

August 2008 Onwards

SCHEME OF EXAMINATION

&

SYLLABUS FOR B.Tech.

in

Biotechnology

Implemented from August 2008

UNIVERSITY SCHOOL OF BIOTECHNOLOGY

GGG INDRAPRASTHA UNIVERSITY

KASHMERE GATE

DELHI - 110 403

SCHEME OF EXAMINATION FOR BACHELOR OF BIOTECHNOLOGY

L	T	P	Credits	Hours
15	5	12	26	32

FIRST SEMESTER EXAMINATION

Code No.	L	T/P	Credits
THEORY PAPERS			
BA-135 Foundation course in Physico-Inorganic Chemistry – I	2	1	3
BA-137 Foundation course in Physics-I	2	1	3
BA-133 Life Sciences – I	3	1	4
BA-131 Essential of Mathematics –I	3	1	4
BT-115 Concepts in Biotechnology	2	1	3
IT- 105 Introduction to Computers	3	0	3
Practicals :			
BA-183 Chemistry - I Lab	0	2	1
BA-185 Physics - I Lab	0	2	1
BA-181 Life Sciences – I Lab	0	2	1
BT-161 Biotechnology- Lab	0	2	1
IT -155 Computer Lab	0	2	1
IT -157 Engineering Graphics - I Lab	0	2	1
TOTAL	15	5/12	26

SECOND SEMESTER EXAMINATION

L	T	P	Credits	Hours
16	6	10	27	32

Code No.	L	T/P	Credits
THEORY PAPERS			
BA-138 Foundation Course in Physics-II	2	1	3
BA-132 Essential of Mathematics – II	3	1	4
BA-136 Foundation Course in Organic Chemistry-II	2	1	3
BA-134 Life Sciences II	3	1	4
BT-124 Laboratory Techniques in Biotechnology	3	1	4
IT -120 Electrical Science	3	1	4
Practicals :			
BA-186 Physics - II Lab	0	2	1
BA-184 Chemistry – II Lab	0	2	1
BA-182 Life Sciences - II Lab	0	2	1
BT-164 Laboratory Techniques in Biotechnology -Lab	0	2	1
IT -166 Electrical Science-Lab	0	2	1
TOTAL	16	6/10	27

THIRD SEMESTER EXAMINATION (B.Tech)

L T P Credits Hours
15 6 13 29 34

Code No.		L	T/P	Credits
THEORY PAPERS				
BT-201	Microbiology	2	1	3
BA-203	Bioenergetics – I	3	1	4
BT-205	Cell Biology	3	1	4
BT-209	Genetics	2	1	3
BT-211	Biostatistics	2	1	3
CT-211	Chemical Engineering-I	3	1	4
Practicals:				
BA-253	Bioenergetics – I Lab	0	3	2
BT-251	Genetics-Lab	0	4	2
BT-255	Cell Biology-Lab	0	3	2
BT-257	Microbiology lab	0	3	2
TOTAL		15	6/13	29

FOURTH SEMESTER EXAMINATION (B.Tech)

L T P Credits Hours
14 5 13 26 32

Code No.		L	T/P	Credits
THEORY PAPERS				
BT-202	Immunology	2	1	3
BT-204	Molecular Biology	3	1	4
BT-206	Enzyme Technology	3	1	4
BA-208	Bioenergetics – II	3	1	4
CT-212	Chemical Engineering-II	3	1	4
Practicals:				
BT-254	Molecular Biology -Lab	0	4	2
BT-256	Enzyme Technology-Lab	0	4	2
BA-258	Bioenergetics - II Lab	0	3	2
BT-258	Immunology –Lab	0	2	1
TOTAL		14	5/13	26

FIFTH SEMESTER EXAMINATION (B.Tech)

L	T	P	Credits	Hours
12	5	15	27	32

Code No.	L	T/P	Credits
THEORY PAPERS			
BT-301 Plant Tissue Culture	2	1	3
BT-303 Microbial Processing Engineering	3	1	4
BT-305 Animal Biotechnology	3	1	4
BT-307 Recombinant DNA Technology & Applications	2	1	3
BT-309 Developmental Biology	2	1	3
Practicals:			
BT-351 Plant tissue Culture -Lab	0	3	2
CT-361 Chemical Engineering -Lab	0	3	2
BT-355 Animal tissue Culture -Lab	0	3	2
BT-357 Rec. DNA Tech. & Appl. Lab	0	3	2
BT-359 Developmental Biology Lab	0	3	2
TOTAL	12	5/15	27

SIXTH SEMESTER EXAMINATION (B.Tech)

L	T	P	Credits	Hours
14	6	12	28	32

Code No.	L	T/P	Credits
THEORY PAPERS			
BT-302 Bioinformatics	3	1	4
BT-304 Food Biotechnology	2	1	3
BT-306 Plant Biotechnology	2	1	3
BT-308 Down Stream Processing	3	1	4
BT-310 Biosensor	2	1	3
BT-312 Biochemical Engineering & Biotechnology (Elective for CT Students)	2	1	3
Practicals:			
BT-352 Bioinformatics -Lab	0	3	2
BT-354 Food Biotechnology -Lab	0	3	2
BT-356 Plant Biotechnology -Lab	0	3	2
BT-358 Downstream / Microbial Processing-Lab	0	3	2
TOTAL	14	6/12	28

SEVENTH SEMESTER EXAMINATION (B.Tech)

L T P Credits Hours
13 5 12 25 30

Code No.	L	T/P	Credits
THEORY PAPERS			
BT-403 Environmental Biotechnology	2	1	3
BT-405 Protein Biotechnology	2	1	3
BT-407 Commercialization, Marketing and Management of Biotechnological Products	2	1	3
BT-411 Intellectual Property Rights in Biotechnology	3	1	4
BT-413 Diagnostics Techniques	2	1	3
BT-413 Diagnostics Techniques	2	0	2
HS-409 Writing Skills for Technical Purposes	0	3	2
Practicals:			
BT-451 Protein Biotechnology-Lab	0	3	2
BT-453 Environmental Biotechnology -Lab	0	3	2
BT-455 Field Trips	0	0	3
TOTAL	12	6/13	26

EIGHTH SEMESTER EXAMINATION (B.Tech)

L T P Credits Hours
9 3 21 30 30

Code No.	L	T/P	Credits
THEORY PAPERS			
BT-402 Industrial Biotechnology	3	1	4
BT-408 Biosafety & Bioethics	2	1	3
Project workl/Viva-voce :			
BT-450 Project Work	0	18	14
TOTAL	7	3/21	21

FIRST SEMESTER EXAMINATION

L	T	Credits	Hours
2	1	3	26

BA-135 FOUNDATION COURSE IN PHYSICO-INORGANIC CHEMISTRY - I

Chemical Bonding:

1. Ionic bond- energy changes, lattice energy Born Haber Cycle, Covalent bond-energy changes, Potential energy curve for H₂ Molecule, characteristics of covalent compound. (4)
2. Co-ordinate bond - Werner's Theory, effective atomic numbers, isomerism in coordinate compounds. Hydrogen bonding. (2)
3. Concept of hybridisation and resonance, Valence Shell Electron Repulsion theory (VSEPR). Discussion of structures of H₂O, NH₃, SiF₄. Molecular orbital theory, Linear combination of atomic orbitals (LCAO) method. Structure of simple homo nuclear diatomic molecule like H₂, N₂, O₂, F₂. (4)

Acids and Bases:

4. Basics of acidities and basicities, electrolytic dissociation, concept of strengths of acids and bases, ionization of water, concept of pH and its scale, Buffer solutions, Buffer solution of weak acid and its salt, calculation of pH of buffer solution, Henderson equation, acid-base indicators and theory of indicators. (4)

Catalysis:

5. Criteria for Catalysis-Homogeneous Catalysis, acid-base, Enzymatic catalysis, Catalysis by metal salts. (2)
6. Heterogeneous catalysis - concepts of promoters, inhibitors and poisoning, Physiosorption, Chemisorption, Surface area, industrially important process. (2)

Polymers:

7. Basic concepts & Terminology, such as monomers, Polymers, Functionality, Thermoplastics, Thermosets Linear, Branched, cross linked polymers etc. different definitions of molecular weight viz., Mw, Mn, Mv and then determinations. (2)
8. Industrial applications of polymers, Addition, condensation and Ionic polymerization's, solutions of polymers, good solvents, & bad solvent, solubility parameter, solutions viscosity and determination of intrinsic viscosity. (2)

Colloids

9. Collidal state, classification of colloidal solution, true solution, colloidal solution and suspensions, preparation of sol, Purification of colloidal solutions. (2)
10. General and optical properties, stability of colloids, coagulation of lyophobic sols, electrical properties of sols, kinetic properties of colloids:- Brownian movement, size of colloidal particle, emulsions, gels, colloidal electrolytes and applications of colloids. (2)

Text / Reference Books:

1. Concise Inorganic Chemistry, 5th Edition by J.D. Lee, *Blackwell Publishing* (1999).
2. Advance Chemistry by Philip Mathews, *Cambridge University Press* (1996).
3. Basic Inorganic Chemistry, 3rd Edition by F. A. Cotton, G. Wilkinson & P. L.Gaus, *Wiley*(1995).
4. Physical Chemistry, 6th Edition by P. W. Atkins, *W.H. Freeman & Company*; (November 1997).

FIRST SEMESTER EXAMINATION

L	T	Credits	Hours
2	1	3	30

BA-137 FOUNDATION COURSE IN PHYSICS - I

1. **Interference By Division Of Wave front:** Coherence and coherent sources, Interference by division of wave front. Young's double slit experiment, Fresnel's biprism (3)
2. **Interference By Division Of Amplitude:** Interference by division of amplitude. Thin films, Newton's rings, Michelson's Interferometer, Fabry Perot Interferometer (3)
3. **Diffraction:** Fresnel and Fraunhofer types of diffraction. Fraunhofer diffraction: Single slit, double slit, circular aperture. Fresnel Diffraction, narrow slit. (3)
4. **Diffraction–Applications:** Fraunhofer diffraction: N-slit. Diffraction grating - wavelength determination, resolving power and dispersive power. Resolving power of optical instruments – Rayleigh criterion. Fresnel Diffraction: zone plate. (3)
5. **Polarization:** Types of polarization, elliptically and circularly polarized light Brewster's law, Malu's law, Nicol prism, double refraction, quarter-wave and half-wave plates, optical activity, specific rotation, Laurent half-shade polarimeter. (3)
6. **Introduction To Lasers:** Introduction, Coherence, Einstein A and B coefficients, population inversion, Basic principle and operation of a laser, (3)
7. **Lasers Types And Applications:** Types of lasers, He-Ne laser, Ruby laser, semiconductor laser and holography. (3)
8. **Fibre Optics:** Introduction to Optical fibre, Types of optical fibres and their characteristics, (Attenuation and Dispersion) step index and graded index fibres, principle of fibre optic communication- total internal reflection, Numerical aperture, Fibre optical communication network- its advantages. Fibre optic sensors (qualitative). (3)
9. **Nature Of Light And Matter:** Particle nature of radiation- The Photoelectric effect, Compton Effect. X-rays (continuous and characteristic), x-ray diffraction- Bragg's law. The origin of quantum theory- Planck's hypothesis, the wave nature of matter- wave-particle duality, matter waves (de Broglie hypothesis). (3)
10. **introduction to quantum mechanics:** Basic postulates of quantum mechanics-the wave function - its physical interpretation, The Schrodinger equation. (3)

Text / Reference Books:

1. Modern Physics by A. Beiser, *Tata Mc Graw Hill Publishing Co.*
2. Optics by A.K. Ghatak, *Tata Mc Graw Hill Publishing Co.*
3. Introduction to Physical Optics by Jenkin & White, *Mc Graw Hill Publishing Co*

FIRST SEMESTER EXAMINATION

	L	T	Credits	Hours
BA-133	3	1	4	40
LIFE SCIENCES - I				

1. **Origin of Life:** History of earth, theories of origin of life nature of the earliest organism. **(2)**
2. **Varieties of life:** Classification, Five kingdoms, viruses (TMV, HIV, Bacteriophage), Prokaryote (Bacteria-cell structure, nutrition, reproduction), Protista, Fungi, Plantae and Animalia. **(5)**
3. **Chemicals of life:** (Biomolecules)- Carbohydrates lipids, amino acids, proteins, nucleic acids, and identification of biomolecules in tissues. **(6)**
4. **Cell:** The cell concept, structure of prokaryotic and eukaryotic cells, plant cells and animal cells, cell membranes, cell organelles and their function. Structure and use of compound microscope. **(5)**
5. **Histology:** Meristemes (apical, intercalary, lateral) and their function; simple tissue (parenchyma, collenchymas, sclerenchyma); Complex tissue (xylem and phloem); Tissue systems (epidermal, ground, vascular); primary body and growth (root, stem, leaf); Secondary growth. Animal Epithelial tissue, connective tissue, muscle tissue and nervous tissue and their function in body. **(5)**
6. **Nutrition:** Autotrophic (Photosynthesis) Pigment systems, Chloroplast, light absorption by chlorophyll and transfer of energy, two pigment systems, photosynthetic unit, phosphorylation and electron transport system, Calvin-Benson Cycle (C₃), Hatch Slack Pathway (C₄), Crassulacian 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)**
7. **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. **(5)**
8. **Transport:** Plant water relationships, properties of water, diffusion, osmosis, imbibition, movement of water in flowering plants, uptake of water by roots, the 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 vessels, formation of tissue fluids, the heart, functions of mammalian blood, the immune system. **(6)**

Text / Reference Books:

LIFE. The Science of Biology. 8th edition, Sadava,,Heller, Orians, purves, Hills. 2008. *W.H.Freeman*.

FIRST SEMESTER EXAMINATION

L	T	Credits	Hours
3	1	4	40

BA-131 ESSENTIAL OF MATHEMATICS –I

1. Algebra of matrices, Row and Column operations, Inverse of matrix, Systems of linear equations- consistency and inconsistency, Cramer's rule, Rank of a matrix. **(4)**
2. Quadratic forms, Eigenvalues and eigenvectors of a matrix, Diagonalization of a matrix, Cayley-Hamilton theorem (without proof) **(5)**
3. Quadratic equations, De-Moivre's theorem and its applications **(4)**
4. Limits, Continuity and Differentiation **(5)**
5. Successive differentiation, Leibnitz's Theorem, Indeterminate forms **(4)**
6. Mean Value Theorems: Rolle's, Lagrange's, Taylor's and Maclaurin theorems and expansions and their applications **(6)**
7. Sequences and its convergence, Convergence and divergence of a series, Comparison test, Ratio test, Cauchy's n^{th} root test, Leibnitz's test (all tests without proof), Absolute and Conditional convergence. **(6)**
8. Partial derivatives, Chain rule, Differentiation of implicit functions, exact differentials. Maxima, Minima and Saddle points, Method of Lagrange multipliers. **(6)**

Text / Reference Books:

1. Advanced Calculus by D.V.Widder, *Prentice Hall, NY*
2. Calculus and Analytic Geometry by G.B. Thomas and R.L. Finney, 6th edition, *Addision Wesley/Narosa*, 1985
3. Engineering Mathematics by K.A.Stroud, *Palgrave*
4. Advanced Engineering Mathematics by K.A.Stroud, *Industrial Press, Inc.*, Newyork.
5. Advanced Engineering Mathematics by Alan Jeffrey, *Harcourt, Academic Press*.
6. Advanced Engineering Mathematics by Petter V.O'Neil, *Thomson*.
7. Differential Calculus by Shanti Narayan, *S. Chand & Co.*
8. A text book of Matrices by Shanti Narayan, *S. Chand & Co.*
9. Advanced Engineering Mathematics by E. Kreyszig 5th Edition, *Wiley Eastern*, 1985.

FIRST SEMESTER EXAMINATION

	L	T	Credits	Hours	
BT-115	2	1	3	32	CONCEPTS IN BIOTECHNOLOGY
1.	Introduction to Biotechnology: Definitions, Historical perspectives, Scope and importance, Commercial potential and interdisciplinary challenge. (7)				
2.	Recombinant DNA Technology: Introduction, Tools of rDNA Technology, Making Recombinant DNA, Introduction of Recombinant DNA into host cells, introduction to screening techniques for Identification of Recombinants, Polymerase Chain Reaction (PCR). Introduction to screening technologies for identification of recombinants. (3)				
3.	Protein Structure and Engineering: Introduction to the world of Proteins, 3-D Shape of Proteins, Structure Function relationship in Proteins, Purification of Proteins, introduction to Protein Designing and Proteomics. (4)				
4.	Microbial Culture and Applications: Introduction, Microbial Culture Techniques, Measurement and Kinetics of Microbial Growth, Scale up of Microbial Process, Isolation of Microbial Products, Strain Isolation and Improvement, Applications of Microbial Culture Technology, Bioethics in Microbial Technology. (3)				
5.	Plant Cell Culture and Application: Introduction, Cell and Tissue Culture Techniques, Applications of Cell and Tissue Culture, Gene Transfer Methods in Plants, Transgenic Plants with Beneficial Traits, Bioethics in Plant Genetic Engineering. (4)				
6.	Animal Cell Culture and Applications: Introduction, Animal Cell Culture Techniques, Characterization of Cell Lines, Scale-up of Animal Culture Process, Applications of Animal Cell Culture, Bioethics in Animal Genetic Engineering. (4)				
7.	Biotechnology and Society: Introduction to Patenting - Criterion for patents, Reading a patent, National and International Patent Laws, Ethical issues in agriculture and health care, Biotechnology in India and global trends; Product safety and Marketing. (2)				
8.	Introduction to Bioinformatics: Introduction to databases and their application. Introduction to Functional Genomics. (2)				
9.	Solutions and buffers: Modes of expressing concentration of a solution, types of solution, Acids and bases, dissociation of water, concept of pH, Buffer system, criteria for selection of buffers. (2)				
10.	Introduction to Statistical analysis: Presentation of experimental data, introduction to data Analysis of graph paper with Logarithmic Coordinates, General procedure for plotting data. (1)				

Text / Reference Books:

1. Biotechnology by Smith, *Cambridge Press*.
2. Introduction to Genomics, Arthur M Lest, *Oxford*
3. Gene cloning and DNA Analysis. An introduction. T. A Brown, 4th Edition. *Blackwell Science*.

FIRST SEMESTER EXAMINATION (B.Tech)

L	T	Credits	Hours
3	0	3	40

IT-105 INTRODUCTION TO COMPUTERS

1. **Introduction: Overview:** of computer organization and historical perspective computer applications in various fields of science and management. **(5)**

2. Data representation: Number systems, character representation codes, Binary, hex, octal codes and their inter conversions. Binary arithmetic, floating point arithmetic, signed and unsigned numbers. **(5)**

3. Data storage: Primary and Secondary storage. Introduction to various computer devices such as keyboard, mouse, printers, disk files, floppies etc. **(5)**

4. Concept of computing, contemporary, Operating Systems such as DOS, Windows 95, UNIX etc. (only brief user level description). Introduction to organization and architecture of mainframe, mini and micro systems. Introduction to E-mail, ftp, login and other network services, worldwide web, MS-Office. **(5)**

5. **Introduction to Programming:** Concept of algorithms, Flow charts, Example of Algorithms such as how to add ten numbers roots of a quadratic equation. Concept of sequentially following up the steps of the algorithm, Notion of program, programmability and programming languages. Structure of programs, object codes, compilers, Introduction to the Editing tools such as vi or MS-VC editors, Concepts of the finite storage, bits, bytes, kilo, mega and gigabytes. Concepts of character representation. **(5)**

6. **Programming using C:** The emphasis should be more on programming techniques rather than the language itself. The C programming language is being chosen mainly because of the availability of the compilers, books and other reference materials, Example of some simple C program. Dissection of the program line by line. Concepts of variables, program statements and function calls from the library (print for example), C data types, int, char, float etc, C expressions, arithmetic operations, relational and logic operations, C assignment statements, extension of assignment to the operations. C primitive input output using getchar and putchar, exposure to the scanf and printf functions, C statements, and conditional executing using if, else. Optionally switch and break statements may be mentioned, Concepts of loops, example of loops in C using for, while and do-while. Optionally continue may be mentioned, One dimensional arrays and example of iterative programs using arrays, 2-d arrays. Use in matrix computations, Concept of Sub-programming, functions. Example of functions. Argument passing mainly for the simple variables, Pointers, relationship between arrays and pointers. Argument passing using pointers. Array of pointers. Passing arrays as arguments, Strings and C string library, Structures and Unions. Defining C structures, passing strings as arguments. Programming examples, File I/O. Use of fopen, fscanf and fprintf routines. **(15)**

Text / Reference Books:

1. Fundamentals of Computers by V. Raja Raman, *Prentice Hall of India*.
2. 'C' Language by Brian Gottfried, *Schaum Series*.
3. Introduction to Computers by Leon & Leon. *Academic Press*

SECOND SEMESTER EXAMINATION

L	T	Credits	Hours
2	1	3	28

BA-138 FOUNDATION COURSE IN PHYSICS – II

1. **Electricity and Magnetism- Basics:** Electric fields, Gauss' Law, its integral and differential form, applications. Lorentz force, fields due to moving charges, the magnetic field, Ampere's law, motion of a charged particle in an electric and magnetic field (3)
2. **Electricity and Magnetism-applications:** Magnetic and electrostatic focusing, Hall effect, determination of e/m by cathode ray tube, positive rays, Electron microscope, Cyclotron and Betatron. (4)
3. **Classical and Quantum Statistics:** The Statistical distributions: Maxwell Boltzmann, the Black-body spectrum and failure of classical statistics to give the correct explanation, Bose-Einstein and Fermi-Dirac statistics, their comparisons, Fermions and Bosons. (3)
4. **Applications of classical and quantum statistics:** Applications of Maxwell-Boltzmann statistics - Molecular speed and energies in an ideal gas, the application of Bose-Einstein statistics to the Black-body radiation spectrum, Fermi-Dirac distribution to free electron theory, electron specific heats, Fermi energy and average energy - its significance. (4)
5. **Band theory of solids:** Origin of energy bands in solids, motion of electrons in a periodic potential- The Kronig-Penny model (qualitative). Brillouin zones, effective mass Metals. Semi-metals. Semi-conductors and insulators and their energy band structure. (3)
6. **Semiconductors and their applications:** Extrinsic and intrinsic semiconductors, doping - Fermi energy for doped and undoped semiconductors, the p-n junction (energy band diagrams with Fermi energy), the unbiased diode, forward and reverse biased diodes- its characteristics, tunnel diode, zener diode, photo-diode, LED, the photo-voltaic cell (4)
7. **Superconductivity:** Introduction to superconductivity, the Meissner effect, Type I and II superconductors, the Josephson effect, flux quantization, Cooper pair, the BCS theory (qualitative) (3)
8. **Applications of superconductors:** Magnetic levitation, superconducting magnets, Josephson junctions and Squids. (4)

Text / Reference Books:

1. Modern Physics by Arthur Beiser, *Tata Mc Graw Hill Publishing Co.*
2. Introduction to Solid State Physics by Charles Kittel, *Wiley.*
3. Electronic Principles by Albert Paul Malvino, *Tata Mc Graw Hill Publishing Co.*

SECOND SEMESTER EXAMINATION

L	T	Credits	Hours
3	1	4	42

BA-132 ESSENTIAL OF MATHEMATICS – II

1. Concavity and Convexity of curves, Asymptotes, Singular points, Curve tracing. **(6)**
2. Integration : Methods of Integration, Integration of algebraic, rational, trigonometric functions and irrational functions, Integration by parts, Substitution method, Definite integrals and its properties. **(6)**
3. Reduction formulae of trigonometric functions, Definition of improper integrals, Beta-Gamma functions and their properties. **(5)**
4. Formation of ordinary differential equation's (ODE), Definition of order and degree, Solutions of ODE's of first order: Method of separation of variables, Homogeneous and non-homogeneous equations, Exactness and integrating factors, Linear equations and Bernoulli's equations. **(5)**
5. Linear ODE's of nth order: Solutions of homogenous and non-homogenous equations, Operator method. Method of undetermined coefficients and variation of parameters. **(6)**
6. Power series method of solution of ODE, Legendre's Equation, Legendre's polynomials, Bessel's equation, Bessel's function of first kind. **(6)**
7. Introduction to probability theory, Definition of sample space, Event, Event space, Conditional probability. **(4)**
8. Additive and Multiplicative laws of probability, Baye's theorem, Application based on these results. **(4)**

Text / Reference Books:

1. Calculus and Analytic Geometry by G.B. Thomas and R.L. Finney, 6th edition, *Addison Wesley/Narosa*, 1985.
2. Differential Calculus by Shanti Narayan, *S. Chand & Co.*
3. Advanced Engineering Mathematics by E. Kreyszig, 5th Edition, *Wiley Eastern*, 1985.
4. Engineering Mathematics by K.A.Stroud, *Palgrave*.
5. Advanced Engineering Mathematics by K.A.Stroud, *Industrial Press, Inc.*, Newyork.
6. Advanced Engineering Mathematics by Alan Jeffrey, *Harcourt Academic Press*.
7. Advanced Engineering Mathematics by Petter V.O'Neil, *Thomson*.
8. Advanced Calculus", Schaum's Outline Series, *Mc Graw Hill Ed.*
9. Advanced Calculus by D.V.Widder, *Prentice Hall*, NY
10. Differential Equations by S.L.Ross, *John Wiley*.
11. Differential Equations by N.M. Kapoor, *Pitamber Pub. Co.*
12. Probability, Schaum Outline Series, *Mc. Graw Hill*.

SECOND SEMESTER EXAMINATION

L	T	Credits	Hours
2	1	3	28

BA-136 FOUNDATION COURSE IN ORGANIC CHEMISTRY – II

1. **Electronic Displacements:** Inductive, mesomeric, field effect and resonance effect - resonance energy and its significance, (vertical and empirical resonance energy). Hyperconjugation: concept and consequences. (2)
2. **Reactive intermediates:** Generation, structure and general reactions of carbocations, carbanions, free radicals, carbenes (singlet and triplet) and benzyne. Wagner-Meerwein rearrangement, Electrophiles and nucleophiles, concepts of acids and bases. Arrhenius, Lowry-Bronsted and Lewis theory of acids and bases (HSAB), Carbon acids (active methylene groups), super acids, Correlation of structure with acidity and basicity. Bonds weaker than covalent bond: Hydrogen bonding - nature, types, stability and effects, vander Waals forces. (5)
3. **IUPAC Nomenclature:** Systematic IUPAC nomenclature of different classes of compounds including aromatic, bicyclic, and spiro compounds and polyfunctional compounds. (2)
4. **Stereochemistry:** Classification of stereoisomers, diastereoisomers, Separation of enantiomers. Absolute configuration (R and S), Projection formulae. Stereochemistry of compounds containing two asymmetric C-atoms. Elements of symmetry - centre, plane and axis of symmetry, Conformations: Conformations around a C-C bond in acyclic compounds, Structure of different cycloalkanes. Strain in acyclic and cyclic compounds. Cyclohexane conformations, Stereochemistry of disubstituted cyclohexanes. Geometrical isomerism- Concept, E and Z nomenclature, Stereoselective and specific Reactions. (8)
5. **pπ - dπ bonding** in organic compounds, ylids (S and P), Wittig reaction. (2)
6. **Tautomerism:** Cationotropy and anionotropy, Prototropic shifts in different systems, ring-chain tautomerism and valence tautomerism, Claisen rearrangement. (2)
7. **Alkanes:** Methods of preparation, Source-petroleum and coal in brief, Cracking and reforming. (2)
8. **Alkenes:** Methods of preparation. Reactions: Hydrogenation, hydroboration, oxidation, hydroxylation, addition- Markownikoff rule with explanation and peroxide effect. Dienes: types of dienes and their characteristic reactions, effect of conjugation on stability and reactivity, Diels-alder reaction in detail with its stereochemistry. Polymerisation of olefinic compounds, Use and mechanism of Ziegler-Natta catalysts. (5)

Text / Reference Books:

1. Modern Organic Chemistry by D. R. Boyed.
2. Organic Chemistry by I. L. Finar, Addison-Wesley Longman, Limited
3. Organic Chemistry by Roger Macomber. *University Science Books*.
4. Organic Chemistry Reaction Mechanism by Jerry March, *McGrawHill Companies*

SECOND SEMESTER EXAMINATION

L	T	Credits	Hours
3	1	4	40

BA-134 LIFE SCIENCES - II

1. **Coordination and control:** Plant movements (Tactic, Tropic, Nastic), plant growth substances (Auxins, Cytokinins, Gibberellins, ABA, Ethylene), phytochrome and effect of light on plant development, vernalisation and flowering. Nervous system, parts of the nervous system, sensory receptors, structure and function of receptors, Endocrine system, role of hormones in growth and development of humans. **(6)**
2. **Homeostasis:** Control system in biology, control of blood glucose level, temperature regulation in endothermic animals, the liver and its importance. **(4)**
3. **Mendelian Analysis:** Experiments of Mendel, Simple mendelian genetics in humans, in agriculture, Variants and genetic dissection. **(4)**
4. **Asexual Reproduction:** Apomixis, and other means of natural vegetative reproduction (Bulb, corm, rhizome, stolon, runner, tuber, tap roots, tillers), advantages and disadvantages of natural asexual reproduction. Artificial propagation - cutting, grafting, budding, layering, micropropagation through tissue culture, advantages and disadvantages of micropropagation. **(5)**
5. **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, embryosac, function of different cells of embryosac, pollination types of pollination, pollen-pistil interaction, self incompatibility, fertilization, double fertilization, post fertilization changes in ovule and embryo, seed formation, structure of seed and its importance. Review of sexual reproduction in vertebrates, human intervention in reproduction. **(7)**
6. **Continuity of life:** Chromosome, cell cycle, mitosis and meiosis, techniques to study mitosis and meiosis. **(4)**
7. **Heredity and Variation:** Mendel's work, chromosomal basis of inheritance, modified dihybrid ratios, gene interaction, linkage, gene mapping, sex determination, cytoplasmic inheritance, variation and mutation. **(5)**
8. **Economically Important Plants :** Classification systems, Important families (Fabaceae, Poaceae, Malvaceae, Cucurbitaceae, Crucifereae, Leguminoseae), Cereals (wheat, rice maize), Beverages (tea, coffee, cocoa), Fibers (jute, linen, cotton), wood (pines, cedar, teak, sisham), rubber (para rubber), spices (turmeric, black pepper, cloves, coriander), medicinal plants (Ephedra, Taxus, Cinchona, Fox glove, Belladonna, Rauwolfia, Neem, Hemp.) **(5)**

Text / Reference Books:

LIFE: The Science of Biology, 8th Edition, Sadava, Heller, Orians, Purves, Hill 2008

SECOND SEMESTER EXAMINATION

L	T	Credits	Hours
3	1	4	39

BT-124 LABORATORY TECHNIQUES IN BIOTECHNOLOGY

1. **pH:** Concept of pH, Henderson Hasselbach equation, preparation of Buffers, composition of some commonly used buffers, pH meters. (3)
2. **Colorimetry and Spectroscopy:** Basic principles, nature of electromagnetic radiation, Beer-Lambert laws, colorimetric methods & instruments, principles of spectroscopy, types of spectra-absorbance, emission, fluorescence and action spectra, single and double beam spectrophotometers, densitometers, flame photometer, fluorimeters, circular dichorism & their applications. (5)
3. **Cell separation:** Flow cytometry, magnetic beads, elutriator. (3)
4. **Microscopy:** Basic principles, instrumentation, sample preparation for optical, phasecontrast, interference, polarization, inverted fluorescence, confocal & electron microscopes & their applications. (4)
5. **Microtomy:** Principles & types, sample preparation & sectioning parameters.(2)
6. **Centrifugation:** Principle, types of centrifuges, differential and gradient ultracentrifugation-preparative & analytical. (5)
7. **Chromatography:** Principles, methodology and applications of chromatography using paper, thin layer, column (gel filtration, ion exchange, affinity), gas, HPCL, FPCL. (4)
8. **Electrophoresis:** Principles and types of electrophoresis and their applications for proteins, nucleic acids, including gradient gel and pulse-filed gel electrophoresis; gel matrices: polyacrylamide, agarose etc. critical parameters for optimum separation and resolution, two dimensional electrophoresis (IEF). (5)
9. **Radioisotope methods and tracer techniques in biology:** Basic principles of radioactivity, properties & handling of radioisotopes in biology & medicine, radiation units, Geiger Muller & scintillation counters, autoradiography, radionucleide imaging, CT scan. (4)
10. **Biophysical Techniques:** X-ray crystallography Nuclear Magnetic Resonance (NMR) spectra, magnetic Resonance Imaging (MRI), lasers in biology and medicine, Mass spectrometry. (4)

Text / Reference Books:

1. Biochemical Calculations by Irwin H. Segel, 2nd Edition, *John Wiley & Sons*, 1975
2. Introductory practical Biochemistry by S. K. Sawhney & Randhir Singh; *Narosa Publishing house*, 2000.

SECOND SEMESTER EXAMINATION

L	T	Credits	Hours
3	1	4	36

IT-120 **ELECTRICAL SCIENCE**

1. **Properties of Conductors and Insulators** : Basic laws of Electrical Engineering, Temperature Resistance Coefficients. **(5)**

2. **D. C. Circuits** : Network theorems and applications, Division of Current, Potentiometer, Circuit parameters, Energy and power, Superposition, Thevenin and Reciprocity theorems, Star Delta Formations. **(6)**

3. **Alternating Currents** : Peak, Average and RMS values for alternating currents, Power and Power factor , Resistance, Inductance and Capacitance, Resonance, Q Factor. **(5)**

4. **Measuring Instruments** : Electromagnetism, Moving Coil and Moving Iron, Instruments, Construction Instruments, Attraction and Repulsion type, Permanent Magnet and Electrostatics, Dynamometer type. **(5)**

5. **D. C. Generators & Motors** : Principle of operation of Generators & Motors, Speed Control of shunt motors, Flux control, Rheostatic control, voltage control, Speed control of series motors. **(5)**

6. **A. C. Generators & Motors** : Principle of operation, Revolving Magnetic field, Squirrel cage and phase wound rotor, Starting of Induction motors, Direct on line and Star Delta starters, Synchronous machines. **(5)**

7. **Transformers:** Construction, Regulation and efficiency calculations, Open and short circuit tests. **(5)**

Text / Reference Books:

1. Electrical Engineering Fundamentals by Vincent DEL TORO. HUGHES, Electrical Technology. *Englewood Cliffs, N.J., Prentice-Hall* [1972]