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S – 6524

Reg. No. : .....

Name : .....

**Second Semester M.Sc. Degree Examination, January 2024.**

**Physics with Specialization in Nano Science/Physics with Specialization  
in Space Physics**

**PHNS 521/PHSP 521 : MODERN OPTICS AND ELECTROMAGNETIC  
THEORY**

**(2020 Admission Onwards)**

Time : 3 Hours

Max. Marks : 75

**SECTION – A**

Answer any five questions. Each questions carry 3 marks.

1. What is Faraday's rotation?
2. Differentiate Fraunhofer and Fresnel diffraction.
3. What are the phase matching criterion and how it reduces to refractive index criterion?
4. Explain how maxwell modified the ampere's circuital law
5. Write a note on scalar and vector potentials.
6. Give the tensor notation of electromagnetic waves. What are its properties?
7. What do you mean by characteristic impedance.
8. Why TEM wave is not possible in rectangular wave guide.

**(5 × 3 = 15 Marks)**

P.T.O.



SECTION – B

Answer **all** questions. Each questions carry **15** mark.

9. What is Fabry-Perot interferometer? Derive the expression for resolving power of Fabry-Perot interferometer.

OR

10. Discuss the theory of two photon process. What are the important features of two photon absorption?
11. (a) Derive the wave equation for electromagnetic wave in vacuum
- (b) Discuss the energy and momentum in electromagnetic waves

OR

12. What is electric dipole radiation? Derive the expression for total power radiated.
13. (a) What are transmission lines? Give a note on the application of transmission lines.
- (b) Discuss the propagation of transverse electric (TE) waves in a rectangular waveguide.

OR

14. Discuss halfwave dipole or quarter wave monopole antenna.

**(3 × 15 = 45 Marks)**

## SECTION – C

Answer three questions. Each questions carry 5 marks.

15. Prove that the secondary maxima of a single slit Fraunhofer diffraction pattern occur at the points for which  $\beta = \tan \beta$ . Also show that the first three roots are given by  $\beta = 1.43\pi, 2.46\pi$  and  $3.47\pi$  approximately.
16. "Self-focussing occurs when intensity reaches a certain limiting value." Substantiate the statement.
17. Show that the standing wave  $f(z,t) = A \sin(kz) \cos(kvt)$  satisfies the wave equation and express it as sum of wave traveling to left and right.
18. Using magnetism as a relativistic phenomenon, find the magnetic field of a point charge  $q$  moving at constant velocity  $v$ .
19. What is Smith chart? Write a note on its advantages in telecommunications.
20. Determine the distance from a  $\lambda/2$  dipole to the boundary of the far field region if the  $\lambda/2$  dipole is used in a 150 MHz communication systems.

**(3 × 5 = 15 Marks)**