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Question Paper Code	12383
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B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2023
 Third Semester
Electronics and Communication Engineering
 (Common to Computer and Communication Engineering)
20ECPC302 - ELECTROMAGNETIC FIELDS AND WAVEGUIDES
 (Regulations 2020)

Duration: 3 Hours

Max. Marks: 100

PART - A (10 × 2 = 20 Marks)
 Answer ALL Questions

	<i>Marks, K-Level, CO</i>
1. Compare orthogonal and non-orthogonal coordinate systems.	2,K2,CO1
2. Justify that electric field is conservative.	2,K2,CO1
3. State vector form of coulombs law.	2,K1,CO2
4. Write the relation between current I and current density J.	2,K2,CO2
5. State the concept of permeability and its unit.	2,K1,CO3
6. Express the self and mutual inductance.	2,K2,CO3
7. Write the Faraday's law of induction.	2,K2,CO4
8. What is uniform wave?	2,K2,CO4
9. Why TEM mode is not possible in a rectangular waveguide?	2,K2,CO6
10. What is meant by dominant mode of the wave?	2,K2,CO6

PART - B (5 × 13 = 65 Marks)
 Answer ALL Questions

11. a) Write the infinitesimal displacement, surface, and volume elements in spherical and cylindrical coordinates.	13,K2,CO1
OR	
b) (i) Summarize the use of Helmholtz's theorem in electromagnetic engineering.	6,K2,CO1
(ii) State and formulate Stokes theorem to relate line integral and surface integral.	7,K2,CO1
12. a) Find the magnetic field at the distance s from a long straight wire carrying a steady current I by using Biot savart law and Ampere's law.	13,K2,CO2
OR	
b) Four point charges each of 10μC are placed in free space at the points (1, 0, 0), (-1, 0, 0), (0, 1,0) and (0, -1, 0) m respectively. Determine the force on a point charge of 30μC located at a point (0, 0, 1) m.	13,K2,CO2

13. a) (i) A cylindrical capacitor consists of an inner conductor of radius 'a' and an outer conductor whose inner radius is 'b'. The space between the conductors is filled with a dielectric permittivity ϵ_r and length of the capacitor is L. Derive the expression for the capacitance. 8,K2,CO3

(ii) Derive the expression for the capacitance of an isolated sphere. 5,K2,CO3

OR

- b) Derive the boundary conditions of the normal and tangential components of electric and magnetic field at the interface of two media with different dielectrics. 13,K3,CO3

14. a) Derive the Maxwell's equation for a time varying are modified for time varying from fundamental laws of electric and magnetic fields. 13,K2,CO4

OR

- b) Derive the nonhomogeneous wave equation for the scalar electric and vector magnetic potentials. Comment on the solutions to these equations. 13,K2,CO4

15. a) Deduce the expressions for the field components of TM waves guided along a rectangular wave guide. 13,K2,CO6

OR

- b) Derive the expressions for the field components of TE waves guided along circular waveguide. 13,K2,CO6

PART - C (1 × 15 = 15 Marks)

16. a) Derive the necessary equations and discuss in detail the wave propagation in a good conducting medium and good dielectric medium. 15,K2,CO5

OR

- b) Define Group velocity. Derive an expression for group velocity in terms of phase velocity. Comment on the expression derived. 15,K2,CO5