

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025

Third Semester

Electrical and Electronics Engineering

20EPC303 - ELECTROMAGNETIC THEORY

Regulations - 2020

Duration: 3 Hours

Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

	Marks	K- Level	CO
1. A Vector field which has a vanishing divergence is called as _____ (a) Rotational field (b) Solenoidal field (c) Hemispheroidal field (d) Irrotational field	1	K1	CO1
2. Coulomb's law is valid for _____ (a) Only point charge (b) Only distributed charges (c) For both point charge and distributed charge (d) Neither distributed nor point charge	1	K1	CO1
3. What will be the nature of equipotential surfaces due to a point charge, situated at infinity? (a) Cylindrical (b) Elliptical (c) Spherical (d) Plane surface	1	K1	CO2
4. If the thickness of the material increases, what happens to the dielectric strength? (a) Increases (b) Decreases (c) Remains the same (d) Becomes zero	1	K1	CO2
5. Ampere law states that (a) Divergence of H is same as the flux (b) Curl of D is same as the current (c) Divergence of E is zero (d) Curl of H is same as the current density	1	K1	CO3
6. Two thin parallel wires carry currents along the same direction. The force experienced by one due to the other is (a) Parallel to the lines (b) Perpendicular to the lines and attractive (c) Perpendicular to the lines and repulsive (d) Zero	1	K1	CO3
7. A loop is rotating about the y-axis in a magnetic field $B = B_0 \sin \omega t$ a _x Wb/m ² . The voltage induced in the loop is due to (a) Motional emf (b) Transformer emf (c) A combination of motional and transformer emf (d) None of the above	1	K1	CO4
8. Which of the following laws do not form a Maxwell equation? (a) Planck's law (b) Gauss's Law (c) Faraday's law (d) Ampere's Law	1	K1	CO4
9. Which property of an electromagnetic wave, depends on the medium in which it is travelling? (a) Velocity (b) Frequency (c) Time period (d) Wave length	1	K1	CO5
10. For the plane wave, if the amplitude is constant over the plane surface then it is called as _____ (a) Circular wave (b) Parallel wave (c) Linear wave (d) Uniform plane wave	1	K1	CO5

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11. List the sources of electric field and magnetic field.	2	K1	CO1
12. What are the three co-ordinate systems?	2	K1	CO1
13. Define gradient of a scalar.	2	K1	CO1
14. Name any two properties of dielectric materials.	2	K1	CO2
15. Write the conditions for Poisson's and Laplace's equation.	2	K1	CO2
16. If a parallel plate capacitor of plate area 2m ² and plate separation 1m store the charge of 1.77*10 ⁻¹¹ C, What is the voltage across the capacitor?	2	K2	CO2
17. State the Biot- Savart's Law.	2	K1	CO3
18. Classify the magnetic materials.	2	K2	CO3
19. Outline the Faraday's law of electromagnetic induction.	2	K2	CO4

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| 20. Summarize the applications of Maxwell's equations. | 2 | K2 | CO4 |
| 21. Name few examples of EM waves. | 2 | K1 | CO5 |
| 22. Give the expression for the characteristic impedance of the wave. | 2 | K1 | CO5 |

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

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| 23. a) (i) Explain Stoke's theorem and prove that divergence of a curl of a vector is zero. | 6 | K2 | CO1 |
| (ii) Outline the nature of the given field by determining the divergence and curl:
$F=30 I_x+2xy I_y+5xz I_z$. | 5 | K2 | CO1 |
| OR | | | |
| b) State and prove the Gauss's law. | 11 | K2 | CO1 |
| 24. a) A circular disc of radius 'R' metre is charged uniformly with a charge density ρ_s C/m ² . Show the electric field intensity & potential at a point 'h' metre away from disc along its axis. | 11 | K2 | CO2 |
| OR | | | |
| b) Illustrate the Boundary conditions as applied to Electrostatic Fields. | 11 | K2 | CO2 |
| 25. a) Demonstrate how flux density varies with field intensity in hysteresis loop. | 11 | K2 | CO3 |
| OR | | | |
| b) Explain about the Magnetic Force & Torque in detail. | 11 | K2 | CO3 |
| 26. a) Develop the expressions for transformer and motional emf. | 11 | K3 | CO4 |
| OR | | | |
| b) Construct the Maxwell's Equations from the fundamental laws and express them in point form. | 11 | K3 | CO4 |
| 27. a) Explain about the electromagnetic wave equation for electric field. | 11 | K2 | CO5 |
| OR | | | |
| b) Interpret about the plane wave propagation in lossy dielectrics. | 11 | K2 | CO5 |
| 28. a) (i) Illustrate the relation between conduction current density and displacement current density. | 6 | K2 | CO4 |
| (ii) Explain short note on skin effect and skin depth. | 5 | K2 | CO5 |
| OR | | | |
| b) (i) Summarize the Maxwell's Equations in integral form. | 6 | K2 | CO4 |
| (ii) Express the equations for wave propagation in a conductor. | 5 | K2 | CO5 |