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57. (a) Discuss the nature of roots of the equation  $x^4 + 4x^3 - 2x^2 - 12x + 5 = 0$ .

- (b) Analyze the situation of roots of the equation  $x^5 + x^4 - 4x^3 - 3x^2 + 3x + 1 = 0$ .

58. (a) Find the nature of roots of the equation

$$x^5 + 2x^4 + x^3 - x^2 - 2x - 1 = 0$$

- (b) Analyze the equation

$$2x^6 - 18x^5 + 60x^4 - 120x^3 - 30x^2 + 18x - 5 = 0$$

59. (a) Write a short note on Newton-Raphson method.

- (b) Find the integer roots of the equation

$$x^4 - 2x^3 - 13x^2 + 38x - 24 = 0$$

60. (a) Find the roots of

$$x^5 - 23x^4 + 160x^3 - 281x^2 - 257x - 440 = 0$$

by the method of divisors.

- (b) Find an approximate positive root of

$$x^3 - 6x - 13 = 0$$

using Newton's method.

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

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

**PHYSICS**  
**( 6th Semester )**

Course No. : PSHCC-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 :  $2 \times 10 = 20$

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?



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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?

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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 :  $6 \times 5 = 30$

21. (a) Write the Maxwell's equations. Explain the physical significance of each equation. 4
- (b) The average intensity of an EM wave is  $10^9 \text{ W/m}^2$  in vacuum. Find the amplitudes of electric and magnetic field vectors  $\vec{E}$  and  $\vec{B}$ . 2



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

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

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

(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.

24. (a) What is isotropic dielectric medium?

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

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

(b) What is reflectivity formula?

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

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(Continued)

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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

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( Turn Over )



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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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