

This question paper contains 3 printed pages]

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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(2)

NY—08—2023

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

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(3)

NY—08—2023

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.

NY—08—2023

3