

Half Yearly Examination 2017-2018

Std. : XII
Subject : PHYSICS

Full Marks : 70
Time : 3 Hrs+15mins.

Part-I

Q1. (A) Choose the correct alternative.

[1x5]

- (i) If a charge 'q' is placed at the centre of the line joining two equal charges 'Q' such that the system is in equilibrium, then the value of 'q' is
(a) $\frac{Q}{2}$ (b) $-\frac{Q}{2}$ (c) $\frac{Q}{4}$ (d) $-\frac{Q}{4}$
- (ii) Three capacitors each of capacitance C and of break down voltage 'v' are joined in series. The capacitance and breakdown voltage of the combination will be
(a) $3C, \frac{V}{3}$ (b) $\frac{C}{3}, 3V$ (c) $3C, 3V$ (d) $\frac{C}{3}, \frac{V}{3}$
- (iii) An electric bulb rated as (220V — 100W). The power consumed by it, when operated on 110V, will be
(a) 25W (b) 50W (c) 75W (d) 40W
- (iv) In a region, steady and uniform electric and magnetic fields are present. These two fields are parallel to each other. A charged particle is released from rest in the region. The path of the particle will be
(a) ellipse (b) circle (c) helix (d) straight line
- (v) Which of the following quantity remains unchanged in a transformer
(a) voltage (b) current (c) frequency (d) none of these

Q1. (B) Answer these questions in brief and to the point.

[1x7]

- (a) Sketch the lines of force due to two equal positive charges placed near each other.
- (b) How does the speed of an electrically charged particles affects its (i) mass and (ii) charge.
- (c) In a certain 0.1 m^3 of space, electric potential is found to be 5V throughout. What is the electric field in this region ?
- (d) Suggest the position related to an electric dipole where intensity is non zero but potential is zero.
- (e) A (40W, 200V) & a (60 W, 220V) bulb is connected in series to the same supply voltage. Which bulb is more likely to fuse and why ?
- (f) Give the statement of Ampere's circuital law.
- (g) The refractive index of diamond is 2.4. What should be the value of critical angle for diamond-air interface.

Q1. (C) Answer these questions in short.

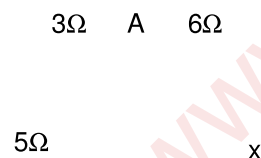
[2x4]

- (i) State Curie Weiss law. Draw graph for susceptibility with respect to temperature for a paramagnetic material.
- (ii) An electron moving with a velocity of 10^6 m/s in a conductor from east to west. Find the magnetic field strength at a point at perpendicular distance of 1m from the conductor in north.
- (iii) An electron is orbiting round the nucleus in an orbit of radius 'r' with constant speed 'v'. What will be the magnetic field strength at the centre. Also find the magnetic moment in this case.
- (iv) A light bulb is kept at a depth 'h' below the surface of water. If the refractive index of water is ' μ ' then through what surface area light can come out over water surface.

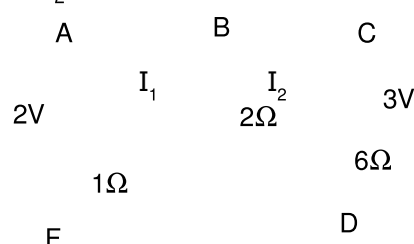
Part-II

(Answer all the questions in this part)

- Q2.** In the figure given below, find the value of resistance 'x' for which points A & B are at the same potential. Also find the current through different branches. [2]



- Q3.** A bar magnet of magnetic moment M is re-cast in the form of a semicircle. What would be its new magnetic moment. [2]
- Q4.** A circular segment of radius 10cm subtends an angle of 30° at its centre. A current of 3A is flowing through it. Find the magnitude of field strength at its centre in C.G.S unit. [2]
- Q5.** State and explain Lenz's law. How is it in accordance with the principle of conservation of energy. [2]
- Q6.** What do you mean by eddy current. Give its two important uses. [2]
- Q7.** A metallic wire has a resistance of 3.0Ω at 0°C and 4.8Ω at 150°C . Find the temperature coefficient of resistance of its material. [2]
- Q8.** Three capacitors of $10\mu\text{F}$, $20\mu\text{F}$ and $30\mu\text{F}$ are connected in parallel to a 100 volt d.c supply. Calculate the energy stored on the capacitors. [2]
- Q9.** Find the values of currents I_1 and I_2 and potential difference across BE in the given figure below. [3]



- Q.10.** Velocity of light in vacuum is 3×10^8 m/s. What would be the velocity of light in a medium whose critical angle is 44° . If the light ray falls normally on this medium of thickness 50cm. In what time it will pass through it [5]

Or
$$\sin \frac{A + \delta}{m}$$

Establish the formula $\mu = \frac{2}{\sin A/2}$ in a prism where the terms have their usual meaning.

- Q.11.** A pendulum in which bob of mass 80 mg carrying a charge of 2×10^{-8} C is at rest in a horizontal electric field of 2×10^4 V/m. Find the tension in the string of pendulum and the angle it makes with the vertical. [3]

- Q.12.** A conductor of length 'L' is connected to a d.c source of potential 'V'. If the length of the conductor is tripled by stretching it, keeping 'V' constant. Explain how do the following factors vary in the conductor : [3]

(i) Drift velocity of electrons. (ii) Resistance. (iii) Resistivity.

- Q.13.** A circular coil of radius 'r' having current strength 'I'. Find the magnetic field strength due to it at a point on the axis of a circular coil at a distance 'x' from its centre. [3]

- Q.14.** What do you mean by motional emf. Derive the expression for it. [3]

- Q.15.** A proton, a deuteron and an α -particle projected normal to a magnetic field with (i) Equal velocity (ii) Equal K.E. Find the ratio of radius of circular track followed by these in the two cases. [3]

OR

Define average value of alternating current & establish the expression for it. For full cycle of A.C what will you expect its value ?

- Q.16.** Explain the construction and working of a moving coil galvanometer. What do you mean by current sensitivity of moving coil galvanometer ? On what factors it depend. [5]

OR

Derive the expression for magnetic field strength due to an infinitely long current carrying conductor using B.S.L law. The sections of two infinitely long current carrying conductor having current 2A and 4A separated by a distance of 80 cm. Find the position of neutral point between the two.

- Q.17.** Find the expression for self inductance of a solenoid. Also derive the work done in setting a current strength in the solenoid. [5]

OR

Derive the expression for current in a purely capacitive circuit when alternating voltage is applied on it. In an RL circuit, the resistance $R = 30\Omega$. reactance $X_L = 40\Omega$ and peak emf = 220V. Calculate (i) Impedance (z) (ii) phase difference between emf and current (iii) Peak current I_0 in the circuit.

- Q.18. a)** Establish the mirror formula $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$ where the terms have their usual meaning. [5]

- b) Calculate the angle of minimum deviation for a regular glass prism. Refractive index of glass is 1.6. OR

- (a) Establish the relation $\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{r}$ for a spherical refracting surface.

- (b) A black dot is at a distance of 3cm from nearest surface on diameter of a glass sphere of radius 5cm. If it is looked from outside, where it will appear ? ($\mu_g = 1.5$)