MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

COURSE CURRICULAM AND SYLLABII OF THREE YEAR DEGREE COURSE
(Effective from the session 2016-17)

PHYSICS

Paper Code	Paper & Title	Hrs/week	Max. Marks
1161	I: Mechanics of Particles, Rigid bodies and Continuous Media	2	50
1162	II: Oscillations, Waves and Acoustics	2	50
1163	III: Electricity and Magnetism	2	50
1164	IV: Practical	4	75

Note:

1 Each theory question paper in the annual examination shall have three sections:
Section A shall contain one compulsory question of 5 marks having 10 parts. Two parts shall be set from each unit. The candidate is required to answer each part in one or few words. **(Total: 5 Marks)**

Section B shall contain five compulsory questions of 5 marks each with internal choice. One question with internal choice will be set from each unit. The answer may be given in approximately 250 words**. (Total 25 Marks)**

Section C shall contain four descriptive questions covering all units and candidates have to answer any two questions of ten marks each. The answer may be given in approximately 500 words. There can be two parts in a question from this section**. (Total 20 Marks)**

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Section B shall contain five compulsory questions of 5 marks each with internal choice. One question with internal choice will be set from each unit. The answer may be given in approximately 250 words**.**

Section C shall contain four descriptive questions covering all units and candidates have to answer any two questions of ten marks each. The answer may be given in approximately 500 words. There can be two parts in a question from this section**.**

FIRST YEAR, T.D.C., SCIENCE
(Effective from the session 2016-17)

Paper-I: 1161 Mechanics of Particles, Rigid Bodies and Continuous media

UNIT – I

Laws of motion, conservation of energy and momentum, transformation equations for rotating frame, centripetal and Coriolis accelerations, Coriolis force, Coriolis force due to earth's rotation – experimental demonstration by Focualt pendulum.

Motion under a central force, conservation of angular momentum, Kepler's laws.

UNIT – II

Fields and potential, gravitational field and potential due to spherical bodies, Gauss's and Poisson's equations, gravitational self energy.

Two body problem, reduced mass, scattering and scattering cross sections, illustrations, Rutherford scattering by hard spheres, centre of mass and laboratory reference frames, binary stars.

UNIT – III

System of particles, centre of mass, calculation of centre of mass of regular bodies, angular momentum, equations of motion, conservation theorems for energy, momentum and angular momentum,system of variable mass, elastic and inelastic collisions, rigid body, degrees of freedom, Euler's theorem.

UNIT – IV

Molecular rotations (as rigid bodies), moment of inertia, di and tri atomic molecules, intrinsic spin, precessional motion, motion of top, gyroscope.

Elastic constants for an isotropic solid, their inter relation, torsion of a cylinder, bending of beam, applications to cantilever.

UNIT – V

Kinematics of moving fluid, equation of continuity, Euler's law for fluidity.

Viscous fluids, streamline and turbulent flow, flow through a capillary tube, Poisvilles law, Reynold's number, Stoke's law, theory of rotation viscometer, effect of temperature and pressure on the viscosity of liquids.

Recent developments in Physics including discussion of Nobel prizes in Physics (no questions to be set in the theory examination).

Text

1. Mechanics- J.C.Upadhyaya, Ram Prasad & Sons
2. Mechanics- D.C.Mathur S.Chand & Co.
3. Mechanics of Particles, Rigid Bodies and Continous Media (In Hindi) by Kalra, Bhandari and Kakani

Reference Books:

1. E.M. Purcell, Editor, Berkeley Physics Course, Vol. 1, Mechanics, McGraw Hill.
2. R.P. Feynmann, R.B. Lighton, M. Sands, The Feynmann Lectures in Physics, Vol. 1. B.I. publications, Bombay, Delhi, Calcutta, Madras.
3. Mechanics of particles, Rigid Bodies and Continuous Media (In Hindi) by Kalra, Bhandari and Kakani

Paper-II : 1162 Oscillations, waves and Acoustics

UNIT - I

Free oscillations of simple systems: Equilibrium; concept of potential well, small oscillations approximation, solutions, linear and transverse oscillations of a mass between two springs, diatomic molecule, reduced mass concept.
Damped and forced oscillations: Damped oscillations; critical damping, Q of an oscillator. Forced oscillator with one degree of freedom; Transient and steady state oscillations, resonance energy absorption, low and high frequency responses.

UNIT - II

Free oscillations of system with two degrees of freedom: Two dimensional oscillator; normal modes, longitudinal and transverse oscillation of coupled masses, energy transfer between modes, coupled pendulum.
Fourier analysis: Fourier series and Fourier coefficients; simple examples (square wave, saw-tooth wave, half and full wave rectifier), use of exponential representation for harmonic oscillations, expression for Fourier coefficients

UNIT - III

Wave equation: Waves in a one-dimensional chain of particles; classical wave equation; wave velocity, boundary conditions and normal modes, dispersion relations, dispersion waves.
Waves in continuous media: Speed of transverse waves on a uniform string, speed of longitudinal waves in a fluid, energy density and energy transmission in waves, dispersion in waves, group velocity and phase velocity
Superposition of waves: Linear homogenous equations and the superposition principle, interference in space and energy distribution; beats and combination tones.

UNIT -IV
Ultrasonics: Production, detection, and applications of ultrasonic waves
Vibrations in bounded systems: Normal modes of a bounded system; harmonics, the quality of sound, Chladni's figures, Vibration of a drum. Noise and Music; Limits of human audibility; intensity and loudness, bel and decibel. Music scale and musical instruments.

UNIT - V
Reflection, refraction, and diffraction of sound: Acoustic impedance of a medium, percentage reflection, and refraction at a boundary, impedance matching for transducers. Diffraction of sound; principle of a sonar system, sound ranging.
Applied acoustics: Transducers and their characteristics, recording and reproduction of sound, measurement of frequency, velocity, waveform, and intensity. The acoustics of halls, reverberation period

Recent developments in Physics including discussion of Nobel prizes in Physics (no questions to be set in the theory examination).

Text book

1. Waves & Oscillations, Satya Prakash, Pragati Prakashan
2. Oscillations,Waves and Acoustics (In Hindi) by Kakani,Bhandari & Kalra

Reference Books:

1. Waves and Oscillations, Berkley Physics Course Vol. III
2. Vibrations and waves, I.G. Main (Cambridge University Press)
3. The Physics of Vibrations and Waves, H.J. Pain, McMillan (1975).

PAPER-III: 1163 ELECTRICITY AND MAGNETISM

UNIT – I

Electric Field: Coulomb's law, unit of charge (SI and other systems of units). Conservation and quantization of charge. Field due to different charge distributions, monopole, dipole, quadrupoles, line charge, sheet charge. Torque on a dipole in uniform field and non-uniform fields, flux of an electric field. Gauss's law - applications to deduce **E** fields, force per unit area on the surface of a charged conductor.

Potential: Line integral of electric field and electrical potential. Field as the gradient of potential. Potential energy of a system of charges and its calculation in various configurations. Field equations for **E** in vacuum. Energy associated with **E** field. Differential form of Gauss's law: Poisson's equation, Laplace's equation, boundary conditions and uniqueness theorems.

Electric field around conductors: induced charges, field and potential inside a conductor, field near the surface of a conductor, method of images.

UNIT – II

Electric fields in matter: atomic and molecular dipoles, induced dipoles, electronic and molecular contributions. Electrical field caused by polarized matter, **E** and **D** fields, permittivity, dielectric constant. Capacitor filled with dielectric, field equations in presence of dielectric. The field of a polarized sphere, dielectric sphere in a uniform field. Energy in dielectric systems. Polarizability and susceptibility, frequency dependence of polarizability, Claussius-Mossotti equation.

Magnetic filed: Magnetic field **B** seen through Lorentz force on a moving charge, unit for B field, magnetic dipoles in atoms and molecules, gyromagnetic ratio. Magnetic field due to currents: Biot and Savart's law. Field equations in magnetostatics, Ampere's law. Fields due to a straight wire, magnetic dipole, circular current and solenoid. Magnetic fields in matter. Magnetizing current, magnetization vector, **H** and **B** fields, magnetic permeability, susceptibility. Comparison of magnetostatics and electrostatics.

UNIT – III

Electrical current: current density and current; non-steady currents and continuity equations. Electrical conductivity, resistivity, conductance and their temperature dependence. Thermo electric current and dark current, non-ohmic circuitry, thermistor. Varying current. Rise and decay of currents in LR and CR circuits, time constant, integrating and differentiating circuits, electrical shielding. Study of a discrete LC transmission line.

UNIT – IV

Alternating currents: Skin effect for resistance at high frequencies, complex impedance, reactance, impedances of LCR series and parallel circuits, resonance, Q

factor, power dissipation and power factor. AC bridges: Anderson's ,deSauty's and Owens bridges, Self and mutual inductance. Measurement of mutual inductance by Carry Foster Method, Coupled circuits and Transformers.

UNIT – V

Ballistic Galvanometer (moving coil type), its distinction from beat type. B.G. differential equation and its solution under different conditions of damping. Critical damping, over damping. Logarithmic decrements, charge sensitivity, current sensitivity, determination of B using search coil and B.G. Determination of high resistance using B.G. Factors for sensitivity. B.G. constant. Measurement of mutual inductance by Carey Foster's bridge by B.G. Measurement of small resistance by Kelvin's double bridge.

Recent developments in Physics including discussion of Nobel prizes in Physics (no questions to be set in the theory examination).

Text

1. A.S. Mahajan and A.A. Rangawala , Electricity and Magnetism, Tata McGraw Hill.
2. Electricity and Magnetism, P. Chakrabarty and K.C.Gupta, New Age International
3. Electricity and Magnetism (In Hindi) by Bhandari, Kalra and Kakani

Reference Books:

1. E.M. Purcell, Ed. Berkely Physics Course, Vol. 1, Electricity and Magnetism McGraw Hill.
2. D. Halliday and R. Resnick, Physics, vol. 2, Wiley Eastern, New Delhi.

Paper-IV: 1164 PHYSICS PRACTICALS

Note: Students are expected to perform sixteen experiments in all taking the eight experiments from each section. One experiment from section A and one from section B will be set in the examination paper.

The distribution of marks in the practical examination will be as follows:

(i) Two experiments 48 Marks

For each experiment, distribution of marks will be as follows:

Figure : 3

Formula/Theory : 3

Observation : 10

Calculation (including error) and Result : 6

Precautions : 2

(ii) Viva voce 12

(iii) Records 15

Total 75 Marks

LIST OF EXPERIMENTS

Important Note:

(i) Before starting experiments, students should be taught errors in measurement, propagation of errors, importance of significant figures, identifying variables in experiment, importance of graphical presentation of data. Results without quoting errors should not be approved.

Section-A

1. Determination of elastic constants Y, η,σ and K by Searle's method.

2. Determination of thermal conductivity 'K' of a bad conductor by Lee's method.

3. Determination of J by Callender and Barne's method.

4. Study of temperature variation of surface tension by Jaegers method.

5. Study of free fall of a body: use of a digital timer to get time and velocity at different depth and analysis.

6. Study of collision in two dimension

7. Kater's pendlum , precise setting ,analysis and determination of value of acceleration due to gravity ‘g’ at a place.

8. Study of damping of a bar pendulum under various kinds of damping mechanisms.

9. To determine coefficient of damping k ,relaxation time T and quality factor of a damped SHM using a simple pendulum.

10. Study of dependence of period of oscillations of a spring or rubber band on mass and spring constant.

11. To determine the velocity of sound in air at room temperature with Kundt’s tube.

12. Using scattering to deduce the nature of potential hump or well(two dimensional)

13 Study of laws of parallel and perpendicular axes for estimation of moment of inertia.

14. Computer simulation of equations of motion for a system of particles.

15. Computer simulation of molecular rotations, as rigid bodies.

16. Study of motion of a top and a gyroscope.

17. Study of torsion of a wire ; dependence on radius, length, torque and material(static method)

18. To determine the modulus of rigidity of the material of a wire by statistical method using Bortan’s apparatus

19. To determine the value of modulus of rigidity of the material of a given wire by dynamical method using Maxwell’s needle

20 .Study of flow of liquids through capillaries: laminar and turbulent flow stages, capillaries

21. To determine the coefficient of viscosity of water by Poisevill’s method

22.Studying the fall of solids through a liquid.

23 To determine the coefficient of viscosity of a liquid (glycerin or castor oil) by Stoke’s method

23. Study of air flow through a capillary: U- tube with a long capillary fitted on one arm, mercury level difference pushing air.

24. To determine Poisson’s ratio of rubber

25. Measurements of length (or diameter) using vernier caliper, screw gauge and traveling microscope.
26. To determine the Height of a Building using a Sextant.
27. To determine the Moment of Inertia of a Flywheel.
28. To determine the Young's Modulus of a Wire by Optical Lever Method.
29. To determine the Modulus of Rigidity of a Wire by Maxwell’s needle.

30. To determine the Elastic Constants of a Wire by Searle's method.
31. To determine g by Bar Pendulum.
32. To determine g by Kater's Pendulum.
34. To determine g and velocity for a freely falling body using digital timing technique
35. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of g

SECTION -B

1. Calibration of Carey Fosters bridge wire and determination of the specific resistance of the material of the given wire.

2. Measurement of thermo e.m.f.

3. To study growth and decay of current in R.C. circuit and determine the time constant.

4. To determine impedance of L-R circuit and find phase relation ship in current and voltage.

5. To determine the constants of a ballistic galvanometer. Current and charge sensitivity, time period, log decrement and galvanometer resistance.

6. To determine intensity of magnetic field using search coil and ballistic galvanometer.

7. To determine high resistance by method of leakage. Measure leakage resistance of a condenser.

8. To determine low resistance by Kelvin's double bridge.

9. Determination of dielectric constant of a given liquid.

10.To determine inductance of a coil using Anderson's method.

11.Desauty's bridge method for comparison of two capacitors.

12. To determine mutual inductance by Carry Foster's Method

13. Study of the impedance of a capacitor of varying frequencies to measure C.

14. Response curve for LCR circuits series resonance.

15. Study of a discrete LC transmission line.

16. Response curve for LCR circuit parallel resonance

17. Measurements of electric charge and related quantities using an electrometer.

18. Study of potential distribution in a given geometrical configuration.

19. Mapping of electric fields for specified configurations.

20. To verify the Superposition, and Maximum Power Transfer Theorem

21 Study of the rise and decay of current in a RL circuits.

22. Characteristics of a choke.

23. Study of the impedance of an inductor at varying frequencies to measure R and L

24. To use a Multimeter for measuring

- Resistances,
- AC and DC Voltages,
- DC Current
- checking electrical fuses.

24. Ballistic Galvanometer:

- Measurement of charge and current sensitivity
- Measurement of CDR
- Determine a high resistance by Leakage Method
- To determine Self Inductance of a Coil by Rayleigh's Method.

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

26. To verify the Thevenin and Norton theorem