Sanjay Ghodawat University, Kolhapur

2017-18

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M.Sc-I **School of Science**

PHS504 **Electrodynamics** **Even II Sem**

Mar 2018 **Examination: ESE, Max Marks: 100, Time 3Hr**

24th May 2018

Instructions: 1) All Questions are compulsory.

10:30 AM to 1:30pm.

Q.1 Select the correct alternative **Marks** **CO**

1. Poynting vector is — 01 CO1

a) $P = \mu_o(E \times B)$ b) $P = 1/\mu_o(E \times B)$

c) $P = 1/\mu_o(E.B)$ d) $P = 1/\epsilon_o(E \times B)$

2. Faradays law states---- — 01 CO1

a) $\nabla \times E = \frac{\partial B}{\partial t}$ b) $\nabla \times B = \frac{\partial E}{\partial t}$

c) $\nabla \times H = \frac{\partial B}{\partial t}$ d) $\nabla \times E = -\frac{\partial B}{\partial t}$

3. The Lienard-Weichert scalar potential is given by--- — 01 CO2

a) $V(r,t) = \frac{1}{4\pi\varepsilon 0}\frac{q}{(\hat{R}c - \vec{R}.v)}$ b) $V(r,t) = \frac{1}{4\pi\varepsilon 0}\frac{c}{(\hat{R}c - \vec{R}.v)}$

c) $V(r,t) = \frac{1}{4\pi}\frac{qc}{(\hat{R}c - \vec{R}.v)}$ d) $V(r,t) = \frac{1}{4\pi\varepsilon 0}\frac{qc}{(\hat{R}c - \vec{R}.v)}$

4. In electrodynamics, the electric field is given by — 01 CO2

a) $E = -\nabla V + \frac{\partial A}{\partial t}$ b) $E = \nabla V + \frac{\partial A}{\partial t}$

c) $E = \nabla V - \frac{\partial A}{\partial t}$ d) $E = -\nabla V - \frac{\partial A}{\partial t}$

5. The power radiated by the oscillating electric dipole is — 01 CO3

a) $P = \frac{\mu_0 p_0^2}{12\,\Pi\, c}$ b) $P = \frac{p_0^2\omega^2}{12\,\Pi\, c}$

c) $P = \frac{\mu_0 p_0^2\omega^4}{12\,\Pi\, c}$ d) $P = \frac{\mu_0 p_0^2\omega^2}{12\, c}$

6. The power is radiated by the charge — 01 CO3

a) In uniform motion b) In acceleration

c) At rest d) Power is not radiated by the charge

7. Which of the following equation shows that the electric field is perpendicular to the magnetic field? 01 CO

a) $B(r,t) = \frac{1}{c}\hat{\varepsilon} X E$ b) $B(r,t) = \frac{1}{c}\hat{\varepsilon} \cdot E$

c) $B(r,t) = \hat{\varepsilon} X E$ d) $B(r,t) = \frac{1}{c}\hat{\varepsilon} X E^2$

8. The antisymmetric tensor is represented as----- 01 CO

a) $t'^{\mu\nu} = \Lambda^{\mu}_{\lambda}\Lambda^{\nu}_{\sigma}t^{12}$ b) $t'^{\mu\nu} = \Lambda^{\mu}_{\lambda}\Lambda^{\nu}_{\sigma}t^{\lambda}$

c) $t'^{\mu\nu} = \Lambda^{\mu}_{\lambda}\Lambda^{\nu}_{\sigma}t^{\lambda\sigma}$ d) $t'^{\mu\nu} = \Lambda^{\mu}_{\lambda}\Lambda^{\nu}_{\sigma}t^{\sigma}$

Q.1 B. Fill in the blanks **Marks (6)** **CO**

a) The Ohm's law in terms of current density is written as _____ 1 CO1

b) Energy density of an electromagnetic wave is given by_____ 1 CO1

c) The Lorentz condition is ____ 1 CO2

d) The d' Alembert's operator is given by ____ 1 CO2

e) The electric field of a point charge moving in arbitrary motion is__ 1 CO3

f) The Lorentz length contraction is _____ 1 CO4

Q.1 C. State true or false **Marks (6)** **CO**

a) Velocity of an electromagnetic wave in the isotropic media is given by $c = \frac{1}{\mu_o \epsilon_o}$ 1 CO1

b) The retarded time is always less than the time at infinite distance from the charge 1 CO2

c) The power radiated by a point charge in a circular motion is given by $P = \frac{\mu_0 q^2 a^2 \gamma^4}{6 \Pi c}$ 1 CO3

d) The radiation that leaves the charge can go to the infinity. 1 CO3

e) The operator ∇^2 is variant under Lorentz transformations 1 CO4

f) The scalar product of velocity with itself is $\eta_\mu \eta^\mu = -c^2$ 1 CO4

Q.2 Answer the following questions **Marks (20)** **CO1**

a)	Obtain equation of continuity and explain how it is used to modify Faraday's 4th equation or Ampere's law?	12	
b)	State and derive Poynting theorem.	8	
	OR		
b)	Explain boundary conditions of E, D, B and H.	8	
Q.3	**Answer the following questions**	**Marks (20)**	**CO2**
a)	Obtain Gauge transformations with the help of scalar and vector potentials. Discuss Coulomb and Lorentz gauge.	12	
b)	Show that the retarded potentials satisfy the inhomogeneous wave equations.	8	
	OR		
b)	Obtain Lienard-Weichert potential.	8	
Q.4	**Answer the following questions**	**Marks (20)**	**CO3**
a)	Obtain the power radiated by an oscillating electric dipole.	12	
b)	Derive the relation for power radiated by a point charge at high velocity.	8	
	OR		
b)	Discuss the linear motion of charge particle moving with high velocity.	8	
Q.5	**Answer the following questions**	**Marks (20)**	**CO4**
a)	Derive transformation equations for E_x, E_y, E_z and B_x, B_y, B_z by considering three frame of references S^0, S and S'.	12	
b)	Explain the Lorentz length contraction with proper example.	8	
	OR		
b)	Write note on relativistic momentum and energy.	8	