

Jharkhand University of Technology, Ranchi

B.Tech. 1st Semester Examination, 2018

Subject : Physics-I (Basic of EMQP)

Subject Code : 18105

Time Allowed : 3 Hours

Full Marks : 70

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Answer any five questions.

1. Multiple choose questions:

2×7=14

(i) The electric field inside a spherical shell of uniform charge density is

- ☒ (a) zero
- (b) non-zero constant
- (c) directly proportional to distance from centre
- (d) inversely proportional to distance from centre

(ii) The unit of \vec{D} is

- (a) V/m^2
- ☒ (b) $Coul/m^2$
- (c) V/m
- (d) $Coul/m$

(iii) The effect of dielectric is to

- ☒ (a) increase the capacitance.
- (b) decrease the capacitance.
- (c) reduce the working voltage.
- (d) increase the distance between the plates.

(iv) Magnetic susceptibility has the dimension of

- (a) $wb-m$
- ☒ (b) dimensionless
- (c) wb/m^2
- (d) $Ampere/m$

- (v) The de-Broglie hypothesis is associated with
- (a) wave nature of electrons only
 - (b) wave nature of α -particles only
 - (c) wave nature of radiations
 - (d) wave nature of all material particles
- (vi) Electrons show the wave behaviour as
- (a) they get diffracted by the crystal.
 - (b) they ionize the gas.
 - (c) they are deflected by the electric field.
 - (d) they are deflected by the magnetic field.
- (vii) According to Schrödinger, a particle is equivalent to a
- (a) single wave
 - (b) wave packet
 - (c) light wave
 - (d) can not behave as wave

Or,

Write down Schrödinger's wave equation for a particle in a three dimensional box. Solve it to obtain eigenfunctions and show that eigenvalues are discrete. Explain clearly the meaning of degeneracy of levels .

14

2. State and explain Faraday's laws of electromagnetic induction. Deduce Faraday's laws of electromagnetic induction in the form $\text{curl } E = \frac{-\partial B}{\partial t}$. What is self inductance? Find the self inductance of a long Solenoid. 14
3. Explain the different types of polarisation mechanism in dielectrics. Derive expressions for electronic polarizability, ionic polarizability and orientational polarizability. 14
4. What is meant by hysteresis? Explain hysteresis loss. Show that the work done per unit volume of the material per cycle is equal to μ_0 times the area of M-H loop or the area of B-H loop. How hysteresis curve is used to select material for the construction of (i) Permanent magnets (ii) electromagnets? 14
5. What is Compton effect? Obtain an expression for Compton shift. Explain why Compton shift is not observed with visible light. 14
6. What is de-Broglie wave? Obtain an expression for its wavelength. Find the de-Broglie wavelength of electrons accelerated through V volts. Describe Davisson and Germer's experiment to show the existence of matter waves. 14
7. What is the physical interpretation of the wave function? Derive Schrödinger's (i) time dependent and (ii) time independent wave equations. 14