S. S. Jain Subodh P.G. (Autonomous) College Jaipur

SYLLABUS

B.Sc. Pass Course
Subject - Physics

(Semester Scheme)

I & II Semester Examination   2022-2023
III & IV Semester Examination   2023-2024
V & VI Semester Examination   2024-2025
[Onwards]

S. S. Jain Subodh P.G. (Autonomous) College, Jaipur
Bachelor of Science (B.Sc. Pass Course)
Subject – Physics

Examination Scheme

Semester - I		
Paper	**Nomenclature of paper**	**Max. Marks**
PAPER – I	MECHANICS – I	50 Marks
PAPER – II	ELECTROMAGNETISM – I	50 Marks
PAPER – III	OPTICS –I	50 Marks
Physics Practical – I		75 Marks
Semester – II		
Paper	**Nomenclature of paper**	**Max. Marks**
PAPER – I	MECHANICS – II	50 Marks
PAPER – II	ELECTROMAGNETISM – II	50 Marks
PAPER – III	OPTICS – II	50 Marks
Physics Practical – II		75 Marks
Semester - III		
Paper	**Nomenclature of paper**	**Max. Marks**
PAPER – I	THERMODYNAMICAL AND STATISTICAL PHYSICS - I	50 Marks
PAPER – II	MATHEMATICAL PHYSICS AND SPECIAL THEORY OF RELATIVITY –I	50 Marks
PAPER – III	ELECTRONICS & SOLID STATE DEVICES – I	50 Marks
Physics Practical– III		75 Marks
Semester - IV		
Paper	**Nomenclature of paper**	**Max. Marks**
PAPER – I	THERMODYNAMICAL AND STATISTICAL PHYSICS - II	50 Marks
PAPER – II	MATHEMATICAL PHYSICS AND SPECIAL THEORY OF RELATIVITY –II	50 Marks
PAPER – III	ELECTRONICS & SOLID STATE DEVICES – II	50 Marks
Physics Practical - IV		75 Marks
Semester - V		
Paper	**Nomenclature of paper**	**Max. Marks**
PAPER – I	QUANTUM MECHANICS – I	50 Marks
PAPER – II	NUCLEAR PHYSICS – I	50 Marks
PAPER – III	SOLID STATE PHYSICS – I	50 Marks
Physics Practical – V		75 Marks
Semester - VI		
Paper	**Nomenclature of paper**	**Max. Marks**
PAPER – I	QUANTUM MECHANICS – II	50 Marks
PAPER – II	NUCLEAR PHYSICS – II	50 Marks.
PAPER – III	SOLID STATE PHYSICS – II	50 Marks
Physics Practical – VI		75 Marks

Marks Break-Up : End-Semester Exam 35 Marks + Internal Assessment (CIA) 15 Marks = Total 50 Marks Per Paper.

Practical Marks : External Practical 45 Marks + Internal Practical Exam 30 Marks = Total 75 Marks.

Theory Classes : Two hours per week for each of the papers; end-semester exam duration of three hours for each of the papers.

Practical Classes : Four hours practical classes per week; practical end-semester examination of three hours duration.

S. S. Jain Subodh P.G. (Autonomous) College, Jaipur
B.Sc. Pass Course – Physics

Examination Scheme For Each Paper

Part A 7 QUESTIONS (Very Short Answer Questions)   7 X 1 MARK EACH = 7 Marks

Part B 4 QUESTIONS (1 Question From Each Unit With Internal Choice)

                                                4 X 7 MARK EACH = 28Marks

Max. Marks of End-Semester Exam (Duration of Exam of 3 Hours)   = 35 Marks

Internal Assessment (CIA)   = 15 Marks

Maximum Marks (Each Theory Paper)   = 50 Marks

Max. Practical Marks   = 75 Marks
                    (External Practical Exam Marks 45 + Internal Practical Exam Marks 30)

Total of Theory Papers : 3 X 50 Marks Each = 150 Marks

(Min. Pass Marks 40% = 60 Marks)

Total of Practical Marks   = 75 Marks

Grand Total of Subject per Semester   = 225 Marks

B.Sc. Pass Course - Physics

Semester I

Paper I : Mechanics – I

Duration: 3 hrs.   **Max. Marks: 35**

Note : There will be two parts in end-semester theory paper.
Part A of the paper shall contain eight short answer questions and the candidate is required to attempt any seven questions. Each question will carry 1 mark for correct answer. (7x1 mark each = 7 marks).
Part B of the paper will consists of four questions one question from each unit with internal choice.
Each question will carry 7 marks. (4 x 7 marks each = 28 marks).

Unit -I

Physical Laws and Frames of Reference : Inertial and non-inertial frames, examples. Transformation of displacement, velocity and acceleration between different frames of reference involving translation, Galilean transformation and invariance of Newton's law, Noninertial frames, fictitous or pseudo forces, Transformation of displacement, velocity and acceleration between rotating co-ordinate systems, centrifugal acceleration, Coriolis force and its applications, Motion relative to earth. Foucault's pendulum.

Unit -II

Conservation Laws : Conservative forces. Potential energy, Potential energy in gravitational and electrostatic field, Rectilinear motion under conservation forces, Discussion of potential energy curves and motion of a particle. Conservation of angular momentum about an arbitrary point, Precessional motion of Spinning top, Spin precession in constant magnetic field.

Unit -III

Centre of Mass Frame : Centre of mass, Two particle System, motion of centre of mass and concept of reduced mass, Conservation of energy and linear momentum, Collision of two particles in one and two dimensions (elastic and inelastic), Analysis of collision in centre of mass frame. Slowing down of neutrons in moderator, System with varying mass. Angular momentum and charged particle scattering by a nucleus as an example.

Unit -IV

Motion Under Central Forces : Motion under central force, Gravitational interaction, Inertial and gravitational mass, General solution under gravitational interaction. Rutherford scattering, Discussion of trajectories, Cases of elliptical and circular orbits, Keppler's laws.

Reference Books
1. Mechanics by Charles Kittel, Berkeley Physics Course.
2. Introduction to Classical Mechanics by R. G. Takwale, P S. Puranik,TMH.
3. Classical Mechanics by Herbert Goldstein, Pearson Education.
4. Classical Mechanics by Dr. J. C. Upadhyaya, Himalaya Publishing House.
5. Analytical Mechanics by Louis N. Hand, Janet D. Finch, Cambridge University Press.
6. Mechanics by L.D. Landau and E. M. Lifshitz, Elsevier.

B.Sc. Pass Course - Physics
Semester I
Paper II : Electromagnetism -- I

Duration : 3 hrs.   **Max. Marks : 35**

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain eight short answer questions and the candidate is required to attempt any seven questions. Each question will carry 1 mark for correct answer. (7x1 mark each = 7 marks).

Part B of the paper will consists of four questions one question from each unit with internal choice. Each question will carry 7 marks. (4 x 7marks each = 28 marks).

Unit - I

Vector Fields : Concept of field, Scalar field, Vector field ,Partial derivative, Gradient of a scalar function, Gradient in Cartesian coordinates, Line integral of a vector field, Divergence of a vector field. Divergence in the Cartesian coordinates, Concept of solid angle. Gauss divergence theorem, Gauss law in differential form, Gauss law from inverse square law, physical meaning of divergence of a vector, Laplacian operator, Poisson's and Laplace 's equations.

Unit - II

Curl and the Field of Stationary Charge : Curl of a vector field, curl in Cartesian coordinates, Stokes's theorem, physical meaning of curl, Potential energy of a system and discrete charges, and continuous charge distribution. Application : energy required to build a uniformly charged sphere. Classical radius of the electron, potential and field due to a short dipole, torque and force on a dipole in uniform & non-uniform electric field.

Unit -III

The Field of Moving Charge : Measurement of charge in motion, Invariance of charge. Electric field measured in different frames of reference, Field of a point charge moving with constant velocity, Force on a moving charge, Interaction between a moving charge and other moving charges.

Unit – IV

The Magnetic Field : The definition of magnetic field, Lorentz force properties of the magnetic field. Ampere's circuital law with applications. Ampere's Law in the differential form. Magnetic vector potential, Poisson's equation for vector potential. Field of any current carrying wire and deduction of Bio-Savart law using vector potential.

Reference Books
1. Electricity & Magnetism by A.S. Mahajan & Abbas A. Rangwala Tata McGraw-Hill.
2. Introduction to Electrodynamics by David J. Griffith, Prentice Hall of India Pvt. Ltd. New Delhi.
3. Fundamental University Physics Vol II: Fields and Waves by Alonso/Finn, Addison – Wesley Publishers.
4. Classical Electrodynamics by J. D. Jackson, Wiley Student Edition.
5. Classical Electrodynamics : A Modern Perspective by Kurt Lechner, Springer International Publishing AG.
6. Classical Electrodynamics by P. Sengupta, New Age International Publishers.
7. Classical Electrodynamics (Revised Edition) by S. P. Puri, Narosa Publishers.

B.Sc. Pass Course - Physics
Semester I
Paper III : Optics – I

Duration : 3 hrs.   Max. Marks : 35

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain eight short answer questions and the candidate is required to attempt any seven questions. Each question will carry 1 mark for correct answer. (7x1 mark each = 7 marks).

Part B of the paper will consists of four questions one question from each unit with internal choice. Each question will carry 7 marks. (4 x 7marks each = 28 marks).

Unit - I

Geometrical Optics : Fermat's principle, laws of reflection and refraction from Fermat's principle, Refraction at a spherical surface, Linear and lateral magnifications, Refraction through thick and thin lenses. Focal lengths of thick and thin lenses. The focal length of two thin lenses is separated by a finite distance. Cardinal points.

Unit - II

Interference : Young's double slit experiment and Superposition of waves from two point sources, necessity of coherence, Concept of spatial and temporal coherence. Fringe width. Shape of interference fringes. Interference by division of amplitude, Interference in thin films. Colours of thin films in transmitted and reflected light.

Unit - III

Application of Interference : Wedge-shaped film, Newton's Rings. Determination of wavelength and refractive index by Newton's ring. Michelson's interferometer, Fringes of different shapes with Michelson's interferometer, Determination of wave length with Michelson's interferometer. Determination of refractive index by Michelson interferometer.

Unit - IV

Laser and Holography : Difference between ordinary and laser source, Spontaneous and stimulated emission, stimulated absorption. Einstein's coefficients, Population inversion, conditions for laser action, meta-stable states, pumping. Types of lasers, construction, working and energy level schemes of He-Ne and Ruby laser. Properties and uses of lasers. Basic concept of Holography, construction of hologram and reconstruction of the images.

Reference Books

1. Optics by Brijlal and Subramanium, S. Chand Publishing.
2. Principles of Optics by B. K. Mathur, Gopalal Printing.
3. Optics by D. P. Khandelwal, Himalaya Publishing House.
4. Introduction to Modern Optics by A. K. Ghatak, McGraw Hill.
5. An Introduction To Modern Optics by G. R. Fowels, Dover Publications.
6. Fundamentals of Optics by Ashok Kumar, D. R. Gulati & H. R. Gulati, R. Chand & Co.
7. Optical Physics South Asian Edition by A. Lipson, S. G. Lipson & H. Lipson, Cambridge University Press.

B.Sc. Pass Course - Physics

Semester - I

Physics Practical - I

Max. Practical Marks = 75 Marks
Internal Marks = 30 Marks
External Practical Exam (Duration : 3 hrs.) = 45 Marks

Note: Out of the following experiments, 8 experiments must be done by the students in each semester.

(4 hrs. per week)

1. To study the variation of power transfer to different loads by a D.C. source and to verify maximum power transfer theorem.

2. To study the variation of charge and current in a RC Circuits with different time constant (using a DC source).

3. To study the behaviour of an RC Circuits with varying resistance and capacitance using AC mains as a power source and also to determine the impedance and phase relations.

4. To study the rise the decay of current in an LR circuit with a source of constant EMF.

5. To study the voltage and current behavior of an LR circuit with an AC power source. Also, determine power factor, impedance and phase relations.

6. To study the characteristics of a semiconductor junction diode and determine forward and reverse resistances.

7. To study the magnetic field along the axis of a current carrying circular coil. Plot the necessary graph and hence find the radius of the circular coil.

8. To determine the specific resistance of a materials and determine difference between two small resistance using Carey Foster's bridge.

9. To convert galvanometer into an ammeter of a given range.

10. To convert galvanometer into a voltmeter of a given range.

11. Study of RC circuits with AC sinusoidal.

12. Study of RC circuits with DC.

13. Study of harmonic motion.

14. Study of torsional motion.

15. Any other experiment that relates to theory.

B.Sc. Pass Course - Physics
Semester II
Paper I : Mechanics – II

Duration: 3 hrs.   Max. Marks : 35

Note : There will be two parts in end-semester theory paper.
Part A of the paper shall contain eight short answer questions and the candidate is required to attempt any seven questions. Each question will carry 1 mark for correct answer. (7x1 mark each = 7 marks).
Part B of the paper will consists of four questions one question from each unit with internal choice.
Each question will carry 7 marks. (4 x 7 marks each = 28 marks).

Unit -I
Rigid Body Dynamics : Equation of motion of a rotating body, inertial coefficients, case of J not parallel to w, kinetic energy of rotation and idea of principle axis. Calculation of moment of inertia of a disc, spherical shell, hollow and solid spheres and cylindrical objects (cylindrical shell, solid cylinder) about their symmetric axis through center of mass.

Unit -II
Damping Oscillations : Oscillations in an arbitrary potential well, simple harmonic motion, examples-spring mass system, mass on a spring, torsional oscillator, LC circuit, energy of the oscillator, Damping of oscillator, viscous and solid friction damping, power dissipation, anharmonic oscillator, simple pendulum as an example.

Unit -III
Driven Oscillator : Driven harmonic oscillator with viscous damping, Frequency response, phase relations, Quality factor, Resonance, Introduction of j operator concept in electrical oscillations, series and parallel LCR circuit, Electro-mechanical system-Ballistic galvanometer effect of damping.

Unit – IV
Coupled Oscillator : Equation of motion of two coupled simple harmonic oscillators, Normal modes, Motion in mixed modes. Transient behaviour, Effect of coupling in mechanical systems,Electrically coupled circuits, Frequency response, Reflected impedance, Effect of coupling and resistive load.

References Books
1. Mechanics by Charles Kittel, Berkeley Physics Course.
2. Introduction to Classical Mechanics by R. G. Takwale, P S. Puranik,TMH.
3. Classical Mechanics by Herbert Goldstein, Pearson Education.
4. Classical Mechanics by Dr. J. C. Upadhyaya, Himalaya Publishing House.
5. Analytical Mechanics by Louis N. Hand, Janet D. Finch, Cambridge University Press.
6. Mechanics by L.D. Landau and E. M. Lifshitz, Elsevier.
7. The Physics of Wave and Oscillation by N.K. Bajaj, McGrow Hill Education.
8. Vibration and Waves by A. P. French, CBS Publishers.

B.Sc. Pass Course - Physics
Semester II
Paper II : Electromagnetism – II

Duration : 3 hrs.   Max. Marks : 35

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain eight short answer questions and the candidate is required to attempt any seven questions. Each question will carry 1 mark for correct answer. (7x1 mark each = 7 marks).

Part B of the paper will consists of four questions one question from each unit with internal choice. Each question will carry 7 marks. (4 x 7marks each = 28 marks).

Unit – I

Magnetic Fields in Matter : Electric current due to orbital electron, the field of current loop, Bohr magneton, Orbital gyromagnetic ratio, Electron spin and magnetic moment, Larmor frequency, Magnetic susceptibility, Magnetic permeability, Induced magnetic moment, ferromagnetism, diamagnetism and paramagnetism, magnetic field caused by uniform and non-uniform magnetized matter. Magnetization current, Free current, bound current and the field H.

Unit – II

Electric Field in Matter : The moment of a charge distribution, Atomic and molecular dipoles, Atomic polarizability, Permanent dipole moment, dielectrics. Polarization, Electric Displacement vector, Electrical susceptibility, Electrical permeability and relation between them, The Capacitor filled with a dielectric, The potential and field due to a polarized sphere.

Unit –III

Dielectric : Dielectric, Dielectric sphere placed in a uniform field. The field of charge in dielectric medium and Gauss's law. The connection between electric susceptibility and atomic polarizability, Polarization in changing field, The bound charge (polarization) current, Clausius- Mossotti relation in dielectrics.

Unit -IV

Transient behavior and Maxwell's Equations : Transient behavior of an R-C circuit. Electromagnetic induction and Maxwell's Equations, Faraday's law in differential form. Mutual inductance, Self-inductance Transient behavior of an L-R circuit, the displacement current, properties of electromagnet wave, Maxwell's equations in differential and integral forms, Electromagnetic wave in isotropic medium, Energy density of electromagnetic wave, Pointing vector, Radiation pressure of free space, Electromagnetic waves in dispersive medium, Spectrum of Electromagnetic waves.

References Books
1. Electricity & Magnetism by A.S. Mahajan & Abbas A. Rangwala Tata McGraw-Hill.
2. Introduction to Electrodynamics by David J. Griffith, Prentice Hall of India Pvt. Ltd. New Delhi.
3. Fundamental University Physics Vol II: Fields and Waves by Alonso/Finn, Addison – Wesley Publishers.
4. Classical Electrodynamics by J. D. Jackson, Wiley Student Edition.
5. Classical Electrodynamics : A Modern Perspective by Kurt Lechner, Springer International Publishing AG.
6. Classical Electrodynamics by P. Sengupta, New Age International Publishers.
7. Classical Electrodynamics (Revised Edition) by S. P. Puri, Narosa Publishers.

B.Sc. Pass Course - Physics
Semester II
Paper III : Optics – II

Duration : 3 hrs.   Max. Marks : 35

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain eight short answer questions and the candidate is required to attempt any seven questions. Each question will carry 1 mark for correct answer. (7x1 mark each = 7 marks).

Part B of the paper will consists of four questions one question from each unit with internal choice. Each question will carry 7 marks, (4 x 7marks each = 28 marks).

Unit - I
Diffraction: Fresnel's class of diffraction : Fresnel's assumptions, Fresnel class of diffraction, half period zones, Zone Plate, diffraction due to circular aperture, straight edge, thin and thick wire and rectangular slit. Cornu's spiral to study Fresnel's diffraction.

Unit - II
Fraunhofer Class of Diffraction : Fraunhofer diffraction at single slit and a circular aperture, intensity distribution and width of central maxima, and determination of slit size, two slit diffraction and its intensity distribution with missing orders. Diffraction due to N slits with intensity distributions. Plane transmission grating, Dispersion by a grating, Rayleigh's criterion of resolution. Resolving power of grating.

Unit-III
Polarization : Plane electromagnetic waves E and B of linearly, circularly and elliptically polarized electromagnetic waves. Reflection and refraction of plane EM Waves at a plane dielectric surface, Boundary conditions, Derivation of Fresnel's relation, Polarisation by reflection. Propogation of EM wave in an anisotropic media.

Unit-IV
Double Refraction and Optical Activity : Huygen's Theory of Double Refraction using Fresnel Ellipsoidal Surfaces (no mathematical derivation), Production and Analysis of Plane Polarized, Circularly and elliptically polarized light, Quarter and half wave plates, optical activity, specific rotation, bi-quartz and half shade polarimeters.

Reference Books
1. Optics by Brijlal and Subramanium. S. Chand Publishing.
2. Principles of Optics by B.K. Mathur. Gopalal Printing.
3. Optics by D. P. Khandelwal. Himalaya Publishing House.
4. Introduction to Modern Optics by A. K. Ghatak. McGraw Hill.
5. An Introduction To Modern Optics by G. R. Fowels, Dover Publications.
6. Fundamentals of Optics by Ashok Kumar, D. R. Gulati & H. R. Gulati, R. Chand & Co.
7. Optical Physics South Asian Edition by A. Lipson, S. G. Lipson & H. Lipson, Cambridge University Press.

B.Sc. Pass Course - Physics

Semester - II

Physics Practical - II

Max. Practical Marks = 75 Marks
Internal Marks = 30 Marks
External Practical Exam (Duration : 3 hrs.) = 45 Marks

Note: Out of the following experiments, 8 experiments must be done by the students in the semester.

(4 hrs. per week)

1. To study the random decay and determine the decay constant using the statistical board.

2. Using compound pendulum study the variation of time period with amplitude in large angle oscillations.

3. To study damping using compound pendulum study the damping.

4. To study the excitation of normal modes and measure frequency splitting using two coupled oscillator.

5. To study the frequency of energy transfer as a function of coupling strength using coupled oscillators.

6. (a) To study the viscous fluid damping of a compound pendulum and determination of damping coefficient and Q of the oscillator.

    (b) To study the electromagnetic damping of a compound pendulum and to find the variation of damping coefficient with the assistance of the conducting lamina.

7. To find J by Callender and Barne's Method.

8. To determine Youngs modulus by bending of beam.

9. To determine Y. σ and η Searle's method.

10. To measure Curie temperature of Monel alloy.

11. To determine modulus of rigidity of a wire using Maxwell's needle.

12. Study of normal modes of a Coupled pendulum system. Study of oscillations in mixed modes and find the period of energy exchange between the two oscillators.

13. To study Variation of surface tension with temperature using Jaegger's method.

14. Composition of two perpendicular SHMs.

15. Study of Fresnel's and Fraunhoffer diffraction.

16. Any experiment according to theory paper.

B.Sc. Pass Course - Physics

Semester III

Paper I : Statistical And Thermodynamical Physics - I

Duration : 3 hrs.   Max. Marks : 35

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain eight short answer questions and the candidate is required to attempt any seven questions. Each question will carry 1 mark for correct answer. (7x1 mark each = 7 marks).

Part B of the paper will consists of four questions one question from each unit with internal choice. Each question will carry 7 marks. (4 x 7marks each = 28 marks).

Unit - I

General Thermo-dynamical Interaction : Thermal interaction; Zeroth law of thermodynamics, Helmholtz free energy; Adiabatic interaction and enthalpy; General interaction and first law of thermodynamics; Infinitesimal general interation; Gibb's free energy and Phase transitions. Clausius-Clapeyron equation; Vapour pressure curve.

Unit - II

Carnot's Engine and Maxwell Relation : Heat engine and efficiency of engine, Carnot's Cycle and efficiency of Carnot's engine, refrigerator, carnot theorem, Second law of thermodynamics, Thermodynamic scale as an absolute scale; Maxwell relations and their applications.

Unit - III

Production of Low Temperature : Joule Thomson expansion and Joule Thomson coefficients for ideal as well as Vander Waal's gas, Porous plug experiment, inversion temperature, Regenerative cooling and cooling by adiabatic expansion and cooling by demagnetization.

Unit - IV

Application of Low Temperature : Liquid Helium, He I and He II, super fluidity, quest for absolute zero. Nernst heat theorem. Qualitative Discussion of Superconductivity, Persistent current, Meissner Effect and Effect of magnetic field on superconductor.

Reference Books
1. Thermal Physics by Kittel, San Francisco: W.H. Freeman Publisher.
2. Statistical and Thermal Physics by S Lokanathan, R S Gambhir, PHI Learning Publisher.
3. Statistical Physics by Berkeley Series Vol. V. McGraw Hill India.
4. Fundamentals of Statistical and Thermal Physics by F. Reif, Sarat Book House.
5. An Introduction To Thermodynamics by Y. V. C. Rao, Universities Press.
6. Thermodynamics : A Complete Undergraduate Course by Andrew M. Steane, OUP Oxford.
7. Thermodynamics (Foundations & Applications) by E. P. Gyftopoulos & G. P. Beretta, Dover Publications.

B.Sc. Pass Course - Physics

Semester III

Paper II: Mathematical Physics And Special Theory Of Relativity -I

Duration: 3 hrs.

Max. Marks : 35

Note : There will be two parts in end-semester theory paper.

Part A of the paper shall contain eight short answer questions and the candidate is required to attempt any seven questions. Each question will carry 1 mark for correct answer. (7x1 mark each = 7 marks).

Part B of the paper will consists of four questions one question from each unit with internal choice. Each question will carry 7 marks. (4 x 7 marks each = 28 marks).

Unit - I

Coordinate Transformation : Orthogonal curvilinear coordinate system, scale factors, expression for gradient, divergence, curl and their application to Cartesian, circular cylindrical and spherical polar coordinate. Coordinate transformation and Jacobian.

Unit - II

Tensor Analysis & Dirac Delta Function : Transformation of covariant, contravariant and mixed tensor; Addition, multiplication and contraction of tensors; Metric tensor and its use in transformation of tensors. Dirac delta function and its properties.

Unit - III

Differential Equations of Second Order and Special Functions – I : Linear differential equation with variable coefficient and singular points, series solution method and its application to the Legendre's differential equations , Integral properties of Legendre's polynomials, generating functions of $P_n(x)$, Recurrence relations of $P_n(x)$, graphical representations of Legendre functions.

Unit -IV

Differential Equations of Second Order and Special Functions – II : Hermite differential equation, generating functions of $H_n(x)$, Recurrence relations of $H_n(x)$, Orthogonality relation for Hermite equation, graphical representation and generating function of Hermitefunctions, Laguerre differential equation, graphical representation and generating functions of Laguerre polynomials, Recurrence relations of $L_n(x)$, Orthogonality relation for Laguerre polynomials.

Reference Books
1. Mathematical Physics by V. Balakrishnan, Published by Ane Books; 1st Edition.
2. Mathematical Physics by H. K. Dass, Published by S. Chand & Company Pvt. Ltd., New Delhi.
3. Mathematical Physics by Satya Prakash, Published by Sultan Chand and Sons.
4. Mathematical Physics by A.K. Saxena, Published by Narosa Publishing House.
5. Mathematics For Physicists by A. Altland & J. von Delft, Cambridge University Press.
6. Mathematical Methods In The Physical Sciences by Mary L. Boas, Wiley.
7. Mathematical Methods by M. C. Potter & J. Goldberg, Prentice Hall Pvt. Ltd.
8. Mathematical Methods For Physicists by Arfken, Weber & Harris, Elsevier.
9. Schaum's Outline of Mathematics For Physics Students by Michael Stone & Paul Goldbart.

B.Sc. Pass Course - Physics
Semester III
Paper III : Electronics & Solid State Devices -I

Duration: 3 hrs.   Max. Marks : 35

Note : There will be two parts in end-semester theory paper.

Part A of the paper shall contain eight short answer questions and the candidate is required to attempt any seven questions. Each question will carry 1 mark for correct answer. (7x1 mark each = 7 marks).

Part B of the paper will consists of four questions one question from each unit with internal choice. Each question will carry 7 marks. (4 x 7 marks each = 28 marks).

Unit -I
Circuit Analysis : Network-some important definitions, loop and nodal equation based on DC and AC circuits (Kirchhoff's Laws),Four terminal network parameters; Current volt conventions, Open circuit, short circuit and hybrid parameters of any four terminals network. Input, Output and mutual impendence for an active four terminal network.

Unit – II
Network Theorems : Superposition, Thevenin, Norton, Reciprocity, Compensation and maximum power transfer and miller theorems.

Unit – III
Transistor : Notations and volt -ampere characteristics for bipolar junction transistor, concept of load line and operating point, hybrid parameters. Transistor as Amplifiers: CB, CE, CC configurations, its characteristic curves and their equivalent circuits, Analysis of transistor amplifiers using hybrid parameters and its frequency response.

Unit – IV
Rectifiers and Voltage Regulation : Half-wave, full wave and Bridge rectifiers, Calculation of ripple factor, efficiency and regulation. Filters: series inductors, shunt capacitor, L sections and π sections filters, Voltage regulation and voltage stabilization by Zener diode, Voltage multiplier circuits.

Reference Books
1. Electronics Fundamental and Applications by John D Ryder, Prentice Hall of India Pvt. Ltd, New Delhi.
2. Engineering Electronics by John D Ryder, McGraw Hill Book Company , New Delhi.
3. Integrated Electronics.Analog & Digital Circuits and Systems by Millman/Hailkias,McGraw Hill Ltd.
4. Digital Computer Electronics by Albert Paul Malvino,Tata McGraw- Hill Pub. Co. Ltd. New Delhi(1983).

B.Sc. Pass Course - Physics
Semester - III
Physics Practical - III

Max. Practical Marks = 75 Marks
Internal Marks = 30 Marks
External Practical Exam (Duration : 3 hrs.) = 45 Marks

Note: Out of the following experiments, 8 experiments must be done by the students.

(4 hrs. per week)

1. Study of dependence of velocity of wave propagation on line parameter using torsional wave apparatus.

2. Study of variation of reflection coefficient on nature of termination using torsional wave apparatus.

3. Using Platinum resistance thermometers find the melting point of a given substance.

4. Using Newton's rings method find out the wave length of a monochromatic source and find the refractive index of liquid.

5. Using Michelson's interferometer find out the wavelength of given monochromatic source (Sodium light).

6. To determine dispersive power of prism.

7. To determine wave length by grating.

8. To determine wave length by Biprism.

9. Determine the thermodynamic constant $\gamma = C_P/C_V$ using Clements & Desorme's method.

10. To determine thermal conductivity of a bad conductor by Lee's method.

11. Determination of ballistic constant of a ballistic galvanometer.

12. Study of variation of total thermal radiation with temperature.

13. To study the specific rotation of sugar solution by polarimeter.

14. To study conductor interaction through fall to magnet in a hollow metal cylinder.

15. To study modulus of rigidity as a function of temperature.

16. Plot of thermo emf versus temperatures graph and determination of neutral temperature uses and bath.

17. Determination of bandgap using a junction diode.

18. Study of single-stage transistor audio amplifier i.e. variation of gain with frequency.

19. Any experiment according to theory paper.

B.Sc. Pass Course - Physics

Semester IV

Paper I : Statistical And Thermodynamical Physics - II

Duration : 3 hrs.   Max. Marks : 35

Note: There will be two parts in end semester theory paper.

Part A of the paper shall contain eight short answer questions and the candidate is required to attempt any seven questions. Each question will carry 1 mark for correct answer. (7x1 mark each = 7 marks).

Part B of the paper will consists of four questions one question from each unit with internal choice. Each question will carry 7 marks. (4 x 7marks each = 28 marks).

Unit - I

Kinetic Theory of Gases : Distribution law of molecular velocities, most probable, average and RMS velocities, Energy distribution function; Experimental verification of the Maxwell velocity distribution the principle of equipartition of energy.

Unit - II

Transport Phenomenon of Gases : Transport Phenomenon: Mean free path, distribution of free paths, coefficients of viscosity, thermal conductivity, diffusion and their interrelation.

Unit - III

Classical Statistics : Validity of classical approximation, Phase space, micro and macro states; Thermodynamical probability, entropy and thermodynamic probability; Monoatomic ideal gas; Barometric equation ; Specific heat capacity of diatomic gas; Heat capacity of solids.

Unit - IV

Quantum Statistics : Black body radiation and failure of classical statistics, Postulates of quantum statistics, indistingushability, wave function and exchange degeneracy, a priori-probability; Bose Einstein statistics and its distribution function; Plank distribution function and radiation formula ;Fermi Dirac statistics and its distribution function , contact potential, thermionic emission ;Specific heat anomaly of metals ;Nuclear spin statistics (para- and ortho-hydrogen).

Reference Books
1. Thermal Physics by Kittel, Publisher: San Francisco. W.H. Freeman.
2. Statistical and Thermal Physics by S. Lokanathan & R. S. Gambhir, Publisher: PHI Learning.
3. Thermodynamics & Statistical Physics (Hindi) by Dr. Arvind Jain, Devi Ahilya Prakashan.
4. Statistical Physics by Berkeley Series Vol. V. Publisher: McGraw Hill India.
5. Fundamentals of Statistical and Thermal Physics by F. Reif, Sarat Book House.

B.Sc. Pass Course - Physics

Semester IV

Paper II : Mathematical Physics And Special Theory Of Relativity - II

Duration: 3 hrs.   Max. Marks : 35

Note : There will be two parts in end-semester theory paper.

Part A of the paper shall contain eight short answer questions and the candidate is required to attempt any seven questions. Each question will carry 1 mark for correct answer. (7x1 mark each = 7 marks).

Part B of the paper will consists of four questions one question from each unit with internal choice.

Each question will carry 7 marks. (4 x 7 marks each = 28 marks).

Unit – I

Lorentz Transformation and Four vector Formulation : Lorentz transformation and rotation in space-time, time like and space like vector, world line, macro-causality. Four vector formulation, energy momentum four vector, relativistic equation of motion, invariance of rest mass, orthogonality of four force and four velocity, Lorentz force as an example of four force, transformation of four frequency vector, longitudinal and transverse Doppler's effect.

Unit – II

Transformation between Lab and CM : Transformation between laboratory and centre of mass system. Four momentum conservation, kinematics of decay products of unstable particles and thresholds reaction: Pair production, inelastic collision of two particles, Compton effect.

Unit - III

Relativistic Electrodynamics : Law of conservation of charge and equation of continuity. Lorentz transformation of charge and current densities, Lorentz transformation offour potentials, Lorentz transformation of an electric field and magnetic field. Description of Maxwell's equation in tensor form.

Unit - IV

Boundary Value Problems : Techniques of separation of variables and its application to following boundary value problems (i) Laplance equation in three dimensional Cartesian coordinate system- line charge between two earthed parallel plates (ii) Helmholtz equation in circular cylindrical coordinates – cylindrical resonant cavity, (iii) Wave equation in spherical polar coordinates – the vibrations of a circular membrane, (iv) Diffusion equation in two dimensional Cartesian coordinate system – heat conduction in a thin rectangular plate, (v) Laplace equation in spherical coordinate system –electric potential around a spherical surface.

Reference Books

1. Mathematical Physics by V. Balakrishnan, Published by Ane Books; 1st Edition.
2. Mathematical Physics by H. K. Dass, Published by S. Chand & Company Pvt. Ltd., New Delhi.
3. Mathematical Physics by Satya Prakash, Published by Sultan Chand and Sons.
4. Mathematical Physics by A.K. Saxena, Published by Narosa Publishing House.
5. Mathematics For Physicists by A. Altland & J. von Delft, Cambridge University Press.
6. Mathematical Methods In The Physical Sciences by Mary L. Boas, Wiley.
7. Mathematical Methods by M. C. Potter & J. Goldberg, Prentice Hall Pvt. Ltd.
8. Mathematical Methods For Physicists by Arfken, Weber & Harris, Elsevier.
9. Schaum's Outline of Mathematics For Physics Students by Michael Stone & Paul Goldbart.

B.Sc. Pass Course - Physics
Semester IV
Paper III : Electronics & Solid State Devices - II

Duration: 3 hrs.   **Max. Marks : 35**

Note : There will be two parts in end-semester theory paper.

Part A of the paper shall contain eight short answer questions and the candidate is required to attempt any seven questions. Each question will carry 1 mark for correct answer. (7x1 mark each = 7 marks).

Part B of the paper will consists of four questions one question from each unit with internal choice. Each question will carry 7 marks. (4 x 7 marks each = 28 marks).

Unit -I

Fixed and emitter biasing, bias stability in transistor circuits, Feedback requirements for oscillations, circuit requirement for oscillation, basis idea of direct coupled and R.C coupled amplifiers, basic oscillator analysis, Colpitt and Hartley oscillators, RC oscillators.

Unit -II

Amplifiers with Feedback : Concept of feedback, positive and negative feedback, voltage and current feedback circuits, Advantages of negative feedback- stabilization of gain by negative feedback, Effect of feedback on output and input resistance. Reduction of nonlinear distortion by negative feedback, Effect on gain- frequency response.

Unit -III

Operational Amplifier : Differential amplifier, DC levels shifter, operational amplifier, input and Output impedances, input offset current, Application: Unity gain buffer, Adder, Subtractor, Integrator and Differentiator.

Unit -IV

Field Effect Transistor and Digital Circuits : Field Effect Transistor (FET) and its characteristic biasing JFET, ac operation of JFET and MOSFET.Binary arithmetic. Logic fundamentals AND, OR, NOT, NOR,NAND, XOR gates, Boolean theorems, transistor as a switch, logic gates: circuit realization of logic functions. Analog to digital and digital to analog analysis. DTL, RTL, TTL circuits.

Reference Books
1. Electronics Fundamental and Applications by John D. Ryder, Prentice Hall of India Pvt. Ltd, New Delhi.
2. Engineering Electronics by John D. Ryder, McGraw Hill Book Company , New Delhi.
3. Integrated Electronics :Analog & Digital Circuits And systems by Millman/Hailkias :McGraw Hill Ltd.
4. Digital Computer Electronics by Albert Paul Malvino,Tata McGraw- Hill Pub. Co. Ltd. New Delhi(1983).

B.Sc. Pass Course - Physics

Semester - IV

Physics Practical - IV

Max. Practical Marks = 75 Marks
Internal Marks = 30 Marks
External Practical Exam (Duration : 3 hrs.) = 45 Marks

Note: Out of the following experiments, 8 experiments must be done by the students in the semester.

(4 hrs. per week)

1. Study of power supply using two diodes/bridge rectifiers with various filter circuits.

2. Study of half wave rectifier using single diode and application of L and π section filters.

3. To study characteristics of a given transistor PNP/NPN (Common emitter, common base and common collector configurations

4. Determination of power factor ($\cos\varphi$) of a given coil using CRO.

5. Study of single stage transistor audio amplifier (Variation of gain with frequency).

6. To determine e/m by Thomson's method.

7. Determination of velocity of sound in air by standing wave method using speaker, microphone and CRO

8. Measurement of inductance of a coil by Anderson's bridge.

9. Measurement of capacitance and dielectric constant of a liquid and gang condenser by de-Sauty Bridge.

10. Study of half-wave rectifier using single diode and application of L and π-section filters.

11. Full wave and bridge rectifiers with various filter circuits.

12. To study the characteristics of a given transistor PNP/NPN.

13. To study analog to digital and digital to analog conversion.

14. Any experiment according to theory paper.