TDC (CBCS) Even Semester Exam., 2022

PHYSICS

(Honours)

(6th Semester)

Course No. : PHSHCC-601T

(Electromagnetic Theory)

Full Marks : 50
Pass Marks : 20

Time : 3 hours

The figures in the margin indicate full marks for the questions

SECTION—A

Answer any *ten* of the following questions : 2×10=20

1. What is displacement current? Give its SI unit.

2. What are the scalar and vector potentials?

3. What is average energy density of the electromagnetic wave?

4. What is meant by wave impedance? Give the formula of it.

5. How does the propagation of electromagnetic waves take place through ionosphere?

6. Why is ionization not affected by electric current?

7. What are the boundary conditions in electromagnetic transmission?

8. How can waves undergo reflection at a plane surface?

9. What are parallel and perpendicular polarizations?

10. State the differences between uniaxial and biaxial crystals.

11. How do you get plane polarized light with the help of double refraction?

12. Why is the velocity of ordinary and extraordinary different in doubly refractive crystal?

13. Define step index planar waveguide. How many types of optical fibres as a waveguide are there?

14. What are the conditions for interface? Which component of magnetic field is continuous across the boundary?

15. Does reflection cause phase shift? How do you know if a reflected wave experience a phase shift?

SECTION—B

Answer any *five* of the following questions : 6×5=30

16. *(a)* Why do you need gauge transformation? Define Lorentz gauge. 4

(b) What is Poynting vector? Write the formula of Poynting vector. 2

17. *(a)* What is electromagnetic energy density? Derive the electromagnetic energy density. 1+3=4

(b) Define momentum density of electromagnetic field. Do all waves carry momentum? 2

18. *(a)* Write the four Maxwell's equations in conducting medium. 2

(b) What is meant by plasma frequency? How do you find the frequency of plasma? What is an ideal plasma? 4

19. *(a)* What is the relation between refractive index and dielectric constant? What factors affect the dielectric constant? 2+2=4

(b) State how the ionosphere is important in long distance communication. 2

20. *(a)* What is an evanescent wave and when does it occur? How are evanescent waves formed? Do evanescent wave carry energy? 4

(b) State the relation between Brewster angle and critical angle. 2

21. *(a)* How does refraction occur at the boundary between two media? What happens when light is falling perpendicular to an interface of two media? 3+1=4

(b) Why are metals reflective? Which metal is highly reflective? 2

22. State the phenomenon of double refraction. Explain how you get plane polarized light with the help of double refraction. Why does double refraction occur? 2+3+1=6

23. Define quarter-wave plate and calculate its thickness. What does a quarter-wave plate do to unpolarized light? 1+3+2=6

24. Define step index planar waveguide. What is the use of waveguide? State different modes in planar guide. Why is waveguide a high filter? 2+1+1+2=6

25. *(a)* What is polarization by transmission? Why is electric field used for polarization? What happens to magnetic field during polarization? 2+2+1=5

(b) Whether there is any relation between phase and polarization? 1

★★★