

(ii) Derive the expression of magnetic field at a point on the axis of current carrying circular loop. 6

(c) (i) Define magnetic induction, magnetic intensity and magnetisation vector. 2+2+2=6

(ii) Draw the hysteresis curve of a ferromagnetic substance. From the graph, define retentivity and coercivity. 4

(d) (i) Explain self inductance. Find the expression of energy stored in an induction coil. 2+4=6

(ii) Write the four Maxwell's equations in differential form. 4

(e) Explain the terms sharpness of resonance, bandwidth, quality factor in L-C-R (series) circuit. How sharpness vary with quality factor? 3+3+3+1=10

(f) Explain the construction and theory of ballistic galvanometer. 3+7=10

Total number of printed pages-4

3 (Sem-2/CBCS) PHY HC 1

2024

PHYSICS

(Honours Core)

Paper : PHY-HC-2016

(Electricity and Magnetism)

Full Marks : 60

Time : Three hours

The figures in the margin indicate full marks for the questions.

1. Answer the following questions: 1×7=7

(a) What is the work done in displacing a charge of 1C through a distance of 1m on an equipotential surface? 7

(b) A parallel-plate capacitor with dielectric of dielectric constant $(K) = 2$ between the plates has a capacitance C . What will be the capacitance if the dielectric is removed? 7

- (c) A proton is moving parallel to the magnetic field. What will be the force on the proton?
- (d) What is the S.I. unit of magnetic flux?
- (e) What is the phase difference between voltage and current in an a.c. circuit containing only pure inductance?
- (f) What is non-linear circuit?
- (g) Write the relation between peak value and r.m.s. value of alternating current.

2. Answer the following questions :

2×4=8

- (a) State Gauss's law in electrostatics and write the differential form of the law.
- (b) What are polar and nonpolar molecules? Give examples.
- (c) State Faraday's laws of electromagnetic induction.
- (d) The instantaneous value of voltage in an a.c. circuit is given by $V = 300 \sin 100\pi t$ volt. Find
(i) Frequency of the source;
(ii) Average value of voltage.

3. Answer any three questions: 5×3=15

- (a) Derive the expression of torque acting on an electric dipole placed in an uniform electric field.
- (b) Derive the relation $K = 1 + \chi_e$ between dielectric constant and electric susceptibility.
- (c) Two straight long parallel conductors are carrying currents I_1 and I_2 in same direction having a distance of separation r . Deduce the expression of force per unit length between them.
- (d) A 100mH inductor, a 25 μ F capacitor and 15 ohm resistor are connected in series to a 120V, 50Hz a.c. source. Calculate
(i) impedance;
(ii) resonance frequency
- (e) State and explain Thevenin's theorem.

4. Answer any three questions: 10×3=30

- (a) Derive the capacitance of a cylindrical capacitor filled with dielectric.
- (b) (i) State Biot-Savart's law in magnetism. Express it in vector form.

3+1=4