



R22 Regulation **Subject code: 4E3BE**
TKR COLLEGE OF ENGINEERING AND TECHNOLOGY
 (Autonomous, Accredited by NAAC with 'A+' Grade)

B.Tech III Semester Regular/Supplementary Examinations, December 2024

**ELECTRO MAGNETIC FIELDS
(EEE)**

Maximum Marks: 60

Date: 11.12.2024

Duration: 3 hours

- Note:**
1. This question paper contains two parts A and B.
 2. Part A is compulsory which carries 10 marks. Answer all questions in Part A.
 3. Part B consists of 5 Units. Answer any one full question from each unit.
 4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A		CO	Bloom Tx
All the following questions carry equal marks		(10X1M=10 Marks)	
1.a)	What is curl of a vector?	1	1
b)	What is physical significance of divergence?	1	1
c)	State Coulomb's law.	2	1
d)	Define electric field intensity.	2	1
e)	Write about magnetic flux?	3	2
f)	What are the boundary conditions of dielectrics?	3	1
g)	Define permeability.	4	1
h)	What is meant by self-inductance?	4	1
i)	State Faraday's laws of electromagnetic induction.	5	1
j)	Write Point form of Maxwell's equation?	5	2
Part-B		CO	Bloom Tx
Answer All the following questions.		(5X10M=50Marks)	
2(a)	Explain the procedure of transformation of vector from Cartesian coordinate system to cylindrical co-ordinate system. [5M]	1	3
2(b)	Determine the divergence of a vector field $A = yza_x + 4xya_y + ya_z$ at (1,-2,3) [5M]	1	3
OR			
3(a)	Given the two vectors $A=3a_x+6a_y+2a_z$, and $B=7a_x-4a_y+3a_z$ (a) What is their dot product? (b) What is their cross product? (c) What is the angle between the two vectors? [5M]	1	3
3(b)	Explain the Spherical coordinate system. [5M]	1	3
4(a)	State and prove Gauss's law as applied to an electric field and determine the field due to an infinite line charge. [5M]	2	3
4(b)	Determine ρ_v at (0.3, 0.4, 0.5) due to $D = 20xy^2(z+1)x + 20x^2(z+1)y + 10x^2y^2z$ C/m ² ? [5M]	2	3
OR			
5(a)	Write short notes on Electrostatic Energy and Energy density? [5M]	2	3

5(b)	Four concentrated charge $Q_1 = 0.3 \mu\text{c}$, $Q_2 = 0.2 \mu\text{c}$, $Q_3 = -0.3 \mu\text{c}$, $Q_4 = 0.2 \mu\text{c}$ are located at the vertices of a plane rectangle. The length of rectangle is 5 cm and breadth of the rectangle is 2 cm. Find the magnitude and direction of resultant force on Q_1 ? [5M]	2	3
6(a)	Derive the relationship between current density \vec{J} and the electric field \vec{E} in a conductor. [5M]	3	4
6(b)	Explain the difference between absolute permittivity, relative permittivity, and vacuum permittivity. How do these quantities relate to each other? [5M]	3	3
OR			
7(a)	Derive the expression for the capacitance per unit length of a two-wire line? [5M]	3	4
7(b)	Discuss about application of Laplace's and Poisson's equations. [5M]	3	3
8(a)	Derive the force between two parallel differential current elements separated by a distance r in free space. [5M]	4	4
8(b)	Explain the characteristics of diamagnetic, paramagnetic, and ferromagnetic materials. [5M]	4	3
OR			
9(a)	Explain the physical significance of these boundary conditions in the design of magnetic circuits. [5M]	4	3
9(b)	Derive an expression for self-inductance in terms of magnetic flux linkage and current in a solenoid. [5M]	4	4
10(a)	Explain Faraday's laws of electromagnetic induction and derive the expression for induced EMF? [5M]	5	3
10(b)	Derive Maxwell's four equations for time varying fields. [5M]	5	4
OR			
11(a)	Derive and Explain Maxwell's equation in Phasor form? [5M]	5	4
11(b)	Explain the wave propagation in lossy dielectrics. [5M]	5	3