3 SEM TDC PHY M 2

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(November)

PHYSICS

(Major)

Course : 302

(Electricity and Magnetism)

Full Marks : 60

Pass Marks : 24/18

Time : 3 hours

The figures in the margin indicate full marks
for the questions

1. Choose the correct option from the following
   (symbols have their usual meanings) :   1×6=6

   (a) Two R-C circuits A and B have equal
        resistances but capacitor of A is twice
        that of B. Which circuit has larger time
        constant ?

        (i) A

        (ii) B

(*Turn Over*)

(iii) Equal for both

(iv) Cannot be compared

(b) When a magnet is broken, which of the following remains unchanged?

(i) Magnetic potential

(ii) Moment of inertia

(iii) Magnetization

(iv) Magnetic moment

(c) Two circuits have mutual induction of 0·1 H. What average e.m.f. is induced in one circuit, when the current in the other circuit changes from 0 to 20 amp in 0·02 sec ?

(i) 20 V

(ii) 2000 V

(iii) 100 V

(iv) 200 V

(d) The resultant capacitance of the following combination
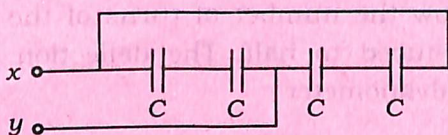
is

(i) $\dfrac{C}{3}$

(ii) $\dfrac{4C}{3}$

(iii) $\dfrac{3C}{4}$

(iv) C

(e) Ampere-hour is the unit of

(i) charge

(ii) power

(iii) potential difference

(iv) capacitance

(f) A galvanometer is connected to a cell directly. It shows a certain deflection. Now the number of turns of the coil is reduced to half. The deflection of the galvanometer

  (i) is doubled

  (ii) is halved

  (iii) remains unchanged

  (iv) is quadrupled

2. Deduce an expression for capacitance of a spherical capacitor in which (i) inner sphere is charged with a charge '+q' and the outer sphere is earthed and (ii) the outer sphere is given a charge '+q' and the inner sphere is earthed.

$$3\tfrac{1}{2}+3\tfrac{1}{2}=7$$

3. Explain what are meant by polar and non-polar dielectric materials. What is electronic polarization?

$$2+1=3$$

4. Deduce an expression for Laplace's equation.

$$3$$

5. What is meant by the capacitance of a capacitor? Find the expression for capacitance of a parallel-plate capacitor. If the gap between the plates is partially filled by a material of dielectric constant k and thickness t, what will be the change in capacitance?   1+3+3=7

6. If

$$\vec{A} = x^2 y\hat{i} - 2xz\hat{j} + 2yz\hat{k}$$

find $\vec{\nabla} \times \vec{\nabla} \times \vec{A}$.   2

7. Describe a method for the measurement of high resistance.   3

8. Find the expressions for growth and decay of current in an L-R circuit, when a direct voltage source is applied.   7

9. (a) Explain the differences between AC and DC generators.   3

    (b) Show that the current lags behind by $\pi/2$ with respect to e.m.f., when AC passes through an inductor.   4

10. Differentiate among diamagnetic, paramagnetic and ferromagnetic substances.   2

(Turn Over)

11. Find the length of a thin wire required to manufacture a solenoid of length l and self-inductance L if the cross-sectional area in negligibly small, where

$$L = \frac{\mu_0 N^2 A}{l}$$

  N = Number of turns per length

  A = Area of cross-section.　　　3

12. Describe a method for the measurement of mutual inductance by ballistic galvanometer.　　5

13. An alternating e.m.f. is applied in a circuit containing R and C in series. Obtain the expressions for current, impedance and power factor of the circuit.　　5

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