Examination Roll No.....

YMCA UNIVERSITY OF SCIENCE& TECHNOLOGY, FARIDABAD

M. Sc. (PHYSICS) 2nd SEMESTER (UNDER CBCS)

ELECTRODYNAMICS & PLASMA PHYSICS (PHY 204)

Time: 3 Hrs. Max. Marks:60

Note: 1. *Part -1 (i.e. Q 1) is compulsory.*
2. *Attempt any **four** questions from Part -2 in detail.*
3. *Different parts of the same question are to be attempted adjacent to each other.*
4. *Use of calculators is not allowed. Assume standard data wherever required, if not given.*

PART -1

Q1 (a) Obtain differential form for the Gauss law in electrostatics. (2)

(b) Write Coulomb Gauge and Lorenz gauge condition. (2)

(c) Define Brewster's angle. (2)

(d) Explain why danger signals are of red colour. (2)

(e) Show that the **E** and **B** vectors of an e.m wave are in same phase when the wave is propagating in an isotropic dielectric medium. (2)

(f) Calculate the skin depth for silver at 60 GHz given that $\sigma = 6x10^7$ mho/m, $\mu = 3x10^{-7}$ H/m. (2)

(g) What is the difference between normal and anomalous dispersion? (2)

(h) How Lienard - Wiechert potentials are special case of retarded potentials? (2)

(i) Calculate the cut off frequency and cut off wavelength for the dominant TE mode in a rectangular waveguide of dimensions 2cm x 3cm. (2)

(j) Discuss the Pinch Effect of plasma confinement? (2)

PART -2

Q2 (a) Derive the expressions for Maxwell's equations in terms of scalar and vector potentials (ϕ & **A**). (5)

(b) Find the expression for the potential between the plates of a cylindrical capacitor of radii a and b (a < b) and having potentials V_a and V_b. (5)

Q3 Discuss the reflection and refraction for normal incidence of a plane e. m. wave on the interface of two dielectric media. Obtain the Fresnel's relations and show that **R+T** = 1, where symbols have their usual meanings. (10)

Q4 Derive the wave equation for the propagation of a plane e.m. wave in free space. Show that (i) the wave is transverse in nature and (ii) the free space impedance is approximately 377Ω. (4,3,3)

Q5 Starting from the expressions for **E** and **B** fields corresponding to L.-W. potentials, derive the Larmor's formula for power radiated by an accelerated point charge

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moving with low velocity (i.e. v << c) (10)

Q6 Discuss the scattering of e. m. waves by a free electron and derive the expression for the scattering cross section and interpret the results. (10)

Q7 (a) Define and derive the expression for Debye shielding distance. (5)

(b) Obtain the dispersion relation for electron oscillations in plasma assuming that the motion of ions is very small. (5)

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