M – 5998

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Second Semester M.Sc. Degree Examination, March 2022

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

PHNS 521/PHSP 521 : MODERN OPTICS AND ELECTROMAGNETIC THEORY

(2020 Admission)

Time : 3 Hours

Max. Marks : 75

PART – A

Answer any **five** questions. **Each** question carries **three** mark.

1. Describe parametric generation of light.

2. Differentiate dextrorotatory crystals with laevorotatory crystals.

3. Account on second harmonic generation.

4. Define electromagnetic field tensor? What are its properties?

5. How can you conclude that magnetism is a relativistic phenomenon?

6. Discuss the theory of wave guides with reference to TM mode.

7. Briefly mention the approximations to electric dipole radiation.

8. Using voltage and current variations along an ideal transmission line, obtain telegraphist's equation.

(5 × 3 = 15 Marks)

P.T.O.

PART – B

(Answer **three** questions. Each carry **15** marks)

9. Briefly explain

   (a) Raman-Nath acoustic-optic modulator

   (b) Bragg modulator and

   (c) Faraday rotation

Or

10. "Two photons are simultaneously absorbed to excite a material system". Brief the theory and experimental techniques behind the process.

11. Discuss reflection and transmission of electromagnetic wave at oblique incidence?

Or

12. Derive the inhomogeneous wave equation for V and A.

13. Derive the field equation for the TE waves in the rectangular wave guides,

Or

14. What are the transmission lines? Derive the transmission line equations and explain any two losses in transmission lines.

PART – C

$(3 \times 15 = 45$ Marks)

(Answer **three** questions. **Each** carry **five** marks)

15. A Fabry–Perot interferometer just resolves two lines of width $\Delta\lambda = 0.1$ Å at $\lambda = 5000$ Å. find the minimum separation between reflecting surfaces with reflectivity 0.95.

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16. Using Fourier transform method, discuss Fraunhofer diffraction due to two nearby parallel narrow slits illuminated by monochromatic light.

17. A plane electromagnetic wave is incident on a plane surface of area A normally and is perfectly reflected. If energy E strikes the surface in time t, then find the average pressure exerted on the surface?

18. Find the charge and current distributions that would give rise to the potentials

    $V = 0$ and $A= -\dfrac{\cancel{kt}}{4\pi\varepsilon_0 r} \hat{r}$

    Where k is a constant and c speed of light.

19. A rectangular wave guide has cross section dimensions, a = 2.28 cm and b = 1.01 cm. what TE mode will propogate in this wave guide if the drivinig frequency is 17 GHz.

20. How Antenna can be used as a matching device between the guiding structure and the surrounding medium?