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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester, B.E. - Electronics and Communication Engineering

Semester End Examination; August - 2023

Electromagnetic Field Theory

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

CO1: Apply the knowledge of physics and Vector calculus to understand EM fields and waves.
CO2: Analyse Electric and magnetic fields and waves and its effect in various charge distribution of medium.
CO3: Compute the electric and magnetic field potentials due to different charge distributions and boundary conditions.
CO4: Analyze time-varying electromagnetic fields and waves as governed by Maxwell's equations.
CO5: Examine the effects and losses of medium on wave and various parameters influencing wave propagation.

***Note**: I) **PART - A** is compulsory. **Two** marks for each question.*
*II) **PART - B**: Answer any **Two** sub questions (from a, b, c) for a Maximum of **18 marks** from each unit.*

Q. No.	Questions	Marks	BLs	COs	POs
	I : PART - A	**10**			
1 a.	Convert x = 2 m, y = 3 m and z = 5 m to Spherical co-ordinate system.	2	L3	CO2	PO1,2
b.	Define Electric Dipole and Dipole Movement.	2	L2	CO3	PO1,2
c.	Write the Lorentz Force equation.	2	L3	CO2	PO1,2
d.	Find the skin effect in a medium with attenuation constant of 0.5 units.	2	L3	CO4	PO1,2
e.	Define Critical Frequency.	2	L2	CO1	PO2
	II : PART - B	**90**			
	UNIT - I	**18**			
2 a.	State Coulombs law. A charge of $Q_1 = 3 \times 10^{-4}$C at M (1, 2, 3) and a charge of $Q_2 = -10^{-4}$C at N(2, 0, 5) in a vaccum. Determine the vector force exerted on Q_2 by Q_1.	9	L3	CO1	PO1
b.	Derive an expression for Electric field intensity ***E*** due to infinite sheet.	9	L2	CO2	PO1,2
c.	State and Prove Divergence theorem.	9	L4	CO2	PO1,2
	UNIT - II	**18**			
3 a.	Define Absolute Potential. Calculate Absolute potential at point A(2, 2, 3) m due to a point charge Q = 0.4 nc is located at; i) Origin ii) N(2, 3, 3) m	9	L4	CO3	PO2,3
b.	Derive the relation between **E** and V. Find the Electric field strength for the scalar field $V = 4xz^2 + 3yz$.	9	L2	CO3	PO2,3
c.	State and Prove Uniqueness theorem.	9	L2	CO3	PO2,3
	UNIT - III	**18**			
4 a.	State Ampere's Circuital law. Determine **H** due to infinite long straight conductor and infinite sheet by applying Ampere's Circuital law.	9	L2	CO3	PO2,3

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	b.	In Cylindrical Coordinates A = $30r^2$ a_z wb/m is a vector magnetic potential, in a certain region of free space. Find H, B and J.	9	L3	CO3 PO2,3
	c.	Illustrate Magnetic boundary conditions for tangential and normal component.	9	L2	CO3 PO2,3
		UNIT - IV	**18**		
5	a.	List and Explain Maxwell's equations in point and integral form for time varying field.	9	L2	CO4 PO2
	b.	Discuss wave propagation in good conductors while highlighting the related equations.	9	L2	CO4 PO2
	c.	State and Prove Poynting's theorem.	9	L4	CO5 PO1,2
		UNIT - V	**18**		
6	a.	Discuss the tilt of wave due to ground losses.	9	L2	CO5 PO1,2
	b.	Explain the effects of imperfect earth and the effects of curvature of earth.	9	L2	CO5 PO1,2
	c.	Describe the terms MUF, LUF, Virtual height and Skip distance.	9	L2	CO5 PO1,2

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