

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) : $1 \times 6 = 6$

(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

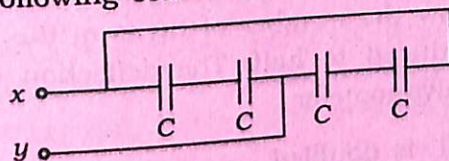
(Turn Over)

(2)

(3)

- (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) $\frac{C}{3}$
(ii) $\frac{4C}{3}$
(iii) $\frac{3C}{4}$
(iv) C
- (e) Ampere-hour is the unit of
- (i) charge
(ii) power
(iii) potential difference
(iv) capacitance

(4)

- (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.
 $3\frac{1}{2} + 3\frac{1}{2} = 7$
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)

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

7. Describe a method for the measurement of high resistance.
2

8. Find the expressions for growth and decay of current in an $L-R$ circuit, when a direct voltage source is applied.
3

9. (a) Explain the differences between AC and DC generators.
7

- (b) Show that the current lags behind by $\pi/2$ with respect to e.m.f., when AC passes through an inductor.
3

10. Differentiate among diamagnetic, paramagnetic and ferromagnetic substances.
4

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 is negligibly small, where

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

N = Number of turns per length

A = Area of cross-section.

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