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

Autonomous Institute Affiliated to VTU

September / October 2024 Supplementary Examinations

Programme: B.E. **Semester: III**
Branch: ES Cluster (EEE/ECE) **Duration: 3 hrs.**
Course Code: 19ES3GCFTH **Max Marks: 100**
Course: 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.

			UNIT - I	CO	PO	Marks
1	a)		Write the expression of divergence $\vec{D}$ in Cartesian , cylindrical and spherical systems.	CO1	PO2	**07**
	b)		A 100 nC point charge is located at $\vec{A}$(-1, 1, 3) in free space. i) Find the locus of all points $\vec{P}$(x,y,z) at which $\vec{E}_x$=500 V/m Find Y_1 if $\vec{P}$(-2, Y_1, 3) lies on that locus.	CO1	PO2	**06**
	c)		State and explain Gauss law. Find electric field intensity at a distance 'r' from an infinite line charge using Gauss law.	CO1	PO1	**07**
			UNIT - II			
2	a)		Calculate the work done in moving a point 4 C charge from B(1,0,0) to A(0,2,0) along the path $y=2^{-2x}$, z=0 in the field $\vec{E}=5xa_x$ V/m and $\vec{E}=5xa_x+5ya_y$ V/m.	CO2	PO4	**08**
	b)		Develop and analyze an expression for boundary conditions between two perfect dielectrics.	CO2	PO3	**06**
	c)		Define continuity equation and write the point form of the continuity equation of the current.	CO2	PO2	**06**
			OR			
3	a)		Evaluate both sides of the divergence theorem for the field $2xy\hat{a}_x+x^2\hat{a}_y$ C/m^2 and the rectangular parallelepiped formed by the planes x=0 and 1, y=0 and 2, and z=0 and 3.	CO3	PO2	**07**
	b)		Define electric field intensity. Also show that the electric field intensity is the negative gradient of potential.	CO3	PO2	**07**
	c)		Define potential difference. Find the potential difference between two points due to an infinite line charge.	CO3	PO2	**06**

			UNIT - III			
	4	a)	From Gauss's law, obtain poisson's and laplace's equation. Write laplace's equation in explicit form in all coordinates systems.	*CO3*	*PO2*	**07**
		b)	Obtain poisson's and laplace's equation. Given $V=(A\rho^4+B\rho^{-4})$ sin4φ. Show that V(ρ,φ) satisfies laplace's equation.	*CO3*	*PO2*	**07**
		c)	Determine whether or not the following potential fields satisfy the laplace's equation: a) $\vec{V}=x^2-y^2+z^2$ b) $\vec{V}=r\cos\phi+z$ c) $\vec{V}=r\cos\theta+\phi$	*CO3*	*PO2*	**06**
			UNIT - IV			
	5	a)	A point charge, Q=-60 nC, is moving with a velocity $6x10^6$ m/s in the direction specified by unit vector $-0.48\vec{a}_x-0.6\vec{a}_y+0.64\vec{a}_z$. find the magnitude of the force on a moving charge in the magnetic field, $B=2\vec{a}_x-6\vec{a}_y+5\vec{a}_z$ mT.	*CO4*	*PO2*	**05**
		b)	Derive the expression for force acting on a differential current element on a straight conductor moving in a steady magnetic field.	*CO4*	*PO2*	**07**
		c)	Find the force per length between two long parallel wires separated by 10 cm in air and carrying a current of 100 A in opposite directions.	*CO4*	*PO1*	**08**
			UNIT - V			
	6	a)	Explain Faradays law and also develop Maxwell's equations in point form and integral for time varying field	*CO4*	*PO2*	**07**
		b)	Let $\mu = 3 \times 10^{-5}$ H/m, & $\varepsilon = 1.2 \times 10^{-10}$ F/m, and $\sigma = 0$ everywhere. If $H = 2\cos(10^{10}\, t - \beta_x)_{az}$ A/m, use Maxwell's equations to obtain expressions for B, D, E, and β.	*CO4*	*PO2*	**05**
		c)	Develop and analyze an expression for electromagnetic waves in free space.	*CO4*	*PO2*	**08**
			OR			
	7	a)	A parallel plate capacitor with plate area of 5 cm^2 and plate separation of 3 mm has a voltage of $50\sin10^3t$ volts applied to its plates. Calculate the displacement current assuming $\varepsilon=2\varepsilon_0$.	*CO4*	*PO2*	**10**
		b)	State and explain poynting theorem.	*CO4*	*PO2*	**10**

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