Syllabus Scheme

for

Bachelor of Science (Physics) Hons.

Title of the paper	**Course code**	**L**	**P**	**Credit hours**	**Contact hours**
Semester I					
Mathematical Physics-I	PHYS 111	4	0	4	4
Mechanics	PHYS 112	4	0	4	4
Chemistry I	CHEM 011	4	0	4	4
Communication Skills	ENG 011	4	0	4	4
Physics Lab I	PHYS 113	0	2	2	4
Chemistry Lab I	CHEM 011P	0	1	3	3
Semester II					
Laser and Optical Fiber	PHYS 121	4	0	4	4
Electronics	PHYS 122	4	0	4	4
Chemistry II	CHEM 022	4	0	4	4
Mathematics I	MATH 021	4	0	4	4
Environmental Studies	ENV 021	4	0	4	4
Physics Lab II	PHYS 123	0	2	2	4
Chemistry Lab II	CHEM 022P	0	1	3	3
Semester III					
Thermodynamics and Statistical Physics	PHYS 231	4	0	4	4
Atomic and Molecular Physics	PHYS 232	4	0	4	4
Electronics II	PHYS 233	4	0	4	4
Mathematics II	MATH 032	4	0	4	4

Physics Lab III	PHYS 234	0	2	2	4
Semester IV					
Mathematical Physics-II	PHYS 241	4	0	4	4
Oscillations and Waves	PHYS 242	4	0	4	4
Electricity and Magnetism	PHYS 243	4	0	4	4
Computer Applications-I	COMP 041	4	0	1	7
Physics Lab IV	PHYS 244	0	2	2	4
Semester V					
Solid State Physics	PHYS 351	4	0	4	4
Nuclear and Particle Physics	PHYS 352	4	0	4	4
Optics	PHYS 353	4	0	4	4
Computer Applications-II	COMP 051	4	0	1	7
Physics Lab V	PHYS 354	0	2	2	4
Semester VI					
Quantum Physics	PHYS 361	4	0	4	4
Classical Mechanics	PHYS 362	4	0	4	4
Nano Physics	PHYS 363	4	0	4	4
Project and seminar	PHYS 364				

*** A Research Laboratory visit is proposed to be conducted for even semester students for their interaction in current research areas.**

Title of Course	Course Code	Marks			
		Theory	Practical	Internal Assessment	Total Marks
SEMESTER –I					
Mathematical Physics-I	PHYS 111	60	-	40	100
Mechanics	PHYS 112	60	-	40	100
Chemistry I	CHEM 011	60	-	40	100
Communication Skills	ENG 011	60	-	40	100
Physics Lab I	PHYS 113	-	50	-	50
Chemistry Lab I	CHEM 011P	-	50	-	50
				Total:	**500**
SEMESTER –II					
Laser and Optical Fiber	PHYS 121	60	-	40	100
Electronics	PHYS 122	60	-	40	100
Chemistry II	CHEM 022	60	-	40	100
Mathematics I	MATH 021	60	-	40	100
Environment	ENV 021	60	-	40	100
Physics Lab II	PHYS 123	-	50	-	50
Chemistry Lab II	CHEM 022P	-	50	-	50
				Total:	**600**
SEMESTER –III					
Thermodynamics and Statistical Physics	PHYS 231	60	-	40	100
Atomic and Molecular Physics	PHYS 232	60	-	40	100
Electronics II	PHYS 233	60	-	40	100
Mathematics II	MATH 032	60	-	40	100
Physics Lab III	PHYS 234	-	50	-	50
				Total:	**450**

SEMESTER –IV					
Mathematical Physics-II	PHYS 241	60	-	40	100
Oscillations and Waves	PHYS 242	60	-	40	100
Electricity and Magnetism	PHYS 243	60	-	40	100
Computer Applications-I	COMP 041	50	30	20	100
Physics Lab IV	PHYS 244	-	50	-	50
				Total:	**450**
SEMESTER –V					
Solid State Physics	PHYS 351	60	-	40	100
Nuclear and Particle Physics	PHYS 352	60	-	40	100
Optics	PHYS 353	60	-	40	100
Computer Applications-II	COMP 052	50	30	20	100
Physics Lab V	PHYS 354	-	50	-	50
				Total:	**450**
SEMESTER VI					
Quantum Physics	PHYS 361	60	-	40	100
Classical Mechanics	PHYS 362	60	-	40	100
Nano Physics	PHYS 363	60	-	40	100
Project and seminar	PHYS 364	50			50
				Total:	**350**

*** A Research Laboratory visit is proposed to be conducted for even semester students for their interaction in current research areas.**

SEMESTER - I

Course Code: PHYS 111
Course Name: Mathematical Physics - I

L	P	Credit hr	Contact hr
4	0	4	4

Unit-1: Introduction to Vector Algebra:- Physical quantities: Scalars, Vectors, Null vectors, Equal vectors, Addable vectors, Graphical addition of vectors, Subtraction and Multiplication of vectors. Scalar and cross product of two vectors, Scalar triple Product and their physical interpretation.

Unit-2: Calculus of Vectors:- Vector Differentiation: Scalar and vector fields, Ordinary and partial derivative of a vector w.r.t. Coordinates, Directional derivative and normal derivative, Divergence and curl of a vector field, Gradient of a scalar field and its geometrical interpretation, Del and Laplacian operator, Vector identities. Vector Integration: Ordinary integral of vectors, Line, surface and volume integrals, Flux of a vector field, Gauss' Divergence Theorem, Stoke's and Green's Theorem.

Unit-3: Orthogonal Curvilinear Coordinates:- Orthogonal curvilinear co-ordinates, Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, spherical and cylindrical co-ordinates systems

Unit-4: Multiple Integrals:- Double and triple integrals, Applications of Multiple integrals: Area enclosed by plane curves and volumes of solids.

Unit-5: Complex Variable:- Differentiation and integration of complex variable, Cauchy's theorem, Cauchy's integral formula, Power series of a complex variable, Taylor and Laurent's series, Residue and Residue theorem, Contour integration and its application to evaluation of integrals and series (simple exercises).

Reference Books:

1. ***Integral Calculus,*** Shanti Narayan, Delhi, S. Chand.
2. ***Mathematical Hand Book,*** M. Vygodsky, Mir, Mascow.
3. ***Higher Engineering Mathematics,*** B.S. Grewal, Delhi, Khanna.
4. ***Introduction to Mathematical Physics,*** Charlie Harper, Prentice Hall of India.

Course Code : PHYS 112
Course Name: Mechanics

L	P	Credit hr	Contact hr
4	0	4	4

Unit-1: Fundamentals of Dynamic:- Dynamics of a System of Particles, Centre of Mass, Conservation of Momentum, Idea of Conservation of Momentum from Newton's Third Law, Impulse, Momentum of Variable, Mass System: Motion of Rocket.

Unit-2: Work and Energy Theorem:- Work and Kinetic Energy Theorem, Conservative and Non-Conservative Forces, Potential Energy, Energy Diagram, Stable and Unstable Equilibrium, Gravitational Potential Energy, Elastic Potential Energy, Force as Gradient of Potential Energy, Work and Potential energy, Work done by Non-conservative Forces, Law of Conservation of Energy, Elastic and Inelastic Collisions between particles, Centre of Mass and Laboratory Frames.

Unit-3: Rotational Dynamics:- Angular Momentum of a Particle and System of Particles, Torque, Conservation of Angular Momentum, Rotation about a Fixed Axis, Moment of Inertia, Calculation of Moment of Inertia for Rectangular, Cylindrical and Spherical Bodies, Kinetic Energy of Rotation, Motion involving both Translation and Rotation.

Unit-4: Gravitation and Central Force Motion:- Law of Gravitation, Inertial and Gravitational Mass, Potential and Field due to Spherical Shell and Solid Sphere, Motion of a Particle under Central Force Field, Two Body Problem and its Reduction to One Body Problem and its Solution, The Energy Equation and Energy Diagram, Kepler's Laws (Ideas Only), Orbits of Artificial Satellites.

Unit-5: Special theory of Relativity:- Frames of references, Postulates of Special Theory of Relativity, Galilean Transformation, Michelson-Morley Experiment and its Outcome, Lorentz Transformations, Simultaneity of Events, Lorentz Contraction, Time Dilation, Relativistic Transformation of Velocity, Velocity addition, Variation of Mass with Velocity, Mass energy Equivalence, Relativistic Doppler effect, Relativistic Kinematics, Transformation of Energy and Momentum, Energy-Momentum Four Vector.

Reference books:

1. ***Mechanics***, D S Mathur, S. Chand & Company Limited.
2. ***An Introduction to Mechanics***, Kleppner, Tata Macgraw Hill.
3. ***University Physics***, Francis W Sears, Mark W. Zemanasky, Hugh D. Young, Indian Student Edition Available with Narosa Publishing House, N. Delhi.
4. ***Analytical Mechanics***: Satish K. Gupta-Modern Publishers.
5. ***Fundamentals of Physics***, D. Halliday, R. Resnick and J. Walker, Wiley India Pvt. Ltd., New Delhi.

Course Code : CHEM 011
Course Name: Chemistry I

L	P	Credit hr	Contact hr
4	1	5	6

Unit -I: Fundamentals & Chemical Bonding: Periodic table, Effective nuclear charge, Slater rules and their applications, Trends of various atomic properties, Qualitative approach to valence bond theory (VBT) and its Limitations, Hybridization, Equivalent and Non-equivalent Hybrid Orbitals, Molecular Orbital Theory: Symmetry and Overlap, Molecular Orbital Diagrams of diatomic and simple polyatomic systems (O_2, C_2, N_2, CO, NO and their ions; HCl) (Idea of sp^3 Mixing and Orbital Interaction to be given), Fajan's rules and consequences of polarization.

Unit-II: Solid state:

Packing of ions in crystals, Size Effects, Radius, Ratio Rules and their Limitations, Lattice Energy: Born Equation (Calculations of Energy in Ion Pair and Ion-pairs Square Formation), Madelung Constant, Born-Haber Cycle and its Applications, Band theory, Electrical properties of material like conductor, semiconductor and insulator, defects in solids.

Unit-III: Coordination Chemistry:

Introduction, Werner's theory, types of ligands, nomenclature, Valence bond theory (inner and outer orbital complexes), Crystal Field Theory: Splitting of d orbital in octahedral and tetrahedral environment, Measurement of 10 Dq CFSE in Weak and Strong\Fields, Pairing Energies, Factors affecting the Magnitude of 10 Dq, Octahedral vs Tetrahedral Coordination, Colour and magnetic properties of coordination compounds, Tetragonal Distortions from Octahedral Symmetry, Jahn-Teller theorem (brief introduction only), square planar geometry.

Unit-IV: Stereochemistry:

Bonding in Organic Molecules and its effects on Shape, Chirality and RS Nomenclature as applied to Chiral Centers, Treatment of Chirality upto three chiral centers, Conformation of Acyclic and Cyclic Systems, Conformational Analysis of Di-substituted Cyclohexanes, Geometrical Isomerism and E-Z Nomenclature.

Unit-V: Polymerization:

Types of Polymerization, Forms of Polymers, Condensation Polymerization, Addition Polymerization, and Natural and Synthetic Rubbers, Molar masses of polymers, Application of polymers.

Suggested Books:

1. ***Modern Chemisty***, P S Sindhu, S. Chand & Sons.
2. ***A New Conscise Inorganic Chemistry***, J.D. Lee, E.L.B.S.
3. ***Organic Chemistry***, I.L. Finar, E.L.B.S.
4. ***Organic Chemistry***, R.T. Morrison & R.N. Boyd, Prentice Hall

Course Code : ENG 011
Course Name: Communication Skills

L	P	Credit hr	Contact hr
4	0	4	4

Unit 1

Communication: Language and communication, differences between speech and writing, distinct features of speech, effective communication.

Unit 2

Writing Skills: Effective writing skills, avoiding common errors. Basics of grammar and language.

Unit 3

Technical Writing: Scientific and technical subjects; formal and informal writings; formal writings/reports, handbooks, manuals, letters, memorandum, notices, agenda, minutes; common errors to be avoided.

Unit 4

Group discussion on current topics and topics of national and national importance, Extempore, News paper reading, paper presentation.

Unit 5

Essential Required Skills: Reading skills, listening skills, note-making, précis writing, audiovisual aids, oral communication

SUGGESTED READINGS

1. ***Writing as thinking: A guided process approach***, M. Frank., Prentice Hall Reagents.
2. ***A course in written English for academic and professional purposes***, L. Hamp-Lyons and B. Heasely, Study Writing; Cambridge Univ. Press.
3. ***A comprehensive grammar of the English language***, R. Quirk, S. Greenbaum, G. Leech and J. Svartik, Longman, London.

Course Code : PHYS 113
Course Name: Physics Lab I

L	P	Credit hr	Contact hr
0	2	2	4

1. To use a Multimeter for measuring (a) Resistances, (b) A/C and DC Voltages, (c) AC and DC Currents, (d) Capacitances, and (e) Frequencies.
2. To test a Diode and Transistor using (a) a Multimeter and (b) a CRO.
3. To measure (a) Voltage, (b) Frequency and (c) Phase Difference using a CRO.
4. To study Random Errors.
5. To determine the Height of a Building using a Sextant.
6. To study the Characteristics of a Series RC Circuit.
7. To determine the Acceleration due to Gravity and Velocity for a freely falling body, using Digital Timing Techniques.
8. To determine the Moment of Inertia of a Flywheel.
9. To determine the Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
10. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
11. To determine the Elastic Constants of a Wire by Searle's method.

Suggested Books:

1. ***Geeta Sanon***, B.Sc. Practical Physics, R. Chand & Co.

2. ***Advanced Practical Physics***, B. L. Worsnop, Asia Publishing House, New Delhi.

3. ***Practical Physics***, C.L. Arora, S.Chand

4. ***A Laboratory Manual of Physics for Undergraduate Classes***, D. P. Khandelwal, Vani Publication House, New Delhi.

SEMESTER II

Course Code : PHYS 121
Course Name: LASER AND OPTICAL FIBER

L	P	Credit hr	Contact hr
4	0	4	4

Unit-1: **Basics Of Laser Physics:-** Introduction, population, thermal equilibrium, three processes, Characteristics and Principle, Einstein's coefficients, Laser Pumping , Resonators, modes of a resonator, quality factor, losses inside the cavity, threshold condition.

Unit-2: **Types of Lasers:-** Types of Lasers: solid, liquids and Gases with one example of each, condition for laser action.

Unit-3: **Application of Laser:-** Holography, non-linear optics: harmonic generation, second harmonic generation, phase matching and optical mixing, brief qualitative description of some experiments of fundamental importance.

Unit-4: **Optical Fibres:-** Introduction, advantages of optical fibres, characteristics of optical fiber, principle, construction of optical fibre, numerical aperature, acceptance angle, Propagation of light in optical fiber

Unit-5: **Types and applications of optical fibre:-** modes of propagation of an optical fibre, single mode, multi mode, step index optical fiber, graded index optical fibre, V number, Losses, dispersion, wave guides, application of optical Fiber in communication.

Reference Books:

1. ***Lasers and Non-linear Optics***, B.B. Laud, Wiley Eastern
2. ***Principles of Lasers***, O. Svelto, Plenum Press
3. ***An Introduction to Lasers and their applications***, Russell and Rhodes, Wesley.
4. ***Laser Theory and Applications***, Thyagarajan and A. Ghatak, MacMillan
5. ***Optical Fiber Communication***, Senior, Prentice Hall India.

Course Code : PHYS 122
Course Name: ELECTRONICS

L	P	Credit hr	Contact hr
4	0	4	4

Unit-1: Electronic Devices :- PN junctions, Characteristic of pn junction diode, pn junction as rectifier, characteristics and applications of Zener diode, Photodiode, LED and photocells.

Unit-2: Power Supplies:- Characteristics, Rectifiers, Filter circuits, efficiency, Ripple factor, voltage multiplying circuits, Regulation, Shunt and Series regulators, Monolithic regulators.

Unit-3: Transistors :- pnp and npn junction transistors, transistor current components, CB, CC and CE configurations, transfer characteristics, Transistor as switch and applications, Transistor biasing, fixed bias, emitter-stabilized biasing, Voltage-divider biasing, Junction FET, V-I Characteristics. Wave shaping Circuits: Clipping and Clamping circuits, Diode and transistor clippers, Clamping circuits, Clamping circuit theorem.

Unit-4: BJT, FET's AND MOSFET's: Structure and working, α and β of BJT, characteristics, common emitter amplifier, Field Effect transistor, JFET V-I curves, biasing JFET, ac operation of JFET, depletion and enhancement mode, MOSFET, Biasing a MOSFET, FET as a variable voltage resistor, FET amplifier.

Unit-5: Communication:- Modulation and detection, AM, FM, Radio wave propagation, Radio transmitter and receiver, TV receiver, Pulse Modulation, Modem.

Reference Books:

1. ***Integrated Electronics***, J.Millman and C.C.Halkias, Tata McGraw Hill.
2. ***Electronic Devices & Circuits***, J.Millman and C.C.Halkias, Tata McGraw Hill.
3. ***Digital Principles & Applications***, P.Malvine & Leach, Tata McGraw Hill.

Course Code : CHEM 022

Course Name: Chemistry II

L	P	Credit hr	Contact hr
4	1	5	6

Unit-I: Electrochemistry

Concept of Redox reaction, Balancing redox reaction, Electrochemical cell, Application of Electrochemical series, Nernst equation, corrosion, Auto ionization of water, pH function, Equilibrium involving weak acids, equilibrium involving weak bases, pH of salt solutions, buffers, Common ion effect.

Unit-II: Thermodynamics:

Basics, First law of thermodynamics, thermo chemistry, second law of thermodynamics: Concept of entropy, Third law of thermodynamics.

Unit-III: Spectroscopy:

Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law, Concepts of Molecular Spectra, Rotational Spectra and Vibrational Spectra.

Unit-IV: Reaction Mechanism in Organic Chemistry:

Electronic Displacements in Organic Molecules, Aromaticity, Reactivity of Organic Molecules, Heterolytic and Hemolytic Fission, Nucleophiles, Electrophiles, Acids and Bases and their Relative Strengths (including Carbon Acids), Addition, Elimination and Substitution Reactions (including Electrophilic, Nucleophilic and Aromatic Types), Arynes and Carbenes as Reaction Intermediates.

Unit-V: Functional Group Chemistry:

Functional Group, Orientation Effect in Aromatic Substitution, Groups (1) Hydroxyl Group, (2) Phenol, (3) Carbonyl Group, (4) Carboxylic Acid Group and its Derivatives: Esters and Amides, (5) Cyno Group (6) Nitro Group and (7) Amino Group.

Suggested Books:

1. ***Modern Chemisty***, P S Sindhu, S. Chand & Sons.
2. ***A New Conscise Inorganic Chemistry***, J.D. Lee, E.L.B.S.
3. ***Organic Chemistry***, (Vol. I & II), I.L. Finar, E.L.B.S.
4. ***Organic Chemistry***, R.T. Morrison & R.N. Boyd, Prentice Hall

Course Code : PHYS 122
Course Name: Mathematics 1

L	P	Credit hr	Contact hr
4	0	4	4

Unit-1: Matrices, Symmetric, Skew symmetric, Hermitian and Skew Hermitian matrices, Elementary operations on matrices, Inverse of a matrix, Linear independence of row and column matrices, Row rank, Column rank and rank of a matrix, Equivalence of column and row ranks, Eigenvalues, Eigenvectors and the characteristic equation of a matrix, Clayey Hamilton theorem and its use in finding inverse of a matrix, Application of matrices to a system of linear (both homogenous and non-homogenous) equations, Theorems on consistency of system of linear equations.

Unit-2: Relations between the roots and coefficients of general polynomial equation in one variable, Transformation of equations, Descartes' rule of signs, Solution of cubic and Biquadratic equations.

Unit-3: Vector functions of one variable and their derivatives, Functions of several variables, partial derivatives, chain rule, gradient & directional derivative, Tangent planes and normals, Maxima, Minima, saddle points, Lagrange multipliers, exact differentials.

Unit-4: Repeated and multiple integrals with application to volume, surface area, moments of inertia, Change of variables, Vector fields, line and surface integrals, Green's, Gauss and Stokes' theorems and their applications.

Unit-5: Formation of Partial Differential Equations, Lagrange equations, Charpit method, Higher order linear differential equation with constant coefficient.

Reference books

1. ***Advanced Engineering Mathematics***, R K Jain, Narosa publication.
2. ***Higher Engineering Mathematics***, B S Grewal, Khanna publication.
3. ***Complex Variables: Theory and Applications***, H S Kasana, PHI.
4. ***Advanced Engineering Mathematics***, Kreyszig Erwin, John Wiley.
5. ***Engineering Mathematics***, Ram Babu, Pearson Education.
6. ***Higher Engineering Mathematics***, N.P.Bali, Laxmi Publication.

Course Code : ENV 021
Course Name: ENVIRONMENTAL STUDIES

L	P	Credit hr	Contact hr
4	0	4	4

Unit I: Multidisciplinary Nature of Environmental Studies: Definition, scope and importance, Need for public awareness

Unit II: 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 forest 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 non renewable energy sources, use of alternate energy sources. 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**.**

Unit III: 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 the following ecosystem: (a) Forest ecosystem; (b) Grassland ecosystem; (c) Desert ecosystem; (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)**.**

Unit IV: 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-sports 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.

Unit V: Environmental Pollution: Definition, Cause, effects and control measures of: Air pollution; Water pollution; Soil pollution; Marine pollution; Noise pollution; Thermal pollution; Nuclear hazards and 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.

Reference books

1. ***Environment Biology***, K C Agarwal, Nidi Publ. Ltd. Bikaner.
2. ***Environment Protection and Laws***, Jadhav & Bhosale, Himalaya Pub House, Delhi.
3. ***Waste Water Treatment***, Rao & Datta, Oxford & IBH Publ. Co. Pvt. Ltd.

Course Code : PHYS 123

L	P	Credit hr	Contact hr
0	2	4	4

Course Name: Physics Lab – II

Compound Pendulums

1. To determine g by Bar Pendulum.

2. To determine g by Kater's Pendulum.

Springs

1. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of g, and (c) Modulus of Rigidity

2. To investigate the Motion of Coupled Oscillators.

Melde's Experiment

1. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment.

2. To verify $\lambda 2 - T$ Law by Melde's Experiment.

Resistance

1. To determine a Low Resistance by Carey Foster's Bridge.

2. To determine a Low Resistance by a Potentiometer.

3. To determine High Resistance by Leakage of a Capacitor.

Ballistic Galvanometer

1. To determine the (a) Charge Sensitivity and (b) Current Sensitivity of a B.G.

2. To determine the (a) Logarithmic Decrement and (b) CDR of a B.G.

Capacitance

1. To determine the Ratio of Two Capacitances by de Sauty's Bridge.

2. To determine the Dielectric Constant of a Dielectric placed inside a parallel plate capacitor using a B.G.

Self & Mutual Inductance

1. To determine Self Inductance of a Coil by Anderson's Bridge using AC

2. To determine Self Inductance of a Coil by Rayleigh's Method.

3. To determine the Mutual Inductance of Two Coils by Absolute method using a B.G.

A.C. Circuits

1. To study the response curve of a Series LCR circuit and determine its (a) Resonant

Frequency, (b) Impedance at Resonance and (c) Quality Factor Q, and (d) Band Width.

2. To study the response curve of a Parallel LCR circuit and determine its (a) Anti-Resonant Frequency and (b) Quality Factor Q.

Reference Books:

1. ***Geeta Sanon***, B.Sc. Practical Physics, R. Chand & Co.

2. ***Advanced Practical Physics***, B. L. Worsnop, Asia Publishing House, New Delhi.

3. ***Practical Physics***, C.L. Arora, S.Chand

4. ***A Laboratory Manual of Physics for Undergraduate Classes***, D. P. Khandelwal, Vani Publication House, New Delhi.

CHEM 022 P: Chemistry Laboratory – II

L	P	Credit hr	Contact hr
0	2	2	4

Chemical Kinetics:

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at rooms temperature.

2. To study the effect of acid strength on the hydrolysis of an ester.

3. To compare the strengths of HCl and H_2SO_4 by studying the kinetics of hydrolysis of ethyl acetate.

4. To study kinetically the reaction rate of decomposition of iodide by H_2O_4.

Distribution Law:

1. To study the distribution of iodine between water and CCl_4.
2. To study the distribution of benzoic acid between benzene and water.

Colloids:

1. To prepare arsenious sulphide sol and compare the precipitating power of mono-, bi- and trivalent anions.

Viscosity, Surface Tension:

1. To determine the percentage composition of a given mixture (non interacting systems) by viscosity method.

2. To determine the viscosity of amyl alcohol in water at different concentration and calculate the excess viscosity of these solutions.

3. To determine the percentage composition of a given binary mixture by surface tension method (acetone & ethyl methyl ketone).

SEMESTER III

L	P	Credit hr	Contact hr
4	0	4	4

Course Code: PHYS 231
Course Name: THERMODYNAMICS AND STATISTICAL PHYSICS:

Unit-1: Basics and Ist law of thermodynamics :- Thermo dynamical analysis, thermodynamic systems, important definitions, thermodynamic variables, work and heat and their sign conventions, Joule's experiment and first law of thermodynamics, Corollaries of first law, sign conventions for heat and work, first law analysis of closed system, calculation of W, E& H under isothermal and adiabatic conditions for reversible and irreversible processes, standard state and standard enthalpies of formation, enthalpy of ionization and enthalpy of formation of ions.

Unit-2: IInd law of thermodynamics :- Carnot's cycle, Carnot's theorem, Thermodynamic temperature scale, Thermoelectric effect and its thermodynamical analysis, change of entropy along a reversible path in P-V diagram, entropy of a perfect gas, equation of state of an ideal gas, Heat death of Universe.

Unit-3: IIIrd law of thermodynamics :- Definition of entropy, change of entropy of a system, third law of thermodynamics. Additive nature of entropy, law of increase of entropy, reversible and irreversible processes and their examples, work done in a reversible process, Increase of entropy in some natural processes, entropy and disorder.

Unit-4: Maxwell's Thermodynamic Relations:-Perfect differentials in Thermodynamics, Maxwell Relationships, cooling produced by adiabatic expansion, adiabatic compression, adiabatic stretching of wires and thin films, change of internal energy with volume, Cp-Cv, variation of Cv with volume, Clapeyron's equation. Second-order phase transitions. Thermodynamic equilibrium of a heterogeneous system. Application of phase rule to systems with one or more components.

Unit-5: Statistical physics:- micro and macrostates, thermodynamic probability distribution of n particles in two compartments, deviation from the state of maximum probability; equilibrium state of dynamic system, distribution of distinguishable particles in compartments and cells, phase space and its division into cells, Boltzmann statistics for ideal gas, Bose-Einstein statistics and its application to black body radiation, Fermi-Dirac statistics and its application to electron gas, comparison of the three statistics.

Reference books:

1. ***A Textbook of Optics***, Subrahmanyam and B. Lal, S. Chand & Co., New. Delhi.
2. ***Statistical Physics, Thermodynamics and Kinetic Theory***, Bhatia, Vishal Publication, Jalandhar.

Course Code : PHYS 232
Course Name : ATOMIC AND MOLECULAR PHYSICS

L	P	Credit hr	Contact hr
4	0	4	4

Unit-1: **X-rays**:- Determination of e/m of the Electron, Thermionic Emission, Isotopes and Isobars, Ionizing Power, X-ray Diffraction, Bragg's Law, Bohr Atomic Model, Critical Potentials, X-rays - Spectra: Continuous and Characteristic X-rays, Moseley Law.

Unit-2: **Atoms in Electric and Magnetic Fields** :- Electron Angular Momentum, Space Quantization, Electron Spin and Spin Angular Momentum, Larmor's Theorem, Spin Magnetic Moment, Stern-Gerlach Experiment, Zeeman Effect: Electron Magnetic Moment and Magnetic Energy, Gyromagnetic Ratio and Bohr Magneton.

Unit-3: **Atoms in External Magnetic Fields**:- Normal and Anomalous Zeeman Effect, Paschen Back and Stark Effect (Qualitative Discussion only).

Unit-4: **Many electron atoms**:- Pauli's Exclusion Principle, Symmetric and Antisymmetric Wave Functions, Periodic table, Fine structure, Spin orbit coupling, Spectral Notations for Atomic States, Total Angular Momentum, Vector Model, L-S and J-J couplings, Hund's Rule, Term symbols, Spectra of Hydrogen and Alkali Atoms (Na etc.).

Unit-5: **Molecular Spectra** :- Rotational Energy levels, Selection Rules and Pure Rotational Spectra of a Molecule, Vibrational Energy Levels, Selection Rules and Vibration Spectra, Rotation- Vibration Energy Levels, Selection Rules and Rotation-Vibration Spectra, Determination of Internuclear Distance, Quantum Theory of Raman Effect, Characteristics of Raman Lines, Stoke's and Anti-Stoke's Lines, Complimentary Character of Raman and infrared Spectra.

Reference books:

1. ***Concepts of Modern Physics***, Arthur Beiser, McGraw-Hill Book Company.
2. ***Atomic physics***, J.B.Rajam & Louis De Broglie, S. Chand & Company.
3. ***Atomic Physics,*** J. H. Fewkes & John Yarwood. Vol. II, Oxford University Press.
4. ***Molecular Spectroscopy***, Banwell.

L	P	Credit hr	Contact hr
4	0	4	4

Course Code : PHYS 233
Course Name : Electronics-II

Unit 1: Amplifiers: Small signal amplifiers: General principles of operation, classification, distortion, RC coupled amplifier, gain frequency response, input and output impedance, Multistage amplifiers, transformer coupled amplifiers, Equivalent circuits at low, medium and high frequencies; emitter follower, low frequency common-source and common-drain amplifier, Noise in electronic circuits. Feed back in amplifiers; Negative feedback and stability

Unit 2: Oscillators: Sinusoidal oscillations; phase shift oscillators, LC oscillator, Hartley oscillator, RC oscillators, phase shift and Wein bridge oscillators, Crystal oscillator, Basic idea about AM modulation and demodulations, Oscilloscope.

UNIT 3: Digital Principles:- Number system, Decimal, binary, Octal, hexadecimal, logic gates, AND, OR, NOT, NAND, NOR, XOR, XNOR, Karnnaugh map techniques.

Unit- 4: Flip Flop circuits: Various kind of Flip Flops, clocked RS flip, Flop, Edge Triggered, D Flip Flop, Flip Flop, twitching time, JK Flip Flop, JK Master slave. Flip Flop, **Counters:** Clock waveforms, 555 timer as Astable Multivibrator; Shift registers: Serial out, parallel in, parallel out; synchronous counters, Asynchronous counters, Ring counters.

Unit -5: Converter Circuits: D/A converters, A/D Counters, clipping and Clamping circuit, Clamping circuit theorem, Diode and transistor clippers, astable, Monostable and bistable multivibrators using transistors.

Reference Books:

1. ***Integrated Electronics***, J.Millman and C.C.Halkias, Tata McGraw Hill.
2. ***Electronic Devices & Circuits***, J.Millman and C.C.Halkias, Tata McGraw Hill.
3. ***Digital Principles & Applications***, P.Malvine & Leach, Tata McGraw Hill.

L	P	Credit hr	Contact hr
4	0	4	4

Course Code : MATH 032
Course Name :Mathematics II

Unit-1: Definition of a group with examples and simple properties, Subgroups, Generation of group, Cylic group, Coset decomposition, Lagrange's theorem and its consequences, Fermat's and Euler's theorems, Homomorphism and Isomorphism, Normal Subgroups, Quotient groups, The fundamental theorem of homomorphism.

Unit-2: Permutation groups, Even and odd permutations, The alternating groups and Cayley's theorem, Indroduction to rings, subrings, integral domains and fields, Characteristic of a ring.

Unit-3: Function of Complex Variable: Analytic function, Harmonic functions, Necessary and sufficient condition for the function W= f(z) to be analytic, Application of analytic function in flow problem, complex integrations, Cauchy's integral theorem, Cauchy's integral formula, Cauchy's integral formula for derivatives,

Unit-4: Power series, Taylor's and Laurent's series, Zero's & singularities of complex function, Evaluation of real integral using residues, Bilinear transformation and conformal mapping.

Unit-5: Partial Differential Equations of first order, Lagrange's solution, Charpit's general method of solution, Partial differential questions of second and higher orders, Classification of linear partial differential equations of second order, Homogenous and non-homogenous equations with constant coefficients, Partial differential equations reducible to equations with constant coefficients, Monge's methods.

Reference books:

1. ***Integral Calculus,*** Shanti Narayan, Delhi, S. Chand.
2. ***Mathematical Hand Book,*** M. Vygodsky, Mir, Mascow.
3. ***Higher Engineering Mathematics,*** B.S. Grewal, Delhi, Khanna.
4. ***Introduction to Mathematical Physics,*** Charlie Harper, Prentice Hall of India.

L	P	Credit hr	Contact hr
0	2	2	4

Course Code : PHYS 234
Course Name : Physics lab III

Mechanical Equivalent of Heat

1. To determine J by Callender and Barne's constant flow method.

Thermal Conductivity

1. To determine the Coefficient of Thermal Conductivity of Copper by Searle's Apparatus.
2. To determine the Coefficient of Thermal Conductivity of Copper by Angstrom's Method.

Resistance Temperature Devices

1. To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer
2. To calibrate a Resistance Temperature Device (RTD) to measure temperature in a specified range using Null Method/ Off-Balance Bridge with Galvanometer based Measurement.

Thermocouples

1. To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its Two Junctions.
2. To Calibrate a Thermocouple to measure Temperature in a Specified Range using Null Method (2) Direct Measurement using an Op-Amp Difference Amplifier and to determine Neutral Temperature.

Electronics

1. To verify and design AND, OR, NOT and XOR gates using NAND gates.

2. To design a combinational logic system for a specified Truth Table.

3. To convert a Boolean Expression into Logic Gate Circuit and assemble it using logic gate ICs.

Text and Reference Books

1. ***Geeta Sanon***, B.Sc. Practical Physics, R. Chand & Co.

2. ***Advanced Practical Physics***, B. L. Worsnop, Asia Publishing House, New Delhi.

3. ***Practical Physics***, C.L. Arora, S.Chand

4. ***A Laboratory Manual of Physics for Undergraduate Classes***, D. P. Khandelwal, Vani Publication House, New Delhi.

SEMESTER IV

Course Code : PHYS 241
Course Name : Mathematical Physics II

L	P	Credit hr	Contact hr
4	0	4	4

Unit-1: Fourier Series:- Fourier series, Dirichlet conditions (statement only), sine and cosine series and their orthogonality and complete distinctive features of Fourier expansions applications: square wave, triangular wave and output of full wave rectifier, Summing of infinite series, Gibb's phenomenon.

Unit-2: Integral Transform:- Fourier integral theorem, Fourier integral transform, sine and cosine transform, conservation theorem.

Unit-3: Special Integrals:- Gamma and beta functions: Definition of beta and gamma functions, Relation between beta and gamma functions, Evaluation of $\Gamma(1/2)$.

Unit-4: Laplace Transforms:- Laplace transform of elementary function of derivative integrals and unit step functions of periodic function, Laplace inverse transform, Application of Laplace transform for solving first and second order differential equations with constant coefficients.

Unit-5: Special Functions:- Legendre, Bessel, Hermite and Laguerre functions, Recurrence relations.

Reference Books:

1. ***Integral Calculus,*** Shanti Narayan, Delhi, S. Chand.
2. ***Mathematical Hand Book,*** M. Vygodsky, Mir, Mascow.
3. ***Higher Engineering Mathematics,*** B.S. Grewal, Delhi, Khanna.
4. ***Introduction to Mathematical Physics,*** Charlie Harper, Prentice Hall of India.

Course Code : PHYS 242
Course Name :WAVES & OSCILLATIONS

L	P	Credit hr	Contact hr
4	0	4	4

Unit-1: Damped Oscillations:- Superposition of two SHM by vector addition, superposition of two perpendicular SHM, Polarization, Lissajous figures–superposition of many SHMs, complex number notation and use of exponential series, Damped motion of mechanical and electrical oscillator, heavy damping, critical damping, Damped single harmonic oscillator, amplitude decay, logarithmic decrement, relaxation time, energy decay, Q value, rate of energy decay equal to work rate of damping force, problems.

Unit-2: Forced Oscillations:- Transient and steady state behavior of a forced oscillator, Variation of displacement and velocity with frequency of driving force, frequency dependence of phase angle between force and (a) displacement, (b) velocity, Vibration Insulation – Power supplied to oscillator, Q-value as a measure of power absorption bandwidth, Q-value as amplification factor of low frequency response, modes of vibration, inductance coupling of electrical oscillators, wave motion as the limit of coupled oscillations.

Unit-3: Wave Motion I(Transverse waves):- The wave equation, transverse waves on a string, the string as a forced oscillator, characteristic impedance of a string, reflection and transmission of transverse waves at a boundary, impedance matching, insertion of quarter wave element, standing waves on a string of fixed length, normal modes and Eigen frequencies, Energy in a normal mode of oscillation, wave groups, group velocity, dispersion, wave group of many components, bandwidth theorem, transverse waves in a periodic structure (crystal).

Unit-4: Wave Motion II(Longitudinal waves):- Sound waves, energy distribution in sound waves, intensity, specific acoustic impedance, longitudinal waves in a solid, Young's modulus, Poisson's ratio, longitudinal waves in a periodic structure, reflection and transmission of sound waves, Doppler effect.

Unit-5: Acoustics:- Harmonic analysis, modulation, pulses and wave groups, Fourier transform, An harmonic oscillations, free vibrations of finite amplitude pendulum, nonlinear restoring force, forced vibrations, Thermal expansion of a crystal, electrical 'relaxation' oscillator, nonlinear acoustic effects, Shock waves in a gas.

Reference Books:

1. ***The Physics of Vibrations and Waves***, H.J. Pain, John Wiley.
2. ***Vibrations and Waves in Physics***, I.G. Main, Cambridge University.
3. ***Berkeley Physics Course Vol. III (Waves)***-Frank S Crawford.

L	P	Credit hr	Contact hr
4	0	4	4

Course Code : PHYS 243
Course Name :ELECTRICITY & MAGNETISM

Unit-1: **Calculus of Vectors:-** Introduction to gradient, divergence & curl; their physical significance. Rules for vector derivatives, useful relations involving gradient, divergence & curl, Fundamental theorem for gradients, Gauss's and Stoke's theorems (Statements only)

Unit-2: **Electrostatics:-** Electric charge and its properties, Coulomb's law, The electric field due to a point charge and continuous charge distributions, Field due to electric dipole, Field lines, flux, Gauss's law and its applications, Curl of electric field. Relation between potential and electric field, Poisson's and Laplace's equations, Potential of a localized charge distribution, The energy for a point and continuous charge distribution, Conductors in the electrostatic field, Capacitors, Current and current density, drift velocity, expression for current density vector, equation of continuity, Ohm's Law and expression for electrical conductivity, limitations of Ohm's law.

Unit-3: **Magnetostatics:-** Magnetic fields, magnetic forces, magnetic force on a current carrying wire, Torque on a current loop, Biot-Savart law, Field due to infinite wire carrying steady current, field of rings and coils, Magnetic field due to a solenoid, Force on parallel current carrying wires, Ampere's circuital law and its applications to infinite hollow cylinder, solenoid and toroid, The divergence and curl of B, Comparison of magnetostatics and electrostatics, Magnetic vector potential and its expression, Surface current density and Change in magnetic field at a current sheet, Hall Effect.

Unit-4: **Electromagnetic Induction and Maxwell's Equation:-** Faraday's laws of electromagnetic induction, Amphere's law for varying currents, Displacement current, Maxwell's equations.

Unit-5: **Electromagnetic wave:** Electromagnetic wave equation, Nature and Properties of electromagnetic Waves, light as transverse waves, Orthogonality of electric and magnetic Fields, Poynting Vector, Poynting Theorem.

Reference Books:

1. ***Introduction to Electrodynamics,*** D.J. Griffiths, Pearson Prentice Hall, New Delhi.
2. ***Berkeley Physics Course Vol.II(Electricity & Magnetism),*** E. M. Purcell, McGraw Hill, New York.
3. ***Electricity & Magnetism,*** A.K. Sikri.
4. ***Fundamental of Physics,*** D. Halliday, R. Resnick and J. Walker, John Wiley.

Course Code : PHYS 244
Course Name : Physics lab IV

L	P	Credit hr	Contact hr
0	2	2	4

Reflection, Refraction and Dispersion

1. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
2. To determine the Refractive Index of a Liquid by Total Internal Reflection using Wollaston's Air-film.
3. To determine the Refractive Index of (1) Glass and (2) a Liquid by Total Internal Reflection using a Gaussian Eyepiece.
4. To determine the Dispersive Power of the Material of a given Prism using Mercury Light.
5. To determine the Resolving Power of a Prism.

Interference

1. To determine wavelength of sodium light using Fresnel Biprism.
2. To determine wavelength of sodium light using Newton's Rings.
3. To determine the Thickness of a Thin Paper by measuring the Width of the Interference Fringes produced by a Wedge-Shaped Film.
4. To determination Wavelength of Sodium Light using Michelson's Interferometer.

Diffraction

1. To determine the Diameter of a Thin Wire by studying the Diffraction Produced by it.
2. To determine the wavelength of Laser light using Diffraction of Single Slit.
3. To determine the wavelength of (1) Sodium and (2) Mercury Light using Plane Diffraction Grating.
4. To determine the Dispersive Power of a Plane Diffraction Grating.
5. To determine the Resloving Power of a Plane Diffraction Grating.

Reference Books

1. ***Geeta Sanon***, B.Sc. Practical Physics, R. Chand & Co.

2. ***Advanced Practical Physics***, B. L. Worsnop, Asia Publishing House, New Delhi.

3. ***Practical Physics***, C.L. Arora, S.Chand

4. ***A Laboratory Manual of Physics for Undergraduate Classes***, D. P. Khandelwal, Vani Publication House, New Delhi.

Course Code: COMP 041
Course Name: Computer application -I

L	P	Credit hr	Contact hr
4	1	1	6

Unit – 1

Computer Fundamentals: Block structure of a computer, characteristics of computers,problem solving with computers, generations of computers, and classification of computers on the basis of capacity, purpose, and generation. **Number System**: Bit, byte, binary, decimal, hexadecimal, and octal systems, conversion from one system to the other, representation of characters, integers and fractions.

Unit—2 Binary Arithmetic: Addition, subtraction and multiplication. **Memory Types**: Magnetic core, RAM, ROM, Secondary, Cache, Bubble Memory. **Input and Output Units**: Keyboard, Mouse, Monitor (CRT and LCD): Light pen, joystick, Mouse, Touch screen; OCR, OMR, MICR. **Overview of storage devices**: Floppy disk, hard disk, compact disk, DVD, tape. **Printers**: Impact, non-impact, working mechanism of Drum printer, Dot Matrix printer, Inkjet printer and Laser printer. **Computer languages**: Machine language, assembly language, higher level language and 4GL. **Software: S**ystem Software, application software and open source software, Introduction to Compiler, Interpreter and Assembler

Unit-3 Operating system: Batch, multi-programming, time sharing, network operating system, on-line and real time operating system, Distributed operating system, multi-processor, Multi-tasking and multiprogramming. **Graphical OS:** Fundamentals of windows, types of windows, anatomy of windows, windows explorer, customizing windows, control panel, taskbar setting, Network settings, Introduction to UNIX/Linux.

Unit- 4 Personal Productivity Software: Word processing: Editing features, formatting features, saving, printing, table handling, page settings, spell-checking, macros, mail-merge, equation editors. **Spreadsheet :** Workbook, worksheets, data types, operators, cell formats, freeze panes, editing features, formatting features, creating formulas, using formulas, cell references, replication, sorting, filtering, functions, Charts & Graphs.

Unit-5 Presentation Graphics Software: Templates, views, formatting slides, slides with graphs, animation, using special features, presenting slide shows. **Computer Network and Communication**: Network types, network topologies, network communication devices, physical communication media. **Internet and its Applications**: E-mail, TELNET, FTP, World Wide Web, Internet chatting; Intranet, Extranet, Gopher, Mosaic, WAIS.

Reference Books:

1. **Fundamentals of Computers,** PK Sinha, 6th Edition, BPB Publications, New Delhi
2. **Fundamentals of Computers**, V. Rajaraman, 4th Edition, Prentice Hall of India, New Delhi.
3. **Information Technology,** Satish Jain, 7th Edition, BPB.
4. **Computers Today,** D. H. Sanders, Fourth Edition, McGraw Hill.

SEMESTER V

Course Code : PHYS 351
Course Name : SOLID STATE PHYSICS

L	P	Credit hr	Contact hr
4	0	4	4

Unit-1: **Crystal Structure, Lattice Vibrations and Phonons:-** Amorphous and Crystalline Materials, Lattice Translation Vectors, Lattice with Basis. Unit Cell, Reciprocal Lattice, Types of Lattices, Brillouin Zones, Types of Bonds, Ionic Bond, Covalent Bond, Vander Waals Bond, Diffraction of X- rays by Crystals, Bragg's Law, Linear Monoatomic and Diatomic Chains (Acoustical and Optical Phonons), Qualitative Description of the Phonon Spectrum in Solids, Einstein and Debye, Theories of Specific Heat of Solids, *T3* Law

Unit-2: **Magnetic Properties of Matter:-** Dia-, Para-, Ferri- and Ferromagnetic Materials, Classical Langevin Theory of dia – and Paramagnetic Domains, Quantum Mechanical Treatment of Paramagnetism, Curie's law, Weiss's Theory of Ferromagnetism, Ferromagnetic Domains, Discussion of B-H Curve, Hysteresis and Energy Loss.

Unit-3: **Dielectric Properties of Materials:-** Polarization, Local Electric Field at an Atom, Depolarization Field, Dielectric Constant, Electric Susceptibility, Polarizability, Classical Theory of Electric Polarizability, Clausius- Mosotti Equation (Statement only), Normal and Anomalous Dispersion, Complex Dielectric Constant (Only Quantitative Study).

Unit-4: **Electrical Properties of Materials:-** Elementary Band Theory of Solids, Bloch Theorem, Kronig-Penney Model, Effective Mass of Electron, Concept of Holes, Band Gaps, Energy Band Diagram and Classification of Solids, Law of Mass Action, Insulators, and Semiconductors, Direct and Indirect Band Gap, Intrinsic and Extrinsic Semiconductors, p- and n- Type Semiconductors, Conductivity in Semiconductors, Hall Effect in Semiconductors (Qualitative Discussion Only).

Unit-5: **Superconductivity:-** Experimental Results, Critical Temperature, Critical magnetic field, Meissner effect, Type I and type II Superconductors, London's Equation and Penetration Depth, Isotope effect, Idea of BCS theory (No derivation): Cooper Pair and Coherence length, Variation of Superconducting Energy Gap with Temperature, Experimental Evidence of Phonons, Josephson Effect.

Reference Books

1. ***Introduction to Solid State Physics***, Charles Kittel, John Wiley and Sons, Inc.
2. ***Solid State Physics***, A J Dekkar, Macmillan India Limited.
3. ***Solid State Physics***, J. S. Blackmore, Cambridge University Press, Cambridge.
4. ***Solid State Physics***, N. W. Ascroft and N. D. Mermin, Harcourt Asia, Singapore.

Course Code : PHYS 352
Course Name: NUCLEAR & PARTICLE PHYSICS

L	P	Credit hr	Contact hr
4	0	4	4

Unit-1: Structure and Properties of the Nucleus:- Discovery of the nucleus, composition, basic properties; charge, mass, size, spin, magnetic moment, electric quadruple moment, binding energy, binding energy per nucleon and its observed variation with mass number of the nucleus, coulomb energy, volume energy, surface energy, other corrections, explanation of the binding energy curve, semi-empirical mass formula.

Unit-2: Radioactivity:- The radioactive decay law, decay constant and half life; methods of measurement of half life, spectra of emitters. Alpha decay, Beta decay, Gamma decay: Basic decay processes, energy releases in decay processes Geiger-Nuttall law, Gamow's explanation, Mossbauer effect, energy levels.

Unit-3: Nuclear reactions:-Types of nuclear reactions, reactions cross section, conservation laws, Kinematics of nuclear reaction, Q-value and its physical significance, compound nucleus.

Unit-4: Nuclear Models:- Introduction, Fermi gas model, Liquid drop model, condition of stability, evidence for nuclear magic numbers, Shell model, energy level scheme, angular moment of nuclear ground states.

Unit-5: Elementary Particles and Their Properties:- Historical survey of elementary particles and their classification, determination of mass, life time, decay mode, spin and parity of muons, pions, kaons and hyperons, Experimental evidence for two types of neutrinos, production and detection of some important resonances and antiparticles.

Reference books:

1. ***Basic ideas and Concepts in Nuclear Physics***, K. Hyde.
2. ***Introduction to Nuclear Physics,*** H.A. Enge.
3. ***Nuclear Physics***, I. Kaplan, Addison Wesley.
4. ***Nuclei and Particles***, E. Segre.

Course Code : PHYS 353
Course Name : OPTICS

L	P	Credit hr	Contact hr
4	0	4	4

Unit -1: Thick Lenses:-Convex lens - Principal foci and principal points - Thick lens formula - Power of a thick lens - Optic centre of a lens - Spherical aberration and lenses - Methods of minimizing spherical aberration - Condition for minimum spherical aberration in the case of two lenses separated by a distance - Chromatic aberration in lenses - Condition for achromatism of two thin lenses (in contact and out of contact) - coma - astigmatism - Curvature of the field - Huygen's and Ramsden's eye pieces.

Unit-2: Dispersion:-Dispersion produced by a thin prism - Angular dispersion - Dispersive power - Cauchy's formula - combination of prisms to produce - Dispersion without deviation - Deviation without dispersion - Achromatic prisms Direct vision spectroscope - Constant deviation spectroscope - Rainbows and haloes.

Unit-3: Interference :- Young's experiment, coherent sources, phase and path differences, Theory of interference fringes, Fresnel's biprism, sheet thickness determination, interference in thin films due to reflected and transmitted lights, Maxima and minima in intensities, Colors of thin films, Newton's rings and its various aspects, Non-reflecting films.

Unit-4: Diffraction:- Introduction, rectilinear propagation, Fresnel and Fraunhofer diffraction, Diffraction at a circular aperture and straight edge and their discussion, Fraunhofer diffraction at a single slit and a double slit. Fraunhofer diffraction at N slits and its discussion, Plane diffraction grating and its theory, Dispersive power of grating, Resolving power of optical instruments, Rayleigh criterion, Resolving power telescope, microscope, prism and diffraction grating. Phase contrast microscope.

Unit-5: Polarization :- Introduction, Polarization by reflection, Brewster's law, Polarization by refraction, Malus's law, Double retraction, Nicol Prism and its use, elliptically and Circularly polarized light, quarter and half-wave plates, production and detection of plane, circularly and elliptically polarized light, optical activity, specific rotation, Half-shade polarimeter.

Reference Books:

1. ***Text book of Optics***, N. Subramanayam, B. Lal and M. N. Avadhamulu.
2. ***Fundamentals of Optics***, Jenkins and White
3. ***Optics***, Ajoy Ghatak

Course Code: PHYS 354
Course Name: Physics Lab V

L	P	Credit hr	Contact hr
0	2	2	4

Polarization

1. To verify the Law of Malus for Plane Polarized Light.

2. To determine the Specific Rotation of cane sugar using Polarimeter.

3. To analyze Elliptically Polarized Light by using a Babinet's Compensator.

4. To measure the Numerical Aperture of an Optical Fibre.

Measurement of Magnetic Field and Related Parameters

1. Measurement of field strength B and its variation in a Solenoid (Determination of dB/dx).

2. To draw the BH curve of iron by using a Solenoid and to determine the energy loss due to Hysteresis.

Measurement in Solid State Physics

1. To measure the Resistivity of a Ge Crystal with Temperature by Four-Probe Method(from room temperature to 200 oC) and to determine the Band Gap Eg for it.

2. To determine the Hall Coefficient and the Hall angle of a Semiconductor.

3. To study the PE Hysteresis loop of a Ferroelectric Crystal.

4. To measure the Magnetic susceptibility of Solids and Liquids.

Text and Reference Books

1. ***Geeta Sanon***, B.Sc. Practical Physics, R. Chand & Co.

2. ***Advanced Practical Physics***, B. L. Worsnop, Asia Publishing House, New Delhi.

3. ***Practical Physics***, C.L. Arora, S.Chand

4. ***A Laboratory Manual of Physics for Undergraduate Classes***, D. P. Khandelwal, Vani Publication House, New Delhi.

Course Code: COMP 051

Course Name: Computer application II

L	P	Credit hr	Contact hr
4	0	4	4

SECTION-A

Algorithm and Programming Development: Steps in development of a program, Flow charts, Algorithm Development, Program Debugging, Compilation and Execution. **Fundamentals of C**: I/O statements, Assignment Statements, Constants, Variables, Operators and Expressions, Standards and Formatted statements, Keywords, Data Types and Identifiers. **Control Structures**: Introduction, Decision making with if –statement, if-else and Nested if, while and do-while, for loop. Jump statements: break, continue, goto, switch Statement **Functions**: Introduction to Functions, Function Declaration, Function Categories, Standard Functions, Parameters and Parameter Passing, Call– by value/reference, Recursion, Global and Local Variables, Storage classes.

SECTION-B

Arrays: Introduction to Arrays, Array Declaration, Single and Multidimensional Array, Memory Representation, Matrices, Strings, String handling functions. **Structure and Union**: Declaration of structure, Accessing structure members, Structure Initialization, Arrays of structure, nested structures, Unions **Pointers**: Introduction to Pointers, Address operator and pointers, Declaring and Initializing pointers, Assignment through pointers, Pointers and Arrays **Files**: Introduction, Creating a data file, opening and closing a data file, processing a data file. **Preprocessor Directives**: Introduction and Use, Macros, Conditional Preprocessors, Header Files

Suggested Readings

1. **Fundamentals of Computer Programming**, Anita Goel, Pearson.
2. **Let us C**, Yashvant P Kanetkar, Twelfth Edition, BPB Publications, New Delhi.
3. **Programming in ANSI C**, E. Balagurusami, Fifth Edition, Tata McGraw Hill
4. **Programming in C**, Byron S. Gottfried, Third Edition, McGraw Hill.
5. **Application Programming in C**, 4th edition, RS Salaria, Khanna Publishers
6. **Programming in C**, Byron S. Gottfried, 3rd Edition, McGraw Hill.
7. **Programming in C**, Ashok Kamthane, Pearson.
8. **C Programming Language**, Kerighan & Richi, PHI

COMPUTER LAB

Practicals Based on BCS-105 & BCS-106

1. Practical Based on operating system (windows/unix)
2. Use of word processing software, spread sheet software and presentation software
3. Keywords and Identifiers: introduction, purpose
4. Variables and constants: data types, Initialization, declaration, scope, memory limits
5. Input-output statements: formatted and non-formatted statements
6. Operators: Arithmetic, logical, conditional, assignment, bitwise increment/decrement operators
7. Decision Making: switch, if-else, nested if, else-if ladder, break, continue, goto
8. Loops: while, do-while, for
9. Functions: definition, declaration, variable scope, parameterized functions,
10. return statement, call by value, call by reference, recursive functions
11. Pre-processor Directives: Pre-processor directives like INCLUDE, IFDEF,DEFINE, etc
12. Header Files: STDIO.H, MATH.H, STRING.H, PROCESS.H etc
13. Arrays: Array declarations, Single and multi-dimensional, memory limits, strings and string functions
14. Pointers: Pointer declarations, pointer to function, pointer to array/string,
15. Files: Creation and editing of various types of files, closing a file (using functions and without functions)

SEMESTER VI

L	P	Credit hr	Contact hr
0	2	2	2

Course Code: PHYS 361
Course Name: QUANTUM PHYSICS

Unit-1: Matter Waves and Uncertainty Principle:- De Broglie's hypothesis – wavelength of matter waves, properties of matter waves. Phase and group velocities, Davisson and Germer experiment. Double slit experiment, Standing de Broglie waves of electron in Bohr orbits, Heisenberg's uncertainty principle for position and momentum (x and p_x), Energy and time (E and t), Gamma ray microscope. Diffraction by a single slit, Position of electron in a Bohr orbit, Particle in a box, Complementary principle of Bohr.

Unit-2: Schrodinger Wave Equation:- Schrödinger equation -time dependent and steady state forms, expectation value, Particle in a box, Schrodinger equation for hydrogen atom, separation of variables, quantum numbers.

Unit-3: Quantum Kinematics:- Stern- Gerlach experiment as a tool to introduce quantum ideas, analogy of two level quantum system with polarization states of light, Complex linear vector spaces, commutator and uncertainty relations, Change of basis and unitary transformations, Diagonalisation of operators, Position, momentum and translation, momentum as a generator of translations, canonical commutation relations.

Unit-4: Quantum Dynamics:- Time evolution operator and Schrödinger equation, special role of the Hamiltonian operator, Ehrenfest's theorem. One Dimensional System: Potential Step, potential barrier, potential well, Scattering vs. Bound states.

Unit-5: Harmonic oscillator and applications:- Harmonic oscillator, energy Eigen states, wave functions and coherent states, Spherical Symmetric Systems and Angular Momentum: Schrödinger equation for a spherically symmetric potential, Orbital angular momentum commutation relations, Eigen value problem for spherical harmonics, Three dimensional harmonic oscillator, three dimensional potential well and the hydrogen atom.

Reference Books:

1. ***Modern Quantum Mechanics***, J. J. Sakurai (Principal text), Pearson Education Pvt. Ltd., New Delhi, 2002.
2. ***Quantum Mechanics***, L I Schiff, Tokyo Mc Graw Hill.
3. ***Feynman lectures in Physics*** Vol. III, Addison Wesly.
4. ***Quantum Physics of Atoms Molecules Solids, Nuclei & Particles***: R. Eisberg and R. Resnick.
5. ***Concepts of modern physics***, A. Beiser
6. ***Introduction to Atomic and Nuclear Physics***: H. Semat and J.R. Albright.

Course Code: PHYS 362
Course Name: Classical Mechanics

L	P	Credit hr	Contact hr
4	0	4	4

Unit-1: Lagrangian Mechanics:- Newton's law of motion, mechanics of a system of particles, constraints, D'Alembert's principle and Lagrange's equations of motion, Velocity dependent potentials and dissipation function, Some applications of Lagrangian formulation, Hamilton's principle, derivation of Lagrange's equations from the Hamilton's principle, Conservation theorems and symmetry properties.

Unit-2: Central Force Problem:- Two body central force problem, reduction to equivalent one body problem, the equation of motion and first integrals, the equivalent one dimensional problem, and classification of orbits, The differential equation for the orbit and integral power-law potential, The Kepler problem, Scattering in a central force.

Unit-3: Rigid Body Dynamics:- The independent co-ordinates of a rigid body, orthogonal transformation, the Euler's angles, Euler's theorem on the motion of rigid body, finite and infinitesimal rotations, rate of change of a vector, angular momentum and kinetic energy about a point for a rigid body, the inertia tensor and moment of inertia, the Eigen values of the inertia tensor and the principal axis transformation, Euler's equations of motion, torque free motion of a rigid body.

Unit-4: Legendre and Hamiltonian Transformations:- Legendre transformation and Hamilton's equations of motion, cyclic co-ordinates and conservation theorems, derivation of Hamilton's equations from a variational principle, the principle of least action.

Unit-5: Canonical Transformations:- The equation of canonical transformation, examples of canonical transformations, Poisson brackets, Equations of motion, infinitesimal canonical transformations and conservation theorems in the Poisson bracket formulation.

Reference Books:

1 ***Classical Mechanics:*** Herbert Goldstein, Narosa Pub. House.
2 ***Mechanics:*** Landau & Lifshitz, Pergamon Press Oxford.
3 ***Classical Mechanics***: Rana and Joag, Tata Mc Graw Hill, New Delhi.

Course Code: PHYS 363
Course Name: NANO PHYSICS

L	P	Credit hr	Contact hr
4	0	4	4

Unit-1: **Introduction of Nano Materials:-** Introduction, Basic idea of nanotechnology, nanoparticles, metal Nanoclusters, Semiconductor nanoparticles, Physical Techniques of Fabrication, inert gas condensation, Arc Discharge, RF plasma, Ball milling, Molecular Beam Epitaxy, Chemical Vapour deposition, Electrodeposition, Chemical Methods-Metal nanocrystals by reduction, Photochemical synthesis, Electrochemical synthesis, Sol-gel, micelles and microemulsions, Cluster compounds. Lithographic Techniques- AFM based nanolithography and nanomanipulation, E-beam lithography and SEM based nanolithography, X ray based lithography.

Unit-2: **Synthesis:-**Free electron theory and its features, Idea of band structure of metals, insulators and semiconductors. Density of state in one, two and three dimensional bands and its variation with energy, Effect of crystal size on density of states and band gap, Examples of nanomaterials, Top-down and bottom-up approaches, Physical and chemical methods for the synthesis of nanomaterials with examples.

Unit 3: **Characterization Techniques**: X-ray diffraction, Scanning Probe microscopy, Scanning Electron microscopy, Transmission Electron Microscopy, Scanning Tunneling Microscopy, Optical microscopy, FTIR Spectroscopy, Raman Spectroscopy.

Unit-4: **Carbon based materials**:- Important Carbon based materials; Preparation and Characterization of Fullerene and other associated carbon clusters/molecules, Graphene preparation, characterization and properties, DLC and nano diamonds, Quantum Dots **Carbon Nanotubes:-** Preparation of Carbon nano tubes, CVD and other methods of preparation of CNT, Properties of CNT; Electrical, Optical, Mechanical, Vibrational properties, Application of CNT.

Unit-5: **Nanosemiconductors and Nano sensors:-** Semiconductor nanoparticles - applications; optical luminescence and fluorescence from direct band gap semiconductor nanoparticles, carrier injection, polymers - nanoparticles, LED and solar cells, electroluminescence, Micro and nanosensors; fundamentals of sensors, biosensor, microfluids, MEMS and NEMS, packaging and characterization of sensors (Only Qualitative Analysis).

Reference books:

1. ***Solid State Physics***, J.P. Srivastva-Prentice Hall.
2. ***Introduction to nanoscience and Nanotechnology***, K.K. Chattopadhyay and A.N. Banerjee- PHI Learning Pvt. Ltd.
3. ***Nanotechnology Fundamentals and Applications***, Manasi Karkare, I.K.- International Publishing House.
4. ***Nanomaterials***, B. Viswanathan- Narosa.
5. ***Encyclopedia of Nanotechnology***, H.S. Nalwa-American Scientific Publishers.

Course Code : PHYS 363
Course Name : Project and seminar