KUMARAGURU
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B.E. DEGREE EXAMINATIONS: NOV/DEC 2023

(Regulation 2018)

Third Semester

ELECTRONICS AND COMMUNICATION ENGINEERING

U18ECT3004**:** Electro Magnetic Fields

COURSE OUTCOMES

CO1: Describe the fundamental concepts of static electric field.

CO2: Explain the fundamental concepts of static magnetic field.

CO3: Analyze the effect of static electric and magnetic fields in materials.

CO4: Understand the significance of Maxwell's equations for time varying field.

CO5: Apply Maxwell's equations to analyze wave propagation in various mediums.

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-
PART A (10 x 2 = 20 Marks)
(Answer not more than 40 words)

1. Find the gradient of the function $f = ax^2y + by^3z$.   CO1   [K_2]

2. List any two applications of Gauss's Law.   CO1   [K_1]

3. Recall Biot Savart's Law.   CO2   [K_1]

4. A conductor of 16m long lies along Z- direction with a current of 2A in $\bar{a}_z$ direction. Find the force experienced by the conductor if $B = 0.07\ \bar{a}_x$.   CO2   [K_2]

5. Identify whether the following potential field satisfies the Laplace's equation. $V=x^2-y^2+z^2$ CO3   [K_3]

6. Recall point form of ohms law.   CO3   [K_1]

7. Recall Faraday's Law.   CO4   [K_1]

8. Compare conduction current and displacement current.   CO4   [K_2]

9. What is skin effect related to electromagnetic waves?   CO5   [K_1]

10. Summarize the general form of wave equation in terms of vector fields E, D, H and B.   CO5   [K_2]

Answer any FIVE Questions:-

PART B (5 x 16 = 80 Marks)

(Answer not more than 400 words)

11.	a)	Find the electric field intensity at P(-0.2, 0, -2.3) m due to a point charge of 5nC at Q(0.2, 0.1, -2.5) m in air.	8	CO1	[K3]
	b)	Find the expression for electric field due to an infinite sheet.	8	CO1	[K2]
12.	a)	Interpret the magnetic field intensity due to infinite wire carrying current using Ampere's circuital law.	8	CO2	[K2]
	b)	A point charge of Q= -1.2 C has velocity v=(5a_x+2a_y-3a_z) m/s. Find the magnitude of the force exerted on the charge if, B= (-4a_x+4a_y+3a_z) T.	8	CO2	[K3]
13.	a)	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 material and length of the capacitor is L. Solve the value of the capacitance.	8	CO3	[K3]
	b)	Construct the boundary conditions for magnetic fields at the interface of two different medium with permeability μ1 and μ2.	8	CO3	[K3]
14.	a)	Interpret the displacement current density in a lossy dielectric medium having relative permittivity of 6.5 and conduction current density of 0.02 sin 10^{9}t A/m^2. Assume σ = 10^3 S/m.	8	CO4	[K2]
	b)	Summarize the integral and point forms of Maxwell's equations.	8	CO4	[K2]
15.	a)	Construct the uniform plane electromagnetic wave equations in terms of E in free space.	8	CO5	[K3]
	b)	A 300 MHz uniform plane wave propagates through fresh water for which the conductivity (σ) is zero. If the relative permittivity and relative permeability of the medium are 1 and 78 respectively, interpret attenuation constant, phase constant, wavelength and intrinsic impedance.	8	CO5	[K2]
16.	a)	Find the inductance of a solenoid of 200 turns wound tightly on a cylindrical tube of 6 cm diameter. The length of the tube is 60 cm and the solenoid is in air.	8	CO3	[K3]
	b)	Find the average power density using Poynting theorem.	8	CO4	[K2]

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