U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

April 2024 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: Electrical and Electronics Engineering **Duration: 3 hrs.**
Course Code: 23EE3ESEFT **Max Marks: 100**
Course: Electromagnetic Field Theory

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	*CO*	*PO*	Marks
1	a)		State and explain vector form of coulomb's law. Write down the expression of electric field intensity due to point charge.	*CO1*	*PO1*	**06**
	b)		Analyses and Evaluate both sides of the divergence theorem precisely for the region: $if\ the\ flux\ density\ \bar{D} = x^2\bar{a}_x + y^2\bar{a}_y + z^3\bar{a}_z; 0 < x < 2m, 0 < y < 2m, 0 < z < 4\ m.$	*CO2*	*PO2*	**08**
	c)		In a certain region of space D = 2xy a_x + 3yz a_y + 4zx a_z. Evaluate the amount of Electric flux that passes through the portion bounded by -1 $\leq$ y $\leq$ 2 and 0 $\leq$ z $\leq$ 4 in the a_x direction with x=3.	*CO3*	*CO2*	**06**
			UNIT - II			
2	a)		Derive an expression for an energy density in an electric field.	*CO1*	*PO1*	**04**
	b)		Determine work done in carrying a charge of -2C from point P1 (2, 1, -1) to P2 (8,2,-1) in the electric field E = y a_x + x a_y v/m, considering i) the path along the parabola x = $2y^2$ and ii) along the straight line joining P_1 and P_2.	*CO2*	*CO2*	**08**
	c)		Develop and analyses an expression for electric boundary conditions between two perfect dielectric of the medium.	*CO2*	*PO2*	**08**
			OR			
3	a)		Show that vector electric field, E is negative gradient of scalar electric potential V.	*CO1*	*PO1*	**04**
	b)		At the boundary between glass (ϵ_r = 4) and air the lines of electric field make an angle of 40^0 with normal to the boundary. If electric flux density in air is 0.25μc/m^2 determine the orientation and magnitude of electric flux density in glass.	*CO2*	*CO2*	**08**
	c)		Electrical potential at an arbitrary point in free space is given as $V = (x+1)^2 + (y+2)^2 + (z+3)^2$ volts. At P(2,1,0), determine i). V; ii). E; iii).Magnitude of E, iv). D; v). magnitude of D and vi).ρ_v	*CO2*	*CO2*	**08**

			UNIT - III			
	4	a)	Analyse and develop an expression for Laplace and Poisson's Equations & also Verify whether Laplace equations satisfied or not: $1).V = x^2 - y^2 + z^2; 2).V = rcos\emptyset + z; 3).rcos\theta + \emptyset$	*CO2*	*PO2*	**10**
		b)	Write Laplace's equation in spherical co-ordinates. Using this equation evaluate and analyse an expression for potential difference between concentric spherical shells. Also find the capacitance of the same	*CO2*	*PO2*	**10**
			UNIT - IV			
	5	a)	State and explain Amperes circuital law. Discuss stokes theorem and explain the concept of curl.	*CO1*	*PO1*	**08**
		b)	Analyses and develop an expression for Lorentz force equation due to a moving point charge.	*CO2*	*PO2*	**06**
		c)	Discuss the boundary conditions applicable to B, H at the interface between two different magnetic materials.	*CO2*	*CO2*	**06**
			UNIT - V			
	6	a)	List Maxwell's equation in point form and integral form for time varying fields.	*CO1*	*PO1*	**06**
		b)	Show that the ratio of amplitudes of conduction current density(J_c) and displacement current density (J_d) is $\sigma/\omega\epsilon$ for the applied field $E = E_m \cos\omega t$. Assume $\mu = \mu_0$.	*CO3*	*CO2*	**08**
		c)	A 300MHz uniform plane wave propagates through fresh water for which $\sigma = 0$, $\mu_r = 1$, $\epsilon_r = 78$. Solve for i) attenuation constant ii) phase constant iii) wavelength.	*CO2*	*CO2*	**06**
			OR			
	7	a)	Define Poynting vector. Check that the power flow for a plane wave is, E X H.	*CO1*	*PO1*	**06**
		b)	Starting from Maxwell's equations generate the general wave equation in electric and magnetic fields.	*CO3*	*CO2*	**08**
		c)	A 9375MHz uniform plane wave is propagating in polystyrene. If the amplitude of the Electric field intensity is 20V/m and the material is assumed to be lossless, Evaluate i). Attenuation constant ii). Phase constant iii). Wavelength iv). Velocity of propagation v). Intrinsic impedance vi). Propagation constant. For polystyrene $\mu_r = 1$, $\epsilon_r = 2.56$.	*CO2*	*CO2*	**06**

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