

L	T	P	Credit
3	1	0	4

1. **Gaseous State:** Kinetic theory, molecular velocity, Probable distribution of velocities, mean free path, collision frequency. Distribution of energies of molecules translational, rotational & vibrational, Law of equipartitions of energies, Equation of State of a real gas. Critical phenomenon & principle of corresponding states.
2. **The phase rule:** Derivation of phase rule, significance of various terms involved in the definition of phase rule. Phase diagrams of one component systems (Water, Sulphur and CO₂). Two component system: Eutectic, congruent and incongruent systems with examples:
Partial miscible liquids: Lower and upper consolute point.
3. **Chemical Kinetics:** Rate, mechanism, steady state concept, Kinetics of complex reactions, concept of energy barrier/energy of activation. Theories of reaction rates, Lindemann theory of unimolecular reaction and reactions in flow system.
4. **Electrochemistry:** Concept of electrolysis, Electrical current in ionic solutions. Kohlrausch's law and migration of ions. Transference number. Hittroff and moving boundary methods. Applications of conductance measurements.
Strong electrolytes: Onsager equation: Activity and activity coefficients of strong electrolyte.
5. **Surface Chemistry:** Adsorption, adsorbate and adsorbents. Types of adsorption. Freundlich adsorption isotherm, Langmuir adsorption isotherms. B.C.T. Isotherm: Surface area of the adsorbent. Changes in entropy, enthalpy and free energy on adsorption. Gibbs adsorption equation.
6. **Catalysis:** Types of catalysis, homogenous/heterogeneous, enzyme catalysis, acid/base catalysis and their kinetics. Mechanism of heterogeneous catalysis. Kinetics of surface reactions: unimolecular and bimolecular. pH-dependence of rate constants of catalysed reactions. Autocatalysis
7. **Colloids:** Classification of colloids. Color of sols, Electrochemical properties of sols, Molecular weight v/s particle weight of colloidal dispersed particles, viscosity & plasticity. Gels and their properties: isobars and adsorption, isotherm, syneresis, thixotropy and diffusion in jellies. Emulsions, emulsifiers, theory of emulsification, properties and stability of emulsions.

Books & References

1. Principles of Physical Chemistry, Maron, Samuel H. Prutton, Carl. E., Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
2. Textbook of Physical Chemistry, Glasstone Samuel, Macmillan and Co. Ltd.
3. Principles of Physical Chemistry, Puri, B.R., Sharma L.R. and Pathania, Mada.
4. Physical Chemistry, Moore W.J., Orient Longman
5. D. Tabor: Solids, liquids & gases, Penguin Press Paper back
6. A text Book of Physical Chemistry, Atkin P.W., Oxford University Press, oxford
7. Introduction to Chemical Reaction Engineering & Kinetics, Missen, Ronald W, Mims, Charles A, Sacelli, Bradley A, John Wiley & Sons Inc., NY.
8. A text book of Physical Chemistry, Negi A.S. and Anand, S.C. Wiley Eastern Ltd., New Delhi.

w.e.f. August 2003

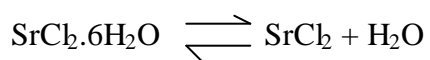
Paper Code: BA-261

PHYSICAL CHEMISTRY LAB

Credits

2

1. Draw calibration graph between concentration and viscosity of glycerol and hence evaluate the concentration of the unknown.
2. Study the distribution of I₂ between water and carbon tetrachloride.
3. Study of distribution of benzoic acid between water & benzene.
4. To study the kinetics of hydrolysis of methyl acetate and evaluate its order.
5. To study the kinetics of saponification of ethyl acetate with Sodium hydroxide and calculate its order.
6. To study the adsorption of acetic acid on activated charcoal at room temperature.
7. Determine the concentration of H₂SO₄/HCl & CH₃COOH present in a mixture by conductometric titration.
8. Verify Lambert Beer's law for copper sulphate solution.
9. Perform Photometric titration of Acid vs Base.
10. Complexometric titration of Ca²⁺/Mg²⁺.
11. To evaluate transition temperature of the reaction



Paper Code: BA-121 Foundation course in Physico Inorganic Chemistry-I

L	T	Credit
2	1	3

1. **Chemical Bonding:** Ionic bond, energy changes, lattice energy, Born Haber Cycle, Covalent bond-energy changes, Potential energy curve for H₂ molecule, characteristics of covalent compound, co-ordinate bond - Werner's theory, effective atomic numbers, isomerism in coordinate compounds, hydrogen bonding, Vander Waal's forces, hybridisation and resonance.
2. **Acids and bases:** Electrolytic dissociation, Basics of acidities and basicities, 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.
- 3 (a) **Reaction kinetics:** Significance of rate law and rate equations, order and molecularity, Determination of order of simple reactions - experimental method, Equilibrium constant and reaction rates - Lindemann, collision and activated complex theories.
(b) **Photochemistry:** Jablonski diagrams, Lambert Beer's law, Grotthus Draper law, Quantum efficiency, Photochemical reactions, kinetics of H₂-Br₂, H₂-Cl₂, H₂-I₂ reactions.
4. **Catalysis:** Criteria for catalysis - Homogenous catalysis, acid-base, Enzyme catalysis, Heterogeneous catalysis - concept of promoters, inhibitors and poisoning, Physisorption, Chemisorption, examples of some industrially important processes.
5. **Polymers:** 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. Types of biopolymers - Fats, Carbohydrates, Proteins & Nucleic acid.
6. **Colloids:** Colloidal state, classification of colloidal solution, colloidal solution and suspensions, stability of colloids, coagulation of lyophobic sols, emulsions, gels, colloidal electrolytes and applications of colloids.

Books and References

1. Inorganic Chemistry by J.D. Lee.
2. Physical Chemistry by More W. J.
3. Principles of Physical Chemistry by Maron, Samuel H (Prutton, Earl E), Oxford and IBH Publishing.
4. Inorganic Chemistry by James E Huheey

BIOENERGETICS - I (BT)

Code: BA-203

L	T/P	Credits
3	1	4

1. **Biochemical Evolution:** Chemogeny, Biogeny, and Evolution of Chromosome Organization and Genetic Regulatory Mechanisms, Time factors in evolution, Evolution of Enzyme Systems.
2. **Amino Acids and Peptides:** Structure, Function, Methods of Characterization, Separation Techniques based on their structure and properties, Clinical Significance, Biosynthesis.
3. **Carbohydrates:** Mono and Polysaccharide, Classification, Structure, Function, Separation and Characterization Techniques, Clinical significance, Biosynthesis.
4. **Lipids:** Classification, Structure, Function, Separation and Characterization Techniques, Clinical Significance.
5. **Nucleic Acids:** Nucleic Acids and Polynucleotides, Classification, Structure, Function, Separation and Characterization Techniques, Clinical Significance.
6. **Vitamins and Micro and MacroNutrients:** classification, Structure, Function, Separation and Characterization Techniques, Clinical Significance.
7. **Biochemical Energetics:** Energy Yielding and Energy Requiring Reactions, Calculations of Equilibrium Concentrations, Oxidation-Reduction Reactions, Metabolism and ATP Yield. Photosynthetic Phosphorylation, Active Transport, Second Law of Thermodynamics, Enthalpy and Entropy, Activation Energy.
8. **Spectrophotometry and other Optical methods:** Spectrophotometry, Flurometry, Optical Rotation - Polarimetry, Photochemistry, and Quantum efficiency.

Text / Reference Books

1. Biochemistry by Lubert Stryer.
2. Biochemistry by Lehninger.
3. Biochemistry by Zubey.

CHEMISTRY-I LAB (BT)

Paper Code: BA-155

L	T	P
0	0	2

1. Preparation of a standard solution of a substance.
2. Determine the strength and percentage purity of the given sample of sodium carbonate.
3. Determination of amount/litre of FAS present in the given solution acidified with H_2SO_4 .
4. Determine the atomic weight of the alkalimetal in the alkalimetal dichromate provided with FAS solution using N-phenylanthranilic acid solution as internal indicator.
5. Determine the strength of given copper sulphate solution with standard hypo solution.
6. Determine the chloride ions in the given sample by Argentometric method.
7. Prepare a colloidal solution of starch and Ferric hydroxide.
8. Determine the precipitation values of $NaCl$, $CaCl_2$ and $AlCl_3$ for As_2S_3 solution. Also test the validity of hardy Schulze law.
9. Determination of acidity and alkanity of a water sample.
10. Determination of hardness of water by EDTA.

BIO ENERGETICS-I LAB (BT)

Paper Code-BA-253

L	T	P
-	-	4

1. Preparation of normal, molar and percent solutions and determination of their pH.
2. Preparation of buffer solutions using buffer tables and verification of their pHs by pH meter.
3. Titration curve and pKa determination for acetic acid, phosphoric acid and amino acid (any one).
4. Qualitative analysis of carbohydrates, amino acids and proteins and cholesterol.
5. Determination of
 - (a) Saponification value
 - (b) Acid value and
 - (c) Iodine value of a fat/oil
6. Preparation of casein from milk.
7. Preparation of starch from potatoes.
8. To study protein denaturation using viscometer.
9. Separation of amino acids by paper chromatography (descending, ascending or circular) and Calculation of Rf values.
10. To understand the functioning of main components of a calorimeter and pH meter.
11. Verification of Beer-Lambert's law using nitrophenol or cobalt chloride.

ORGANIC CHEMISTRY

Paper Code: BA-117

L	T/P	Credits
3	1	4

1. **Classification of Organic compounds** IUPAC nomenclature, Structural isomerism, Cis-trans isomerism, shapes and molecular orbital structures of compounds containing C,N and O conformation of alkanes, structures of dienes, pyridine, pyrrole, aromatic compounds, delocalisation, concept of aromaticity, stability of cycloalkanes, resonance concept, inductive and mesomeric effects, directive effects, activating and deactivating groups, hydrogen-bonding, organic reagents and reaction intermediates.
2. **Chemistry of hydrocarbons** House synthesis halogenation of alkanes, free radical mechanism, cracking effect of structure on Physical properties of compounds, alkenes catalytic hydrogenation, dehydration of alcohols, dehydrogenation, Saytzeff rule, electrophilic addition reactions, peroxide effect, mechanism of allylic substitution, acidity of 1-alkynes, conjugated dienes, 1,2 and 1,4 additions, free radical and ionic mechanisms of addition polymerisation reactions. Ring opening reactions of cyclopropane and cyclobutane, chemistry of benzene and alkyl benzenes. Aromatic electrophilic substitution reaction, Friedel-Crafts reaction.
3. **Chemistry of functional groups** Alkyl and aryl halides, nucleophilic substitution, synthetic utility of Grignard reagents and alkallithiums, Mechanism of Grignard reaction of alcohols, Benzyl alcohol, acidity of phenols, Epoxy compounds, Anisole nucleophilic addition, Benzaldehyde, acetophene, benzophenone, aldol condensation, acidity of acids, alkyl and aryl amines.
4. **Synthetic utility of diazonium salts** basicity of amines, Multistep synthesis.

Suggested Text Books & References

1. Text book of Organic Chemistry by B.S. Bahl and Arun Bahl, S. Chand and Company Ltd. Delhi.
2. Fundamentals of Organic Chemistry by T.W.G. Solomons, John Wiley and Sons, Inc., New York

ORGANIC CHEMISTRY PRACTICAL

Paper Code: BA-163

L	T/P	Credits
0	3	2

1. Technical and preparation: Lab safety, melting points, recrystallisation, distillation and reflux, drying agents, percentage yield, preparation of benzamide, aspirin, mdinitobenzene dyes.
2. Identification of Organic compounds: Hydrocarbons, halogen compounds, phenols, aldehydes and ketones, carboxylic acids, amides, amines, formation of derivative, identification of unknowns.

Suggested Text Books & References

1. Experimental Organic Chemistry by William Kemp and Arun Bahl, S.Chand and Company Ltd. Delhi
2. Experimental Organic Chemistry by Charles A. Mackenzie, Prentice-Hall, Inc., New Jersey (USA)

CHEMISTRY-I (IT)

Paper Code: BA-103

L	T/P	Credits
2	1	3

- Water:** Specifications for water, Analysis of water-Alkanity, hardness and its determination (EDTA Method only), water for domestic use, Water-softening-Lime-Soda process, Ion-exchanger polished water, Boiled-feed water, boiler problems-scale, sludge priming and foaming, caustic embrittlement and corrosion, their causes and prevention, removal of silice, removal of dissolved gases, carbonates phosphates conditioning, colloidal conditioning, Calgon treatment, conditioning, Numerical problems of Alkanity, hardness Lime-Soda process and EDTA method.
- Fuels:** Definition and classification, combustion and chemical principles involved in it. Calorific value: Gross and Net Calorific values and their determination by Boy's Gas Calorimeter and Bomb Calorimeter.
 - Solid fuels:** Proximate and ultimate analysis of coal and their importance. Carbonization: High and Low temperature carbonization, coke, its manufacture by the Otto Hoffman Oven and uses.
 - Liquid fuels:** Converison of coal into liquid fuels (Bogius process & Fischer Tropsch process and mechanism, Petroleum: its chemical composition and Fractional distillation, Cracking of heavy oil residues: thermal cracking and catalytic cracking, Knocking-chemical structure and knocking: Octane and Cetane number and their significance, Power alcohol.
 - Gaseous Fuels:** Natural gas, producer gas, water gas, carburetted water gas, coal gas and oil gas, fuel and fuel gases and their analysis by Orsat's apparatus.
 - Numerical on calorific value, combustion, Proximate and ultimate analysis of coal and fuel gas analysis.
 - Nuclear Fuels:** Nuclear reactions, nuclear fission and nuclear fusion, Nuclear reactor.
- Polymers:** Basic concepts & Terminology, such as monomers, Polymers, functionality, Thermoplastics, Thermosets, Linear, Branched, cross linked polymers etc. Different definitions of molecular weight's viz. Mw, Mn, Mv and then determinations, 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.
- Corrosion:** Definition and types of corrosion, Laws of oxide film 'growth (Linear, parabolic and logarithmic), different theories of corrosion, Atmospheric corrosion, Stress corrosion, water-line, pitting and soil corrosion.

Protective measures against corrosion:

- Modification of environment
- Modification of the properties of the metal
- Use of protective coatings
- Cathodic Protection
- Material selection and design

CHEMISTRY-I LAB (IT)**Paper Code: BA-151**

L	T/P	Credit
0	2	1

1. Determination of percentage composition of a mixture of sodium hydroxide and sodium carbonate.
2. Determination of Carbonate, bicarbonate and chloride contents of irrigation water.
3. Determination of the amount of Oxalic acid and sulphuric acid in one litre of solution provided standard NaOH and KMnO_4 .
4. Determination of the strength of FeSO_4 solution provided standard potassium dichromate solution.
 - i) Internal indicator method
 - ii) External indicator method
5. Determination of the amount of Cu in the copper ore solution. Provided $\text{Na}_2\text{S}_2\text{O}_3$ solution.
6. Determination of the amount of KMnO_4 in acidic medium provided $\text{Na}_2\text{S}_2\text{O}_3$ solution.
7. Determination of the amount of $\text{K}_2\text{Cr}_2\text{O}_7$ in the given solution. Provided $\text{Na}_2\text{S}_2\text{O}_3$ solution.
8. Determination of the strength of sodium bromide by Vohlard's method. Provided standard potassium thiocyanates and silver nitrate solutions.
9. Estimation of silver in silver alloy solution. Provided standard sodium chloride solution.
10. Determination of dissolved oxygen in the given sample of water.
11. Estimation of manganese dioxide in pyrolusite.
12. Determination of surface tension of the given liquid by drop pippete method.
13. Determination of available lime as CaO in industrial lime iodimetrically.

Syllabus of Life Sciences

(For B. Tech / M. Tech Bio-Technology)

(Section A Botany, Section B Zoology)

BA-113

L T/P Credits
3 1 4

Section	Unit	Topics
(A+B)	Origin of Life	- History of earth, theories of origin of life nature of the earliest organism
(A+B)	Varieties of life	- Classification, Five kingdoms, viruses (TMV, HIV Bacteriophage), Prokaryote (Bacteria-cell structure, nutrition, reproduction), Protista, Fungi, Plantae and Animalia.
(A+B)	Chemicals of life	- (Biomolecules), carbohydrates, lipids, amino acids, proteins, nucleic acids, identification of biomolecules in tissues
(A+B)	Cell	- The cell concept, structure of prokaryotic and eukaryotic cells, plant cells and animal cells, cell membranes, cell organelle and their function. Structure and use of compound microscope.
A	Histology	- Meristems (apical, intercalary, lateral) and their function, Simple tissue (Parenchyma, collenchyma, sclerenchyma), Complex tissue (xylem and phloem), Tissue Systems (epidermal, ground, vascular), primary body growth (root, stem, leaf), Secondary growth.
B		- Animal Epithelial tissue, connective tissue, muscle tissue and nervous tissue and their function in body.
A		- 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(C ₃), Hatch Slack Pathway (C ₄),Crassulacan Acid Metabolism (CAM), factors affecting photosynthesis, Mineral Nutrition in plants.
B		- 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.
A+B	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.
A	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.
B		- 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.

Text / Reference Books

1. Biological Science, D.J. Taylor, N.P.O. Green and G.W. Stout (Ed.), R. Soper IIIrd Ed., Cambridge Low Price 1998.
2. Botany, An Introduction to Plant Biology (2nd Edn.) J.D. Mauseth, Jones and Bartlett Publ. Inc. 1998.
3. Cell and Molecular Biology, G. Karp, 2nd Ed. John Wileys concepts and Experiments Sous, jue 1999.
4. Anatomy of seed plants, K. Esau. Wiley Eastern Ltd. 2nd Edn. 1997.
5. Economics Botany of Tropics, S.L. Koccher, Mac. Millan, 1999.
6. Plants, Their Biology and Importance. Peter B. Kaufman et al., Harper & Row, Publ. New York 1989.
7. Plant Physiology, R.M. Devlin & F.H. Witham. CBS Publisher & Distub. 1999.
8. Plant Physiology, F.B. Salisbury & C.W. Ross. Wadsworth Publ. Co, 1992.
9. Plant Physiology, L. Taiz & E. Zeiger, Sinauer Association, Inc. Publ. 1998.

Life Sciences Lab
(For B.Tech/M.Tech in Biotechnology)

Paper Code: BA-159

L	T/P	Credits
0	2	1

1. To study and sketch the ultrastructures of a plant cell and animal cell; cell organelles (Nucleus, Chloroplast, Mitochondria, Golgi body, Endoplasmic reticulum (SEM, TEM micrographs and drawings).
2. To study and sketch the different life forms from specimens and photographs.
 - (a) Virus - TMV, HIV, Bacteriophage
 - (b) Bacteria - Cell structure, Binary fission, conjugation
 - (c) Algae - *Spirogyra* (Slide)
 - (d) Fungi - *Mucor* (Slide)
 - (e) Bryophyta- Liverwort - *Marchantia* (Female & Male thallus)
Moss - *Funaria* (with sporophyte)
 - (f) Pteridophyta- Fern *Pteris*
Nephrolepis
 - (g) Gymnosperm- *Cycas* - leaf, megasporophyll, microsporophyll
Pinus - Needles, male cone, female cone
 - (h) Angiosperms - Dicot - Mustard, Monocot-wheat
3. To identify the proteins, carbohydrates, fats (lipids), vitamin-C in pure form and their identification in plant tissues.
4. To test the activity of enzymes-protease, amylase urease.
5. To study the different types of tissues by making temporary preparations - (i) parenchyma, collenchyma, sclerenchyma, (ii) xylem and phloem (macerated material)
6. To the study the anatomy of root, stem and leaf of dicot and monocot plant by sectioning them and making temporary preparations.
7. To observe and measure the factors affecting the rate of transpiration using Ganong's potometer (a) wind velocity (b) light intensity (c) removal of half the leaves from the twig (d) clogging the stomata with vaseline.
8. To investigate the effect of light intensity on the rate of photosynthesis.
9. To investigate the need of CO₂ in photosynthesis.

MATHEMATICS (MEM)

Paper Code: BA-601

L	T/P	Credits
2	1	3

Differential Calculus: Functions-Logarithmic, Exponential, hyperbolic, limit of a function, derivative of functions, implicit functions, chain rule, application of derivative, Maxima and Minima; successive differentiation; Partial differentiation; total differentiation; Taylor's series for functions of single and multiple variables; Maxima and minima of functions for two or more variables.

Integral Calculus: Integration: Simple techniques; Reduction formulae properties of definite integrals; Application of integration to areas, lengths, arcs, surface and volume of solids of revolution; Simpson's and Trapezoidal rule.

Differential Equations: Linear differential equations of first order and first degree (Leibnitz and Bernoulli's form), General linear differential equations with constant coefficients, Operator D, Complimentary functions; Particular integral.

Linear Algebra: Matrix, Determinant, Rank and inverse of a matrix, Solution of linear system of equation, Gauss elimination method.

Text/References:

1. M.K. Singhal & Asha Singhal, Algebra, R. Chand & Co.
2. Shanti Narayan, Matrices, S. Chand & Co.
3. G.B. Thomas and R.L. Finney, Calculus and Analytic Geometry, Addison-Wesley/Narosa.
4. E. Kreyszig, Advanced Engineering Mathematics, 5th Ed., Wiley Eastern Ltd., 1985.
5. N.M. Kapoor, Differential Equations, Pitamber Pub Co.
6. Schaum Outline Series, Differential Equations, McGraw Hill
7. Schaum Outline Series, Linear Algebra, McGraw Hill

DISCRETE MATHEMATICS (M.S.E.)

Paper Code: BA-607

L	T/P	Credits
3	1	4

Sets, Relations & Functions: Property of binary relations, equivalence, compatibility, partial ordering relations, hosse diagram, functions, inverse functions, composition of functions, recursive functions.

8 hrs

Combinatorics & Recurrence Relations: Principles of inclusion and exclusion, combinations and permutation, enumeration without repetition, recurrence relation, fibonacci relation, solving recurrence relation by substitution, solving non-recurrence relation by conversion to linear recurrence relation.

6 hrs.

Mathematical Logic: Logic operators, Truth tables, Theory of inference and deduction, mathematical calculus, predicate calculus, predicates and quantifiers, normal forms, disjunctive and conjunctive normal forms.

10 hrs.

Lattices & Boolean Algebra: Definition, examples, properties, sub lattice, and examples, Axiomatic definition of Boolean algebra as algebraic structures with two operations basic results truth values and truth tables, the algebra of propositional functions, boolean algebra of truth values, switching of circuits.

12 hrs.

Graph Theory: Definition of graph, relations on graphs, paths, circuits, connected graph, components, Euler graph, Hamiltonion graph, cycle, Directed graph, trees spanning trees, minimum spanning tree (example only), Matrix representation of graph, Adjancy Matrix, coloring of graphs (edge only).

15 hrs.

Suggested Text Books & References:

1. Kolman, Busby & Ross "Discrete Mathematical Structures", PHI
2. Trembly J.P. & Manohar. P "Discrete Mathematical Structures with Applications to Computer Science", Mc Graw Hill
3. F. Harray, Graph Theory, Addison Wesley/Narosa 1988
4. Kenneth H. Rosen, "Discrete Mathematics and its Applications" Mc Graw Hill.
5. Schaum's Outline Series "Discrete Mathematics" Tata Mc Graw Hill.

MATHEMATICS-I (M.S.E.)

Paper Code: BA-609

L	T	Credits
3	1	4

Probability: Sample space, events, axioms, conditional probability, Baye's rule, random variables: discrete and continous, distribution and density functions, marginal and conditional distributions, stochastie independence.

5 hrs.

Expectation: Expectation of a function, conditional expectation and variance, moment, moment generating function, cumulant generating functions, skewness, kutosis, characteristic functions, distributions: discrete and continous distributions.

8 hrs.

Probability distributions: Random variables, mean and variance of a probability distribution, Chebyshev theorem, law of large number, central limit theorem, binomial distribution, poisson distribution, poisson approximation to binomial distribution, poisson processes, Binomial process.

13 hrs

Probability Densities: Continous random variables, normal distribution, normal approximation to the binomial distribution.

5 hrs.

Sampling distributions: Population and samples, sampling distribution of the mean (σ known), sampling distribution of the mean (σ unknown), sampling distribution of the variance, Testing of statistical hypothesis, F-test, T-test, χ^2 - test, estimation of parameters (point and interval estimation of mean and variance).

16 hrs.

Regression Analysis: Correlation, covariance, regression, the method of least square, inferences based on the least square estimators, curvilinear regression.

References:

1. Irwin Miller and John .E. Freund "Probability & Statistics for Engineers" PHI
2. Spiegel, "Probability and Statistics", Schaum Series.
3. S.C. Gupta & V.K. Kapur "Fundamentals of Mathematical Statistics".
4. Schaum's outline series "Probability of Statistics" Tata Mc Graw Hill.
5. Bansi Lal & Sanjay Arora "Introduction to Statistics" Satya Prakashan.
6. Mood & Graynill "Introduction to Probability & Statistics" Mc Graw Hill.

MATHEMATICS-I (IT, BT, CT)

Paper Code: BA-109

L	T/P	Credits
3	1	4

1(a) Calculus of functions of One variable

- (i) Successive Differentiation, Leibnitz's theorem (without proof). Lagrange's Theorem, Cauchy Mean value theorems, Taylor's theorem (without proof), Remainder term, Asymptotes, Curvature, Curve Tracing.

14 hrs

- (ii) Infinite Series: Convergence, divergence, Comparison test, Ratio Test, Cauchy n^{th} root test, Leibnitz's test (without proof), Absolute and Conditional Convergence, Taylor and Meclaurin series, Power Series, Radius of Convergence.

5 hrs

- (iii) Integral Calculus: Reduction Formulae of trigonometric functions, Properties of definite Integral, Applications to length, area, volume, surface of revolution, Definition of improper integrals, Beta-Gamma functions.

8 hrs

1(b) Calculus of Functions of several variables:

Partial derivatives, Chain rule, Differentiation of Implicit functions, Exact differentials. Maxima, Minima and saddle points, Method of Lagrange multipliers. Differentiation under Integral sign, Jacobians and transformations of coordinates. Double and Triple integrals. Simple applications to areas, Volumes etc.

12 hrs

II Vector Calculus:

Scalar and vector fields, Curves, Arc length, Tangent, normal, Directional Derivative, Gradient of scalar field, divergence and curl of a vector field. Line integral (independent of path), Green's theorem, Divergence theorem and Stoke's theorem (without proofs), Surface Integrals.

12 hrs

Suggested Text Books & References

1. G.B. Thomas and R.L. Finney, "Calculus and Analytic Geometry", 6th edition, Addison-Wesley/Narosa, 1985.
2. Shanti Narayan, "Differential Calculus", S. Chand & Co.
3. Shanti Narayan, "Integral Calculus", S. Chand & Co.
4. Grewal B.S., "Higher Engineering Mathematics", Khanna Publ.
5. E. Kreyszig, "Advanced Engineering Mathematics", 5th Edition, Wiley Eastern, 1985.
6. Murray R. Spiegel, "Theory and Problems of Vectors Analysis", Schaum's Outline Series, Mc Graw Hill Ed.
7. S.C. Malik, "Mathematical Analysis", Wiley Eastern Ltd.
8. "Advanced Calculus", Schaum's Outline Series, Mc Graw Hill Ed.
9. Widder, "Advanced Calculus", 2nd Edition, Prentice Hall Publishers.

APPLIED MATHEMATICS-III (CT)

Paper Code: BA-213

L	T	Credits
3	1	4

I Laplace Transformation

Laplace Transform, Inverse Transforms, Laplace Transform of Derivative and Integrals, Shifting Theorems, Differentiation and Integration of Transforms, Convolution, Periodic Functions, Solutions of ODE's using Laplace Transforms.

12 hrs.

II Fourier Series and Integrals

Periodic Functions, Fourier Series, Euler Formulas, Even and Odd Functions, Half Range Expansions, Harmonic Analysis, Fourier Integral.

10 hrs.

III Partial Differential Equations

Formation, Solution, Linear partial differential equations I order, Non-linear p.d.e. of Ist order, Charpit's Method (without proof), Classification of linear IInd order equations, Linear equations with constant coefficients, Method of Separation of Variables, Wave equation, heat equation, Laplace's equation.

15 hrs.

IV Numerical Methods

Solution of Equation by Iteration: Bisection Method, Newton Raphson Method.

Interpolation: Lagrange Interpolation, Difference Operators, Newton's forward and Backward Interpolation, Error Formulae.

Numerical Integration & Differentiation: Trapezoidal Rule, Simpson's one-third rule including error formula, Numerical differentiation.

System of Linear Equation: Gauss-Siedel Iteration.

Numerical Methods for Differential Equations: Range's method, Runge-kutta Method, Adams-moulton method.

14 hrs

Suggested Text Books & References

1. Piskunov, Differential and Integral Calculus, Vol. I & II Mir Publishers, Moscow, 1979.
2. Grewal, B.S., Higher Engineering Mathematics, Khanna Pub., New Delhi.
3. Kreyszig Erwin., Advanced Engineering Mathematics, John Wiley and Sons.
4. Ian N. Sneddon, Elements of Partial Differential Equations, Mc-Graw Hill Book Company, Inc.
5. Jain, Iyengar, Jain, Numerical Methods for Scientific and Engineering Computations, Wiley Publishers.
6. T.J. Akai, Numerical Analysis, John-Wiley & Sons.
7. K. Atkinson, Elementary Numerical Analysis, Wiley & Sons.
8. Sastry, Introduction Methods of Numerical Analysis, Prentice Hall of India Pvt. Ltd.

PHYSICS-I (IT, CT)

Paper Code: BA-111

L	T/P	Credits
2	1	3

I OPTICS

Polarization

Types of polarization, elliptically and circularly polarized light Brewsters law, Malu's law, Nicol prism, double refraction, quarter-wave and half-wave plates, optical activity, specific rotation, Laurent half shade polarimeter.

5 hrs.

Interference

Coherence and coherent sources, interference by division of wave front (young's double slit experiment, Fresnel's biprism), interference by division of amplitude (thin films, Newton's rings, Michelson's interferometer, Fabry Perot interferometer)

7 hrs.

Diffraction

(Fresnel and Fraunhofer types of diffraction) Fraunhofer diffraction: Single slit, double slit, circular aperture and N-slit, diffraction grating wavelength determination, resolving power and dispersive power, Fresnel Diffraction: Zone plate, circular aperture, opaque circular disc, narrow slit.

7 hrs.

II LASER AND FIBRE OPTICS

Lasers

Introduction, coherence, Einstein A and B coefficients, population inversion, basic principle and operation of a laser, type of lasers, He-Ne laser, Ruby laser, semiconductor laser, holography-theory and applications.

5 hrs.

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 (qualitative)-its advantages.

5 hrs.

III Theory of relativity

Absolute and Inertial frames of reference, Galenlian transformations, Michelson-Morley experiment, the postulates of the special theory of relativity, Lorentz transformations, time dilation, length contraction, velocity addition, mass energy equivalence.

5 hrs.

Recommended Books

1. Concepts of Modern Physics: A. Beiser
2. Modern Physics: Kenneth Krane
3. Fundamentals of Optics: Jenkins and White
4. Optics: Ghatak
5. Fundamental of Physics by RESNICK & HALLIDAY

I. OPTICS

INTERFERENCE:

Coherence and coherent sources, Interference by division of wavefront (Young's double slit experiment, Fresnel's biprism), Interference by division of amplitude (Thin films, Newton's rings, Michelson's Interferometer, Fabry Perot Interferometer)

7 hrs.

DIFFRACTION:

(Fresnel and Fraunhofer types of diffraction) Fraunhofer diffraction: Single slit, double slit, circular aperture and N-slit. Diffraction grating - wavelength determination, resolving power and dispersive power. Fresnel Diffraction: zone plate, circular aperture, opaque circular disc, narrow slit.

7 hrs.

POLARIZATION:

Types of polarization, elliptically and circularly polarized light Brewster's law, Malus's law, Nicol prism, double refraction, quarter-wave and half-wave plates, optical activity, specific rotation, Laurent half-shade polarimeter.

5 hrs.

II. LASERS AND FIBRE OPTICS

LASERS:

Introduction, Coherence, Einstein A and B coefficients, population inversion, Basic principle and operation of a laser, Types of lasers, He-Ne laser, Ruby laser, semi-conductor laser, holography - theory and applications

5 hrs.

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.

5 hrs.

III. 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). Basic postulates of quantum mechanics - the wave function - its physical interpretation, the Schrodinger equation.

5 hrs.

Text / Reference Books

1. Modern Physics by A. Beiser.
2. Optics by A.K. Ghatak.
3. Modern Physics by K. KRANE
4. Introduction to Physical Optics by Jenkins & White.
5. Fundamental of Physics by RESNICK & HALLIDAY

PHYSICS LAB-I (IT, BT, CT)

Paper Code: BA-153

L	T/P	Credits
0	2	1

List of experiments

1. To determine wavelength of sodium light source using Newton's Rings.
2. To determine wavelength of sodium light source using Fresnel Biprism assembly.
3. To determine wavelength of different colours using diffraction grating.
4. To determine refractive index of prism.
5. To determine resolving power of a Telescope.
6. To determine specific rotation using polarimeter.
7. To determine wavelength of laser light using pinhole and grating.
8. To determine g by bar pendulum.
9. To determine g by kater's pendulum.
10. To determine moment of inertia of a fly wheel.
11. Computer simulation of brownian motion.
12. Computer simulation of physics experiments based on the theory syllabus.
13. To determine Wavelength Micheleon Interferrometer.
14. To determine wavelength by fabry perot interferrometer.