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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; Sep. / Oct. - 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: Analyze Electric fields, magnetic fields and EM 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: Discuss 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.	Define electric field intensity and electric flux density.	2	L2	CO2	PO1
b.	Define current density.	2	L2	CO3	PO2
c.	Write the equation of Curl of a vector in rectangular coordinate systems.	2	L2	CO4	PO2
d.	Define critical frequency and MUF.	2	L2	CO2	PO1
e.	Define Poynting vector.	2	L2	CO2	PO2
	II : PART - B	**90**			
	UNIT - I	**18**			
2 a.	Derive the equations for electric field intensity and electric flux density due to infinite line charge using Gauss's law.	9	L2	CO2	PO2
b	State and prove Gauss's law. Mention the nature of Gaussian surface.	9	L2	CO2	PO2
c.	Given that $\vec{D} = \frac{5r^2}{4} \hat{a}_r \; c/m^2$. Evaluate both the sides of divergence theorem for the volume enclosed by $r = 4\ m$ and $\theta = \frac{\pi}{4}$.	9	L3	CO2	PO3
	UNIT - II	**18**			
3 a.	State and prove uniqueness theorem.	9	L3	CO3	PO3
b.	Obtain the point form of continuity equation.	9	L4	CO3	PO2
c.	Establish the relationship between E and V. Find the E and V for the potential field at $P(2, 30^o, 1)$ $V = \frac{Cos2\phi}{r}$	9	L4	CO3	PO3

Contd…2

	UNIT - III	**18**	L2	CO2	PO1
4 a.	Derive an expression for the magnetic field intensity at a point due to current carrying straight conductor of infinite length using Biot-Sevart's law.	9	L2	CO2	PO2
b.	State and explain Lorentz force equation. Find the force on the conductor, if the field in the region is $\vec{B} = 0.005\ \hat{a}_x$ Tesla, if a conductor 4 m long lies along y-axis with a current of 10 A in $\hat{a}_y$ direction.	4+5	L2	CO2	PO3
c.	State and explain Stoke's theorem.	9	L2	CO2	PO3
	UNIT - IV	**18**			
5 a.	List all Maxwell's equations in integral and differential form.	9	L2	CO4	PO2
b.	State and prove Poynting theorem.	9	L2	CO4	PO2
c.	Derive the solution of wave equation in free space.	9	L2	CO4	PO2
	UNIT - V	**18**			
6 a.	Briefly explain the concept of refraction and reflection of sky waves by ionosphere and derive the relation between MUF and the skip distance.	9	L2	CO5	PO2
b.	Explain the tilt of wave front due to ground wave propagation.	9	L2	CO5	PO2
c.	Explain the following with respect to sky wave propagation: i) Critical frequency ii) Virtual height iii) Skip distance	9	L2	CO5	PO2

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