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R – 6729

Reg. No. : .....

Name : .....

Second Semester M.Sc. Degree Examination, April 2023

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

PART – A

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

1. Give Kirchhoff integral theorem. What is its significance?
2. Discuss the fundamental harmonic of polarization.
3. What is multi quantum photoelectric effect?
4. "Electromagnetic waves not only carry energy; they also carry momentum". Substantiate the statement.
5. What is Lorentz gauge?
6. How will you demonstrate magnetism as a relativistic phenomenon?
7. What are the applications of transmission lines?
8. Write a note on the significance of Frii's equation in telecommunication.

(5 × 3 = 15 Marks)

P.T.O.

PART – B

Answer **all** questions. Each carries **15** marks.

9. What is interference? Derive the equation for maximum and minimum transmittance of interference with multiple beams.

OR

10. (a) What is non-linear optics? Briefly explain second harmonic generation.

    (b) Discuss phase matching in a negative uniaxial crystal.

11. (a) Discuss reflection and transmission at oblique incidence.

    (b) Explain vector and scalar potentials.

OR

12. (a) What is magnetic dipole radiation?

    (b) Derive the expression for total power radiated.

13. (a) Contrast the propagation of TM and TE waves in a rectangular wave guide.

    (b) Explain power transmission and attenuation.

OR

14. (a) Explain antenna characteristics.

    (b) Write a note on antenna arrays.

(3 × 15 = 45 Marks)

PART – C

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

15. Explain Fresnel diffraction patterns.

16. Discuss multiphoton process. How does a virtual level differ from a real level?

17. Explain electric field of a uniformly moving point charge.

18. Briefly represent electrodynamics in tensor notation.

19. A band transmitter operating at 27 MHz with 4 W output is connected via 10 m of RG-8A/U cable to an antenna that has an output resistance of 300 ohm. Calculate :

    (a) The reflection coefficient

    (b) The electrical length of cable in wavelengths

    (c) The VSWR

    (Hint : Given $Z_0 = 50$ ohm)

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 300 MHz communication systems.

($3 \times 5 = 15$ Marks)
