PHYSICS
SYLLABUS

FOR

B.Sc.

(12+3 SYSTEM OF EDUCATION)

(SEMESTER–I-VI)

Examinations: 2016–17

KHALSA COLLEGE
AMRITSAR

(ii) **Subject to change in the syllabi at any time. Please visit the University website time to time.**

B.Sc. (Semester System) (12+3 System of Education)

SEMESTER–I

PHYSICS

PAPER–A: MECHANICS

(THEORY)

Time: 3 Hours **Marks: 30**

Total Teaching Hrs: 40

Pass Marks: 35%

Instructions for the Paper Setters:

There will be five sections. Section A will consist of six short answer type questions covering the whole syllabus and is compulsory. Sections B, C, D and E will consist of two questions each. The candidates are required to attempt one from each section. All questions carry equal marks.

UNIT–I

Cartesian and spherical polar co–ordinate systems, area, volume, velocity and Acceleration in these systems. Solid angle, Relationship of conservation laws and symmetries of space and time.

UNIT–II

Various forces in Nature (Brief introduction) centre of mass, equivalent one body problem, central forces, equation of motion under central force, equation of orbit and turning points. Kepler Laws. Concept of Ether and Michel son–Morley experiment.

UNIT–III

Inertial frame of reference. Galilean transformation and Invariance. Non Inertial frames, coriolis force and its applications. Variation of acceleration due to gravity with latitude. Focault pendulum.

UNIT–IV

Elastic collision in Lab and C.M. system, velocities, angles and energies, crosss section of elastic scattering, Rutherford scattering. Rigid Body motion; Rotational motion, principal moments and Axes. Euler's equations, precession and elementary gyroscope.

Books Suggested:

1. Mechanics, Berkeley Vol.–I by C. Kittle.

2. Mechanics, H.S. Hans & S.P. Puri.

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SEMESTER–I

PHYSICS

PAPER–B: ELECTRICITY AND MAGNETISM

(THEORY)

Time: 3 Hours **Marks: 30**

Total Teaching Hrs: 40

Pass Marks: 35%

Instructions for the Paper Setters:

There will be five sections. Section A will consist of six short answer type questions covering the whole syllabus and is compulsory. Sections B, C, D and E will consist of two questions each. The candidates are required to attempt one from each section. All questions carry equal marks.

UNIT–I

Basic ideas of Vector Calculus Gradient, Divergence, curl and their physical significance. Laplacian in rectangular, cylindrical and spherical coordinates. Coulomb's Law for point charges and countinuous distribution of charges. Electric field due to dipole, line charge and sheet of charge. Electric flux, Gauss's Law and its applications. Gauss's divergence theorem and differential form of Gauss's Law. Green's theorem.

UNIT–II

Work and potential difference. Potential difference as line integral of field. Electric potential due to a point charge a group of point charges, dipole and quadrupole moments, long uniformly charged wire, charged disc. Stoke's theorem and its applications in Electrostatic field, curl E=0. Electric fields as gradient of scalar potential. Calculation of E due to a point charge and dipole from potential. Potential due to arbitrary charge distribution and multipole moments.

UNIT–III

Poisson and Laplace's equation and their solutions in Cartesian and spherical coordinates. Concept of electrical images.Calculation of electric potential and field due to a point charge placed near an infinitely conducting sheet.Current and current density, equation of continuity. Microscopic form of Ohm's Law (J=□E) and conductivity, Failure of Ohm's Law. Invariance of charge.

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UNIT–IV

E in different frames of reference. Field of a point charge moving with constant velocity. Interaction between moving charges and force between parallel currents. Behaviour of various substances in magnetic field. Definition of M and H and their relation to free and bound currents. Permeability and susceptibility and their interrelationship. Orbital motion of electrons and diamagnetism.

Books Suggested:

1. Fundamentals of Electricity and Magnetism by Arthur F. Kipp.
2. Electricity and Magnetism, Berkeley Physics Course, Vol. II by E.M. Purcell.
3. Introduction to Classical Electrodynamics by David Griffith.
4. EM Waves and Radiating System by Edward C. Jordan and K.G. Balmain.
5. Fields and Waves Electromagnetic by David K. Cheng.

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SEMESTER–I

PHYSICS

(PRACTICAL)

General Guidelines for Practical Examination:

I. The distribution of marks is as follows : **Marks: 20**

i) One experiment **10 Marks**

ii) Brief Theory 3**Marks**

iii) Viva–Voce **4Marks**

iv) Record (Practical file) **3Marks**

II. There will be one sessions of 3 hours duration. The paper will have one session.

Paper will consist of 8 experiments out of which an examinee will mark 6 experiments and one of these is to be allotted by the external examiner.

III. Number of candidates in a group for practical examination should not exceed 12.

IV. In a single group no experiment be allotted to more than three examinee in any group.

1. To determine low resistance with Carey Fosters Bridge.
2. To determine the resistance and specific resistance of copper with the help of Kelvin's double bridge.
3. To study the variation of resistance of a filament of a bulb with its temperature.
4. Capacitance by flashing and quenching of a neon lamp.
5. Measurement of Capacitance, determination of permittivity of a medium air and relative permitivity by de–Sauty's bridge.
6. To determined I using Anderson Bridge.
7. Exercise on fitting of given data to straight line and calculation of probable error.
8. To study the dependence of moment of inertia on distribution of mass (by noting time periods of oscillations using objects of various geometrical shapes but of same mass).
9. To establish relationship between torque and angular acceleration using fly wheel.
10. To find the moment of inertia of a flywheel.
11. Study of bending of beams and determination of young's Modulus.
12. Determination of Poissons or rubber plastic.
13. To find young's modulus, modulus of rigidity & Poisson ratio by Searle's method.

14. To study flow of water through capillary tubes of different length and area of cross section of (at least two each) and calculate coefficient of viscosity.
15. To determine energy transfer, coefficient of restitution and verify laws of conservation of linear momentum and kinetic energy in elastic collisions using one dimensional collisions of hanging spheres.
16. Kundt's tube.
17. Energy meter.

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SEMESTER–II

PHYSICS

PAPER–A: RELATIVITY AND ELECTROMAGNETISM

(THEORY)

Time: 3 Hours **Marks: 30**

Instructions for the Paper Setters:

There will be five sections. Section A will consist of six short answer type questions covering the whole syllabus and is compulsory. Sections B, C, D and E will consist of two questions each. The candidates are required to attempt one from each section. All questions carry equal marks.

UNIT–I

Postulates of special theory of relatively. Lorentz transformations, observer and viewer in relativity. Relativity of simultaneity, Length, Time, velocities. Relativistic Dopper effect. Variation of mass with velocity, mass–energy equivalence, rest mass in an inelastic collision, relativistic momentum & energy, their transformation, concepts of Minkowski space, four vector formulation.

UNIT–II

Lorentz's force, Definition of B. Biot Savart's Law and its application to long straight wire, circular current loop and solenoid. Ampere's Circuital law and its application. Divergence and curl of B.Hall effect, expression and co–efficient. Vector potential, Definition and derivation, current–density–definition, its use in calculation of charge in magnetic field at a current sheet. Transformation equation of E and B from one frame to another.

UNIT–III

Faraday's Law of EM induction, Displacement current, Mutual inductance and reciprocity theorem. Self inductance, L for solenoid, Coupling of Electrical circuits. Analysis of LCR series and parallel resonant, circuits Q–factor, Power consumed, power factor.

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UNIT–IV

Maxwell's equations their derivation and characterizations, E.M. waves and wave equation in a medium having finite permeability and permitivity but with conductivity _=). Poynting vector, Impedance of a dielectric to EM waves. EM waves in a conducting medium and Skin depth. EM wave velocity in a conductor and anomalous dispersion. Response of a conducting medium to EM waves. Reflection and transmission of EM waves at a boundary of two dielectric media for normal and oblique incidence.

Recommended Books:

1. Fundamentals of Vibrations and Waves by S.P. Puri.
2. Physics of Vibrations and Waves by H.J. Pain.
3. EM Waves and Radiating Systems by Edward C. Jordan and K.G. Balmain.
4. Fields and Waves Electromagnetic by David K. Cheng.

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SEMESTER–II

PHYSICS

PAPER–B: WAVES AND OSCILLATIONS

(THEORY)

Time: 3 Hours **Marks: 30**

Total Teaching Hrs: 40

Pass Marks: 35%

Instructions for the Paper Setters:

There will be five sections. Section A will consist of six short answer type questions covering the whole syllabus and is compulsory. Sections B, C, D and E will consist of two questions each. The candidates are required to attempt one from each section. All questions carry equal marks.

UNIT–I

Simply harmonic motion, energy of a SHO. Compound pendulum. Torsional pendulum Electrical Oscillations Transverse Vibrations of a mass on string, composition of two perpendicular SHM of same period and of period in ratio 1:2.

UNIT–II

Decay of free Vibrations due to damping. Differential equation of motion, types of motion, types of damping. Determination of damping co–efficient– Logarithmic decrement, relaxation time and Q–Factor. Electromagnetic damping (Electrical oscillator).

UNIT–III

Differential equation for forced mechanical and electrical oscillators. Transient and steady state behaviour. Displacement and velocity variation with driving force frequency, variation of phase with frequency, resonance. Power supplied to an oscillator and its variation with frequency. Q–value and band width. Q–value as an amplification factor. Stiffness coupled oscillators, Normal co–ordinates and normal modes of vibration. Inductance coupling of electrical oscillators.

UNIT–IV

Types of waves, wave equation (transverse) and its solution characteristic impedance of a string. Impedance matching. Reflection and Transmission of waves at boundary. Reflection and transmission of energy. Reflected and transmitted energy coefficients. Standing waves on a

string of fixed length. Energy of vibration string. Wave and group velocity.

Recommended Books:

1. Fundamentals of Vibrations and Waves by S.P. Puri.

2. Physics of Vibrations and Waves by H.J. Pain.

3. EM Waves and Radiating Systems by Edward C. Jordan and K.G. Balmain.

4. Fields and Waves Electromagnetic by David K. Cheng.

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PHYSICS

SEMESTER–II

(PRACTICAL)

Marks: 20

General Guidelines for Practical Examination:

I. The distribution of marks is as follows :

i) One experiment 10 Marks

ii) Brief Theory 3 Marks

iii) Viva–Voce 4 Marks

iv) Record (Practical file) 3 Marks

II. There will be one sessions of 3 hours duration. The paper will have one session.

Paper will consist of 8 experiments out of which an examinee will mark 6 experiments and one of these is to be allotted by the external examiner.

III. Number of candidates in a group for practical examination should not exceed 12.

IV. In a single group no experiment be allotted to more than three examinee in any group.

1. To study the magnetic field produced by a current carrying solenoid using a search coil and calculate permeability of air.
2. To study the induced e.m.f. as function of the velocity of the magnet.
3. Study of phase relationships using impedance triangler for LCR circuit and calculate impedance.
4. Resonance in a series and parallel LCR circuits for different R–value and calculate Q–value.
5. To find the coefficient of self inductance by Lay Leigh's Method.
6. To measure the charge sensitivity of a moving coil Ballistic galvanometer using a known capacitor.
7. To find the angle of dip in the lab using an earth inductor.
8. To find the value of BH the horizontal component of earth's magnetic field in the lab using a deflection & vibration magnetometer.

9. To study the variation of magnetic field with distance along the axis of coil carrying current by plotting a graph.
10. Measure time period as a function of distance of centre of suspension (oscillation) from centre of mass, plot relevant graphs, determine radius of gyration and acceleration due to gravity.
11. Melde's experiment.
12. Find the value of g by Caterer's pendulum.
13. To compare the M.I. of solid & hollow sphere of same mass using tensional pendulum.
14. Measure time period of oscillation of a Maxwell needle and determine modulus of rigidity of the material of a given wire.
15. To measure obtain logarithmic decrement, coefficient of damping, relaxation time, and quality factor of a damped simple pendulum.

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SEMESTER–III

PHYSICS

PAPER-A

STATISTICAL PHYSICS & THERMODYNAMICS

(THEORY)

Time: 3 Hours **Marks: 30**

Total Teaching Hrs: 40

Instructions for the Paper Setters:

There will be five sections. Section A will consist of six short answer type questions covering the whole syllabus and is compulsory. Sections B, C, D and E will consist of two questions each. The candidates are required to attempt o*ne from each section. All questions carry equal marks.*

UNIT–I

Basic ideas of Statistical Physics, Scope of Statistical Physics, Basic ideas about probability, Distribution of four distinguishable particles into compartments of equal size. Concept of macrostates, microstates, Thermodynamic Priobability, Effects of constraints on the system. Distribution of n particles in two compartments. Deviation from the state of maximum probability. Equilibrium state of dynamic system. Distribution of distinguishable n particles in k compartments of unequal sizes.

UNIT–II

Phase space and division into elementary cells. Three kinds of statistics. The basic approach in three statistics. Maxwell Boltzman (MB) statistics applied to an ideal gas in equilibrium. Experimental verification of law of distribution of molecular speeds. Need for Quantum Statistics – B.E. Statement of planck's law of Radiation Wien's Displacement and Stefan's law. Fermi Dirac (FD) statistics. Comparison of M.B, B.E and F.D statistics.

UNIT–III

Statistical definition of entropy, Change of entropy of system, additive naturwe of entropy, Law of increase of entropy, Reversible and irreversible processes, and their examples, work done in reversible process, examples of increase in entropy in natural processes, entropy and disorder, Brief review of Terms, Laws of Thermodynamics, Carnot Cycle, Entropy changes in carnot cycle, Applications of thermodynamics to thermoelectric effect, change of entropy along

reversible path in P-V diagram. Heat death of universe.

UNIT–IV

Derivation of Maxwell Thermodynamics relations, Cooling produced by adiabatic stretching, Adiabatic Compression, change of internal energy with volume, Specific heat and constant pressure and constant volume. Expression for CP-Cv, Change of state and Claypron equation.

Text Reference Books:

1. Statistical Physics and Thermodynamics, V.S. Bhatia (Sohan Lal Nagin Chand), Jalandhar.

2. A Treatise on Heat, M.N. Saha & b.N. Srivastava (The Indian Press Pvt. Ltd., Allhabad), 1965.

3. Statistical Mechanics: An Introductory Text, Bhattacharjee, J.K. (Allied Pub., Delhi), 2000.

4. Statistical Physics, Bhattacharjee, J.K. (Allied Pub., Delhi) 2000.

5. Statistical Mechanics, B.B. Laud, (Macmillan India Ltd.) 1981.

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SEMESTER–III

PHYSICS

PAPER–B

OPTICS

(THEORY)

Time: 3 Hours **Marks: 30**

Total Teaching Hrs: 40

Instructions for the Paper Setters:

There will be five sections. Section A will consist of six short answer type questions covering the whole syllabus and is compulsory. Sections B, C, D and E will consist of two questions each. The candidates are required to attempt one from each section. All questions carry equal marks.

UNIT–I

Interference of Light:

Superposition of light waves and interference, young's double slit experiment, Distribution of intensity in young's double slit experiment, Conditions for sustained interference pattern, Coherent sources of light, Temporal and spatial coherence, Mathematical analysis of temporal coherence, Interference pattern by division of wave front, Fresnel Biprism, Fresnel double mirror, Llyod's single mirror, Displacement of fringes,

UNIT–II

Interference by Division of Amplitude:

Change of phase on reflection, Interference in thin films due to reflected and transmitted light, Need for extended source for interference by division of amplitude, Fringes of equal inclination and equal. Thickness non reflecting films, Newton's Rings.

Michelson Interferometer, Fabry Perot interferometer and etalon. Distribution of intensity in Fabry Perot fringes.

UNIT–III

Diffraction:

Huygen's fresnel theory, half-period zones, Zone plate, Distinction between fresnel and fraunhoffer diffraction. Fraunhoffer diffraction at rectangular and circular apertures, Effect of diffraction in optical imaging, Resolving power of telescope in diffraction grating, its use as a

spectroscopic element and its resolving power, Resolving power of microscope. Resolving power of fabry-perot interferometer.

UNIT–IV

Polarization:

Plane Polarized light, Elliptically polarized light, wire grid polarizer, Sheet polarizer, Maul's Law, Brewester Law, Polarization by reflection, Scattering, Double reflection, Nicol prism, Retardation plates, Production Analysis of polarized light, Quarter and half wave plates.

Text Reference Books:

1. Fundamentals of Optics, F.A. Jenkins and Harvey E White,(Mcgraw Hill) 4th edition, 2001

2. Optics, Ajoy Ghatak,(McMillan Indian) 2nd edition, 7th reprint, 1997

3. Introduction to Atomic Spectra, H.E. White (Mcgraw Hill, Book Co., Inc., New York)

4. Laser Fundamentals, W.T. Silfvast (Foundation Books), New Delhi, 1996

5. Laser and Non-Liner Optics, B.B. Laud (New Age Pub.) 2002

6. Optics, Born and Wolf, (Pergamon Press) 3rd edition, 1965

7. Laser, Svelto, (Plenum Pres) 3rd edition, New York

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SEMESTER–III

PHYSICS

(PRACTICAL)

General Guidelines for Practical Examination:

I. The distribution of marks is as follows : **Marks: 20**

i) One experiment **10 Marks**

ii) Brief Theory **3 Marks**

iii) Viva–Voce **4 Marks**

iv) Record (Practical file) **3 Marks**

II. There will be one sessions of 3 hours duration. The paper will have one session.

Paper will consist of 8 experiments out of which an examinee will mark 6 experiments and one of these is to be allotted by the external examiner.

III. Number of candidates in a group for practical examination should not exceed 12.

IV. In a single group no experiment be allotted to more than three examinee in any group.

1. To determine refractive index of glass and liquid using spectrometer.
2. To determine the Cauchy's constants.
3. To study the refractive index of a doubly refracting prism.
4. To set up Newton's rings to determine wavelength of sodium light.
5. To determine the wavelength by using plane diffraction grating (Use Hg source)
6. To determine dispersive power of plane diffraction grating.
7. To determine resolving power of a telescope.
8. To determine resolving power of a grating.
9. To measure an accessible (Horizontal and vertical) height using sextant.
10. To measure inaccessible height by using sextant.
11. Verify Laws of probability distribution by throwing of similar coins.

12 To study the rotation of plane of polarization by using polarimeter.

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SEMESTER–IV

PHYSICS

PAPER–A

QUANTUM MECHANICS

(THEORY)

Marks: 30 **Time: 3 Hours**

Total Teaching Hrs: 40

Instructions for the Paper Setters:

There will be five sections. Section A will consist of six short answer type questions covering the whole syllabus and is compulsory. Sections B, C, D and E will consist of two questions each. The candidates are required to attempt one from each section. All questions carry equal marks.

UNIT–I

Formalism of Wave Mechanics:

Brief introduction to need and development of quantum mechanics, Wave particle duality, De broglie hypothesis, Uncertainity principle, Guassian wave packet. Operator correspondence. Normalization and probability interpretation of wave function. Superposition principle.

UNIT–II

Expectation value, Probability current and conservation of probability. Admissibility conditions or wave function. Ehrenfest theorem, Eigen function and eigen value. Operator formalism, orthogonal system, expansion in eigen functions, Hermitian operator, simultaneous eigen function, equation of motion.

UNIT–III

Problem in One and Three Dimensions: Fundamental postulates of wave mechanics, Schrodinger equation for a free particle and equation of a particle subject to forces. Schrodinger equation, Application to stationary states for one dimension, Potential Barrier, rectangular potential well, degeneracy, Orthogonality, Linear harmonic oscillator. Schrodinger equation for spherically symmetric potential for hydrogen atom. Spherical harmonics and their solution. Physical significance of quantum number. Degeneracy

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UNIT–IV

Interaction energy ideas, X-ray spectra, Mosley law, Absorption spectra, Auger effect, Molecular bonding, Molecular spectra, selection rules, symmetric structure, Rotational Vibrational, electronic level and spectra of molecules, Raman spectra. Introduction to Raman spectra.

Text Reference Books:

1. A Text book of Quantum Mechanics, P.M. Mathews and K. Venkatesan, (Tata McGraw Hill Pub., Co., Delhi) 2002.

2. Quantum Mechanics J.L. Powell and B. Craseman (Narosa Pub. House, New Delhi) 1997.

3. Concepts of Modern Physics, Arthur Beiser (McGraw Hill Pub. Co., New Delhi, 9th Ed.) 1995.

4. Elements of Modern Physics, S.H. Patil (McGraw Hill), 1998.

5. Quantum Mechanics, E. Merzbacher (John Wiley, 2nd Edition)

6. Fundamentals of Molecular Spectroscopy, C.N. Banwell (Tata McGraw Hill Pub. Co., Delhi), 2001.

7. Atomic Spectra, H.G. Kuhn (Longmans), 2nd Ed., 1969.

8. Introduction to Quantum Mechanics, L. Pauling and E.B. Wilson (Tata McGraw Hill Pub. Co., Delhi), 2002.

9. Quantum Mechanics, W. Greiner (Springer Verlag), 1994.

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SEMESTER–IV

PHYSICS

PAPER–B

ATOMIC SPECTRA & LASERS

(THEORY)

Time: 3 Hours **Marks: 30**

Instructions for the Paper Setters:

There will be five sections. Section A will consist of six short answer type questions covering the whole syllabus and is compulsory. Sections B, C, D and E will consist of two questions each. The candidates are required to attempt one from each section. All questions carry equal marks.

UNIT–I

One Electron Atomic Spectra:

Spectrum of Hydrogen atom, Line structure, Normal Zeeman effect, electron spin, Stern Gerlach experiment, spin orbit coupling, electron magnetic moment, total angular momentum, Hyperfine structure, examples of one electron systems, anomalous Zeeman effect, Lande g factor (Sodium D-Lines).

UNIT–II

Many Electron System Spectra:

Exchange symmetry of wave function, exclusion principle, shells, subshells in atoms, atomic spectra (Helium), spectra of alkaline earth atoms, LS coupling, selection rules, Regularities in atomic spectra.

UNIT–III

Laser Fundamentals:

Derivation of Einstein relations, Concept of stimulated emission and population inversion, Fauchber Ledenberg formula, Threshold and Schawlow Tonnes condition, three level and four level laser schemes, elementary theory of optical cavity, Longitudinal and transverse modes.

UNIT–IV

Laser Systems:

Components of laser devices, condition for laser action, types of lasers, Ruby and Nd:YAG lasers, He-Ne and CO2 lasers construction, mode of creating population inversion and output

characteristics, Q-switching, application of lasers –a general outline, Basics of holography.

Text Reference Books:

1. Introduction to Atomic Spectra: H.E. White-Auckland McGraw Hill, 1934.

2. Fundamentals of Molecular Spectroscopy: C.B. Banwell-Tata McGraw Hill, 1986.

3. Spectroscopy Vol. I, II & III: Walker & Straughen

4. Introduction to Molecular Spectroscopy: G.M. Barrow-Tokyo McGraw Hill, 1962.

5. Spectra of Diatomic Molecules: Herzberg-New York, 1944.

6. Molecular Spectroscopy: Jeanne L McHale.

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SEMESTER–IV

PHYSICS

(PRACTICAL)

General Guidelines for Practical Examination:

I. The distribution of marks is as follows : **Marks: 20**

i) One experiment **10 Marks**

ii) Brief Theory **3 Marks**

iii) Viva–Voce **4Marks**

iv) Record (Practical file) **3 Marks**

II. There will be one sessions of 3 hours duration. The paper will have one session.

Paper will consist of 8 experiments out of which an examinee will mark 6 experiments and one of these is to be allotted by the external examiner.

III. Number of candidates in a group for practical examination should not exceed 12.

IV. In a single group no experiment be allotted to more than three examinee in any group.

1. To study adiabatic expansion of gas and hence to calculate value of V.
2. To find the coefficient of Thermal Conductivity of a bad conductor by Lee's method.
3. To plot a calibration curve of a given thermocouple (copper constantan) using a potentiometer.
4. Study the Hydrogen gas discharge tube spectra and obtain the value of Rydberg constant.
5. To study the photoelectric effect and determine the value of planck's constant.
6. To determine the ionization potential of mercury.
7. Study of variation of light intensity with distance using photovoltaic cell (Inverse Square Law)
8. To determine the heating efficiency of an electric kettle with varying voltage.
9. To study the absorption spectra of iodine vapours.
10. Determination of wavelength of He-Ne laser using single slit /N slit diffraction patteren.
11. Determination of the wavelength of the seminconductor diode laser.

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SEMESTER–V

PHYSICS

PAPER–A

CONDENSED MATTER PHYSICS

(THEORY)

Time: 3 Hours **Marks: 30**

Instructions for the Paper Setters:

There will be five sections. Section A will consist of six short answer type questions covering the whole syllabus and is compulsory. Sections B, C, D and E will consist of two questions each. The candidates are required to attempt one from each section. All questions carry equal marks.

UNIT–I

Crystal structure, Symmetry operations for a two and three dimensional crystal, Two dimensional Bravais lattices, Three dimensional Bravais lattices, Basic primitive cells, Crystal planes and Miller indices, Diamond and NaCl structure.

UNIT–II

Crystal Diffraction: Bragg's law, Experimental methods for crystal structure studies, Laue equations, Reciprocal lattices of SC, BCC and FCC, Brag's law in reciprocal lattice, Brillouin zones and its construction in two and three dimensions, Structure factor and atomic form factor.

UNIT–III

Lattice vibrations, Concepts of phonons, Scattering of photons by phonons, Vibration and monoatomic, linear chains, Density of modes, Einstein and Debye models of specific heat.

UNIT–IV

Free electron model of metals, Free electron, Fermi gas and Fermi energy, Band Theory: Kronig-Penney model, Metals and insulators, Qualitative discussion of the following: Conductivity and its variation with temperature in semiconductors, Fermi levels in intrinsic and extrinsic semiconductors, band gap in semiconductors.

Books Suggested:

1. Introduction to Solid State Physics by C. Kittel (Wiley Eastern)
2. Elements of Modern Physics by S.H. Patil (TMGH, 1985).
3. Solid State Physics by Puri and Babbar.

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SEMESTER–V

PHYSICS

PAPER–B: NUCLEAR PHYSICS

(THEORY)

Time: 3 Hours **Marks: 30**

Instructions for the Paper Setters:

There will be five sections. Section A will consist of six short answer type questions covering the whole syllabus and is compulsory. Sections B, C, D and E will consist of two questions each. The candidates are required to attempt one from each section. All questions carry equal marks.

UNIT–I

I. Nuclear Properties: Constituents of nucleus, non-existence of electrons in nucleus, Nuclear mass and binding energy, features of binding energy versus mass number curve, nuclear radius, angular momentum and parity, qualitative discussion of two-body nuclear forces, nuclear moments, magnetic dipole moment and electric quadruple moment.

UNIT–II

II. Radioactive decays: Modes of decay of radioactive nuclides and decay Laws, chart of nuclides and domain of instabilities, radioactive dating, constituents of Cosmic rays, Beta decays: β-, β+ and electron capture decays, allowed and forbidden transitions (selection rules), parity violation in β decay, Alpha decay : Stability of heavy nuclei against beak up, Geiger-Nuttal law, barrier penetration as applied to alpha decay, reduced widths, deducing nuclear energy levels, Gamma transitions : Excited levels, isomeric levels, Gamma transitions, multipole moments, selection rules, transitions probabilities, internal conversion (IC), determination of multipolrity from $\gamma\gamma$-correlation and IC measurements.

UNIT–III

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

UNIT–IV

IV. Nuclear Models: Liquid drop model, semi-empirical mass formula, condition of stability, Fermi gas model, evidence for nuclear magic numbers, Shell Model, energy level scheme, angular momenta of nuclear ground states.

TUTORIALS: Relevant problems on the topics covered in the course.

Reference Books:

1. Basic Ideas and Concepts in Nuclear Physics by K. Hyde

2. Introduction to Nuclear Physics : H.A. Enge

3. Nuclear Physics : I. Kaplan (Addison Wesley)

4. Nuclei and Particles by E. Segre

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SEMESTER–V

PHYSICS

(PRACTICAL)

Marks: 20

General Guidelines for Practical Examination:

I. The distribution of marks is as follows :

i) One experiment **10 Marks**

ii) Brief Theory **3Marks**

iii) Viva–Voce **4 Marks**

iv) Record (Practical file) **3 Marks**

II. There will be one sessions of 3 hours duration. The paper will have one session. Paper will consist of 8 experiments out of which an examinee will mark 6 experiments and one of these is to be allotted by the external examiner.

III. Number of candidates in a group for practical examination should not exceed 12.

IV. In a single group no experiment be allotted to more than three examinee in any group.

List of Experiments

i. Measurement of reverse saturation current in p-n-junction diode at various temperatures and to find the approximate value of energy gap.

ii. To draw forward and reverse bias characteristics of a p-n junction diode and draw a load line.

iii. To trace the B-H curves for different materials using CRO and find the magnetic parameters from these.

iv. To study the characteristics of a thermistor and find its parameters.

v. To study the response of RC circuit to various frequencies.

vi. Study the working of CRO and measure voltage and frequency of AC and DC supply.

vii. To compare the frequencies of oscillations produced by two audio oscillators using the Lissajous figures on CRO.

viii. Study the working of LED, silicon and germanium diode.

ix. To obtain the wave form of a given oscillator using a cathode ray oscilloscope.

xi. To study the characteristics of a differentiating circuit using RC circuit.

xii To study the characteristics of a integrating circuit using RC circuit.

xiii. To draw the characteristics of a Zener diode.

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SEMESTER–VI

PHYSICS

PAPER–A

ELECTRONICS

(THEORY)

Time: 3 Hours **Marks: 30**

Instructions for the Paper Setters:

There will be five sections. Section A will consist of six short answer type questions covering the whole syllabus and is compulsory. Sections B, C, D and E will consist of two questions each. The candidates are required to attempt one from each section. All questions carry equal marks.

UNIT–I

Concepts of current and voltage sources, p-n junction, Biasing of diode, V-I characteristics, Zener diode, Rectification: half wave, full wave rectifiers and bridge rectifiers, Filter circuits (LC and π filters), Efficiency, Ripple factor, Voltage regulation.

UNIT–II

Junction transistor : Structure and working relation between different currents in transistors, Sign conventions, Amplifying action, Different configurations of a transistor and their comparison, CB and CE characteristics, Structure and characteristics of JEFT, Transistor biasing and stabilization of operating point, Voltage divider biasing circuit.

UNIT–III

Working of CE amplifier, Amplifier analysis using h-parameters, Equivalent circuits, Determination of current gain, Power gain, Input impedance, FET amplifier and its voltage gain, Feed back in amplifiers, Different types, Voltage gain, Advantage of negative feed back, Emitter follower as negative feed back circuit.

UNIT–IV

Barkausen criterion of sustained oscillations, LC oscillator (tuned collector, tuned base Hartley), RC oscillators, phase shift and Wein bridge.

Books Suggested:

1. Basic Electronics and Linear Circuits by N.N. Bhargave, D.C. Kulshreshtha and S.C. Gupta.

2. Foundations of Electronics by D. Chatophadhyay, P.C. Rakshit, B. Saha and N.N. Purkit.

3. Basic Electronics by D.C. Tayal (Himalaya Pub.)

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SEMESTER–VI

PHYSICS

PAPER–B: PARTICLE PHYSICS

(THEORY)

Time: 3 Hours **Marks: 30**

Instructions for the Paper Setters:

There will be five sections. Section A will consist of six short answer type questions covering the whole syllabus and is compulsory. Sections B, C, D and E will consist of two questions each. The candidates are required to attempt one from each section. All questions carry equal marks.

UNIT–I

I. Interaction of radiation and charged particles with matter: Energy loss of electrons and positrons, Positrons annihilation in condensed media, Sopping power and range of heavier charged, derivation of Bethe-Bloch formula, interaction of gamma rays with matter.

UNIT–II

II. Nuclear radiation detection: Gas-filled detectors, proportional and Geiger-Mueller counters, Scintillation detectors, solid-state detectors, Cherenkov effect, calorimeter-electromagnetic and hadron, specialized detectors, solid state nuclear track detectors, bubble chambers, nuclear emulsions.

UNIT–III

III. Accelerators: Accelerators, linear accelerators, cyclic accelerators, ion sources, focussing stability, electron synchrotron, colliding beam machines, particle beams for fixed target experiments, CERN Super Proton Synchrotron (SPS) and Fermilab Tevatron

UNIT–IV

IV. Elementary Particles: Historical introduction, fermions and bosons, particles and antiparticles, Classification of particles, types of interactions, electromagnetic, weak, strong interactions, gravitational interactions, Quantum numbers and conservation laws, isospin, charge conjugation, Yukawa theory, Introduction to quarks and qualitative discussion of the model, high energy physics units.

TUTORIALS: Relevant problems on the topics covered in the course.

Reference Books:

1. Basic Ideas and Concepts in Nuclear Physics by K. Hyde

2. Introduction to Nuclear Physics : H.A. Enge

3. Nuclear Physics : I. Kaplan (Addison Wesley)

4. Nuclei and Particles by E. Segre

5. Introduction to High Energy Physics by D.H. Perkins

6. Elementary Particles by I.S. Hughes

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SEMESTER–VI

PHYSICS

(PRACTICAL)

Marks: 20

General Guidelines for Practical Examination:

I. The distribution of marks is as follows :

i) One experiment **10 Marks**

ii) Brief Theory **3 Marks**

iii) Viva–Voce **4 Marks**

iv) Record (Practical file) 3 **Marks**

II. There will be one sessions of 3 hours duration. The paper will have one session.

Paper will consist of 8 experiments out of which an examinee will mark 6 experiments and one of these is to be allotted by the external examiner.

III. Number of candidates in a group for practical examination should not exceed 12.

IV. In a single group no experiment be allotted to more than three examinee in any group.

List of Experiments

i. To study the stabilization of output voltage of a power supply with Zener diode.

ii. To draw output and mutual characteristics of an FET (Experiments) and determine its parameters.

iii. To set up an oscillator and to study its output on CRO for different C values.

iv. To draw the plateau of a GM counter and find its dead time.

v. To study the statistical fluctuations and end point energy of beta particles using GM counter.

vi. To study the absorption of beta particles in aluminium using GM counter and determine the absorption coefficient of beta particles from it.

vii. Study of a diode as a clipping element.

viii. To measure the efficiency and ripple factors for (a) halfwave (b) full wave and (c) bridge rectifier circuits.

ix To study characteristics of Common Base transistor and determine h-parameters of a given transistor.

x. To study characteristics of Common Emitter transistor.

xi. To study the gain of an amplifier at different frequencies and to find Band width

xii. To study the reduction in the ripple in the rectified output with RC, LC and л filters.