marriage-Divorce-Abortion.
- Values of Belonging .. Family-Friends-Faith-Community-Nation-World.

Section-IV. God-Human-Plants-Animals

- Stewardship of Creation.
- Biotechnological Advancement.
- Exploitation of Animals, Plants and Microorganisms.
- Environmental Hazards.

Section-V. Our Constitution

- Fundamental Rights
- Directive Principles of State Policy.
- Fundamental Duties.
- Enlightened Citizenship: Ten Points of Dr. A.P.J.AbdulKalam.

Section-VI. Interactive Sessions

- Sexual Harassment.
- Corruption.
- Substance Abuse.
- Violence.
- Communalism.
- Cyber crime.

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ME-304 : Workshop Practice and Technology 4 (2-0-2)

Introduction to Tools- Description, applications of tools used in different shops.

Carpentry- Classification of tools- marking and measuring- holding and supporting- planning- cutting- boring- striking- miscellaneous- etc.

Fitting shop- Marking and measuring, holding, cutting tools etc.

Smithy- holding and supporting tools, cutting tools, striking tools.

Sheet metal: Welding: Properties of metals- Strength, elasticity, plasticity, Malleability, hardness, brittleness etc.

Timber- Introduction- selection of timbers- seasoning of timbers- timber defects.

Brief introduction to joining process- Nuts and bolts- Screw- Screws- rivets and riveting- welding- electric arc-gas welding- TIG-MIG welding- threads.

Extrusion- Classification- process geometry- Geometrical relationship- analysis of extrusion- stresses- load- power- maximum reduction possible- working and application of indirect extrusion- hydrostatic extrusion- defects in extruded parts.

Forging- Classification- strip and disc forging- Process geometry- geometrical relationship- geometrical relationship- Analysis of defects in forged products.

Practical:

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PHY-309 : Applied Physics 3 (3-0-0)

Unit-1. Optics: Interference: Coherent sources, conditions of interference, Fresnel's bi-prism experiment, interference in thin films, wedge shaped film, Newton's ring.
Diffraction: Single slit and double slit diffraction, diffraction grating, Raleigh's criterion of limit resolution, resolving power of telescope and microscope.
Polarization: Polarization of light, Brewster's law, Malus law, phenomenon of double refraction, geometry of calcite crystal, optic axis, principal section, ordinary and extraordinary rays, construction and working of Nicol prism. Plane, circularly and elliptically polarized light. There production and analysis. Retardation Plates, optical activity, specific rotation, polarimeters.

Unit-2. X-rays: Origin of X-rays, continuous and characteristic X-ray spectra, Mosley's law, absorption of X-rays, Diffraction of X-rays, Bragg's law, Bragg's spectrometer, practical applications of X-ray, X- ray Machine.

Unit-3. Laser: Spontaneous and stimulated emission of radiation, Einstein's Coefficients. Components of laser. Type of laser and their working and application. Classes of laser equipments.

Unit-4. Electromagnetic Theory: Gauss's law, Poisson and Laplace equation, Maxwell's equations, Basic concepts of Electromagnetic waves and its solution in free space. Para, dia, ferro, antiferro and ferri magnetic materials. Hysteresis and magnetic circuits.

Reference books:
1. Fundamentals of Optics [Jetkins and White]
2. Perspectives of Modern Physics [Beiser]
3. Electrodynamics [David Griffith]
4. Laser – Theory and Applications [Thyagranjan / Ghatak]
5. Fundamentals of Physics [Resnick and Halliday]
6. Engineering Physics [Uma Mukherjee]
7. Text book of Engineering Physics [Navneet Gupta and Kumar]

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CHEM-311 : Inorganic Chemistry 3 (2-0-1)

Unit-1. Nature of Covalent bond and shapes of molecules: Valence bond theory, pauleing slater theory, formation of hydrogen, fluorine, HF molecules, molecular orbital theory (MOT), LCAO (Liner combination of atomic orbital). Electronic configuration of Hetero nuclear diatomic molecules, VSEPR theory, Introduction of hybridization.

Unit-2. Nuclear and Radiochemistry: Nuclear shell model, Mass defeat, packing fraction, Binding energy, Natural radioactive disintegration, concept of Half Life, Group displacement Law, Artificial radioactivity, Nuclear fusion and Nuclear fission reaction.

Unit-3. Coordination Chemistry: Legends, coordination number complex ion, IUPAC rules for coordination compounds, Nomenclature chirality, Warner theory of coordination, pauling theory, crystal Eigand field theory.

Unit-4. Organometallic Compounds: Types, Classification, Nature of carbon metals bond, preparation, Propeties

Unit-5. Biochemical Significance of Inorganic metals: Introduction, Na, K, Cl, Fe, Zn, Co.

Unit-6. Inorganic Polymers: Classification of inorganic polymers, preparation, Phosphate containing polymers. A general idea of Boranes, Carbides, Silicones, Carbonyles, Nitrosyles.

Practical: Semi microanalysis of inorganic salts and mixtures.

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CHEM-313 : Organic Chemistry 3 (2-0-1)

Unit-1. Carbohydrates: Introduction, Classification, Monosaccharide stereochemistry, Fischer projection, Structure of D-glucose, Cyclic structure of D-glucose, Haworth projection, properties. Oligosaccharides- Structure of Sucrose. Polysaccharides- Structure of Starch, Cellulose and Glycogen.

Unit-2. Aminoacids: Classification, Essential and Non-essential Amino acids, Optical activity, synthesis. Properties, Zwitter ion and Isoelectric Point.

Unit-3. Proteins: Classification, Primary, Secondary and Tertiary structure. Properties, Colloidal nature, Denaturation, Test for Proteins.

Unit-4. Fats and Oil: Composition of fats, Introduction, Nomenclature of fats, Physical and Chemical properties of fats, Rancidity, Analysis of fats chemical constants, Saponification, Specification Number, Iodine Number, Acid value, Reichert Miessl value, Polenski value.

Unit-5. Alkaloids: Introduction, Classification, Determination of molecular structure of Alkaloids, Properties, Nicotine, Coniine.

Unit-6. Terpenoids: Introduction, Classification. Structural features of Terpens or Isoprene Rule, Myrcene, Citral.

Unit-7. Nucleic Acids: Chemistry of Nucleic acids, Structure and composition of purine and pyrimidines, Nucleosides, Nucleotides, general composition of DNA and RNA.

Practical:
Identification of sugars and organic acids.
Test for proteins and aminoacids.
Test for fats, fatty acids, acids and saponification.
Identification of phenol, acids, carbonyl compounds, hydrocarbons.

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MAS-313 : Elementary Mathematics-I 4 (3-1-0)

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-Movier'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, Trangent and Noraml, 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).

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BIOL-403 : Life Science-I (Botany) 3 (2-0-1)

Unit 1. Study of plant parts (root, stem, leaf, flower), inflorescence. Seed and seed germination.

Unit 2. Classification of angiosperm with reference of Bentham and Hooker, its merit and demerits. Distinguishing characters of the following families; Leguminaceae, Solanaceae, Liliaceae, Poaceae.

Unit 3. Study of structure and function of plant tissue.

Unit 4. Plant and Environment: Atmosphere, water, light, Temperature, soil and biota. Ecosystem's structure and function, abiotic and biotic components, food chain, green house effect.

Unit 5. Economic botany (name and precise part used); cereals, pulses, fiber, medicines, timber.

Practical:
Study of primary structure of root, stem and leaves.
Study of stamata.
Description and identification of important families:
(a) Leguminaceae (b) Liliacae (c) Solanaceae (d) Poaceae.
Study of economically important plants (cereals, pulses, vegetables, medicinal plants).
Demonstration of Osmosis, Transpiration, Photosynthesis, Respiration.

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ENV-415 : Environmental Studies-I 2 (2-0-0)

The multidisciplinary nature of environmental studies: Definition, scope and importance- need for public awareness- Ecosystems- Concept of an ecosystem- structure and function of an ecosystem- producers, consumers and decomposers- energy flow in the ecosystem- Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features structure and function of following ecosystems- [(a) Forest ecosystem, (b) Grassland ecosystem, (c) Desert ecosystem, (d) Aquatic ecosystem (ponds, streams, lakes, rivers, ocean, estuaries)].

Social issues and the environment- from unsustainable to sustainable development urban problems related to energy- water conservation, rain water harvesting, water sheds management- resettlement and rehabilitation of people; its problems and concerns. Case studies.

Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies, Wasteland reclamation. Consumerism and waste products.

Environmental protection act. Air (prevention and control of pollution) Act – Water (Prevention and control of pollution) Act– Wild life protection Act- Forest Conservation Act- Issues involved in enforcement of environmental legislation- public awareness.

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SEMESTER - II

ME-301 : Engineering Graphics-I 2 (0-0-2)

Introduction: Graphics as a tool to communicate ideas, Engineering drawing instruments and its uses, Lettering and dimensioning, scales, layouts of drawing sheets, Construction of geometrical figures like pentagon and hexagon.

Orthographic Projection: Principles of orthographic projection, Principal of auxiliary planes, First and third angle projections. Projection of points, Pictorial view. Projection of lines parallel to both the planes. Parallel to one and inclined to other, Inclined to both the planes, Application to practical problems. Projection of solid in simple position, Axis or slant edge inclined to one and parallel to other plane, Solids lying on a face or generator on a plane. Sectioning of solids lying in various positions. True shape of the section. Development of lateral surfaces, sheet metal drawing.

Isometric Projection: Principles of isometric projection, Isometric projection using box and offset methods.

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PHY-308 : Biophysics 3 (3-0-0)

Unit-1 : Physical Techniques: Diffusion, Sedimentation, Osmosis, Viscosity, their definition, factors Influencing them and their application in biology.

Unit-2: Spectroscopic Techniques: Explanation of Absorption Spectroscopy, Fluorescence, Phosphoresce. An introduction to NMR, ESR, IR, Visible/ UV, X-rays and Raman Spectroscopy and their application in Biomedical field.

Unit-3: Radiation Biophysics: Ionizing Radiation, Interaction of Radiation with matter, Dosimetry and Application of Radio isotopes. Biological effect and radiation effects on living system.

Unit-4: Thermodynamics**:** Thermodynamic System, Equilibrium, laws and their applications. Different type of processes, Thermodynamic variables and Entropy. Thermodynamic potentials and Relations Maxwell's, Equations, Fundamental equation of heat flow.

Reference books:

1. A Text book of Bio Physics (R.N. Roy)
2. Essential of Bio Physics (P. Narayanan)
3. Bio Physics (Pattabhi and Gautam)
4. Bio Physics - An Introduction (Rodney Cotterill)
5. Heat and Thermodynamics (Brij Lal and Subrahamanyam)
6. Heat and Thermodynamics (Zemensky)
7. Heat and Thermodynamics and Statistical Physics (Satya Prakash)
8. Basic Thermodynamics (E. Guha)
9. Modern Physics (Richtmyer)
10. Basic Nuclear Physics (B.N. Srivastava)

11. Atomic and Nuclear Physics (S.N. Ghoshal)
12. Fundaments of Molecular Spectroscopy (C.N. Banwell)
13. Molecular Structure and Spectroscopy (G. Aruldhas)
14. Atomic and Molecular Physics (Gupta Kumar and Sharma)

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CHEM-312 : Physical Chemistry 3 (2-0-1)

Unit 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.

Unit 2. 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.

Unit 3. 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, hydrolics constant solubility, soluble salts.

Practical:

Determination of rate constant and order of reaction for hydrolysis of ester by an acid.

To study the kindtics of dissociation of Magnesium in dilute HCl.

To determine the order of saponification of ethyl acetate with NaOH.

Determination of density of liquid by density bottle.

To find surface tension of the given liquid.

To find the relation and absolute viscosity of given liquid.

Determination of carbonates, bicarbonates and total alkalinity in water.

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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 and 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 and protozoa.

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BCBE-401 : Biochemistry-I 3 (2-0-1)

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

Intermediary metabolism- concept of anabolism and catabolism, metabolism of carbohydrates, lipids and aminoacids and their interrelationship.

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

Metabolism of nucleic acids and proteins.

Hormones: regulation of metabolism by various hormones.

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CSIT-401: Computer and Languages 4 (2-1-1)

Unit- 1. Introduction to Computers

- Need and Role.
- Definition, Characteristics and Applications.
- Hardware : Basic block diagram and components.
- Software : System and Application.

Unit- 2. Information Concepts

- Data and its representation.
- Introduction to Database.

Operating System

- Introduction, Functions.
- Working with DOS, Windows and Linux.

Computer Networks and Internet

- Introduction.
- Types.
- OSI reference model.
- Internet: History, usage and applications.

Unit-3. Computer Languages

- Generations.
- Translators (Assembler, Interpreter and compiler).

Programming Techniques

- Programming constructs.
- Algorithms and Flowcharts.

Unit- 4. 'C' Language

- Introduction.
- History.
- Character set.
- Expressions and Operators.
- Input/Output Statements.
- Control Statements.
- Branching Statements (if, if-else, Nested if), switch.
- Looping Statements (while, do-while, for).

Unit-5. 'C' Language

- Arrays.
- Functions.

- Introduction to pointers and structure.
- Structured Programming and Software development.

Practical:

Operating System

Working with Dos commands

Windows and its applications.
Linux commands and Editors.

'C' Programming: Draw flow chart and write C program for the following:

1. To find the largest among three numbers.
2. To check whether a given string is a palindrome or not.
3. To find factorial of a given number by iteration.
4. To find whether the given integer is: (i) a prime number; (ii) an Armstrong number.
5. To find sum of n terms of series:
6. n – n*2/2! + n*3/3! - n*4/4! + ...
7. To find sum and average of n integers using a linear array.
8. To read n numbers from the keyboard and display these numbers in the reverse order their entry.
9. To sort a given list using either selection or bubble sort.
10. To search a given number within a linear array.
11. To perform Addition, Multiplication, Transpose of matrices.
12. To generate the fibbonacci series using a function.
13. To find factorial of a given number using a function.
14. To interchange two values using: (i) Call by value; (ii) Call by reference.
15. Write a C program to display the mark sheet of a student using structure

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BIOL-404 : Life Science-II (Zoology) 3 (2-0-1)

Unit 1. General principles of classification of animal kingdom with special reference to orders of agricultural importance.

Unit 2. Life history and control of important animals parasitic on man and animals

Unit 3. Economic importance of following animals (a) Indian Snail (b) Slugs (c) Crabs (d) Mammals (e) Birds (f) Earthworm.

Unit 4. Life history and brief rearing methods of some useful insects (a) Honeybee (b) Lac Insects (c) Silk worm.

Unit 5. Identification of poisonous and non-poisonous snakes of India. Symptoms of snakebite and antidotes.

Unit 6. Crustacea and Mollusca.

Unit 7. Local fishes of economic importance, planning and implementation of fish farming.

Practical:

Study of the life cycle of the honey bee, silkworm and lac insect by preparation slides and charts.
Study of the general anatomy of an economically important insect by the procedure of dissection.
Study of microscopic preparation (Permanent mounts) under the microscope.

Study of morphology (external form and structure) of some of the preserved animals in the laboratory.

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MAS-408 : Technical Mathematics-I 4 (3-1-0)

Matrices: Theory of Matrices, Types, Addition, Subtraction, Multiplication, Transpore, Ad joint and Inverse of Matrices, Rank of Matrix, Solution of simultaneous equations, Eigun values, Cayley-Hamilton theorem.

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, Applications in determining arc 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, Homogeneous differential equations, Linear differential equation, Exact differential equations, Linear differential equations of second order with constant coefficient, Homogeneous linear equations, Applications.

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ENV-416 : Environmental Studies-II 2 (2-0-0)

Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems.
(a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
(b) Water resources: Use and over-utilization of surface and ground water, floods, drought conflicts over water, dams-benefits and problems.
(c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
(d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. (e) Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources, case studies.
(f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification
Role of an individual in conservation of natural resources.- Equitable use of resources for sustainable lifestyles. Biodiversity and its conservation- Introduction- Definition: genetic, species and ecosystem diversity.
Biogeographical classification of India- Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values
Biodiversity at global, national and local levels-India as a mega-diversity nation-Hot-spots of biodiversity- Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts-Endangered and endemic species of India- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
Environmental Pollution- Definition-Causes, effects and control measures of: Air pollution-Water pollution- Soil pollution-Marine pollution- Noise pollution- Thermal pollution- Nuclear pollution. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of

pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

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SEMESTER – III

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.

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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.

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ME-306 : Fluid Mechanics and 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 fluid s, 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.

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CHEM-330 : Analytical Chemistry 3 (2-0-1)

Unit 1. General principle of analytical chemistry: Volumetric analysis. Solutions, preparation of primary and secondary standard solutions, Neutralization (Acid- Base) Titration, Iodometry, Iodimetry, Permagnometry. Volumetric determination of calcium. Gravimetric analysis: principles and methodology. Estimation of calcium.

Unit 2. Colorimetry: Principle Lamberts and Beer's law. Absorption law (Derivation required), methodology and applications.

Unit 3. Thermometric analysis: Thermo gravimetric Analysis - types, Instrumentation, methodology and Application.

Unit 4. Potentiometer titration: Electrode system, Ion selective electrodes, Ion selective membrane electrode, advantages of potentiometric titrations. Application of potentiometer titrations.

Unit 5. Polarimetry and flourimetry: Instrumentation methodology and applications.

Unit 6. Spectrophotometry: Principle, Instrumentation, methodology and Application.

Unit 7. Spectroscopic techniques: Introduction of UV, IR and Mass Spectroscopy.

Practical:
Preparation of primary and secondary standard solution.
Standardization of secondary standard solution.
Preparation of and standardization of an acid solution.
Preparation and standardization of solution of $KMnO_4$.
Volumetric determination of Fe by $KMnO_4$, $K_2CO_2O_7$ solution.
Determination of Ca volumetrically.

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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.

Practical:
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.

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BCBE-403 : Biochemistry-II 3 (2-0-1)

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.).

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.

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

Physiochemical 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.

Practical:
Fractionation of egg proteins.
Detection of alpha – amylase activity in saliva.
Determination of sugar/glucose/urine (Benedict's Tritrimetric method).
Identification of blood constitution.
Extraction of total nucleic acid from plant tissues.
Extraction of RNA from yeast.
Assay of protein by Biuret's method.

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MCE-405 : Introduction to Food Biotechnology 3 (3-0-0)

Unit 1. Role of microbes in food process, operation and production; new protein foods:- single cell protein, mushroom food yeasts, algal proteins, Nutraceuticals. Enzymes and chemicals used in food processing.

Unit 2. Fermentation as a method for preparing and preserving foods. Food additives like coloring, flavors and vitamins.

Unit 3. Organism and their use for production of fermented foods and beverages, cheese, sauerkraut, idli, vinegar.

Unit 4. Quality control, case studies on Biotechnology in the evolution of food quality. Food spoilage and food borne diseases, food borne infections and intoxications.

Unit 5. Post harvest technology and process of food preservation.

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MAS-488 : Technical Mathematics-II 4 (3-1-0)

Integral Calculus: Multiple integrals, Double, Triple integrals, their application in determining area and volume.

Vector Calculus: Vector differentiation, Gradient, Divergent, Curl, their physical interpretation, Directional and Normal derivatives, Vector integration. Line surface and volume integrals, Green's theorems, Gauss theorem, Stoke's theorem.

Fourier Series: Periodic function, Fourier series, Fourier coefficient and their determination (Euler formula).

Partial differential equations: Partial differential equations of first order, Non linear partial differential equations, Linear homogeneous and non-linear homogeneous differential equations and applications.

Series solution and special functions: Series solution of ordinary differential equations of second order, Bessel and Legendre functions and their properties.

Laplace transformation: Laplace transform, Inverse Laplace transform and applications.

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MAS-511 : Statistical Methods 3 (2-0-1)

Definition and Scope of Statistics: Source of Animal-Husbandry and Dairy Statistics.
Method of condensation of data, frequency distribution.
Measures of central-tendency, Measures of dispersion, Moments, skewness and kurtosis.
Elementary notions of Probability, laws of addition and multiplication of probability.
Theoretical frequency distributions.
Binomial- frequency distributions and its applications.
Poisson- frequency distributions and its applications.
Normal- frequency distributions and its applications.
Concept of Sampling. Simple Random Sampling (with and without replacement).
Introduction to testing of Hypothesis and tests of significance. Z and t test for one and Two sample problems. Chi square test for independence of attributes and Goodness of fit.
Simple correlation coefficient and its significance. Line of Regression and Rank-Correlation.

Practical:
1. Formation of frequency distribution and Graphical representation.
2. Measures of central-tendency.
3. Measures of dispersion.
4. Applications of Z- test for one and two sample problems.
5. Applications of T-test for one and two sample problems.

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SEMESTER - IV

EE-302 : Electrical Engineering 4 (2-1-1)

1. Sinusoidal Steady State circuit Analysis: Voltage, Current, Sinusoidal and Phasor representation 1 Phase A.C. Circuit behavior of Resistance, Inductance and Capacitance and their combination, Impedance concept of power, power factor, series and parallel resonance, band width and quality factor.

2. Network theory: Introduction to basic physical laws, Network theory, Theveinin's, Norton's, Maximum Power transfer theorems, Star- delta transformation, Circuit theory concepts: Mesh and nodal analysis.

3. Three Phase supply: Star/ delta connections, line and phase voltage / current relations, three phase power and its measurement.

4. Measuring Instruments: Instruments for measurement of voltage, Current, power and energy: Construction, principle and application.

5. Magnetic Circuit and Transformer: Magnetic circuit concept, Theory and working principle of single phase transformer.

6. Rotating Machines: Principles of energy conversion, Basic concepts of rotation machines, DC Machines, Different types and their Characteristics and application, Elementary idea of operation of synchronous and induction machines. Single phase induction and stepper motors, applications.

Practical:

- To verify Kirchhoff's Current Law and Kirchhoff's Voltage Law.
- Verification of Norton's Theorem.
- Verify Thevenin's Theorem and to calculate Thevenin's equivalent of given circuit.
- To verify the superposition theorem and to circulate current in any branch of a multisource using superposition theorem.
- To find the value of impedance and power factor of R-L-C series circuit.
- To find the value of impedance and power factor of R-L-C parallel circuit.
- To perform open circuit test and short circuit of a single phase transformer.

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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 Labware used for isolation of DNA.
Isolation of genomic DNA from plant tissues by CTAB method.
Purification of crude DNA samples.

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BCBE-402 : Basic Proteomics 2 (2-0-0)

Introduction, birth of large scale biology, the genome transcriptome and proteome, functional genomics at the DNA and RNA levels, transcriptomics, large-scale mutagenesis, RNA interference, the need for proteomics, the scope of proteomics, sequence and structural proteomics, Expression proteomics, interaction proteomics, functional proteomics, the challenges of proteomics.

Strategies of protein separation, protein separation in proteomics-general principles, principles of two dimensional gel electrophoresis, general principles of protein separation by electrophoresis, separation according to charge but not mass-isoelectric focusing, separation according to mass but not charge-SDS-PAGE, two dimensional gel electrophoresis proteomics, principles of liquid chromatography in proteomics.

Protein expression mapping, protein expression mapping in mammalian systems, microbial system and plat system, quantitative protein expression mapping by metabolic labeling of proteins with radioactive amino acids metabolic labeling of proteins with stable isotopes, *in vitro* labeling of proteins using isotopes–coded affinity tags.

Current status of and future of proteomics in health and care, plant biochemistry and animal biochemistry.

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BCBE- 404 : Enzymology and Enzyme Technology 3 (2-0-1)

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. extracellular enzymes, extremozymes abzymes, ribozymes, induced enzyme etc.

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

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

Regulation of enzyme activity: Covalent modification, enzyme inhibition and kinetics. Allosteraeric enzyme:- feed back inhibition, allostearic model concerted and sequential, co-operativity.

Mechanism of enzyme action and concept of active site: vis-à-vis lysozyme, chymotrypsin, alcohol dehydrogenase, glycerldehyde 3-phosphate dehydrogenase, proteases.

Enzyme Technology: Commercial production of enzymes, preference of extracted enzyme 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:
Determination of protein.
Determination of salivary amylase.
Activity of effect of salt on salivary amylase.

Detection of effect of pH on enzyme activity.
Determination of Acid/Alkaline phosphatase.
Determination of enzyme kinetics.
Separation of protein by PAGE.
Identification of extra cellular enzymes like protease, oxidase, urease, catalase and lipase.

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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.

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.

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BCBE-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 cycle.

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GPB-412 : Genetics 3 (2-0-1)

Unit 1. Cell: Plant cell anc animal cell, chromosome structure, cell divisions- mitosis, meiosis, variations in chromosomes; polytene chromosome, lampbrush chromosome.

Unit 2. Structural changes in chromosomes: Deletions and duplications, translocation and inversion. Numerical changes in chromosomes.

Unit 3. History: Pre-mendelian and post-mendelian concepts of heredity, mendelian principles of heredity, dominance relationship, gene interaction.

Unit 4. Linkage and crossing over mechanisms, multiple alleles, pleitropism and pseudoalleles. Sex determination and sex linkage, sex limited and sex influenced traits.

Unit 5. Chemical basis of heredity, mode of replication of genetic material transcription and translation mechanisms of genetic material. Gene regulation and operon concept.

Unit 6. Mutations: Chemical and physical mutagenes, mode of action of mutagenes. Extranuclear inheritance, Polygene and quantitative inheritance.

Practical:
Simple and compound microscope.
Numericals on monohybrid and dihybrid crosses.
Numericals on epistatic interactions.
Practice on mitotic and meiotic cell divisions.
Numericals on probability.
Numericals on chi-square.
Coefficient of coincidence.
Coefficient of interference.
Sex linked inheritance.

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ME-417 : 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 of 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 or columns, spray tower and spray chamber, packed tower or columns. 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, leaching.

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CSIT-501 : Applications of Information Technology 4 (2-1-1)

Unit-1. Information and Processing Concepts: Definition of Information, Need of Information, Quality of Information, Value of Information, concept of Information,

Entropy Category and Level of Information in Business Organization, Data Concepts and Data Processing, Data Representation.

Information Representation: Information Contents, Introduction to Information Representation in Digital Media, Elementary Concepts in Information Perseverance. Data Compression – Huffman coding, LZW Coding. Text, Image Compression. Introduction to JPEG, MPEG, MHEG.

Unit-2. Database Concepts: Definition of Database, Importance of Database, Overview of Database, Models, Schemas and Instances, DBMS architecture, Database languages, Relational Database. Database applications (MS ACCESS).

Unit-3. Programming Language Classification and Program Methodology: Overview of Programming Languages, generations and programming techniques, Software Development Methodology, Life Cycles, Software Coding, Testing, Maintenance, Industry Standards. Introduction to ISO, SEI-CMM Standards for IT Industry.

Unit-4. Data Communications and Computer Networks: Data Transmission, Need for Data Transmission over Distances, Types of Data Transmission, Media for Data Transmission. Computer Networks, Network Classification and Network Topologies.

Unit-5. Internet: WWW, Gopher, FTP, Telnet, Web Browsers, Net Surfing, Search Engines, Email. Basic Concepts in E-Commerce, Electronic Payments, Digital Signatures, Network Security, Firewall.**Web Technologies:** introduction to HTML, DHTML, Java Script, ASP.

IT Industry Trends, Careers and Applications in India: Scientific, Business, Educational and Entertainment applications. Industry Automation.Weather forecasting. Awareness of ongoing IT projects in India: NICNET ERNET. e-governance.

Practical:

1. Working with MS ACCESS:
    - **o** Creating tables, relating tables, inserting, deleting and updating records of a table.
    - **o** Designing User Interface screens.
    - **o** Generating reports.
2. Creation of web pages using HTML.
    - **o** Program to illustrate operation of tables.
    - **o** Ordered and unordered lists.
    - **o** Working with frames.
    - **o** Hyperlinks.
3. Practicing with Web site designing tools like Microsoft FrontPage, Adobe's Dreamweaver.
4. Internet concepts : www, Internet surfing, live demo on websites, web Browser, file transfer Protocol.
5. Connecting remote machines using Telnet.
6. Working with search engines.

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SEMESTER – V

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

Language

[a] Word enrichment (Antonyms, synonyms, homonyms, acronyms, homophones).
[b] Tenses.
[c] Concord.
[d] Modifiers.
[e] Preposition.
[f] Inflection.
[g] Determiners.
[h] Voice.

Communication

[a] Role of Body language in communication.
[b] Self introduction.
[c] Conversation in different situations.
[d] Use of specific expressions.
[e] Group Discussions.
[f] Role Plays.
[g] Interviews.
[h] To cater different types of audience.

Technical writing

[a] Resume.
[b] Curriculum vitae.
[c] Letters.
[d] Memos.
[e] Report.
[f] Proposals.
[g] Usage of graphics.
[h] Different administrative documents (Notices, Circulars, Memos, Agenda, Minutes).

Speech

[a] Accent.
[b] Intonation.
[c] Different types of speeches.
[d] Delivering of different types of speeches.

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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.

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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*.

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ECE-404 : Electronic Measurement and Instrumentation 5 (3-1-1)

Precision and Accuracy: Errors in measurement application, AC and DC Bridges; and Q-meter.

Measurement of Frequency, Phase, Time Interval: Cathode Ray Oscilloscopes- The block diagram, compensated attenuators, Horizontal and vertical amplifiers, Synchronization, Storage oscilloscope, Measurements using CROs- Voltage, Frequency, Period, Phase etc., Oscilloscope, probes, Specifications of typical CRO.

Measurement of distortion, Measurement of Amplifier and Receiver characteristics.

Measurement and Instrumentation of Non-electrical quantities: Active and passive transducers, Measurement of temperature, pressure, liquid level, humidity, flow and IC sensors.

Instrumentation Interface bus: IEEE-483.

Telemetry and Data Acquisition System.

Advanced measuring Instruments: IP Display devices (CRT, LED, LCD), Block diagram and Application Recorders. Spectrum analyzer. Network analyzer, Storage Oscilloscope. Measurement of frequency and Time, Universal frequency counter and modes of measurement, Automatic time and Frequency Scaling, Digital Clock, Digital RF Frequency measurement, Phase meter, Energy meter.

Practical:
Study of Spectrum Analyzer.
Study of CRO.
Study of Q-meter.
Measurement of temperature using RTD.
Measurement of temperature using Thermocouple.

Measurement of Water Level.
Measurement of Pressure.
Instrumentation of Amplifier; Design for gain for verification of CMRR.
Study of Network Analyzer.
Study of LVDT.
Study of Strain Gauge.
Study of Digital Storage Oscilloscope.
Study of Frequency Counters.

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BCBE-405 : Basic Immunology 3 (2-0-1)

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, phagoytes, mast cells granulocytes, etc.

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.

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).

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:

To prepare blood smear.
Separation of serum and plasma from blood.
Qualitative tests of important constituents of plasma and serum.
Separation of plasma proteins (i.e., Fibrinogen, globulin, and albumin).
Determination of E.S.R. of any blood sample.
Preparation of antigen from blood.

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BCBE-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 number of stages. Psychrometric chart and its application.

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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, Kreb's cycle, Fermentation Electron transport system, ATP production

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

Catabolism of lipids.

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CBBI-502 : Concept of Bioinformatics 3 (2-0-1)

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

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

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

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

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.

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

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

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

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.

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

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

Practical:

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.

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MBFT-507 : Microbial Biotechnology 3 (2-0-1)

History of Microbial Biotechnology.

General Concept of microbial biotechnology.

Principles of exploitation of microorganism, primary and secondary metabolism.

Microbial Production of:

Antibiotics: penicillin, streptomycin**;** Enzymes: proteases, amylases, lipases**;** Organic acids: Citric acid acetic acid**;** Vitamins: Glutamic acid lysine**;** Alkaloids, Alcohol, beer, wine, sake Polysaccharides**;** Food and Dairy Products: Single cell protein, Single cell oil, Flavours, Cheese, bread and yogurt.

Mushroom cultivation: Production of mushrooms-production steps, harvesting and preservation and nutritive value.

Microbial production of nucleosides, nucleotides and pigments.

Microbial transformations of antibiotics and steroids.

Bio-fertilizers and bio-pesticides.

Biopolymers and bio-plastics.

Practical:
Isolation of industrially and biotechnologically important microorganisms.
Production of SCP.

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SEMESTER – VI

MCE-501 : Biosafety, Bioethics and IPR Issues 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.

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BCBE-501 : Biochemical Engineering 3 (2-0-1)

Biochemical Engineering: 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.

Control 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.

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.

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:

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

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BAM-502 : Marketing and Management of Biotechnology Products 3 (3-0-0)

1. Concept of marketing
2. Customer Satisfaction and Buyer Behaviour.
3. Marketing Mix
4. Analyzing Consumer Markets of Biotechnological products.
5. Pricing-strategies and methods of pricing of Biotechnological products.
6. Identifying Markets Segments and Selecting Target Markets for Biotechnological products.
7. Positioning the Market Offering Through the Product Life Cycle.

8. Distribution Channel.

9. Promotion of Biotechnological Products.

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MBFT-502 : Industrial Microbiology 3 (2-0-1)

>> Production of aminoacids.

>> Production of vinegar.

>> Manufacture of various chemicals: Lactic acid, Citric acid, Ethanol.

>> Industrial production of therapeutic compounds- penicillin, vitamins, vaccines.

>> Microbial transformation of steroids.

>> Production of microbial enzymes.

>> Microbial deterioration of materials- textile, paper, paint and painted surfaces etc.

>> Production of Vaccines.

>> Use of microorganisms in bioassays.

Practical:
Demonstration of fermentor its parts and maintenance.
Screening for antibiotic production.
Screening for enzyme production.
Assay of antibiotics.

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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.

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MCE-503 : Fundamentals of Nanotechnology 3 (3-0-0)

Unit 1. Introduction: Overview, history and background, importance of nanotechnology in modern science.

Unit 2. Analyzing tools: Overview of modern microscopic tools like SEM, TEM, STM, AFM, Confocal Microscopy. Overview of types of Spectroscopies like UV-Vis, IR, Raman spectroscopy. X-Ray Crystallography.

Unit 3. Nanomaterial Synthesis: Basic physics and chemistry of nanomaterials. Types of synthetic routes, Top-down and Bottom-up techniques.

Unit 4. Nanomaterial Applications: Application of nanomaterials in the field of electronics, composites, catalysis, ceramics. Uses in biosensors, drug delivery, gene therapy.

Unit 5. Safety aspects: Nanoparticle related Health and safety issues, ethical, legal and social implications, environmental issues.

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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 and 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 monopliod production, cybridizaiton, preservation of genetic resources, cryporeseration.

Practical:

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.

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MCE-601 : Molecular Breeding 3 (2-0-1)

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 interogression, 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.

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MBFT-601 : Fermentation Technology 3 (2-0-1)

Fermentation equipment and its use. Basic functions of a fermenter, body construction, aeration, agitation, theories of aeration, oxygen transfer kinetics, baffles. Design of fermentation vessels viz., Airlift Fermenter, Tower fermenter, Continous fermenter, Fed batch fermenter, Waldhof type fermenter.

Growth and product formation: Concept of primary and secondary formation (growth rate, yield coefficient, efficiency).

Development of microbial processes: (i) Screening (ii) Strain improvement (iii) Scale up in fermentations (iv) Inoculum preparations (v) Stock culture maintenance (vi) Contamination problems in fermentation industry.

Control of metabolic pathways: Environmental control and genetic control of metabolic pathways.

Fermentation media: Types of fermentation media, sources of carbon, nitrogen, trace elements, growth factors, precursors, buffers, antifoam agents, sterilization of media, screening for fermentation media.

Computer applications in fermentation technology: General applications and specific applications.

Process validation and quality assurance, Current Good Manufacturing Practices (CGMP), and Current Good Laboratory Practices (CGLP).

Practical:
Formulation of media.
Different parts of fermenter.
Production of primary and secondary metabolites.
Scale up fermentation.

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SEMESTER – VII

PHA-574 : Pharmaceutical Biotechnology 4 (4-0-0)

1. Immunology and Immunological preparations: Principles, antigens and haptens, immune system, cellular humoral immunity, immunological tolerance, antigen-antibody reactions and their application. Hypersensitivity, Active and Passive immunization; Vaccines- their preparation, standardization and storage.

2. Genetic Recombination: Transformation, conjugation, transduction, protoplast fusion and gene cloning and their applications. Development of hybridoma for monoclonal antibodies. Study of drugs produced by biotechnology such as activase, humulin, and humatrope, HB etc.

3. Antibiotics: Historical development of antibiotics. Antimicrobial spectrum and methods for their standardization. Screening of soil for organisms producing antibiotics, fermenter, its design, and control of different parameters. Isolation of mutants, factors influencing rate of mutation. Design of fermentation process. Isolation of fermentation products with special reference to penicillins, streptomycins, tetracyclines and vitamin B12.

4. Microbial transformation: Introduction, types of reactions mediated by microorganisms, design of biotransformation process and its improvements with special reference to steroids.

5. Enzyme Immobilization: Techniques of immobilization, factors affecting enzyme kinetics. Study of enzymes such as: hyaluronidase, pencillinase, streptokinase and streptodornase, amylases and proteases etc. Immobilization of bacteria and plant cells.

6. Blood products and plasma substitutes: Collection, processing and storage of whole human blood, concentrated human RBCs, dried human plasma, human fibrinogen, human thrombin, human normal immunoglobulin, human fibrin, foam plasma substitutes- ideal requirements, PVP, Dextran etc. for control of blood pressure as per I.P.

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CBBI-601 : Structural Bioinformatics 3 (2-0-1)

Introduction: Definition of BioMolecular modeling, Protein Structure- Primary, Secondary and Tertiary structure of Nucleotides, Molecular mechanics, Quantum mechanics, force fields.

Structural Databases: Types of databases and their introduction, PDB, MMDB, Ligand Databases, Structural classifications of proteins- SCOP, CATH etc.

Protein Structure determining methods: X-Ray crystallography, Nuclear Magnetic Resonance, RNA Structure prediction.

***In silico* methods of protein structure prediction**: Homology Modeling, Threading approach, *Ab initio* methods.

Evaluation of modeled protein structure: Ramachandran plot, ProCheck, What check, Verify 3-D, Errat Servers- SAVES, ProSA.

Molecular docking: Definition, Types- Protein-protein, Protein-ligand, Protein-DNA, Rigid body docking Flexible docking Softwares; Application of BioMolecular modeling – in computational chemistry, drug design, computational biology.

Practical:
Introduction to the structure database PDB.
Visualization of the protein structure using VMD.
Secondary structure prediction using GOR algorithm.
Teritiary structure prediction using SWISS-MODEL, ModWeb and Geno3D.
Using Modeller for homology modeling.
Protein Structure validation using SAVS and ProSA server.
Protein active site prediction using CastP and Pocket Finder.
Chemical file format conversion using Open Babel.
Automated docking using PATCH DOCK webserver.
Structural alignment using DaliLite and SSAP.

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BCBE-601 : Bioprocess Engineering and Downstream Processing 3 (2-0-1)

Microbial biomass, single cell proteins and its nutritional values, bakers yeast brewers yeast, food and fodder yeast, carbohydrates – whey molasses starch cellulose / wood waste, sulfite liquor, SCP production technology bacterial protein ICI process yeast protein actionomyceatous protein, mycoproteins, algal proteins (spirulina cultivations) Production of antibiotics vitamins definition, classification of antibiotics and biochemistry, penicillin, streptomycin, tetracycline's, geriosofulvin, cephalosporin, ampicillin, piocyanase, vitamins-A, Riboflavin, cephalosporin, valinomycin, carotenoids.

Solvents, biopolymers and microbial insecticides solvents, ethylalcohol, glycerol, acetone, butanol, 2, 3 butandiol, Biopolymers – expolysacharides, alaganides, xanthan, dextran, curdlan polyhydroxybutrate.

Computer control of fermentation process of computer, hardware and software application in fermentation technology, fermentation economics, fermentation. biofertilizer production, fuel alcohol production, biogas production technology, silage production, aspartame.

Practical:

- Determination of growth curve.
- Effect of temp. on microbial growth.
- Effect of pH on microbial growth.
- Effect of osmotic pressure on microbial growth.

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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.

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MCE-603 : Genetically Modified Foods 3 (2-0-1)

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.

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BCBE-603 : Medical and Molecular Diagnostics 3 (2-0-1)

Introduction: Definitions, Diagnosis, Pathogens, abnormality, disorder, infection, virulence, sampling, diagnostic cycle, clinical lab structure- maintenance, sample processing, principles of specimen interpretation, ethical issues.

Cytological disorders: Techniques and diagnosis- Cancer, pathology of cancer, diagnostic features. Different types of tumors and their diagnosis

Molecular diseases: Sickle cell anemia, thalassemia, erythenolosis, leber's hereditary.

Infectious disease and their diagnosis: Bacterial: salmonella, mycobacterium, Viral: hepatitis virus, HIV (Human immunodeficiency virus).

Immune disease: Autoimmune diseases and hypersensitivity reactions type I and IV and their diagnosis.

Metabolic Diseases: Carbohydrate and lipid metabolism- Diabetes mellitus, porphyries, and gout atherosclerosis.

Protein metabolism: phenyl ketonouria, maple syrup, cystinosis.

Diagnostic techniques: Microscopic techniques, biopsy techniques, flowcytometry, biosensors, and their application.

Practical:

Estimation of blood glucose.
Estimation of blood urea.
Estimation of cholesterol in blood.
Estimation of iron in blood.
Estimation of creatinine.
Estimation of bilirubin.
Detection of plasmodium pathogen.
Detection of salmonella typhae.

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MCE-604 : Gene Cloning and Gene Therapy 3 (2-0-1)

Unit 1. Gene cloning: Introduction to gene cloning, basic events of gene cloning, selection stratergies 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.

Practical:

Preparation of Buffers for Genomic and Plasmid DNA 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.

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MBFT-604 : Microbial Enzyme Technology 3 (2-0-1)

Introduction to enzymes and its classifications.

Specificity of enzyme action.

Bacterial and Fungal enzymes, Recent developments and present position

Production of microbial enzymes, Strain selection and development, Fermentation, Recovery and finishing.

Cell and enzyme immobilization.

Applications of microbial enzymes: Detergent, starch, paper, leather and textile industries; Synthesis of fine chemicals, medical, pharmaceutical and environmental applications.

Regulation and specifications of enzymes.

Extremozymes and their structural modifications: Thermostable enzymes and cold active enzymes, Alkalophillic and halophillic enzymes.

Practical:
To study the hydrolysis of starch by microorganisms.
To study the hydrolysis of gelatine by microbes.
Fermentative production and extraction of amylase by *Aspergillus niger*.
Estimation of reducing sugars by DNS method.
Production of lipase by submerged fermentation.

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MBFT-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 and 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).

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