

Reg.No.: 

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**VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN**  
 [AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]  
 Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

**Question Paper Code: 80027**

**B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – JAN. 2026**  
**Fourth Semester**  
**Electrical and Electronics Engineering**  
**U23EE408 – ELECTROMAGNETIC FIELDS**  
**(Regulation 2023)**

Time : Three Hours

Maximum : 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

**PART – A**

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Define vector.	2	K1	CO1
2.	Write Divergence theorem.	2	K1	CO1
3.	State Gauss law for electric field.	2	K1	CO2
4.	Give the relationship between potential gradient and electric field.	2	K1	CO2
5.	State Biot –Savarts law.	2	K1	CO3
6.	What is the point form of ampere's circuit law?	2	K1	CO3
7.	Define self inductance.	2	K1	CO4
8.	State Faraday's law.	2	K1	CO4
9.	Define conduction current.	2	K1	CO5
10.	Write the Maxwell's equation for static electric field in time varying field.	2	K1	CO5

**PART – B**

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	i. Transform the given vector $A=3a_x-2a_y-3a_z$ at $P(-2,-3,4)$ into spherical co-ordinate system.	13	K1	CO1
	ii. Determine the curl of $A=yx a_x+4yz a_y+ty a_z$ .			

(OR)

- b) The vector  $A$  is given in the cylindrical co-ordinate system as  $A = 3 \cos \phi a_r + 4 r a_\phi - 5 a_z$ . Convert it into Cartesian co-ordinate system. 13 K1 CO1
12. a) i. Explain Coulomb's law and deduce the vector form of force equation between two point charges. 13 K2 CO2  
ii. The two charges  $3 \mu\text{C}$  and  $5 \mu\text{C}$  are separated by 6 cm. Find the force between them.
- (OR)
- b) i. Consider a pair of point charges in free space: charge  $Q_1 = -300 \mu\text{C}$  is located at  $(-1, 3, 5)$  m and the charge  $Q_2 = 25 \mu\text{C}$  is located at  $(1, 1, 2)$  m. What is the vector force on  $Q_2$ ? 13 K1 CO2  
ii. A  $250 \mu\text{C}$  point charge  $Q_1$  is located in the rectangular system at  $(1, 2, 1)$  m and another point charge  $Q_2$  of  $150 \mu\text{C}$  is located at  $(-2, 1, -2)$  m. Find the vector force on  $Q_2$ ?
13. a) Develop an expression for magnetic field intensity due to a linear conductor of infinite length carrying current  $I$  at a distance, point  $P$ . Assume  $R$  to be the distance between conductor and point  $P$ . Use Biot-Savart's Law. 13 K4 CO3
- (OR)
- b) i. Describe Ampere's circuital law. 13 K2 CO3  
ii. List the applications of Ampere's circuital law  
iii. Interpret the point form of Ampere's circuital law.
14. a) An air coaxial transmission line has a solid inner conductor of radius 'a' and a very thin outer conductor of inner radius 'b'. Determine the inductance per unit length of the line. 13 K3 CO4
- (OR)
- b) An inductor of 3 henries and resistance 4 ohms is connected to the terminals of a battery of emf, 20 volts and of negligible internal resistance. determine  
i. The initial rate of increase of current in the circuit,  
ii. The rate of increase of current at the instant when the current in the circuit is 1 amp. 13 K3 CO4
15. a) State Poynting's theorem and relevant factors with proof and explain its physical significance. 13 K2 CO5

(OR)

- b) i. Find the displacement current at  $t=0$  passing in an aluminium conductor of circular cross section having a total resistance of 0.15 ohm and voltage of  $100 \sin(106\pi t)$  volts across it. Given conductivity of aluminium =  $3.5 \times 10^7$  mhos /meter and relative permittivity =1.      13      K3      CO5
- ii. Moist soil is having the conductivity of  $10^{-3}$ s/m and  $\epsilon_r=2.5$ . If electric field intensity is  $E=4.5 \times 10^{-6} \sin 10t$  then find the conduction current density and displacement current density.

PART – C

(1 x 15 = 15Marks)

Q.No.	Questions	Marks	KL	CO
16. a)	Using Biot-savart law, find the magnetic field intensity due to finite length current filament.	15	K5	CO3
(OR)				
b)	Derive the 1-dimensional (1-D) Wave equations with suitable examples. Find the skin depth at a frequency of 3 MHz in Aluminium where $\sigma= 35.2$ M s/m and $\mu_r=1$ .	15	K5	CO5