

Syllabus

Department of Physics

North Lakhimpur College (Autonomous)



Approved by the Meeting of the Board of Studies, Deptt. of Physics held on

20/09/2013

B.Sc. (Core) PROGRAMME PHYSICS
SCHEME OF COURSES
 COURSE STRUCTURE AND ALLOTMENT OF PAPERS FOR EACH
 SEMESTER EXAMINATION TO BE CONDUCTED BY
 THE NORTH LAKHIMPUR COLLEGE (Autonomous)

Semester	Paper	Title	Marks	Credit	L-T-P
I	CT-5-PHY-101	Mechanics and Properties of Matter	100	5	4-1-0
II	CT-5-PHY-201	Thermal Physics and Waves & Oscillation	100	5	4-1-0
III	CT-3-PHY-301	Optics	60	3	2-1-0
	CT-3-PHY-302	Electricity and Magnetism	60	3	2-1-0
	CP-2-PHY-303	Test of Laboratory Skill	40	2	0-0-2
IV	CT-3-PHY-401	Mathematical Physics I	60	3	2-1-0
	CT-3-PHY-402	Quantum Mechanics	60	3	2-1-0
	CP-4-PHY-403	Laboratory I	80	4	0-0-4
V	CT-5-PHY-501	Electrodynamics & Special Theory of Relativity	60	3	2-1-0
	CT-4-PHY-502	Mathematical Physics II	80	4	3-1-0
	CT-4-PHY-503	Atomic & Molecular Physics	80	4	3-1-0
	CT-4-PHY-504	Electronics	80	4	3-1-0
	CP-2-PHY-505	Laboratory II	40	2	0-0-2
	CP-4-PHY-506	Laboratory III	80	4	0-0-4
VI	CT-4-PHY-601	Nuclear and Particle Physics	80	4	3-1-0
	CT-3-PHY-602	Condensed Matter Physics	60	3	2-1-0
	CT-3-PHY-603	Statistical Mechanics	60	3	2-1-0
	CT-3-PHY-604	Optional	60	3	2-1-0
	CP-4-PHY-605	Laboratory IV	80	4	0-0-4
	CP-4-PHY-605	Project work	80	4	0-0-4

Total credit: 70 (Theory- 50, Lab- 20)

CT-5-PHY-101
Mechanics and Properties of Matter
Total Marks: 100
Total No. of Lectures: 112 L-4,T-1,P-0

Unit I: Inertial and Non inertial frame of reference (Marks: 20)

Concept of frame of references (inertial and non inertial), Inertial frame of reference: Galilean invariance and conservation laws. Non inertial frame of reference and fictitious force, rotating frames and Coriolis force at any latitude, deviation of freely falling bodies from the vertical and Foucault pendulum

Unit II: Forces and collision (Marks: 25)

Two body problem, reduction of two body problem into one body problem, Conservative and non conservative force, conservation of angular momentum, central force, Kepler's law of planetary motion, Gravitational field and potential, potential at a point due to a spherical shell and a solid sphere, Elastic and inelastic collisions, laboratory and c.m reference frame, kinematics of elastic collision

Unit III: Properties of matter (Marks: 30)

Motion of a rigid body: Angular momentum of system of particle, torque, Equation of motion of a rotating rigid body, theorems on moment of inertia, calculation of moment of inertia of a circular lamina, solid cylinder, hollow sphere and a solid sphere.
Elasticity: Elastic constants and the relations between them, Poisson's ratio, bending of beam, cantilever, twisting torque on a cylinder or wire.
Hydrostatic: Surface tension, excess pressure inside a curved surface, rise of liquid in a capillary tube.
Hydrodynamics: Poiseuille's equation for flow of liquid through a capillary tube.

Unit IV: Classical Mechanics (Marks: 25)

Constrained motion and constraints, degrees of freedom, generalized co-ordinates, virtual work, D' Alembert's principle, Lagrange's equation of motion and its applications in simple problems. Cyclic co-ordinates, conservation of linear momentum, angular momentum and total energy
Hamilton's canonical equation of motion, physical significance of Hamilton's equation, derivation of Hamilton's equation from variational principle

Suggested readings:

1. Elements of Properties of Matter, D.S. Mathur, S. Chand and Company
2. Mechanics, B.S. Agarwal, S. Chand and Company
3. Classical Mechanics, H. Goldstein, C.P. Poole, John Safko, Pearson Education
4. Classical Mechanics, Gupta, Kumar and Sharma, Pragati Prakashan

CT-5-PHY-201
Thermal Physics and Waves & Oscillation
Total Marks: 100

Total No. of Lectures: 112 L-4,T-1,P-0

Unit I: Kinetic Theory of gases (Marks: 30)

Maxwell's law of distribution of velocities (derivation not required), law of equipartition of energy, mean free path, transport phenomena (viscosity, conduction and diffusion), Avogadro number-experimental determination by the kinetic theory method, Brownian motion (theory of translational Brownian movement)

Difference between ideal and real gases, Andrew's experiment for carbon dioxide, Vander Waal's equation of state, critical constant and law of corresponding states

Unit II: Thermodynamics (Marks: 30)

The zeroth law, indicator diagram, Thermodynamical system work done, first law of thermodynamics, application of first law of thermodynamics, internal energy, Carnot cycle and its efficiency, Carnot's theorem, second law of thermodynamics, entropy as a thermodynamic variable, entropy changes in reversible and irreversible processes, principle of increase of entropy, thermodynamic temperature, Clausius inequality.

Thermodynamic relationships: Maxwell's relations, Clausius-Clapeyron's equation and simple applications- boiling point, melting point and latent heat, and Joule-Thomson effect; Thermodynamic potential and its relation to thermodynamic variables

Unit III: Blackbody radiation (Marks: 15)

Kirchhoff's law, Stefan-Boltzmann law, spectral distribution, Wein's displacement law, Wien's distribution law, Rayleigh-Jean's law and ultra violet catastrophe, Planck's hypothesis, Planck's black body distribution law, pressure due to radiation.

Unit IV: Waves and Oscillations (Marks: 25)

Mechanical waves and its types, Propagating waves and wave equation, particle velocity in a transverse wave, wave equation for a vibrating string, plucked string and struck string, Velocity of sound in gaseous mediums, dispersion relations, Lissajou's figure, damped and forced vibration, Resonance.

Suggested readings:

1. A Treatise on Heat, M.N. Saha and B.N. Shrivastava Indian Press, Allahabad
2. Heat and Thermodynamics, A.W. Zemansky, McGraw Hill
3. Thermal Physics, Garg, Bansal and Ghosh, Tata McGraw Hill
4. Advanced Textbook on Heat, Chakravarty, P. K., New Central Book agency (P) Ltd
5. A Text Book of Oscillations, wave and acoustics, M.Ghosh, S. Chand and Company

CT-3-PHY-301
Optics
Total Marks 60
Total No. of Lectures: 64 L-2,T-1,P-0

Unit I: Geometrical optics (Marks: 18)

Fermat's Principle: Optical Path, Fermat's Principle of Least Time or Extremum Path.
Applications of Fermat's Principle in (1) Reflection and (2) Refraction

Matrix method: Translation matrix and Refraction Matrix, use of matrix method in refraction at a spherical surface and refraction through thin lens

Aberrations: Spherical aberration and methods of minimizing it, qualitative idea of coma, astigmatism and curvature of field and distortion, chromatic aberration, circle of least confusion, achromatic combination of lenses and prism, Ramsden and Huygen's eyepieces

Unit II: Interference (Marks: 17)

Theories of Light, Electromagnetic Nature of Light, Definition of a Wave Front, Propagation of a Wave Front, Huygens Principle of Secondary Wavelets, Coherent sources

Interference by division of wave front: Young's double slit experiment, Fresnel's biprism and Lloyd's mirror.

Interference by division of amplitude: interference in thin films (parallel and wedge shaped), Newton's ring.

Interferometers: Michelson interferometer, application in determining closely spaced wavelengths, Fabry Perrot and Jamin's interferometer.

Unit III: Diffraction (Marks: 15)

Fraunhofer diffraction: Single slit diffraction (Circular and rectangular), two slit diffraction, N slit diffraction, plane diffraction grating, resolving and dispersive power of a plane diffraction grating, secondary maxima.

Fresnel diffraction: Fresnel's integral, Cornu's spiral, Fresnel diffraction pattern at a straight edge and a slit, Fresnel's half period Zones, zone plates.

Unit IV: Polarization and dispersion (Marks 10)

Brewster's law, Malus' law, double refraction, circular and elliptical polarization, analysis of polarized light (Nichol Prism and Quarter wave plate), optical rotation, polarimeter

Suggested readings:

1. Optics, A.K. Ghatak, Tata McGraw Hill
2. A Text Book on Light, B. Ghosh, K.G. Mazumdar, Sreedhar Publishers
3. A Text Book of Optics, Brij Lal, Subrahmanyam & Avadhanulu, S. Chand & Company Ltd
4. Fundamentals of optics, Zenkins and White, Tata McGraw-Hill.

CT-3-PHY-302
Electricity and Magnetism
Total Marks: 60
Total No. of Lectures: 64 L-2,T-1,P-0

Unit I: Electrostatics (Marks: 22)

Ideas of gradient, divergence and curl; Electric Intensity, Electric potential, Electric dipole, Gauss' law in electrostatics, some applications (spherical shell and infinite sheet of charge) of Gauss' law, Laplace's equation and its application, capacity of various types of condensers- parallel plate, spherical and cylindrical; energy stored in parallel plate capacitor, dielectric, polarization and displacement vector, Boundary conditions Clausius-Mosotti equation.

Unit II: Current electricity (Marks: 10)

Kirchhoff's law and its applications, Thevenin's and Norton's Theorems and their applications, Moving coil Ballistic Galvanometer, dc bridges, Kelvin's double bridge, Thermoelectric effects, Seebeck effect, Peltier effect, Thomson effect, measurement of thermo emf, Thermoelectricity in Semiconductors.
Growth and decay of current in L-R, C-R and LCR circuit

Unit III: Magnetism (Marks: 11)

Magnetic field due to a circular current loop and solenoid, Gauss' theorem in magnetism and its applications, magnetic permeability and susceptibility, magnetization, magnetic intensity and their relation, dia-, para-, ferromagnetism, Hysteresis in ferromagnetic materials.

Unit IV: Electromagnetic Induction (Marks: 17)

Electromagnetic induction, Faraday's law and Lenz's law, self and mutual inductance
AC and DC generators and motors, transformer, relation between maximum, average and virtual or effective (rms) values of current, AC through resistance (R), inductance (L) and capacitance (C), AC through RL, RC and LCR circuits, phasor diagrams, measurements of self inductance by Anderson's bridge, measurements of mutual inductance by ballistic galvanometer, power in AC circuits.

Suggested readings:

1. Electricity and Magnetism, D.C.Tayal ,Himalaya Publication
2. Fundamentals of Magnetism and Electricity, D.N. Basudeva, S. Chand and Company
3. Electricity and Magnetism, D. Chattopadhyay and P.C. Rakshit, New Central Book Agency (P) Ltd.
4. Electricity and Magnetism, Khare and Shrivastava , Atmaram and Sons
5. Electricity and Magnetism, Brijlal and Subramanyan ,S.Chand & Company

CP-2-PHY -303
TEST OF LABORATORY SKILL
Total Marks: 40
Total No. of Laboratory Session: 64 L-0,T-0,P-2

- I. Identification of active and passive components of an electronic circuit.
- II. Familiarization with operation of basic measuring and test equipments(analog and digital multimeters, function generator, Cathode ray oscilloscope)
- III. To use a multimeter for identification of different terminals of (i) diode and (ii) transistor.
- IV. To find the value of resistor from colour code and verify by measuring the resistance by multimeter.
- V. To make connections using soldering.
- VI. To measure small distances and angles using different vernier scales attached to (i) travelling microscope, (ii) polarimeter and (iii) spectrometer.
- VII. To check the condition of a lead-acid battery – (i) acid strength by common hydrometer, (ii) acid level and (iii) emf (using multimeter).
- VIII. To check the condition of capacitor using multimeter.

CT-3-PHY-401
Mathematical Physics I

Total Marks- 60

Total No. of Lectures: 64 L-2,T-1,P-0

Unit I: Vector Analysis (Marks: 22)

Scalar and vector fields, differentiation of a vector with respect to a scalar, unit tangent vector, normal vector.

Derivatives of vectors: gradient of a scalar, flux of a vector field, divergence and curl of a vector field, idea of line, surface and volume integration, Gauss's, Stokes' and Green's theorem. Laplacian in Cartesian, spherical and cylindrical co ordinate system

Unit II: Tensor (Marks: 13)

Introduction to Tensor, transformation of co-ordinates, scalars, contra variant and co-variant vectors, transformation rules for tensors of arbitrary rank (Contra-variant and co-variant) symmetric and anti symmetric tensors, tensor algebra, Kronecker delta, Levi civita tensor.

Unit III: Matrices (Marks: 15)

Definition and types of matrices, transformation of matrices, characteristics equation, solution of inhomogeneous linear equations, eigen values and eigen vectors, Caley Hamilton theorem, diagonalization of matrices.

Unit IV: Calculus of variation (Marks: 10)

Variational principle, Euler Lagrange equation, geodesic on a plane and spherical surface, Brachistochrone problem, constrained maxima and minima, method of Lagrange undetermined multipliers and its application to isoperimetric problems.

Suggested readings:

1. Vector Analysis and an introduction to Tensor Analysis, M. Spiegel, McGraw Hill
2. Mathematical Physics, H.K.Dass and Rama verma, S.Chand and Company
3. Mathematical Physics, B.D. Gupta, Vikash Publishing House
4. Mathematical Physics, B.S. Rajput, Pragati Prakashan
1. Essentials of mathematical methods for physicists, Arfken and Weber, Elsevier Ltd, Oxford

CT-3-PHY-402
Quantum Mechanics
Total Marks: 60
Total No. of Lectures: 64 L-2 ,T-1,P-0

Unit I: Introduction (Marks: 20)

Inadequacy of classical physics, development of quantum theory, wave particle duality of matter, de-Broglie hypothesis, phase and group velocity of de-Broglie waves, concept of wave packet experimental verification of wave nature of particle (Davison-Germer experiment)
Young's double slit experiment- electron interference, Heisenberg's uncertainty principle with examples, gamma ray experiment,

Unit II: Wave equation (Marks: 26)

Schrodinger equation for free particle and particle in a field, physical interpretation of wave function, equation of continuity and probability current density, separation of Schrodinger's equation into space and time parts, stationary states
Application of Schrodinger's equation to simple problems: (1) Free particle (2) Particle in one dimensional box with rigid walls, zero point energy, (3) Step potential, calculation of transmission and reflection coefficient, quantum mechanical tunneling

Unit III: Operators in Quantum Mechanics (Marks: 14)

Operators in quantum mechanics, linear, Hermitian and Unitary operators, eigen values and eigen values of an operator, orthonormality of eigen functions of Hermitian operator, expectation values of an observable, Ehrenfest's theorem
Hilbert's space, Dirac's Bra Ket notation (elementary idea only)

Suggested readings:

1. Introduction to Quantum Mechanics, D.J. Griffiths, Pearson Education
2. Quantum Mechanics- Theory and Applications, Ajoy Ghatak, S Lokanathan, McMillan
3. Quantum Mechanics, P.M. Mathews and K. Venkateshan, Tata McGraw Hill
4. Principles of Quantum Mechanics, S.P. Kuila, New Central Book Agency P Ltd.
5. Quantum Mechanics, G. Aruldas, Prentice Hall of India
6. Advanced Quantum Mechanics, Satya Prakash, Pragati Prakashan.

CP-4-PHY -403
Laboratory I
Total Marks: 80
Total No. of Laboratory Session: 96
L-0,T-0 P-4

The examination should be on one experiment in 6 hrs.

List of experiments:

- I. Determine the value of g with the help of Kater's reversible pendulum. Obtain true length and time period of the equivalent simple pendulum with the help of graphical plot of distance between knife edges and the time periods.
- II. To determine Young's modulus of a material in the form of a rectangular beam by bending. Show graphically that the depression is directly proportional to the cube of its length.
- III. To determine the surface tension of a liquid by capillary tube method and to verify Jurin's law graphically.
- IV. To determine coefficient of viscosity of water by capillary flow method.
- V. To draw the I-D curve using a spectrometer and hence determine the refractive index of the material of the prism used.
- VI. Determination of thermal conductivity of a material by Searle's method.
- VII. Verification of the laws of transverse vibrations of a string by Melde's Experiment.
- VIII. To determine the Cauchy's constants.
- IX. To determine the modulus of rigidity of a given specimen by static method.

CT-3-PHY-501
Electrodynamics and Special Theory of Relativity
Total Marks: 60
Total No. of Lectures: 64 L-2,T-1,P-0

Unit I: Electromagnetic fields (Marks: 20)

Electrodynamics before Maxwell, Displacement current, Modification of Ampere's law by Maxwell, Maxwell's equations and their interpretations (integral and differential forms), Maxwell's equations in Matter, Boundary conditions.

The Potential Formulation: Scalar and vector potentials, Gauge Transformations, Coulomb gauge and Lorentz gauge.

The Continuity Equation, Poynting vector and Poynting theorem,

Unit II: Electromagnetic Waves (Marks: 22)

Electromagnetic waves in free space: Wave Equations for Electric and Magnetic field vectors, Monochromatic Plane Waves (Relation between wave vector and field vectors), Energy and Momentum in Electromagnetic Waves.

Electromagnetic Waves in dielectric medium (or in Matter): Plane waves in non-conducting media, polarization, reflection and refraction of a plane wave at a plane interface (normal and oblique incidence) between two dielectrics, Fresnel's formula, total internal reflection, Brewster's angle. Plane waves in a conducting medium, skin effect.

Unit III: Special Theory of Relativity (Marks: 18)

Problem of absolute motion in classical physics, Ether hypothesis, nullity of ether hypothesis, Michelson-Morley experiment, Einstein's postulates of special relativity, Lorentz transformation, length contraction, time dilation, twin paradox, relativistic mass, mass energy relation, energy momentum relation

Suggested readings:

1. Introduction to Electrodynamics, D.J. Griffiths, PHI Learning Private Limited
2. Electromagnetics, B.B. Laud, New Age International
3. Electricity and Magnetism, D. Chattopadhyay and P.C. Rakshit, New Central Book Agency (P) Ltd.
4. Introduction to Special Relativity, Robert Resnick, John Wiley & Sons
5. Relativistic Mechanics, Satya Prakash, Pragati Prakashan
6. Modern Physics, R. Murugesan, K. Sivaprasath, S. Chand & Company Ltd.
7. Concept of Modern Physics, Arthur Beiser, Shobhit Mahajan, S Rai Choudhury, Tata McGraw Hill Education Private Limited

CT-4-PHY-502
Mathematical Physics-II
Total Marks: 80
Total No. of Lectures: 96 L-3,T-1,P-0

Unit I: Differential equations and special functions (Marks: 35)

Order and Degree of a differential equation, Solution of Differential equations of the first order and first degree (Variable Separation, Homogenous equations, Equations reducible to Homogenous form, Linear differential equation, Bernoulli equation, Exact differential equation, Equations reducible to Exact differential equation), Solutions of Linear differential equations of second order with constant coefficient, Series solutions of Second order Differential equations (ordinary point, singular point), Frobenius method.

Special functions: Legendre's polynomials, Bessel's function, beta and gamma functions and their inter relations, error functions.

Unit II: Complex variables (Marks: 20)

Graphical representation of complex numbers, functions of complex variables, limit and continuity, analytic functions, Cauchy-Riemann conditions and applications, singularities, contour integration, Cauchy's theorem, Cauchy's integral formula, Taylor's and Laurent's expansion, residue theorem and its application in evaluation of integrals.

Unit III: Fourier series (Marks: 15)

Fourier series: Fourier sine and cosine series, determination of coefficients, applications to analysis of saw tooth and square waves.

Unit IV: Error Analysis (Marks: 10)

Significant figure, rounding off, types of errors, error due to approximation of function, error in a series approximation, mean and standard deviation of distributions, least squares fitting, chi-square test

Suggested readings:

1. Mathematical Physics, H.K.Dass and Rama verma, S.Chand and Company
2. Complex Variables, M. Spiegel, McGraw Hill
3. Mathematical Physics, B.D. Gupta, Vikash Publishing House
4. Mathematical Physics, B.S. Rajput, Pragati Prakashan
5. Mathematical Methods for Physicists, G.B. Arfken and H.J. Weber, Elsevier Ltd, Oxford

CT-4- PHY-503
Atomic and Molecular Physics
Total Mark- 80
Total no. of Lectures: 96 L-3, T-1, P-0

Unit I: Quantum Theory of Atoms (Marks: 20)

Background of Quantum Theory: Bohr's model of the hydrogen atom, origin of spectral lines, Bohr's correspondence principle, Sommerfeld's atom model, designation of spectral term symbol. Vector atom model, space quantization, the four quantum numbers, spectral terms arising from L-S coupling and j-j coupling, selection rules

Unit II: Fine structures of atoms (Marks: 25)

Fine structure of hydrogen spectra, doublet spectra of Na-atom, Gyromagnetic ratio for orbital and spin motion, Lande's 'g' factor, strong and weak field effects, Larmor precession, Zeeman Effect (normal and anomalous), qualitative ideas of Stark effect

X-ray Spectra: Continuous X-ray spectrum, Moseley's law, X-ray absorption spectra- Experimental and theoretical explanation, Comparison between X-ray and optical spectra.

Unit III: Molecular spectra and lasers (Marks: 35)

Molecular spectra: Pure rotation spectra, theory of pure rotation spectra, selection rules, vibration spectra and selection rules, theory of rotation-vibration spectra, P and R branches.

Rayleigh and Raman scattering, Raman Effect, classical and quantum theory of Raman effect, Raman Spectroscopy

Introduction to Lasers: Spontaneous and stimulated emission, population inversion, Einstein's A and B coefficients, qualitative ideas of Ammonia beam maser, ruby laser, He-Ne laser, Neodymium based laser, Semiconductor Laser, Dye Laser, Application of Laser, Elements of nonlinear optics

Suggested readings:

1. Atomic Physics, J.B. Rajam, S. Chand and Company
2. Fundamentals of Molecular Spectroscopy, Banwell and McCash, Tata McGraw Hill
3. Molecular Structure and Spectroscopy, G. Aruldas, Prentice Hall of India

Additional references:

1. Atomic Spectra, H.E. White, McGraw Hill
2. Modern Physics, G. Aruldas and P. Rajagopal, Prentice Hall of India

CT-4-PHY -504

Electronics

Total Marks: 80

Total No. of lectures: 96 L-3,T-1,P-0

Unit I: Semiconductors (Marks: 20)

Electronic structure of elements, energy band theory of crystals, conductors, semiconductors and insulators, electrons and holes in semiconductor, donor and acceptor impurity, generation and recombination of charge, diffusion, continuity equation. Junction diode characteristics: the open circuited P-N junction, I-V characteristics of P-N diode, breakdown diodes, diode as a rectifier, half-wave and full-wave rectifier with resistance load, ripple factor, smoothing filters, DC power supply

Unit II: Transistors and amplifiers (Marks: 20)

Transistors: NPN and PNP transistors, transistor action, common emitter, common base and common collector connections, transistor biasing (fixed bias, base-resistor, voltage divider) and thermal stabilization, amplifier equivalent circuits, hybrid parameters, small signal transistor voltage amplifier, RC coupled amplifier, power amplifier (Class A and Class B), distortion in amplifier, amplifier with negative feedback, effect of negative feedback on gain, output impedance and distortions

Unit III: Oscillators and integrated circuits (Marks: 20)

Oscillators: transistor as sinusoidal oscillator, Barkhausen criterion, tuned collector, Hartley, RC, Wein Bridge and crystal oscillator.

Integrated Circuit: basic ideas, differential amplifier, operational amplifiers, common mode rejection ratio, inverting, non-inverting, basic mathematical operations- addition, differentiation, integration.

Unit IV: Digital electronics (Marks: 20)

Logic gates: binary numbers, decimal to binary and binary to decimal conversion, logic gates and their realization by P-N diodes and transistor, half adder, full adder, NAND, NOR and XOR gates, Boolean algebra, de Morgan's theorem and its applications, K-maps, digital-to-analog converters, analog-to-digital converters

Suggested readings:

1. Semiconductor Materials and Devices, M.S. Tyagi, John Wiley and Sons
2. Physics of Semiconductor Devices, S.M. Sze, Wiley Eastern Ltd.
3. Semiconductor Devices, Basic Principles, Jasprit Singh, John Wiley and Sons
4. Electronic Principles, A.P. Malvino, Tata McGraw Hill
5. Solid state electronic devices, Streetman and Banerji, Prentice Hall of India.
6. Fundamentals of electronics, Chattopadhyai and Rakshit, New Central Book Agency (P) Ltd.
7. Principles of electronics, V.K.Mehta, S Chand & Company
8. Integrated Electronics: Analog and Digital, Circuit Systems, Millman and Halkias, McGraw Hill
9. Digital Principles and Applications, D.P. Leach and A.P. Malvino, Tata McGraw Hill

CP-2-PHY-505
Laboratory II
Total Marks: 40
Total No. of Laboratory Session: 64 L-0,T-0,P-2

The examination should be on one experiment in 6 hrs.

List of experiments:

- I. To determine the modulus of rigidity of a given specimen by Maxwell's needle method.
- II. To determine the wavelength of the monochromatic radiation using Newton's ring method.
- III. To measure the width of a double slit by diffraction of monochromatic radiation and verify the result by microscopic measurement.
- IV. To determine the wavelength of the given monochromatic radiation using a biprism/Lloyd's mirror.
- V. To determine the magnetic moment of the given bar magnet and the value of horizontal intensity of earth's magnetic field at your place
- VI. To verify the inverse square law of force in magnetism.

CP-4-PHY-506
Laboratory III
Total Marks: 80
Total No. of Laboratory Session: 96 L-0,T-0,P-4

The examination should be on one experiment in 6 hrs.

List of experiments:

- I. Determine the melting point of a solid by means of a thermocouple.
- II. Determine the constant of a given ballistic galvanometer by passing a steady current through it.
- III. Determine the E.C.E. of copper (using a potentiometer).
- IV. To find the optical rotation produced by solution of the given optically active substance at different concentrations with the help of a polarimeter. Hence to determine the specific rotation and the unknown concentration of the given solution.
- V. To measure the self induction of a given solenoid using Anderson's bridge method and compare the result with theoretical value.
- VI. To study a series and parallel resonant circuit and to determine the Q-factor.
- VII. To study half wave and full wave rectifier and to determine the ripple factor.
- VIII. To determine the energy band gap of a junction diode or LED.
- IX. Determine the boiling point of the given liquid using platinum resistance thermometer.
- X. Determine the ratio of two specific heats of a gas by Clement and Desorme's method

CT-4-PHY -601
Nuclear and Particle Physics
Total Marks- 80
Total No. of Lectures: 96 L-3,T-1,P-0

Unit I: Properties of Atomic Nuclei (Marks: 15)

Introduction, nuclear size and its determination, hypotheses of nuclear composition (proton-electron and proton-neutron hypothesis), mass of nucleus and nuclear atoms, quantum numbers of individual nucleus, quantum properties nuclear states, nuclear angular momentum, nuclear magnetic dipole moment.

Unit II: Nuclear forces and Stability of Nuclei: (Marks: 10)

Concept of mass defect, packing fraction and binding energy, binding energy curve and its significance. Nucleon-nucleon forces – qualitative discussions on nuclear force. Brief outline of Yukawa's meson theory, Nuclear stability, neutron proton ratio in stable nuclei, stability curve, odd-even rules of nuclear stability

Unit III: Nuclear models (Marks: 10)

Qualitative discussion of the liquid drop model of the nucleus in relation to the semi-empirical mass formula, Applications of mass formula – estimation of fission energy, prediction of most stable member of an isobaric family, qualitative discussion on the Shell model of the nucleus

Unit IV: Radioactivity and Nuclear reactions (Marks: 20)

Alpha decay: Cause of alpha decay, basic α -decay process, *Beta-decay*: Types of β -decays, Pauli's neutrino hypothesis, *Gamma-rays*: γ -rays and their origin.

Types of nuclear reactions, conserved quantities of nuclear reaction, energies of nuclear reaction – Q-value, qualitative discussion on induced radioactivity, spontaneous and proton induced reaction, alpha induced reaction, sustained nuclear chain reaction, nuclear fission and fusion.

Particle accelerators-van de Graaff generators, linear accelerators, cyclotron

Unit V: Cosmic Rays, Particle Accelerator & Detector (Marks: 18)

Origin of cosmic rays, primary & secondary cosmic rays, The East West effect, Latitude, longitude & altitude effect, Extensive Air Shower (EAS)

Construction and working principle of linear accelerator, Construction and working principle of a cyclotron

Principles of detection of charge particles, Construction and working principle of gas filled detectors, Ionization chamber – its construction & working principle

Unit VI: Elementary particles (Marks: 7)

Classification of elementary particles, qualitative introduction to leptons, quarks and gauge bosons, Fundamental Interactions, Conservation Laws

Suggested readings:

1. Nuclear Physics, D.C. Tayal, Himalaya Publishing House
2. Modern Physics, A.Beiser, Tata McGraw-Hill.
3. Atomic and Nuclear Physics, K. Gopalakrishnan, McMillan
4. Nuclear Physics, Irving Kaplan, Narosa Publishing House

CT-3-PHY -602
Condensed Matter Physics
Total Marks- 60
Total No. of Lectures: 64 L-2,T-1,P-0

Unit I: Crystal structure (Marks: 20)

Crystal structure, idea of a lattice, unit cell, Bravais' lattice, primitive lattice vectors, translational lattice vectors, Wigner-Seitz cell, Miller indices, some simple crystal structures (sc, bcc, fcc, hcp, diamond, zinc blend, NaCl, CsCl structures).

X-ray diffraction, Bragg's equation, reciprocal lattice for sc, bcc and fcc lattice, concept of Brillouin zone, lattice energy of ionic crystals, Born's theory, Madelung constant

Unit II: Properties of solids (Marks: 24)

Electrical and thermal conductivity of metals from classical free electron theory, Ohm's law, Wiedemann-Franz's law, Free electron Fermi gas, electron gas in one dimension and in three dimensions, density of states, E-k diagram, Fermi-Dirac distribution and Fermi level of energy.

Band theory of solids, formation of bands in a solid, classification of solids into metal, insulator and semiconductor, crystal potential due to periodic array of atoms, one dimensional Bloch theorem, Kronig-Penney model (qualitative idea only), important conclusions from the model, energy band diagram in reduced zone representation, effective mass

Unit III: Lattice Vibration (Marks: 10)

Basic Concept, Vibration of one dimensional monatomic lattice, Vibration of one dimensional diatomic lattice, quantization of lattice vibration, Phonons, Momentum of Phonons, inelastic scattering of photons by phonons, specific heat.

Unit IV: Superconductivity (Marks: 6)

Superconductivity: electrical and magnetic properties in the superconducting state, Meissner effect, type I and type II superconductors

Suggested readings:

1. Solid State Physics, C. Kittel, John Wiley and Sons
2. Solid State Physics, A.J. Dekker, McMillan
3. Elementary Solid State Physics, M. Ali Omar, Pearson Education
4. Solid State Physics, S.O. Pillai, New Age International
5. Introduction to Condensed Matter Physics, K.C.Barua, Narosa Publishing House Pvt Ltd.
6. Solid State Physics, Puri & Babbar, S. Chand & Company.

CT-3-PHY -603
Statistical Mechanics
Total Marks: 60
Total No. of Lectures: 64 L-2,T-1,P-0

Unit I: Classical statistical physics (Marks: 15)

Postulates of classical statistical mechanics, phase space, Liouville's theorem, Ensembles: micro canonical, canonical and grand canonical, Maxwell-Boltzmann (MB) distribution laws, thermodynamic interpretation of the Lagrange's undetermined multipliers appearing in the distribution laws

Unit II: Entropy and partition function (Marks: 10)

Statistical definition of entropy, Boltzmann relation between entropy and probability, Equilibrium condition, Partition function, thermodynamic variables in terms of partition function, calculation of partition function for an ideal monatomic gas

Unit III: Quantum statistical physics (Marks: 24)

Limitation of Maxwell-Boltzmann distribution law, basic postulates of quantum statistical mechanics, classical limit, symmetry of wave function of two particles, distribution laws for distinguishable and indistinguishable particles, Fermi-Dirac (FD) and Bose Einstein (BE) distribution functions, reduction of FD and BE statistics to MB statistics

Unit IV: Application of quantum statistical mechanics (Marks: 11).

Application of Bose-Einstein distribution law to an ideal Bose gas, photons as an ideal Bose gas, derivation of Planck's law of blackbody radiation and Stefan's law, Bose-Einstein condensation, application of Fermi-Dirac statistics to white dwarf stars, Chandrasekhar limit

Suggested readings:

1. Statistical Mechanics, K. Huang, John Wiley and Son
2. Statistical Mechanics, R.K. Patharia, Butterworth Heinemann
3. Statistical Mechanics, B.K. Agarwal, M. Eisner, New Age International Publishers
4. Statistical Physics, F. Reif, Tata McGraw Hill
5. Fundamentals of Statistical Mechanics, B.B. Laud, New Age International Publishers
6. Statistical Mechanics, K.M. Khanna, Today and Tomorrow, New Delhi

CT-3-PHY -604
(A)Astrophysics and Particle Physics
(Optional Course)
Total Marks: 60
Total No. of Lectures: 64 L-2,T-1,P-0

Unit I: Basic Concepts of Astronomy, properties of stars (Marks: 20)

Introduction to astronomy and astrophysics, ideas of celestial sphere, equator, ecliptic and constellations;

Apparent and absolute magnitudes of stars, distance modulus, color index, distance measurements by trigonometric parallax and Cepheid variables, bolometric magnitudes, flux of radiation, surface temperature of stars, mass-luminosity relation of main sequence stars, variable stars, star clusters (open and globular clusters), spectral classification, Hertzsprung- Russel diagram.

Unit II: Stellar structure and evolution (Marks: 10)

Hydrostatic equilibrium, temperature gradient, proto star, main sequence, nuclear energy generation, P-P chain and CNO cycle, red giants and super giants.

Unit III: Galaxies and cosmology (Marks: 10)

Types of galaxies, Hubble's classification (tuning fork diagram), size and shape of the Milky Way, difference between spirals and ellipticals; basic idea of cosmology, Newtonian cosmology, expansion of the universe- Hubble's law.

Unit IV: Properties of elementary particles (Marks: 10)

Concept of elementary particles, types of elementary particles, hadrons and leptons, intrinsic properties of elementary particles (mass, charge, spin, isospin, strangeness, hypercharge), bosons and fermions, particles and antiparticles, discovery of elementary particles.

Unit V: Fundamental interactions and conservation laws (Marks: 10)

Nature of interaction between elementary particles, four fundamental interactions, conservation laws for interaction of elementary particles, different particle reactions, conservation laws for electromagnetic, weak and strong force, Internal structure of protons, quarks and gluons

Suggested readings:

1. Introduction to Astrophysics: H. L. Duorah and K. Dourah (Authors)
2. An Introduction to Astrophysics: B. Basu (Prentice-Hall of India)
3. Astrophysics: Stars and Galaxies: K. D. Abhyankar(Orient Longman)
4. Galaxies: Structure and Evolution: R. J. Tayler (Cambridge University Press)
5. Introductory Astronomy and Astrophysics: S. A. Gregory and M. Zeilik (Brooks Cole)
6. Modern Physics: A. Beiser, TataMc Graw-Hill
7. Introduction to elementary particles, D.J.Griffiths, John Willey & Sons
8. Quarks and Leptons, F.Halzen & A.D.Martin, John Willey & Sons.

CT-3-PHY -604
(B) Space and Atmospheric Physics
(Optional Course)
Total Marks: 60
Total No. of Lectures: 64 L-2,T-1,P-0

Unit I: Lower Atmosphere (Marks: 22)

Atmospheric Structure, composition and thermodynamics:

Pressure, density and composition, Temperature structure, Equation of state, Changes of pressure with altitude, Entropy and potential temperature, Parcel concept, the available potential energy, Water in the atmosphere, The saturated adiabatic lapse rate, First law of thermodynamics

Unit II: Upper Atmosphere (Marks: 19)

The earth's ionosphere:

The D region, the E and F1 layers, the F region, F region anomalies, The balance of ionization, The basic theory of photoionization, Production of the ionospheric layers Loss reactions

Unit III: Physics of the Sun (Marks: 19)

The sun and the magnetic field in the sun, Solar activity, Prominences, Coronal heating, Solar flares, The solar wind

Suggested readings:

1. Introduction to Atmospheric Physics, D.G. Andrews, Cambridge University Press
2. Introduction to Ionospheric Physics, H. Rishbeth and O.K. Garriot, Academic Press
3. Introduction to Space Physics, M.G. Kivelson and C.T. Russell, Cambridge University Press

CT-3-PHY -604
(C) Laser and its Applications
(Optional Course)
Total Marks: 60
Total No. of Lectures: 64 L-2,T-1,P-0

Unit I: Introduction to Lasers (Marks: 20)

Absorption and emission of radiation, Spontaneous emission of radiation, stimulated emission, Einstein coefficients, significant of Einstein coefficients Basic Laser system requirements, Method of creation of population inversion, optical resonator, Q factor, optical cavity, Standing wave , Threshold condition for laser oscillator .

UnitII: Laser system (Marks: 10)

Description of Ammonia beam Maser, Ruby Laser, He-Ne Laser, Semi conductor Laser.

Unit III: Properties of Laser radiation (Marks: 10)

Intensity, Monochromaticity, Coherence properties of Laser radiation, spatial, and Temporal Coherence, Purity of spectral line and Temporal Coherence relation with Coherence, visibility of fringes and degree of coherence relation between visibility and coherence.

Unit IV: Laser Applications (Marks: 10)

Introduction: Basic principle of Fiber optics, structure and classification, acceptance angle and numerical aperture, Intermodal dispersion in a step index fiber, Ray path in index fiber, Fiber optics communication.

Unit V. Magneto-Optics and Electro Optics (Marks: 10)

Faraday effect- Determination of magnetic rotation, Classical theory of Faraday Effect, Kerr electro Optic effect, Harmonic generation, second harmonic generation

Suggested readings:

1. Modern Optics: Dr. A.B.Gupta, Books and Allied Pvt. Ltd. Kolkata.
2. Opto electronics: J. Wilson and J.F.B.Hawkes prentice Hall of India.
3. Lasers (Theory & applications): K, Thyagrajan and A.K.Ghatak, Macmillan India.
4. Lasers and Nonlinear Optics: B.B. Laud, New age international, Delhi
5. Laser and nonlinear optics: G D Baruah, Pragati Prakashan, Meerut

CT-3-PHY -604
(D) Material Science and Nanomaterials
(Optional Course)
Total Marks: 60
Total No. of Lectures: 64 L-2,T-1,P-0

Unit I: Classification and selection of Materials (Marks: 26)

Classification of materials, requirement of classifications, Engineering requirements, classification of engineering materials, organic, inorganic and biological materials
Semiconductors, Biomaterials, Advanced materials, Smart materials, nanostructured materials, spintronics, Material structure, Engineering metallurgy, Selection of Materials
Composites: Composite materials and its characteristics, Particle reinforced composites; Fibre reinforced composites and fabrication of composite materials

Unit II: Nano materials (Marks: 10)

Idea of nano structured materials, electron confinement in infinitely deep potential well, quantum dots, quantum wires, quantum wells, Carbon nanotubes

Unit III: Preparation of nanostructured materials (Marks: 12)

Different Physical and chemical methods, Plasma arcing, Chemical vapour deposition, Sol-gel technique, Electrodeposition, Chemical bath deposition

Unit IV: Nanomaterials characterization (Marks: 12)

Instruments, principle of measurements, measurement techniques: X-ray diffraction, scanning electron microscopy, transmission electron microscopy, scanning tunneling microscopy
Applications: nanostructured materials, Sensors, Catalysis, medical applications, advanced electronic materials, nano machines and novel devices

Suggested readings:

1. Physics of semiconductor nanostructures: K P Jain, Narosa
2. Nanoparticles and nanostructured films; Preparation, characterization and applications: J H Fendler, John Wiley & sons
3. Nanotechnology: Mick Wilson, K K G Smith, M Simmons, B Raguse; Overseas Press
4. Elements of Solid State Physics: J P Srivastava, Prentice Hall of India
6. Nanotechnology: M Ratner & D Ratner, Pearson Education

CP-4-PHY -605
Laboratory IV
Total Marks: 80
Total No. of Laboratory Session: 96 L-0,T-0,P-4

The examination should be on one experiment in 6 hrs.

List of experiments:

- I. Compare two high resistances using mirror galvanometer method.
- II. Determine the current in an external circuit by potentiometer and to compare emfs of two cells.
- III. To study the basic logic gates using the NAND gate.
- IV. To fabricate half-adder using NAND gate
- V. To determine the number of rulings per meter in a diffraction grating using a beam.
- VI. To study the characteristic curve of a Zener diode and to study it as a voltage regulator.
- VII. To determine Planck constant by using photocell
- VIII. To study frequency response curve of an RC couple amplifier using transistor.
- IX. To study the characteristics of full wave bridge rectifier and determine ripple factor and rectifier efficiency.

CP-4-PHY -606
Project Work
Total Marks: 80
Total No. of Laboratory Session: 96 L-0,T-0,P-4

Students will have to design simple electronic Circuits like

1. Battery Eliminator
2. Radio Transmitter
3. Radio Receiver
4. RC Couple Amplifier
5. Logic Gates
6. Transistor Characteristic apparatus

Students will prepare a project report under the guidance of a teacher and present the same at the examination

SCHEME OF COURSES, PHYSICS (ELECTIVE)

COURSE STRUCTURE AND ALLOTMENT OF PAPERS FOR EACH SEMESTER
EXAMINATION TO BE CONDUCTED BY
THE NORTH LAKHIMPUR COLLEGE (Autonomous)

Semester	Paper	Title	Marks	Credit	L-T-P
I	ET-5-PHY-101	Mechanics & Thermodynamics	100	5	4-1-0
II	ET-3-PHY-201	Optics	60	3	2-1-0
	EP-2-PHY-202	Practical-I	40	2	0-0-2
III	ET-5-PHY-301	Electromagnetism and Waves & Oscillations	100	5	4-1-0
IV	ET-3-PHY-401	Quantum Mechanics & Mathematical Physics	60	3	2-1-0
	EP-2-PHY-402	Practical-II	40	2	0-0-2
V	ET-4-PHY-501	Atomic & Molecular Physics	80	4	3-1-0
	ET-3-PHY-502	Nuclear Physics & Special Theory of Relativity	60	3	2-1-0
VI	ET-4-PHY-601	Electronics & Solid state Physics	80	4	3-1-0
	EP-3-PHY-602	Practical-III	60	3	0-0-3

Total credit: 34 (Theory- 27, Lab- 7)

ET-5-PHY -101
Mechanics & Thermodynamics
Total Marks: 100
Total No. of Lectures: 112 L-4,T-1,P-0

Unit I: (Marks: 25)

Laws of conservation of linear momentum and angular momentum of a system of particles, torque, moment of inertia of a rigid body and its physical significance, radius of gyration, kinetic energy of rotation, theorems on moment of inertia, calculation of moment of inertia of uniform rectangular lamina, spherical shell solid sphere and solid cylinder

Unit II: (Marks: 20)

Constrained motions and constraints, degrees of freedom, generalized co ordinates, transformation equations, virtual work, D' Alembert's principle, Lagrangian and its application, simple pendulum, Hamiltonian

Unit III: (Marks: 20)

Stress and strain, Young's modulus, Bulk modulus, modulus of rigidity, Poisson's ratio, relation among the constants, work done in twisting a wire; Surface tension of a liquid, surface energy, excess pressure inside a curved surface, rise of liquid in a capillary tube

Unit IV: (Marks: 20)

Zeroth and first law of thermodynamics, adiabatic and isothermal changes, second law of thermodynamics, reversible and irreversible process, Carnot's engine, definition of Entropy.

Unit V: (Marks: 15)

Kirchhoff's law, Stefan-Boltzman law, Spectral distribution, Wien's displacement law, Rayleigh-Jean's law and ultra violet catastrophe, Planck's hypothesis, Planck's black body distribution law

Suggested Readings:

For Units I, II & III

1. Elements of Properties of matter, D.S Mathur , S Chand & Company Ltd.
2. Classical Mechanics, H Goldstein, Narosa Publishing House
3. Classical Mechanics, Gupta, Kumar and Sharma , Pragati Prakashan
4. Elements of Mechanics, Gupta, Prakash, Agarwal, Pragati Prakashan

For Units IV&V

1. Heat, Thermodynamics and Statistical Physics, Brijlal, N. Subrahmanyam , & P. S Hemne, S Chand & Company Ltd.

ET-3-PHY-201

Optics

Total Marks: 60

Total No. of Lectures: 64 L-2,T-1,P-0

UNIT I: (Marks: 26)

Refraction at spherical surfaces, thin lenses, combination of lenses, lenses in contact and separated by a distance, achromatic combination of lenses, spherical and chromatic aberration, eyepieces,

Huygen's theory, reflection and refraction from curved surface, interference of light, Young's double slit experiment, Fresnel's biprism and Lloyd's mirror, Newton's ring

UNIT II: (Marks: 16)

Diffraction of light, Fresnel and Fraunhofer diffraction, Zone plate, diffraction at a straight edge, single slit, double slit,

UNIT III: (Marks: 18)

Polarization of light, production of polarized light, Brewster's law, double refraction, circular and elliptical polarization, analysis of polarized light (Nichol Prism), optical rotation

Suggested Readings:

1. Optics- A B Gupta, Books and Allied Ltd
2. A Text Book on Light, B. Ghosh, K.G. Mazumdar, Sreedhar Publishers
3. A Text Book of Optics, Brij Lal, Subrahmanyam & Avadhanulu, S. Chand & Company Ltd
4. Optics- A.K. Ghatak Tata McGraw Hill

EP-2-PHY -202
Practical -I
Total Marks: 40
Total No. of Laboratory Session: 64 L-0,T-0,P-2

The examination should be on one experiment in 4 hrs.

List of experiments:

1. To determine the acceleration due to gravity at your place with the help of a bar pendulum.
2. To determine surface tension of a liquid by Jaeger's method.
3. To determine the coefficient of viscosity of water by measuring the flow through a Capillary tube.
4. To determine the magnetic moment of the given bar magnet
5. To determine the value of horizontal intensity of earth's magnetic field at your place.
6. To verify the inverse square law of force in magnetism
7. To determine the angle of the given prism with a spectrometer obtaining the angle of minimum deviation
8. To determine the wave length of a monochromatic radiation using Newton's ring.

ET-5-PHY -301
Electromagnetism and Waves & Oscillations
Total Marks: 100
Total No. of Lectures: 112 L-4,T-1,P-0

Unit I: Electricity (Marks: 35)

Gauss's law and its application to calculation of fields due to hollow and solid sphere ,energy density in electric field ,capacitance with dielectrics, RC-circuits, charging and discharging of a capacitor, time constants , AC through R , C, and L , L-C-R circuits and resonance

Unit II: Magnetism (Marks: 20)

Magnetic potential, field intensity, magnetic shell, magnetic permeability, susceptibility, magnetization, magnetic intensity and their relation, dia-, para- and ferro-magnetic

Unit III: Electromagnetic Theory (Marks: 25)

Dielectric medium, displacement current, Biot-Savart law, Ampere's circuital law, vector potential, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic waves, Hertz experiment.

UNIT IV: Waves and Oscillations (Marks: 20)

Equation of motion of a progressive wave, longitudinal and transverse wave, superposition of waves, standing waves, transverse waves on a string, velocity of sound in a medium (solid, liquid and gas), Doppler effect

Suggested Readings:

For Unit I, II & III

1. Fundamentals of Magnetism and Electricity, D.N. Basudeva, S. Chand Company Ltd.
2. Electricity and Magnetism with Electromagnetic Theory and Special Theory of Relativity, D. Chattopadhyaya, Books and Allied, Kolkata
3. Electromagnetic B.B. Laud, New Age International.

UNIT IV

1. Waves and Oscillations, N.Subrahmanyam, Vani Educational Books, New Delhi
2. Waves and Oscillations, Gupta and Verma, S. Chand and Company Ltd.

ET-3-PHY-401
Quantum Mechanics and Mathematical Physics
Total Marks: 60
Total No. of Lectures: 64 L-2,T-1,P-0

Unit I: (Marks: 16)

Inadequacy of classical physics, wave particle duality of matter, de-Broglie hypothesis, experimental verification of wave nature of particle (Davisson-Germer experiment), Heisenberg's uncertainty principle with examples, gamma ray experiment

Unit II: (Marks: 16)

Schrodinger equation, interpretation of wave function, probability density and Probability current density, concept of wave packet, operators, expectation values of physical observables; particle in a one- dimensional box.

Unit III: (Marks: 14)

Scalar and vector fields, Gradient of scalar field, Divergence of a vector field, curl of a vector field, idea of line, surface and volume integration, Gauss' and Stokes' theorems.

Unit IV: (Marks: 14)

Classifications of differential equations, Solution of Differential equations of the first order and first degree (Variable Separation, Homogenous equations, Linear differential equation, Bernoulli equation, Exact differential equation) simple cases of ordinary differential equation of second order with constant coefficient.

Suggested Readings:

For Units I & II

1. Quantum Mechanics: G Aruldas, Prentice Hall of India
2. Quantum Mechanics: S P Kuila, New Central Book Agency (P) Ltd.
3. Quantum Mechanics: A.K Ghatak and S Lokanathan, McGraw Hill

For Units III & IV

1. Mathematical Physics: B.S Rajput, Pragati Prakashan

EP-2-PHY-402
Practical II
Total Marks: 40
Total No. of Laboratory Session: 64 L-0,T-0,P-2

The examination should be on one experiment in 4 hrs.

List of experiments:

1. To draw the I-D curve using a spectrometer for two monochromatic radiations.
2. To determine the thermal conductivity of a metallic rod by Searl's method.
3. To determine the resistance of a galvanometer by half-deflection method.
4. To determine the current in an external circuit by potential drop method using a potentiometer.
5. To study the static characteristics of a junction transistor in common emitter configuration.
6. To study a junction diode as a rectifier and to draw the I-V characteristics.
7. To determine the ratio of two specific heats of a gas by Clement and Desorme's method.
8. To determine the moment of inertia of a given body about an axis passing through its centre of gravity by the torsional oscillation method.

ET-4-PHY -501
Atomic and Molecular Physics
Total Marks: 80
Total No. of Lectures: 96 L-3,T-1,P-0

UNIT I: (Marks: 30)

Cathode rays, Franck-Hertz experiment, determination of e/m by Thomson's Method, Millikan's oil drop experiment, Production and properties of X-rays, Characteristic and continuous X-ray spectrum, photoelectric effect and its properties, Einstein's photoelectric equation, determination of Planck's Constant, Compton effect.

UNIT II: (Marks: 30)

Bohr's atom model, origin of spectral lines, Bohr's Correspondence principle, Sommerfeld's relativistic atom model, designation of spectral term symbols, Atomic spectra, atomic transition and origin of spectral lines, fine structure, L-S Coupling, j-j coupling, Zeeman effect, Stark effect.

X-ray Spectra: Continuous X-ray spectrum, Moseley's law, X-ray absorption spectra- Experimental and theoretical explanation, Comparison between X-ray and optical spectra

Unit III: (Marks: 20)

Molecular spectra: Pure rotational spectra, selection rules, vibrational spectra and selection rules, rotation-vibration spectra, P and R branches.

Rayleigh and Raman scattering, Raman Effect, classical and quantum theory of Raman effect.

Suggested Readings:

1. Atomic Physics: J.B.Rajam, S Chand & Company Ltd.
2. Fundamentals of Molecular Spectroscopy, Banwell and McCash, Tata McGraw Hill
3. Modern Physics, R. Murugesan, K. Sivaprasath, S. Chand & Company Ltd

ET-3-PHY -502
Nuclear Physics & Special Theory of Relativity
Total Marks: 60
Total No. of Lectures: 64 L-2,T-1,P-0

UNIT I: (Marks: 18)

Introduction, nuclear size and its determination, hypotheses of nuclear composition (proton-electron and proton-neutron hypothesis), Concept of mass defect, packing fraction and binding energy, binding energy curve and its significance, Qualitative introduction to the nature of nuclear forces

UNIT II: (Marks: 24)

Qualitative discussion of the liquid drop model of the nucleus in relation to the semi-empirical mass formula,

Types of nuclear reactions, conserved quantities of nuclear reaction, energies of nuclear reaction – Q-value, qualitative discussion on induced radioactivity, spontaneous and proton induced reaction, alpha induced reaction, sustained nuclear chain reaction, nuclear fission and fusion

Accelerators: Van-de-Graff generator, linear accelerator, cyclotron.

UNIT III: (Marks: 18)

Problem of absolute motion in classical physics, Ether hypothesis, nullity of ether hypothesis, Michelson-Morley experiment, Einstein's postulates of special relativity, Lorentz transformation, length contraction, time dilation, twin paradox, relativistic mass, mass energy relation.

Suggested Readings:

1. Nuclear Physics: D.C.Tayal, Himalaya Publishing House.
2. Concept of Modern Physics, Arthur Beiser, Shobhit Mahajan, S Rai Choudhury, Tata McGraw Hill Education Private Limited
3. Modern Physics, R. Murugesan, K. Sivaprasath, S. Chand & Company Ltd

ET-4-PHY-601
Electronics & Solid State Physics
Total Marks: 80
Total No. of lectures: 96 L-3,T-1,P-0

Unit I: (Marks: 18)

Semiconductor and insulators, electrons and holes in semiconductors, donor and acceptor impurity, generation and recombination of charge, diffusion, equation of continuity, Junction diode characteristics : The open circuit P-N junction, I-V characteristics P-N junction diode, breakdown diodes, diode as rectifier, half wave and full wave rectifier with resistance load, ripple factor, smoothing filters.

Unit II: (Marks: 28)

Transistor: PNP and NPN transistor, transistor as an amplifier, common emitter, common base and common collector connections, transistor biasing and thermal stabilization, amplifier, equivalent circuits, small signal transistor ,voltage amplifier, R- C coupled, L-C coupled amplifier. Oscillator: Transistor as sinusoidal oscillator, Barkhausen criterion, tuned collector, Hartley and RC oscillator.

Logic gates: binary numbers, decimal to binary and binary to decimal conversion, logic gates and their realization by P-N diodes and transistor, NAND and NOR gates

UNIT III: (Marks: 18)

Basic ideas of lattice and crystals, primitive lattice vectors, unit cell, translational lattice vectors, two and three dimensional Bravais lattices, some simple crystal structures (sc, bcc, fcc, hcp, Nacl), Miller indices and lattice planes, packing fraction for cubic crystal structure, Braggs law of diffraction by crystal planes.

UNIT IV: (Marks: 16)

Free electron theory of metals, Drude model, electrical and thermal conductivity, Wiedmann-Franz law, Band theory of solids, Classification of solids, metals, semiconductor and insulator, Phenomenon of superconductivity, critical temperature, Meissner effect Type I and Type II superconductors.

Suggested Reading:

1. Principles of electronics: V.K. Mehta, S. Sand and Company Ltd.
2. Hand Book of Electronics: S.L. Gupta and V.Kumar, Pragati Prakashan
3. Introduction to Solid State Physics, C.Kittel, Wiley Eastern
4. Solid State Physics, Puri & Babbar, S. Chand & Company Ltd.
5. Solid State Physics: S.O. Pillai, New Age International

EP-3-PHY -602
Practical III
Total Marks: 60
Total No. of Laboratory Session: 64 L-0,T-0,P-3

The examination should be on one experiment in 4 hrs.

List of experiments:

1. To determine the value of 'g' using Kater's pendulum.
2. To determine the surface tension of a liquid by the capillary rise method and verify Jurin's law.
3. To verify the laws of transverse vibration of string by Melde's method.
4. To find the optical rotation produced by an optically active solution using a polarimeter and then determine its specific rotations.
5. To determine the number of rulings per cm of a plane diffraction grating.
6. To study the Network Theorems.
7. To determine the modulus of rigidity using Maxwell's needle method.
8. To determine the resistivity of a wire using meter bridge.
9. To convert a galvanometer into a ammeter and a voltmeter.
10. To compare the e.m.f of two cells using a potentiometer
11. To determine the angular magnifying power of a telescope.