(6 pages) **Reg. No. :** .....

Code No. : 6379 **Sub. Code : HPHM 22**

M.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2016.

Second Semester

Physics

ELECTROMAGNETIC THEORY

(For those who joined in July 2012 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer.

1. The electric charge in a conductor

(a) resides on the inner side of isolated conductor

(b) resides on the outer side of isolated conductor

(c) is equally distributed throughout

(d) is concentrated at the centre of the conductor

2. Poisson's equation states that

(a) $\nabla^2 V = -\frac{\rho}{\varepsilon}$ (b) $\nabla^2 V = \frac{\rho}{\varepsilon}$

(c) $\nabla V = \frac{\rho}{\varepsilon}$ (d) $\nabla V = \frac{\rho^2}{\varepsilon}$

3. The ratio of the intensity of magnetic field at the centre of a very long solenoid to that at the extreme ends is

(a) 2 (b) $\frac{1}{2}$

(c) 4 (d) $\frac{1}{4}$

4. When a substance is placed in a magnetic field, its ability to get magnetized depends upon its

(a) Permeability (b) Susceptibility

(c) magnetic viscosity (d) permitivity

5. The idea of displacement current is due to

(a) Ampere (b) Faraday

(c) Gauss (d) Maxwell

6. The energy per unit time, per unit area transported by the fields is called

(a) Power (b) Lorentz force

(c) Poynting vector (d) Energy flux

7. According to wave equation for electric field $\vec{E}$

(a) $\nabla.\vec{E} = \mu_0\varepsilon_0 \frac{\partial^2 \vec{E}}{\partial t^2}$ (b) $\nabla X\vec{E} = \mu_0\varepsilon_0 \frac{\partial^2 \vec{E}}{\partial t^2}$

(c) $\nabla^2\vec{E} = \mu_0\varepsilon_0 \frac{\partial^2 \vec{E}}{\partial t^2}$ (d) $\nabla^2\vec{E} = \frac{1}{\mu_0\varepsilon_0} \frac{\partial^2 \vec{E}}{\partial t^2}$

8. The distance it takes to reduce the amplitude by a factor of 1/e is called

(a) Skin depth (b) range

(c) dispersion (d) group velocity

9. Lienard Wiechert potential are for

(a) Moving point charge

(b) Moving monopole

(c) Moving dipole

(d) Moving quadrupole

10. $F_{rad} = \frac{\mu_0 q^2}{6\pi c}\hat{a}$ is called

(a) Larmor formula

(b) Lienard's formula

(c) Amour formula

(d) Abraham- Lorentz formula

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Determine energy due to a point charge distribution.

Or

(b) Find the energy of a uniformly charged spherical shell of total charge q and radius R.

12. (a) Show that the magnetic field of the toroid is circumferential at all points, both inside and outside the coil.

Or

(b) Explain the magnetic susceptibility and permeability in linear and nonlinear media.

13. (a) Show that energy density in a magnetic field is $\frac{1}{2}\mu_0 B^2$.

Or

(b) Explain and obtain the boundary conditions on field vectors.

14. (a) Derive the wave equation for E and B.

Or

(b) Describe the propagation of plane EM wave through the coaxial transmission line.

15. (a) Explain the radiation field of an electric dipole

Or

(b) Describe and arrive the power radiated by a point charge.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Explain the method of images for induced surface charge and forced energy.

Or

(b) Discuss and derive susceptibility, permittivity and dielectric constant of linear dielectrics.

17. (a) Discuss about bound current and its physical interpretations.

Or

(b) Explain about domain theory of ferro magnetism and its properties.

18. (a) Explain gauge transformation and arrive Coulomb gauge and Lorentz gauges.

Or

(b) Define Poynting vector. Deduce theoretically Poynting theorem for the flow of energy in an field.

19. (a) Explain and arrive the reflection and transmission of electromagnetic waves at normal incidence.

Or

(b) Describe the propagation of plane electromagnetic waves through a conductor and write a short note on skin depth.

20. (a) Discuss and deduce the retarded potentials and Lienard Wiechert potentials.

Or

(b) Explain about magnetic dipole radiation and arrive the expression for A,E,B,S and total radiated power.

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