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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 any **eight** questions

1. State Gauss' law in electrostatics. Using this law, calculate the electric field due to a uniformly charged spherical shell at a point outside the shell. 1+6=7
2. A solid sphere of radius R has a uniform volume charge density ρ . Calculate the potential at a point (a) outside the sphere and (b) on the surface of the sphere. 5+2=7
3. (a) Find the magnetic field due to a circular coil of radius 0.1 m and having 200 turns at the centre of the coil when circulating current is 500 mA. 3

- (b) Establish the relationship between magnetic dipole moment and angular momentum for an electron moving in a circular orbit. Hence define gyromagnetic ratio. 3+1=4

4. Derive an expression for the growth and decay of an electric current in a circuit having a resistance R and self-inductance L . What is meant by time constant of the circuit? 3+3+1=7
5. An alternating e.m.f. $E_0 \sin t$ is applied to the ends of a circuit containing resistance R , self-inductance L and capacitance C . Calculate the impedance of the circuit, phase angle and the current at any instant. 7
6. (a) State Faraday's law of electromagnetic induction and obtain the integral and differential form of the law. 1+1½+1½=4
- (b) A solenoid 16 cm long has 1280 turns and its cross-section is 10 sq. cm. There is another coil of 1000 turns closely wound on the central part of the solenoid. Find the mutual inductance of the coil in henry. 3

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7. State and prove Norton's theorem. 7
8. What are h -parameters? Obtain expressions for input impedance and voltage gain for a transistor amplifier in CE configuration using h -parameters. 2+2+3=7
9. Explain with a suitable diagram, the operation of a full-wave rectifier. Calculate the efficiency of rectification and ripple-factor for a full-wave rectifier. 1+3+1½+1½=7
10. Obtain the relation between β and β_{AC} of a transistor. Draw the typical output characteristics of CE transistor and show the different regions of operation of the transistor in the output characteristics. 2+2+3=7
11. (a) What are binary numbers? Explain with an example the method of conversion from binary number into decimal number. 1+2=3
- (b) State the rules for binary subtraction using 2's complement method and subtract 10001_2 from 10011_2 using the same method. 2+2=4

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12. (a) State De Morgan's theorem and use them to prove the following Boolean expression : 1+3=4
- $$Y = \overline{(A \cdot \overline{B} \cdot C)} \cdot (\overline{B} \cdot \overline{C}) \cdot 0$$
- (b) Construct an AND gate using NOR gates. Give its truth table. 2+1=3

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