Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

Make Up Examinations – December 2025

Date: 27-12-2025 **Time:** 09:30am – 12:30pm

School: SOE	**Program:** B. Tech (EEE)	
Course Code : EEE2028	**Course Name:** Electromagnetic Fields	
Semester: MK	**Max Marks**:100	**Weightage**:50%

CO - Levels	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Marks	**26**	**26**	**24**	**24**	**-**

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1	Define the following fields. a. Divergence of a vector b. curl of a vector	**2 Marks**	**L1**	**CO1**
2	Since all the coordinates in electromagnetics are space coordinates, direction and magnitude both are important. List the different coordinate systems with their coordinates.	**2 Marks**	**L1**	**CO1**
3	Define position vector and displacement vector	**2 Marks**	**L1**	**CO1**
4	Recall Gauss law with the mathematical expression	**2 Marks**	**L1**	**CO2**
5	List the expressions for Poisson's equation in rectangular and cylindrical System.	**2 Marks**	**L1**	**CO2**
6	Define Electric dipole. List the expression for Electric field E due to a dipole**.**	**2 Marks**	**L1**	**CO2**
7	Recall Ampere's law with the mathematical expression	**2 Marks**	**L1**	**CO3**
8	Define the Lorentz force with the mathematical expression	**2 Marks**	**L1**	**CO3**
9	Define Poynting Vector in Electromagnetic Fields	**2 Marks**	**L1**	**CO4**
10	Recall the concept of displacement current	**2 Marks**	**L1**	**CO4**

Part B

Answer the Questions **Total 80 Marks.**

11.	**a.**	Interpret the divergence of the following vector fields and evaluate them at the specified points. (a) $\mathbf{A} = yz\mathbf{a_x} + 4xy\mathbf{a_y} + y\mathbf{a_z}$ at (1, -2,3) (b) $\mathbf{B} = rz\sin\varphi\ \mathbf{a_r} + 3rz^2\cos\varphi\ \mathbf{a_\varphi}$ at (5, π /2, 1)	**10 Marks**	**L2**	**CO1**
	b.	A vector field is uniquely characterized by its divergence and curl. Neither the divergence nor curl of a vector field is sufficient to completely describe the field. Given the vector field G = (16xyz) $\mathbf{a_x}$ + (8x²) $\mathbf{a_y}$ – (x)$\mathbf{a_z}$. Outline whether the given field is irrotational or not	**10 Marks**	**L2**	**CO1**

or

12.	**a.**	The steepness of the slope at a point is given by the magnitude of the gradient vector. The gradient can also be used to measure how a scalar field changes in other directions. In view of this interpret the gradient of the following functions in their respective coordinates. $P = 10x^2y + 8y^3z$, $Q = rz\cos\Phi$	**10 Marks**	**L2**	**CO1**
	b.	The collection of partial derivative operators is commonly called the del operator. Outline the possible ways of using the del operator in electromagnetic fields. Summarize their expressions in Rectangular and Cylindrical coordinate systems	**10 Marks**	**L2**	**CO1**

13.	**a.**	The space around an electric charge in which its influence can be felt is known as the electric field. The electric field intensity at a point is the force experienced by a unit positive charge placed at that point. Point charges 1 mC and - 2 mC are located at (3, 2, -1) and (-1, -1,4), respectively. Infer the electric force on a 10-nC charge located at (0, 3, 1) and the electric field intensity at that point	**10 Marks**	**L2**	**CO2**
	b.	If the electric field exists in a region consisting of two different media, the conditions that the field must satisfy at the interface separating the media are called boundary conditions. These conditions are helpful in determining the field on one side of the boundary if the field on the other side is known. Explain the boundary conditions with respect to Electric field at the boundary between a)Two different dielectric media with dielectric constants ϵ_{r1} and ϵ_{r2} b) A dielectric and a conductor	**10 Marks**	**L2**	**CO2**

		c) Conductor and free space			

or

14.	**a.**	The Electro-hydrodynamic (EHD) pumping is based on the force transmitted to the cooling fluid by charges in an electric field. The procedure for determining the electric field E is either using Coulomb's law or Gauss's law when the charge distribution is known, or from the potential V if it is known throughout the region. In free space if $V = x^2 y(z + 3)$ V, compute E at (3, 4, -6)	**10 Marks**	**L2**	**CO2**
	b.	In free space, $V = 6xy^2z + 8$. At point P(1, 2, -5), estimate E and ρ_v.	**10 Marks**	**L2**	**CO2**

15.	**a.**	Explain Bio-Savart law with neat sketch. Assume that a conductor is along the z-axis with its upper and lower end subtending angles α_2 and α_1 at P, the point at which H is to be determined. Obtain the expression for Magnetic Field Intensity at H.	**10 Marks**	**L2**	**CO3**
	b.	An experimental set up requires a rectangular electromagnet with iron core. The length l and uniform cross sectional area S of the rectangular magnetic circuit with iron core are 120cm and 24cm2 respectively. The core carries two coils of N1=750 and N2=357 turns respectively. The relative permeability of the core material is 600. Compute, a) The external self-inductances of the coils. b) The mutual inductance between the coils if the mutual flux is 92% of the total flux.	**10 Marks**	**L2**	**CO3**

Or

16.	**a.**	Consider a magnetic field with intensity H (or flux density B) passing from one magnetic media to another having relative permeability μr1 and μr2. Explain down all the boundary conditions possible during the transfer with suitable sketches.	**8 Marks**	**L2**	**CO3**
	b.	The Planes z = 0 and z = 4 carry current K = -l0ax A/m and K = l0ax A/m, respectively. Solve H at (a) (1,1,1) (b) (0, - 3 ,10)	**12 Marks**	**L3**	**CO3**

17.	**a.**	According to Faraday's experiments, a static magnetic field produces no current flow, but a time-varying field produces an induced voltage (called electromotive force or simply emf) in a closed circuit, which causes a flow of current. Faraday discovered that the induced emf (in volts), in any closed circuit is equal to the time rate of change of the magnetic flux linkage by the circuit. Explain the three different methods by which variation in flux is realized with necessary equations	**10 Marks**	**L2**	**CO4**
	b.	A parallel-plate capacitor with plate area of 5 cm2 and plate separation of 3 mm has a voltage 50 sin 103 t V applied to its plates. Solve for the displacement current assuming $\varepsilon = 2\varepsilon o$.	**10 Marks**	**L3**	**CO4**

Or

18.	**a.**	Outline the Maxwell's equations for time varying field in integral and differential form	**10 Marks**	**L2**	**CO4**
	b.	With neat sketch explain the construction of a coaxial cable and the flow of power in a coaxial cable	**10 Marks**	**L2**	**CO4**

***** BEST WISHES *****