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 : EEE2003	**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	Depending upon the nature of the quantity under consideration, the field may be a vector or a scalar field. Define a scalar and vector with some examples.	**2 Marks**	**L1**	**CO1**
2	Define position vector and displacement vector	**2 Marks**	**L1**	**CO1**
3	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**
4	A fundamental fact of electricity is that every proton and electron in an atom have a unique, fascinating trait called an electric charge. State Coulomb's law	**2 Marks**	**L1**	**CO2**
5	Define Electric dipole. List the expression for Electric field E due to a dipole**.**	**2 Marks**	**L1**	**CO2**
6	Define electric potential. List the expression for electric potential due to point charge and 'n' number of point charges.	**2 Marks**	**L1**	**CO2**

7	State Ampere's law and write the mathematical expression	**2 Marks**	**L1**	**CO3**
8	Define the Lorentz force with the mathematical expression	**2 Marks**	**L1**	**CO3**
9	Recall the concept of displacement current	**2 Marks**	**L1**	**CO4**
10	Define Poynting Vector in Electromagnetic Fields	**2 Marks**	**L1**	**CO4**

Part B

Answer the Questions **Total 80 Marks.**

11.	**a.**	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**
	b.	In some cases, vector field like a source at a given point**.** If a gas is heated, it will expand. This will cause a net motion of gas particles outward in all directions. Consider the vector field given below, and identify its strength at the point Q(-2,1,6). Comment on the result. $P = x^2yz\,\mathbf{ax} + xz\,\mathbf{az}$	**10 Marks**	**L3**	**CO1**

or

12.	**a.**	Interpret the divergence of the following vector fields at the specified points. (a) $\mathbf{A} = yz\mathbf{ax} + 4xy\mathbf{ay} + y\mathbf{az}$ at (1, -2,3) (b) $\mathbf{B} = rz\sin\varphi\,\mathbf{ar} + 3rz^2\cos\varphi\,\mathbf{a\varphi}$ 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 $P = (2x^2z)\,\mathbf{a_x} - (xy^2z)\,\mathbf{a_y} - (3yz^2)\mathbf{a_z}$. Identify whether the given field is solenoidal or not	**10 Marks**	**L3**	**CO1**

13.	**a.**	The vector field D is called the electric flux density and is measured in coulombs per square meter. Given that $D = z\ r\cos^2(Ø)\,\mathbf{az}$ C/m^2, infer the volume charge density at (1, Π/4, 3) in C/m^3	**10 Marks**	**L2**	**CO2**
	b.	A total charge Q = 60 μC is split into two equal charges located at 180° intervals around a circular loop of radius 4 m. Estimate the potential at the center of the loop.	**10 Marks**	**L3**	**CO2**

or

14.	**a.**	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	**10 Marks**	**L2**	**CO2**

		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 c) Conductor and free space			
	b.	Laplace's equation is of primary importance in solving electrostatic problems involving a set of conductors maintained at different potentials. Among the following potentials identify the potential equation for that the Laplace's equation can't be applied. 1. $V = X^2 + Y^2 - 2Z^2 + 20$ 2. $V = (z \cos\phi) / r$ 3. $V = r \cos\phi$	**10 Marks**	**L3**	**CO2**

15.	**a.**	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 24cm^2 respectively. The core carries two coils of N1=750 and N2=357 turns respectively. The relative permeability of the core material is 600. Find 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**	**L3**	**CO3**
	b.	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**	**L3**	**CO3**

Or

16.	**a.**	The core carries two coupled coils of N1=360 and N2=480 turn respectively. The self inductance of coil 1 is 0.2mH and mutua inductance between the coils is 0.24mH. Determine 1. The coupling coefficient 2. The total inductance if the mmfs of both coils are in the same direction and also in the opposite direction.	**10 Marks**	**L3**	**CO3**
	b.	Consider a magnetic field with intensity H (or flux density B) passing from one magnetic media to another having relative permeability μr_1 and μr_2. Explain all the boundary conditions possible during the transfer with suitable sketches.	**10 Marks**	**L2**	**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 close, 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.	**10 Marks**	**L2**	**CO5**

		Explain the three different methods by which variation in flux is realized with necessary equations			
	b.	With neat sketch explain the construction of a coaxial cable and the flow of power in a coaxial cable	**10 Marks**	**L2**	**CO5**

Or

18.	**a.**	Express Maxwell's equations for time varying field in integral and differential form	**10 Marks**	**L2**	**CO5**
	b.	In free space. E – 20 cos(ωt-50x)ay V/m. Compute the following. 1.Displacement current density J_d 2. Magnetic Field Intensity, H	**10 Marks**	**L3**	**CO5**

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