Syllabus

PHYSICS CPL-101

PAPER–1 : MECHANICS
[B.Sc : SEMESTER–1]

Time : 3 Hours

Marks for Major test (External) : 80
Marks for internal Exam : 20

Note : 1. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight short answer type questions each of 2 marks.

2. *The remaining eight questions are to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory.*
3. *The paper will include at least 20% of total marks as numerical problems.*

UNIT–I

Vectors: Scalar and vector fields, Derivatives of a vector with respect to a parameter, Gradient of a scalar field and its geometrical interpretation, Divergence and curl of a vector field, Lapalacian operator, Vector identities, Line, surface and volume integrals of Vector fields, Flux of a vector field, Gauss's divergence theorem, Stokes Theorem and their applications (no rigorous proofs) (Any mathematical physics book)

UNIT–II

(A) Time derivative of vectors with examples, Concepts of cartesian, polar and spherical coordinates, Motion in plane Polar Coordinates, velocity and acceleration in polar coordinates, Dynamics Using Polar Coordinates

(B) Momentum and Energy: Momentum, Conservation of momentum, Centre of mass, Centre of mass coordinates with examples, Motion of rockets, Work and energy, Conservation of energy

UNIT–III

(A) Dynamics of a system of particles: Elastic and inelastic collisions between particles, Centre of Mass and Laboratory frames

(B) Rotational Motion: Angular velocity and angular momentum, Moment of inertia and parallel and perpendicular axis theorem, Moment of inertia of (a) thin uniform wire (b) Thin rectangular sheet (c) Rectangular slab (d) ring (e) disc (f) spherical shell (g) solid sphere (h)

hollow sphere, Torque, Conservation of angular momentum, Angular momentum as vector

(C) Coriolis forces and its effect on motion

UNIT–IV

(A) Central force: Basics properties of central forces, Two body problem equivalent to one body problem and concept of reduced mass, Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant), Kepler's Laws of planetary Motion

(B) Elasticity: Hooke's law - Stress-strain diagram - Elastic moduli, Poisson's Ratio, Relation between four elastic constants, Bending moments, Bending of cantilever and centrally loaded beams

***

Syllabus

PHYSICS CPL-102

PAPER–2 : ELECTROSTATICS & MAGNETISM
[B.Sc. : SEMESTER–1]

Time : 3 Hours

Marks for Major test (External) : 80
Marks for internal Exam : 20

Note : Paper setter is required to set nine questions in all.

1. *Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight short answer type questions each of 2 marks.*
2. *The remaining eight questions are to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory*
3. *The paper will include at least 20% of total marks as numerical problems.*

UNIT–I

Electrostatics: Electrostatic Field, Electric flux, Gauss's theorem of electrostatics, Applications of Gauss theorem , Divergence and curl of electrostatic field and their physical significance, Electric potential, Electric potential as line integral of electric field, Calculation of electric field from potential, Energy stored in electrostatic field per unit volume

UNIT–II

Application of Electrostatics: Laplace and Poisson's equations for the electrostatic field, Multi-pole expansion of potential due to arbitrary charge distribution, Dielectric medium, Polarization, Bound charges in a polarized dielectric and their physical interpretation, Electric displacement , Gauss's theorem in dielectrics, Parallel plate capacitor completely filled with dielectric, Susceptibility, Permittivity and dielectric constants

UNIT–III

Magnetism: Lorentz force law, Magnetic forces, Magneto statics, Biot-Savart's law & its applications : (1) straight conductor (2) circular coil (3) solenoid carrying current, Divergence and curl of magnetic field, Ampere's circuital law and it's applications for simple current configurations, Magnetic vector potential

UNIT–IV

Magnetization: The field of a magnetized object, bound currents, ph
interpretation of bound currents, Ampere's law for magnetized object
Auxiliary field (H), Magnetic properties of materials, Permeability, Mag
susceptibility, diamagnetism, Para-magnetism and ferromagnetism,
Curve, Currie point

***

Syllabus

PHYSICS CPL - 201

PAPER–1 : MECHANICS
[B.Sc : SEMESTER–2]

Time : 3 Hours

Marks for Major test (External) : 80
Marks for internal Exam : 20

Note : *Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight short answer type questions each of 2 marks. The remaining eight questions are to be set uniformly having two questions from each unit. The student is required to attempt five question in all, selecting one question from each unit and Question no. 1 is Compulsory. The paper will include at least 20% of total marks as numerical problems.*

Course Objective	Course Outcome
The course on mechanics deals with Lagrangian formulation of mechanics, Oscillatory motion and damping and special theory relativity.	The student will be able to understand some advanced motion of mechanics, SHM and relativistic addition of velocities.

UNIT–I

Constrained motion, Degree of freedom and Generalized co-ordinates, Generalized displacement, velocity, acceleration, momentum, force and potential Hamilton's variational principle, Lagrange's equation of motion from Hamilton's principle, Application of Lagrange's equation for simple problems of mechanics

UNIT–II

Oscillations : Simple harmonic motion, Simple pendulum, Compound Pendulum, Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages, Damped oscillation, Forced oscillations.

UNIT–III

Theory of Relativity : Inertial and non-inertial frame of references, Galilean transformation (velocity, acceleration) and its inadequacy, Michelson-Morley Experiment and its outcom, Postulates of Special Theory of Relativity, Lorentz Transformation, Lorentz Transformations, Length contraction. Time dilation.

UNIT–IV

Application of Relativity : Relativistic transformation of velocity, frequency and wave number, Variation of mass with velocity, Massless Particles, Mass-energy Equivalence, Relativistic Doppler effect, Relativistic Kinematics, Transformation of Energy and Momentum, **Four Vectors.**

* * *

Syllabus

PHYSICS CPL-202

PAPER–2 : ELECTRICITY, MAGNETISM & ELECTROMAGNETIC THEORY–II
[B.Sc. : SEMESTER–2]

Time : 3 Hours ***Marks for Major test (External) : 80***
Marks for internal Exam : 20

Note : *Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight short answer type questions each of 2 marks. The remaining eight questions are to be set uniformly having two questions from each unit. The student is required to attempt five question in all, selecting one question from each unit and Question no. 1 is Compulsory. The paper will include at least 20% of total marks as numerical problems.*

Course Objective	Course Outcome
The course on Electricity, Magnetism deals with the Electromagnetic induction, Maxwell's Equations, Electromagnetic wave propagation, Poynting's Vecor and electromagnetic field transformation.	The student will be able to understand electromagnetic induction and it's applications, Maxwell's equations and generation of electromagnetic fields, wave propagation through vacuum and isotropicdielectricmedium. dielectric medium

UNIT–I

Electromagnetic Induction : Motional EMF, Faraday's laws of electromagnetic induction, Self and mutual inductance, Energy stored in magnetic field.
AC Circuit Analysis : AC circuit analysis using complex variables, AC circuits with (a) R and C (b) R and L (c) R, L and C, Series and parallel resonance circuits, Quality factors and its importance.

UNIT–II

Maxwell's equations : Maxwell's fixing of Ampere's law, Displacement current, Maxwell's equations in vacuum, Maxwell's equation in matter, The

continuity equation, Poynting Theorem and Poynting vector, Momentum and angular momentum in electromagnetic field (qualitative only), Energydensity in electromagnetic field.

UNIT–III

The wave equation, Sinusoidal waves, Wave equations for E and B fields, Electromagnetic wave propagation through vacuum and isotropic dielectric medium, tranverse nature of EM waves, Energy and momentum in EM waves, Propagation in linear media, Reflection and transmission at Normal and Oblique incidence, Brewster's angle.

UNIT–IV

Scalar and vector potential for electromagnetic fields, Gauge Transformation, Coulomb Gauge, Lorentz Gauge, Electric and magnetic dipole radiation, Magnetism as relativistic phenomenon, Transformation of electric and magnetic fields between two inertial frames.

***

SYLLABUS

G.J.U., Hissar

B.Sc. I

Physics Practical – I

Paper-I (CPP-108)

Time : 4 Hours *Max. Marks : 50*

Notes :

1. *Do any four experiments from each section.*
2. *The students are required to calculate the error involved in a particular experiment.*
3. *For giving marks under lab record, each college will maintain practical assessment record by using the following procedure :*
   Each student has to perform a minimum number of experiments prescribed in the syllabus.
   After the completion of a practical, the teacher concerned will check the notebook and conduct the viva-voce of each student to find out how much concepts related to the theoretical and experimental part of the experiment he/she has understood. According to his/her performance, marks will be recorded on their practical notebook. These marks will constitute the lab record.
4. *To compute the final marks for lab record, a separate register will be maintained. Each student will be assigned separate page on this register. On this page, the marks obtained by the student in different practicals will be entered. This record will be signed by the concerned teacher.*
5. *The lab record register will be presented to the external practical examiners for lab record marks. These external examiners will verify the record randomly.*

SECTION - A

1. Moment of Inertia of a fly-wheel.
2. M.I. of an irregular body using a torsion pendulum.
3. Surface tension by Jaeger's method.
4. Young's modulus by bending of beam.
5. Modulus of rigidity by Maxwell's needle.

SECTION - B

6. E.C.E. of hydrogen using a voltameter.
7. Determination of impedance of an A.C. circuit and its verification.
8. Frequency of A.C. mains by Sonometer using an electromagnet.
9. Frequency of A.C. mains by Sonometer using an electrical vibrator.
10. Low resistance by Carey Foster's bridge with calibration.

SYLLABUS

GURU JAMBHESHWAR UNIVERSITY, HISAR
B.Sc.II, Semester–III

Core Course –VI CPL-301
Semiconductor Devices
(Credits – 02, 30 Hrs (2 Hrs/week))

Marks for Major test (External): 80
Marks for internal Exam : 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit.The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory. The paper will include at least 20% of total marks as numerical problems.

Course Objective	Course Outcome
The course on Semiconductor Devices deals with basic semiconductor properties, band formation, intrinsic and extrinsic semiconductors and formation of junction. After discussing the transistor physics, applications of diodes and transistors in various devices are given.	The student will be able to understand the semiconductor junctions, transistors and various devices based on these basic semiconductor elements.

UNIT–I

Semiconductor Diodes and applications : p and n type semiconductors. Barrier Formation in PN Junction Diode, Drift and Diffusion Currents, Current flow mechanism in Forward and Reverse biased PN Junction Diodes mentioning the roles of drift and diffusion currents, V-I characteristics of PN Junction Diode, Static and Dynamic Resistance, Applications of PN Junction Diode as Half-wave rectifier, Full-wave Rectifier (both center-tapped and bridge FWR),Calculation of ripple factor and rectification efficiency, Zener Diode, Applications of Zener Diode as DC voltage Regulator, Principle and structure of (1) LEDs (2) Photodiode (3) Solar Cell.

UNIT–II

Semiconductor Transistors: Bipolar Junction transistors: n-p-n and p-n-p Transistors, Biasing of transistors in Active, Cutoff, and Saturation Modes, Circuit configurations of CB ,CE and CC transistors, characteristics of transistors in CB,CE and CC, Current gains α and β. Relations between α and β, Current gain and power gain, DC Load line and Q- point.

UNIT–III

Amplifiers and Their Biasing : Voltage Divider Bias Circuit for CE Amplifier, bias stabilization, Class-A, B&C amplifiers, RC coupled amplifiers and its frequency response, Feedback in amplifiers, positive and negative feedback in amplifiers, Advantages of negative feedback in amplifiers.

Sinusoidal Oscillators : Barkhausen's Criterion for Self-sustained oscillations, Circuit and working of Hartley oscillator, Circuit and working of Colpit's oscillator, Uses of oscillator.

UNIT–IV

Operational Amplifiers (Black Box approach) : Qualitative idea of differential amplifier, CMRR, Characteristics of an Ideal and Practical Op-Amp (IC 741), Open-loop& Closed-loop Gain. concept of Virtual ground, Applications of Op-Amps as Inverting Amplifier, Non-inverting Amplifier, Differentiator, Integrator.

SYLLABUS

GURU JAMBHESHWAR UNIVERSITY, HISAR
B.Sc.II, Semester–III

CPL-302
Core Course-V
HEAT AND THERMODYNAMICS
(Credits – 02, 30 Hrs (2 Hrs/week))

Marks for Major test (External): 80
Marks for internal Exam : 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory, The paper will include at least 20% of total marks as numerical problems.

Course Objective	Course Outcome
The course on Thermal physics deals with some important laws of thermodynamics, concepts of heart, work, temperature and entropy. Behavior of real gases as thermodynamical systems will be of interest.	The student will be able to understand basic concepts of thermodynamical systems.

UNIT–I

Zeroth and First Law of Thermodynamics : Extensive and intensive thermodynamic variables, Thermodynamic equilibrium, Zeroth law and Concept of Temperature, Work and heat, State functions, First law of thermodynamics, Internal energy, Applications of first law, General relation between C_p and C_v, Work done during isothermal and adiabatic Processes .

Second Law of Thermodynamics : Reversible and Irreversible process with examples, Conversion of Work into Heat and Heat into Work, Heat Engines, Carnot's Cycle, Carnot engine & efficiency, Refrigerator & coefficient of performance, 2nd Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their Equivalence, Carnot's Theorem

UNIT–II

Entropy and Third law of Thermodynamics : Concept of entropy, Clausius theorem, Clausius Inequality,Second Law of Thermodynamics in terms of Entropy, Entropy of a Perfect Gas and

Universe, Entropy Changes in Reversible and Irreversible Processes, Principle of Increase of Entropy, Third Law of Thermodynamics, T-S Diagrams, Phase Change, Classification of Phase Changes.

UNIT–III

Thermodynamic Potentials : Extensive and Intensive Thermodynamic Variables, Internal Energy, Enthalpy, Gibbs, Helmholtz function and Their Definitions, Properties and Applications.
Maxwell's Thermodynamic Relations: - Derivations of Maxwell's Relations. Applications of Maxwell's Relations: (1) Clausius Clapeyron equation, (2) Values of $C_p - C_v$, (3) Energy equations (4) Change of temperature during adiabatic process.

UNIT–IV

Real gases : Behaviour of Real Gases, Deviations from the Ideal Gas Equation. The Virial Equation, Critical Constants. Continuity of Liquid and Gaseous State. Vapour and Gas, Boyle Temperature, Van der Waal's Equation of State for Real Gases. Values of Critical Constants. Law of Corresponding States. Comparison with Experimental Curves, p-V Diagrams, Joule's Experiment, Free Adiabatic Expansion of a Perfect Gas.

Syllabus

GURU JAMBHESHWAR UNIVERSITY, HISAR

PHYSICS

STATISTICAL MECHANICS CPL-401

[B.Sc : SEMESTER–4]

UNIT–I

Statistical Basis of Thermodynamics : Statistical Basis, probability and Frequency, Permutations and Combinations, Distribution of a n distinguishable and indistinguishable particles in two boxes, Macrostate and Microstate, Thermodynamic Probability, Fluctuations and their Dependence on n : (narrowing of probability distribution with increasing n), Constraints on a System, Statics and dynamics system, most probable state, Concept of cell in a compartment, Concept of Ensembles and type of Ensembles (Qualitative Idea only) Universal Law in Statistics : Fundamental Postulates of Statistical Mechanics, Density of Quantum States of energy of a particle, Entropy and thermodynamics Probability, Statistical Interpretation of 2nd law of thermodynamics, Partition function and Relation with Thermodynamics Quantities.

UNIT–II

Kinetic Theory of Gases : Maxwell-Boltzmann Law of Distribution of Particle speed in an Ideal Gas and its Experimental Verification, Mean, RMS and Most Probable Speeds. Molecular Collisions : Mean Free Path. Collision Probability, Estimages of Mean Free Path, Transport Phenomenon in Ideal Gases : (1) Viscosity, (2) Thermal Conductivity, (3) Diffusion. Brownian Motion and its Significance. Equipartition Law : Degrees of Freedom, Law of Equipartition of Energy (No proof required) and its application to the specific heat of monoatomic and diatomic gases and its limitations.

UNIT–III

Classical Statistical : Phase space and Application to one Dimension Harmonic Oscillator and Free particle. Division of phase space into cells. Basic approach in three statistics. Maxwell Boltzmann Distribution Law, Thermodynamic Functions of Finite Number of Energy Levels, Negative Temperature, Thermodynamic Functions of an Ideal Gas, Classical Entropy.

UNIT–IV

Bose-Einstein Statistics : B.E. distribution law, Thermodynamic functions of a Completely Degenerate Bose Gas, Bose-Einstein condensation, properties of liquid He (qualitative description), Radiation as photon gas, Bose's derivation of Planck's law. Fermi-Dirac Statistics : - Fermi - Dirac Distribution Law, Thermodynamic functions of an ideal Completely Degenerate.

Syllabus

GURU JAMBHESHWAR UNIVERSITY, HISAR

PHYSICS CPL-402

WAVES AND OPTICS

[B.Sc : SEMESTER–4]

UNIT–I

Wave Motion : Wave Equation, Solution of wave equation, Particle and Wave Velocities, Intensity of Wave, Superposition Principle, Group velocity, Phase velocity.

Transverse Waves : The string as a force oscillator, Velocity of Transverse Vibrations of Stretched Strings, Reflections and transmission of waves on a string at a boundary, Transverse wave on a string. Travelling and standing waves on a string, Normal Modes of a string, Reflections and transmission of Energy.

Longitudinal Waves : Velocity of Longitudinal Waves in a Fluid in a Pipe, Newton's Formula for Velocity of Sound, Laplace's Correction (qualitative), Reflections and transmission of sound waves at a boundary, Energy distribution in sound waves.

UNIT–II

Interference : Division of amplitude and division of wave front, Young's Double Slit experiment, Lloyd's Mirror and Fresnel's Biprism, Phase change on reflection : Stokes' treatment,

Interference in Thin Films : Parallel and wedge-shaped films, Newton's Rings : measurement of wavelength and refractive index.

UNIT–III

Diffraction : Fresnel Diffraction : Fresnel's Assumptions, Fresnel's Half-Period Zones for Plane wave, Rectilinear propagation of Light, Theory of a Zone Plate and its application, Multiple Foci of a Zone Plate, Qualitative description for Fresnel diffraction pattern of a straight edge, a slit and a wire. Fraunhofer diffraction : Single slit, Double slit multiple slits and '*n*' multiple slits, diffraction grating and it's resolving power, Rayleigh Criteria of the limit of resolution and Resolving Power of a telescope.

UNIT–IV

Polarization : Plane polarized light – Production and analysis, Circular and elliptical polarization, Optical activity, Specific Rotation.

Fibre Optics : Optical Fibres – Construction and working, Critical angle of propagation, Modes of propagation, Acceptance angle, Attenuation. Advantages and applications of Optical Fibre.

SYLLABUS

G.J.U., Hissar

B.Sc. II

Physics Practical – III

Paper-III (CPP-308)

Time : 4 Hours

Notes : *Max. Marks : 50*

1. *Do any four experiments from each section.*
2. *The students are required to calculate the error involved in a particular experiment.*
3. *For giving marks under lab record, each college will maintain practical assessment record by using the following procedure :*

   Each student has to perform a minimum number of experiments prescribed in the syllabus.

   After the completion of a practical, the teacher concerned will check the notebook and conduct the viva-voce of each student to find out how much concepts related to the theoretical and experimental part of the experiment he/she has understood. According to his/her performance, marks will be recorded on their practical notebook. These marks will constitute the lab record.
4. *To compute the final marks for lab record, a separate register will be maintained. Each student will be assigned separate page on this register. On this page, the marks obtained by the student in different practicals will be entered. This record will be signed by the concerned teacher.*
5. *The lab record register will be presented to the external practical examiners for lab record marks. These external examiners will verify the record randomly.*

List of Experiments :

1. To measure the (a) area of a window (b) height of an inaccessible object.
2. Refractive index and dispersive powder of a prism material by spectrometer.
3. To draw a graph between wave length and minimum deviation for various lines from a Mercury dischage source.
4. Determination of wavelength of Na light and the number of lines per centimeter using a diffraction grating.
5. To draw common base and common emitter characteristics of a transistor and calculate transistor characteristics parameters.
6. To study the ripple factor in a d.c. power supply.
7. Study of Hartley oscillator (calibration of gang condenser).
8. To measure (a) Voltage, and (b) Frequency of a periodic waveform using a CRO.
9. Study of voltage doubler and trippler circuits.
10. To determine value of Boltzmann constant using V-I characteristics of PN diode.
11. To determine the Frequency of an Electricity Maintained Tuning Fork by Melde's Experiment and to verify $\lambda^2 - T$ Law.

CPL-501

Discipline Specific Course-I

Elements of Modern Physics

(Credits – 02, 30 Hrs (2 Hrs/week))

Marks for Major test (External): 80

Marks for internal Exam: 20

Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory, The paper will include at least 20% of total marks as numerical problems.

Course Objective	Course Outcome
The course on Elements of Modern Physics deals with Bohr Model, Fundamentals of Wave Mechanics, Heisenberg uncertainty principle, Schrodinger Equation and LASER.	The student will be able to understand Photo-electric effect and Compton scattering, calculation of energy levels for Hydrogen like atoms, Principle and working of LASER systems.

UNIT-I

Introduction to Quantisation: Properties of Thermal Radiation, Spectral Distribution of Blackbody Radiation, Kirchhoff's Law, Stefan-Boltzmann Law and Wien's Distribution and Displacement law, Rayleigh-Jean's Law, Ultraviolet Catastrophe, Planck's Quantum Postulates, Planck's Law of Blackbody Radiation: Experimental Verification.

Photo-electric effect and Compton scattering; Pair production and annihilation, Bremsstrahlung effect, Cherenkov radiation, Production of X-rays.

UNIT-II

Bohr Model: Drawbacks of Rutherford model, Bohr atomic model; Bohr's quantization rule and atomic stability; Calculation of energy levels for hydrogen like atoms and their spectra, Effect of nuclear mass on spectra, Correspondence principle.

Fundamentals of Wave Mechanics: De Broglie wavelength and matter waves; Wave-particle duality; Frank-Hertz, Davison and Germer experiment, phase velocity, group velocity and their relations.

UNIT-III

Heisenberg Uncertainty Principle; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle, Properties of wave-function, Physical Interpretation of wave-function.

Schrodinger Equation: Momentum and Energy operators, Stationary states, Physical interpretation of a wave function, probabilities and normalization, Schrodinger Equation, Particle in1-dimention infinite potential well.

UNIT – IV

LASER: Absorption and emission of radiation (qualitative only); Basic features of LASER, Population inversion; Resonance cavity; laser pumping; threshold condition for laser emission; Einstein's Co-efficient, 3 level and 4 level system, Basic principle and working of He-Ne LASER and Ruby LASER, Applications of LASER.

Reference Books:

- Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill.
- Modern Physics, John R. Taylor, Chris D. Zafiratos, Michael A. Dubson,2009, PHI Learning.
- Quantum Physics, Berkeley Physics Course Vol.4. E.H. Wichman, 2008, Tata McGraw-Hill Co.
- Modern Physics, R.A. Serway, C.J. Moses, and C.A. Moyer, 2005, Cengage Learning.

CPL-502

Discipline Specific Course-II
Nuclear Physics
(Credits – 02, 30 Hrs (2 Hrs/week))

Marks for Major test (External): 80
Marks for internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory, The paper will include at least 20% of total marks as numerical problems.

Course Objective	Course Outcome
The course on Nuclear Physics deals with Basic Properties of Nuclei Radioactivity, Nuclear Models and nuclear forces, Radiation Interaction, Nuclear Reactions, Nuclear Radiation Detector and Nuclear Reactors.	The student will be able to understand Nuclear composition and nuclear properties, Nuclear models, Nuclear detectors and reactors.

UNIT-1

Basic Properties of Nuclei: Nuclear composition (p-e and p-n hypotheses), Nuclear properties; Nuclear mass, size, spin, parity, magnetic dipole moment, quadruple moment (shape concept) and binding energy, nuclear binding energy curve.

Radioactivity: Law of Radioactive Decay, Half-life, Radioactive Series, α-decay: Range of α-particles, Geiger-Nuttal law and α-particle Spectra, β-decay, Energy Spectra and Neutrino Hypothesis, γ-decay : Origin of γ-rays.

UNIT-II

Nuclear Models and Nuclear Forces: Similarity between nuclear matter and liquid drop, Liquid Drop Model, Semi-classical Mass formula, Limitations of liquid drop model, Magic number, Experimental signature of shell structure in nuclei, Nuclear Shell Model (qualitative only) and its application, Meson Theory of Nuclear Forces.

UNIT -III

Radiation Interaction: Interaction of heavy charged particles (proton, Alpha particles etc.); Energy loss of heavy charged particle (Discussion of Bethe formula), Range of alpha particles. Interaction of light charged particle (Beta-particle), Interaction of Gamma Ray; Passage of Gamma radiations through matter (Photoelectric, Compton and pair production effect), Absorption of Gamma rays (Mass attenuation coefficient),

Nuclear Reactions: Types of nuclear reactions, Concept of reaction cross-section, Concept of Compound and Direct Reactions.

UNIT- IV

Nuclear Radiation Detectors: Gas filled counters; Ionization chamber, proportional counter, G.M. Counter (detailed study), Basic principle of scintillation counter and semiconductor detectors.

Nuclear Reactors: General aspects of reactor design, Nuclear fission reactor (Principle, construction, working and use) **Particle Accelerators:** Particle Accelerator facilities in India, Linear Accelerator, Cyclotron, Synchrotron

References:

- Concepts of Modern Physics by Arthur Beiser (McGraw-Hill Book Company, 1987)
- Nuclear Physics, S. B. Patel, New Age publication
- Introduction to the physics of nuclei and particles by R.A. Dunlap.(Singapore: Thomson Asia, 2004).
- Nuclear physics by Irving Kaplan. (Oxford & IBH, 1962).
- Introductory nuclear physics by Kenneth S. Krane.(John Wiley & Sons, 1988).

CPP- 508

Practical -V; Physics Lab--V
(Credits: 02, 60 Hours (4hrs. per week))

Max marks: 100
Examination Time: 3 Hours

Note:

1. *Each student should perform any seven experiments.*
2. *The students are required to calculate the error involved in a particular experiment.*
3. *For giving marks under Lab. Record each college will maintain practical assessment record by using the following procedure:-*
   i. *Each student has to perform a minimum number of experiments prescribed in the syllabus.*
   ii. *After completion of experiment, the teacher will check the note book and conduct Viva – voce of each student to find out how much theoretical and experimental concept the student has understood. Lab. record will be maintained by giving marks on his practical note-book.*
4. *To compute total marks for lab. performance, a separate register will be maintained. Each student will be assigned separate page on this register. Marks obtained by the student in different experiements will be entered. This record will be signed by the concerned teacher.*
5. *The laboratory 'record register' will be presented to each external examiner for Lab. Record marks. External examiners may verify the record randomly.*

List of Experiments

1. Determine e/m by Thomson's method
2. Study the frequency response of C B transistor amplifier
3. To determine Hall coefficient of a semiconductor sample.
4. Measurement of energy band gap of Ge/Si by four probe method
5. (a) Draw the plateau using G M counter (b) Determine the mass attenuation coefficient by G M counter
6. Determine the wavelength of Na by Fresnel Byprism
7. Diameter of a Lycopodium powder using corona rings
8. Study double slit interference by He-Ne laser
9. Determine the diameter of a thin wire using (He-Ne Laser) diffraction method

Extended list of experiments that may be added in above list (Experiments based on Computer programming in FORTRAN language.)

1. Compute the product of two matrices of different dimension using DO loop
2. Numerical integration by Simpson 1/3 rule
3. Fitting of a straight line using Least-Square method

References:

1 Worsnop and Flint, Advanced Practical Physics
2 Nelkon M and Ogborn, Advanced Level Practical Physics, Heinemann Education Bookd Ltd, New Delhi
3 Srivastava S S and Gupta M K, Experiments in Electronics, Atma Ran & Sons, Delhi 4 Gupta S L and Kumar V, Practical Physics, Pragati Prakashan, Meerut.

CPL- 601
Discipline Specific Course-III
Solid State Physics
(Credits – 02, 30 Hrs (2 Hrs/week))

Marks for Major test (External): 80
Marks for internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory, The paper will include at least 20% of total marks as numerical problems.

Course Objective	Course Outcome
The course on Solid State Physics deals with some important concepts of crystal structure, lattice vibrations, band theory, magnetic properties of matter and superconductivity.	The student will be able to understand the concept of crystal planes and Miller indices, Phonon, Curie law, Applications of Superconductivity.

UNIT-I

Crystal Structure I: Crystalline and glassy forms, liquid crystals, crystal structure, periodicity, lattice and basis, crystal translational vectors and axes. Unit cell and Primitive Cell, Winger Seitz primitive Cell, symmetry operations for a two dimensional crystal, Bravais lattices in two and three dimensions. Crystal planes and Miller indices, Inter-planer spacing, Crystal structures of Zinc Sulphide, Silicon, Sodium Chloride and Diamond.

UNIT- II

Crystal Structure II: X-ray diffraction, Bragg's Law and experimental X-ray diffraction methods. K-space and reciprocal lattice and its physical significance, reciprocal lattice vectors, reciprocal lattice to a simple cubic lattice, b.c.c. and f.c.c.

Lattice vibrations: Phonon concept, Vibration of monoatomic and diatomic lattice, Acoustical and optical modes, Dispersion relation for phonons, Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids, Debye T^3 law.

UNIT- III

Band Theory: Free electron gas models, Nearly free electron model, Bloch function, Kronig Penny model, Velocity and Effective mass of electron, Distinction between metals, semiconductors and insulators, Hall Effect

Magnetic Properties of Matter: Dia-, Para-, Ferromagnetic Materials, Classical Langevin Theory of dia - and Paramagnetic Domains, Curie's law.

UNIT- IV

Super Conductivity: Historical introduction, Survey of superconductivity, Super conducting systems, High T_c Super conductors, Isotopic Effect, Critical Magnetic Field, Meissner Effect, London Theory and Penetration Depth, Classification of Superconductors (type I and Type II), BCS Theory of Superconductivity, Flux quantization, Josephson Effect (AC and DC), Practical Applications of superconductivity and their limitations.

Reference Books:

- Solid State Physics, M.A. Wahab, Narosa Publication
- Solid state physics, S.O. Pillai, New Age Publication
- Introduction to Solid State Physics, Charles Kittel, 8th Edition, 2004, Wiley India Pvt. Ltd.
- Elements of Solid State Physics, J.P. Srivastava, 4th Edition, 2015, Prentice-Hall of India

CPL-602
Discipline Specific Course-IV
Quantum Mechanics
(Credits – 02, 30 Hrs (2 Hrs/week))

Marks for Major test (External): 80
Marks for internal Exam : 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory, The paper will include at least 20% of total marks as numerical problems.

Course Objective	Course Outcome
The course on Quantum Mechanics deals with applications of Schrodinger equation, spectroscopic terms and Rotational and vibrational spectra of diatomic molecules	The student will be able to understand basic concepts of Quantum Mechanics, one dimentional Harmonic Oscillator problem,Coupling Schemes, Rotational and vibrational spectra of diatomic molecules.

UNIT -1

Basics of Quantum Mechanics: Wave function and its physical significance, Properties of wave-function, Orthogonality and Normalization of wave function, Time dependent Schrodinger wave equation, Time Independent Schrodinger Equation, Momentum and Energy operators; Hermitian Operators- Eigenvalue and Eigen functions, Commutator relations of various operators, Stationary states; Probabilities and normalization, Probability current densities and its relation to wavefunction, Expectation Values of Dynamical quantities, Particle in 1-dimention Infinite Square Well (Energy levels and general Wavefunction)

UNIT-2

Application of Schrodinger Wave Equation: Solution of Schrodinger Equation for the Finite Potential Well, 1-Dimention Harmonic Oscillator problem - Algebraic and Analytical solutions, Free particle and concept of group velocity, Tunneling through finite potential barrier - Examples of alpha decay and tunnel diodes (qualitative only), Generalized uncertainty principles for Position-Momentum and Energ

UNIT-3

Larmor's precession, Spectroscopic terms and their notation, Selection rule, Orbital magnetic dipole moment (Bohr magneton), Coupling scheme; LS or Russel-Saunders Coupling scheme and JJ coupling scheme, Pauli principal, Hyperfine structure of spectral lines and its origin, isotopic effect, Atom in external magnetic field; Normal Zeeman effect

UNIT-4

Rotational spectra of diatomic molecules as rigid rotator, energy levels, Rotational spectra of diatomic molecules as non-rigid rotator, Intensity of rotational lines, Vibrational spectra, Vibrational-Rotational, Raman and electronic spectra of molecules: Vibrational energy of diatomic molecules, Molecules as Harmonic Oscillator

Reference:

- Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill
- Quantum Mechanics, D.J. Griffith, Pearson Ltd.
- Quantum Mechanics, V. K. Jain
- Quantum Physics, Berkeley Physics Course Vol.4. E.H. Wichman, 2008, Tata McGraw-Hill Co.

CPP- 608

Practical -VI; Physics Lab--VI
(Credits: 02, 60 Hours (4hrs. per week))

Max. Marks: 100
Examination Time: 3 Hours

Note:

1. *Each student should perform any seven experiments.*
2. *The students are required to calculate the error involved in a particular experiment.*
3. *For giving marks under Lab. Record each college will maintain practical assessment record by using th following procedure:-*
   iii. *Each student has to perform a minimum number of experiments prescribed in the syllabus.*
   iv. *After completion of experiment, the teacher will check the note book and conduct Viva – voce of eac student to find out how much theoretical and experimental concept the student has understood. La record will be maintained by giving marks on his practical note-book.*
4. *To compute total marks for lab. performance, a separate register will be maintained. Each student will b assigned separate page on this register. Marks obtained by the student in different experiements will b entered. This record will be signed by the concerned teacher.*
5. *The laboratory 'record register' will be presented to each external examiner for Lab. Record mark External examiners may verify the record randomly.*

List of Experiments

1. Study the frequency response of C E transistor amplifier
2. Study the B H curve using oscilloscope
3. Experiments based on application of OPAMP
4. Determine the velocity of ultrasonic in the Kerosene oil
5. Photo electric effect:
   I. Photo current *vs* Intensity.
   II. Energy of photo electron *vs* frequency of light photon.
6. Determine the resolving power of a prism
7. Thickness of a thin paper using interference fringes in an air wedge
8. Determine the resolving power of a transmission grating

Extended list of experiments that may be added in above list (Experiments based on Computer programming in FORTRAN language.)

1. Using array variable, find out the average and standard deviation
2. Compute the sum of a finite series up to correct three decimal place
3. With the help of a program arrange the marks in ascending of descending order

References:

1 Worshnop and Flint, Advanced Practical Physics
2 Nelkon M and Ogborn, Advanced Level Practical Physics, Heinemann Education Bookd Ltd, New Delhi
3 Srivastava S S and Gupta M K, Experiments in Electronics, Atma Ran & Sons, Delhi 4
Gupta S L and Kumar V, Practical Physics, Pragati Prakashan, Meerut.