

Reg. No. : .....

Name : .....

**Second Semester M.Sc. Degree Examination, May 2020**

**Branch : Physics**

**PH 221 : MODERN OPTICS AND ELECTROMAGNETIC THEORY**

**(2018 Admission onwards)**

Time : 3 Hours

Max. Marks : 75

**PART A**

Answer any **five** questions. Each question carries **3** marks.

- I. (a) Explain the theory of multilayer films.
- (b) What is non linear polarization?
- (c) Obtain classical wave equation for electric field in an electromagnetic wave in vacuum. Find its velocity.
- (d) What is current density 4-vector?
- (e) Write a short note on radiation reaction.
- (f) Explain characteristic impedance of transmission line.
- (g) What is meant by dominant mode of a waveguide? Write down the dominant mode of a rectangular wave guide.
- (h) What do you mean by Hertzian dipole? Write the expression for radiation from a Hertzian dipole.

**(5 × 3 = 15 Marks)**

P.T.O.



## PART B

Answer any **three** questions. Each question carries **15** marks.

- II. (a) Explain the Second Harmonic Generation process. Obtain the expression for SHG efficiency.

Or

- (b) (i) Discuss the theory of interference with multiple beams.  
(ii) Write a brief note on Fabry-Perot interferometer filter.

- III. (a) Obtain the transformation equations for the field vectors E and B.

Or

- (b) Discuss the oblique incidence of electromagnetic waves at a plane non-conducting boundary of two linear media and obtain Fresnel's equations.

- IV. (a) Discuss the radiation from a quarter wave monopole antenna. Find its radiation resistance.

Or

- (b) Discuss, with necessary theory the propagation of electromagnetic wave along a transmission line and obtain the expression for characteristics impedance and propagation constant.

**(3 × 15 = 45 Marks)**

## PART C

Answer any **three** questions. Each question carries **5** marks.

- V. (a) Show that E.B is relativistically invariant.

- (b) Find the potentials of a point charge moving with constant velocity.



- (c) A rectangular waveguide has a broad wall dimension of 0.9 inch and is fed by a 10 GHz carrier from a coaxial cable. Determine whether  $TE_{10}$  wave will be propagated. If so, find its guide wavelength, phase and group velocities.
- (d) Explain Raman-Nath diffraction.
- (e) What is dispersive power of a grating? Obtain the resolving power of a diffraction grating.
- (f) Explain antenna array. Distinguish between broadside array and end-fire array.

**(3 × 5 = 15 Marks)**

