

A Answer All :-

Q-1) a) State Gauss law for electrostatics. [2]

b) Derive the expression for electric field at an inside ($r < R$) outside ($r > R$) point due to a non conducting solid sphere of radius R which carries a charge $+Q$ uniformly. [4+4]

Q-2) a) State Biot-Savart Law. [2]

b) A circular loop carries a current i . The radius of the loop is R . Find the magnetic field at a point on the axis at a distance r from the centre of the loop. [5]

c) Find the self inductance of a long solenoid of radius r , no. of turns per unit length n and total length l . [3]

B Correct Answer $\rightarrow (+2)$, Wrong answer $\rightarrow (-1)$ [15 × 2 = 30]

3) The electrostatic force between the metal plates of an isolated parallel plate capacitor C having a charge Q and area A is:-

- independent of the distance between the plates.
- inversely proportional to the distance between the plates.
- proportional to the square root of the distance between the plates.
- linearly proportional to the distance between the plates.

4) An inductor 20 mH , a capacitor $100 \mu\text{F}$ and a resistor 50Ω are connected in series across a source of emf $V = 10 \sin 314t$. The power loss in the circuit is

- a) 0.80 W b) 1.13 W c) 2.74 W d) 0.43 W

5) A set of n equal resistors of resistance R each are connected in series to a battery of emf E and internal resistance R . The current drawn is I . Now the n resistors are connected in parallel to the same battery. Then the current drawn from the battery becomes $10I$. The value of ' n ' is

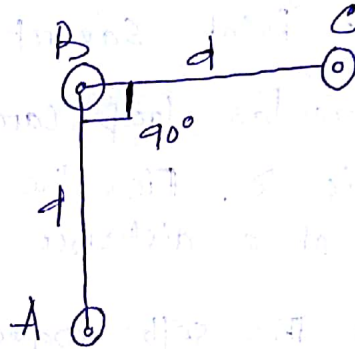
- 11
- 9
- 10
- 20

6) The magnetic potential energy stored in an inductor is 25 mJ. The current in the inductor is 60 mA. The inductance is

- a) 0.138 H b) 13.89 H c) 1.389 H d) 138.88 H

7) An arrangement of three parallel straight wires placed perpendicular to plane of paper carrying current i along the same direction is shown in figure. Magnitude of force per unit length on the middle wire B is -

- a) $\frac{2\mu_0 i^2}{\pi d}$
 b) $\frac{\sqrt{2}\mu_0 i^2}{\pi d}$
 c) $\frac{\mu_0 i^2}{\sqrt{2}\pi d}$
 d) $\frac{\mu_0 i^2}{2\pi d}$



8) A long solenoid has 1000 turns. When a current of 4A flows through it, the magnetic flux linked with each turn is 4×10^{-3} Wb. The self inductance of the solenoid is -

- a) 4H b) 3H c) 2H d) 1H.

9) The charge flowing through a resistance R varies with time t as $Q = at - bt^2$, where a and b are positive constants. The total heat produced in R is -

- a) $\frac{a^3 R}{b}$ b) $\frac{a^3 R}{3b}$ c) $\frac{a^3 R}{6b}$ d) $\frac{a^3 R}{8b}$

10) Four electric charges $+q, +q, -q$ and $-q$ are placed at the corners of a square of side $2L$. The electric potential at point A, midway between the two charges $+q$ & $+q$ is

- a) $\frac{1}{4\pi\epsilon_0} \frac{2q}{L} (1 + \sqrt{5})$
 b) $\frac{1}{4\pi\epsilon_0} \frac{2q}{L} (1 + \frac{1}{\sqrt{5}})$
 c) $\frac{1}{4\pi\epsilon_0} \frac{2q}{L} (1 - \frac{1}{\sqrt{5}})$
 d) zero

