**22PHU308N**

**PSG COLLEGE OF ARTS & SCIENCE**
(AUTONOMOUS)

**BSc DEGREE EXAMINATION DECEMBER 2025**
(Third Semester)

Branch - **PHYSICS**

**ELECTRICITY AND MAGNETISM**

Time: Three Hours Maximum: 75 Marks

**SECTION-A (10 Marks)**
Answer **ALL** questions
**ALL** questions carry **EQUAL** marks (10 × 1 = 10)

| Module No. | Question No. | Question | K Level | CO |
|---|---|---|---|---|
| 1 | 1 | Gauss's law states that:<br>a) The total magnetic flux through a closed surface is zero<br>b) The total electric flux through a closed surface is equal to the charge enclosed divided by ε<br>c) The electric field is proportional to charge density<br>d) None of these | K1 | CO1 |
| | 2 | When a dielectric is placed in an external electric field, the field inside it becomes<br>a) Stronger than external field<br>b) Weaker than external field<br>c) Same as external field<br>d) Zero | K2 | CO1 |
| 2 | 3 | Electric current is defined as<br>a) Rate of change of voltage b) Rate of flow of charge<br>c) Charge per unit voltage d) Charge per unit resistance | K1 | CO2 |
| | 4 | The Carey Foster bridge is mainly used to:<br>a) Compare two EMFs b) Measure very low resistance<br>c) Measure inductance d) Measure capacitance | K2 | CO2 |
| 3 | 5 | Ionic mobility is defined as<br>a) Velocity of an ion under unit potential gradient<br>b) Charge per ion<br>c) Distance moved per unit charge<br>d) Product of charge and velocity | K1 | CO3 |
| | 6 | Peltier coefficient (π) is defined as<br>a) Heat absorbed or evolved per coulomb of charge at a junction<br>b) emf developed per degree temperature difference<br>c) Work done per mole<br>d) Charge per unit mass | K2 | CO3 |
| 4 | 7 | If the peak value of an alternating current is $I_m$, it's RMS value is<br>a) $I_m$ b) $\frac{I_m}{2}$ c) $\frac{I_m}{\sqrt{2}}$ d) $\frac{I_m}{\sqrt{3}}$ | K1 | CO4 |
| | 8 | In a parallel resonant circuit, at resonance the current<br>a) Is minimum b) Is maximum<br>c) Depends only on resistance d) Becomes zero | K2 | CO4 |
| 5 | 9 | Diamagnetic substances have<br>a) Positive susceptibility b) Negative susceptibility<br>c) Zero susceptibility d) Very high susceptibility | K1 | CO5 |
| | 10 | According to Langevin's theory, diamagnetism arises due to<br>a) Permanent magnetic dipoles<br>b) Orbital motion of electrons creating small opposing fields<br>c) Alignment of dipoles in field direction<br>d) Presence of unpaired electrons | K2 | CO5 |

**Cont...**

## SECTION - B (35 Marks)

Answer **ALL** questions

**ALL** questions carry **EQUAL** Marks (5 × 7 = 35)

| Module No. | Question No. | Question | K Level | CO |
|---|---|---|---|---|
| 1 | 11.a. | State Gauss's law in integral and differential forms. | K2 | CO1 |
| | | (OR) | | |
| | 11.b. | Define dielectric constant K and electric susceptibility $\chi_e$, and write the relation between them. | | |
| 2 | 12.a. | Define current density and explain the equation of continuity for steady current. | K3 | CO2 |
| | | (OR) | | |
| | 12.b. | State Ohm's law in microscopic form and calculate the electrical conductivity of a material given current, area, and potential difference. | | |
| 3 | 13.a. | Calculate the transport number of ions in an electrolyte given the ionic velocities and the total current. Discuss the significance of transport numbers in electrolysis. | K4 | CO3 |
| | | (OR) | | |
| | 13.b. | Calculate the heat absorbed or evolved per unit charge in a conductor exhibiting the Thomson effect and explain its significance. | | |
| 4 | 14.a. | Apply the J-operator method to determine the current in a series RLC circuit driven by an AC voltage. | K4 | CO4 |
| | | (OR) | | |
| | 14.b. | Determine the decay constant for current in a CR circuit and analyze its effect on voltage across the resistor. | | |
| 5 | 15.a. | Classify materials as diamagnetic, paramagnetic, and ferromagnetic, and give examples of each. | K3 | CO5 |
| | | (OR) | | |
| | 15.b. | State Ampere's circuital law and apply it to find the magnetic field around a long straight current-carrying conductor. | | |

## SECTION -C (30 Marks)

Answer **ANY THREE** questions

**ALL** questions carry **EQUAL** Marks (3 × 10 = 30)

| Module No. | Question No. | Question | K Level | CO |
|---|---|---|---|---|
| 1 | 16 | Explain the concept of electric potential. Show that the electric field is equal to the negative gradient of the electric potential and describe the significance of this relation. | K4 | CO1 |
| 2 | 17 | Solve a Carey-Foster bridge problem to determine an unknown resistance from measured deflection readings. | K4 | CO2 |
| 3 | 18 | Calculate the thermo emf of a thermocouple using the Seebeck coefficients of its metals and determine the temperature at which the thermo emf becomes zero. | K4 | CO3 |
| 4 | 19 | Analyze a parallel resonance circuit and calculate the resonant frequency, current, and voltage across the branches. | K4 | CO4 |
| 5 | 20 | Discuss the domain theory of ferromagnetism and analyze how it explains saturation magnetization. | K4 | CO5 |

Z-Z-Z END