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**NY—08—2023**

**FACULTY OF SCIENCE AND TECHNOLOGY**

**M.Sc. (Third Semester) EXAMINATION**

**NOVEMBER/DECEMBER, 2023**

**(New/CBCS Pattern)**

**PHYSICS**

**PH-15**

**(Electrodynamics)**

**(Tuesday, 5-12-2023)**

**Time : 2.00 p.m. to 5.00 p.m.**

*Time—3 Hours*

*Maximum Marks—75*

*N.B. :—* (1) *All questions are compulsory and carry equal marks.*

(2) *Figures to the right indicate full marks.*

(3) *Symbols used have their usual meanings.*

1. Discuss the propagation of electromagnetic waves in ionosphere. Obtain expression for the propagation constant. At what frequency it becomes imaginary ? What will be its effect on the propagating waves ? 15

*Or*

(a) With suitable expressions explain why electromagnetic waves can propagate in dielectric medium but not in the conducting medium ? 8

(b) Discuss polarization of electromagnetic waves. What are the necessary conditions for plane polarization, circular polarization and elliptical polarization ? Explain. 7

2. What is a wave guide ? Discuss TE, TM and TEM modes of propagation. Obtain expression for the guide wavelength of TE propagation mode in a rectangular wave guide. Explain how the cut-off modes arise. Obtain expression for cut-off frequency. 15

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*Or*

- (a) Discuss reflection and refraction of electromagnetic waves from a metallic surface. Obtain an expression for reflected power in this case. 8
- (b) Obtain an expression for Poynting's vector. Explain meaning of each term involved in it. 7
3. Obtain the expression for radiation resistance of centre fed half wave antenna. Explain why it is an efficient radiator compared to the dipole antenna. 15

*Or*

- (a) Obtain expression for power radiated by a linearly accelerated charged particle. Describe its power distribution pattern. 8
- (b) Explain the concept of retarded potentials deriving expression for them for moving charges. 7
4. Express Maxwell's equations in covariant form and derive the transformation laws for the electric and magnetic fields. 15

*Or*

- (a) Obtain the components of electromagnetic field tensor. 8
- (b) Obtain electromagnetic wave equation in 4-vector form and give its plane wave solution. 7

5. Write short notes on (any *three*) :

15

- (a) EM waves in free space
- (b) Fresnel's equations
- (c) Electric quadrupole radiation
- (d) Kinematical results of special relativity.