**2021/TDC(CBCS)/EVEN/SEM/
PHSHCC–601T/096**

**TDC (CBCS) Even Semester Exam.,
September—2021**

PHYSICS

(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. Which of the Maxwell equations indicates the absence of magnetic monopoles?

2. Explain the physical significance of the equation $\nabla \cdot \vec{B} = 0$.

3. How has electromagnetism integrated the electric and magnetic phenomena?

(Turn Over)

(2)

4. What is the physical significance of Poynting vector? What is its unit?

5. What is dielectric constant? How is it related to the refractive index in case of dielectrics?

6. Plasma is quasineutral. Justify the statement.

7. How do electromagnetic waves propagate?

8. Write some of the characteristics of plasma.

9. Write down the four electrodynamic boundary conditions.

10. What is reflectivity formula?

11. What are evanescent waves?

12. State the laws of reflection of electromagnetic waves.

13. What is linear polarization?

14. How is linear polarization different from circular and elliptical polarization?

(Continued)

(3)

15. What is half-wave plate? Mention two of its uses.

16. Mention some of the uses of Babinet compensator.

17. What do you mean by waveguide? Explain briefly.

18. What is meant by phase change on reflection?

19. What is optical fibre? Mention some of its uses.

20. Write down the condition of continuity at the interface for a waveguide.

SECTION—B

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

21. *(a)* Write the Maxwell's equations. Explain the physical significance of each equation. 4

(b) The average intensity of an EM wave is 10^9 W/m^2 in vacuum. Find the amplitudes of electric and magnetic field vectors $\vec{E}$ and $\vec{B}$. 2

(Turn Over)

(4)

22. *(a)* Define Poynting vector for EM waves. What does it represent? 3

    (b) Calculate the value of Poynting vector at the surface of the Sun; if the energy radiated per second by the Sun is 3.8×10^{26} J. 3

23. *(a)* What do you mean by 'skin depth'? 1

    (b) Find the expression of current density due to wave propagation in dilute plasmas and hence show that the current density and electric fields are $90°$ out of phase. 5

24. *(a)* What is isotropic dielectric medium? 1

    (b) Explain the propagation of EM waves in dielectric medium and hence find the corresponding equations. 5

25. *(a)* What is Fresnel reflection at interface formula? 2

    (b) What is reflectivity formula? 2

    (c) What is Brewster's law of polarization? 2

(Continued)

26. (a) What are meant by reflection and transmission coefficients? 2

   (b) How do you calculate transmission coefficient? 2

   (c) What is the sum of reflection and transmission coefficients? 1

   (d) Why is the coefficient of transmission greater than 1? 1

27. (a) What are phase retardation plates? 2

   (b) Explain the function of quarter-wave plate in positive and negative crystals. 4

28. (a) What are plane, elliptical and circularly polarized light? 3

   (b) Explain, how the production of plane, elliptical and circularly polarized light can be done. 3

29. (a) What are phase velocity and group velocity of wave? 2

   (b) Find the relation between phase velocity and group velocity of wave. 4

(6)

30. (a) What is numerical aperture of optical fibre? 2

(b) Find the phase and group velocity of an electron whose de Broglie wavelength is 1·2 Å. (Neglect the relativity effect.) 4

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