

2nd Semester (B.Sc.-H) Final Internal Examination-2020

**Department of Physics
Prabhat Kumar College, Contai
Paper-C3 (Electricity and Magnetism)**

Group-A (Theory)

(Answer any one of the following)

1. A) State and explain the Lenz's law of electromagnetic induction. B) For two inductances connected in parallel, calculate the equivalent inductance assuming that the mutual flux aids the self-flux. C) If two circuits of self-inductances L_1 and L_2 are coupled by a mutual inductance M , show that the magnetic energy U of the system is $U = \frac{1}{2}L_1I_1^2 + \frac{1}{2}L_2I_2^2 + MI_1I_2$, where I_1 and I_2 are the currents in the two circuits.
2. What is series resonance in an electric circuit? What are the resonant frequency, bandwidth, sharpness of resonance, and Q-factor of this circuit? How are they related? Why is the series resonant circuit called an acceptor circuit?
3. A) Write a short note on Thevenin's theorem and Maximum power transfer theorem. B) Define the Z-parameter of the two-port network. When is a two-port network termed as a reciprocal and non-reciprocal?
4. A) What is toroid? Apply Ampere's circuital law to determine the magnetic field inside and outside of a toroid. B) State and explain the Biot-Savart law. Using this calculate the magnetic field at a point on the axis of a circular conductor carrying current I .
5. A) A dielectric sphere of relative permittivity K_2 is placed in a uniform field in a medium of relative permittivity K_1 . Find the field inside the sphere when $K_2 > K_1$ and when $K_2 < K_1$. B) What is meant by polarization? Show that the polarization of a dielectric medium gives rise to a volume density of charge $\rho_p = -\vec{\nabla} \cdot \vec{P}$ and a surface density of charge $\sigma_p = \vec{P} \cdot \hat{n}$.
6. A) A dipole moment \vec{p}_1 is fixed at the origin of coordinates. Another coplaner dipole of moment \vec{p}_2 is placed at the position \vec{r} and is free to rotate. Show that for equilibrium $\tan\theta_1 = -2\tan\theta_2$, where θ_1 and θ_2 are angles that \vec{r} makes with \vec{p}_1 and \vec{p}_2 respectively. B) A sphere of radius R contains a uniform volume density of charge ρ . Determine the electric potential at a distance r from the centre of the sphere.

Group-B (Practical)

(Answer any one of the following)

1. For determine an unknown Low Resistance using Potentiometer, write down the theory and draw the circuit diagram of this experiment.
2. For determine an unknown Low Resistance using Carey Foster's Bridge, write down the theory and draw the circuit diagram of this experiment.
3. For measurement of field strength B and its variation in a solenoid (determine dB/dx), write down the theory with working formula, draw circuit diagram and procedure of error calculation.
4. For verify the Superposition, and Maximum power transfer theorems, write down the theory, working formula and procedure of this experiment.
5. For determine self-inductance of a coil by Anderson's bridge, write down the working formula, circuit diagram and discussion of this experiment.

Answer script submitted to goutammanna84@gmail.com