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(July)

PHYSICS

(Elective/Honours)

(Electromagnetism, Electronics—I)

[PHY02 (T)]

Marks : 56

Time : 3 hours

The figures in the margin indicate full marks
for the questions

Answer Question No. 1 and any four from the rest

1. (a) The total charge within a sphere of radius r is given by

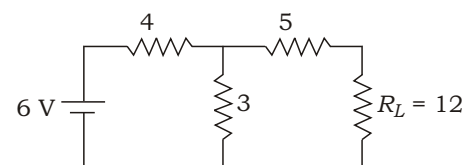
$$Q = q \frac{r^2}{a^2} \left(e^{\frac{r}{a}} - e^{\frac{2r}{a}} \right)$$

where q and a are constants. Calculate the electric potential and the corresponding electric field at a point outside the sphere. 1½+1½=3

- (b) Calculate the value of gyromagnetic ratio and the value of Bohr magneton of an electron. 1½+1½=3

- (c) A steady current of 2 A flows through a coil of self-inductance 30 mH when connected to a 20 V DC supply. Calculate the current and power factor in the coil when it is reconnected to a 200 V, 50 Hz AC power supply. 1½+1½=3

- (d) Reduce the following circuit to Thevenin's equivalent circuit and hence calculate the current through the load resistance (R_L) : 3



2. (a) Deduce Gauss' law in a dielectric medium. 5

- (b) Explain electric polarization. Establish the relation between $\vec{D}$, $\vec{E}$ and $\vec{P}$ where $\vec{D}$ is the electric displacement vector, $\vec{E}$ is the electric field intensity and $\vec{P}$ is the electric polarization vector. 2+4=6

3. (a) Obtain the expression of electric potential and electric field at any arbitrary point due to an electric dipole. 3+3=6

(3)

- (b) State Biot-Savart law and hence using this law, obtain the expression of magnetic field due to an infinitely long straight current carrying conductor. 1+4=5
4. (a) Obtain the expression of resonant frequency of an L - C - R parallel circuit. Why is the circuit called 'rejector circuit'? 5+2=7
- (b) Discuss the growth and decay of electric current in C - R circuit. Define the time constant of the circuit. 3+1=4
5. (a) State Faraday's law of electromagnetic induction. Obtain the differential form of Faraday's law. 1+4=5
- (b) Give the principle, construction, working and theory of transformer. 1+2+1+2=6
6. (a) State and prove superposition theorem. 2+6=8
- (b) Explain various characteristics of a bipolar junction transistor in CE configuration. 1+1+1=3

(4)

7. (a) What is a multi-stage transistor amplifier? With the help of a neatly labelled circuit diagram, briefly explain the working of a two-stage R - C coupled amplifier in CE configuration. 1+1+4=6
- (b) What is an oscillator? With the help of a block diagram, explain the functions of the essential components of an oscillator. 1+1+3=5
8. (a) With the help of circuit diagrams using diodes, explain the working of OR and AND gates. Write down their truth tables. 3+3=6
- (b) Describe the principle of working of an ideal operational amplifier (OP-AMP). Give the characteristics of an ideal operational amplifier (OP-AMP). 2+3=5

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