PVP 23

Code: 23ES1301

II B.Tech - I Semester – Regular / Supplementary Examinations
NOVEMBER 2025

ELECTROMAGNETIC FIELD THEORY
(ELECTRICAL & ELECTRONICS ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: 1. This question paper contains two Parts A and B.
2. Part-A contains 10 short answer questions. Each Question carries 2 Marks.
3. Part-B contains 5 essay questions with an internal choice from each unit. Each Question carries 10 marks.
4. All parts of Question paper must be answered in one place.

BL – Blooms Level CO – Course Outcome

PART – A

		BL	CO
1.a)	Express the importance of Coulomb's law?	L2	CO1
1.b)	Define the concept of electric field intensity.	L1	CO1
1.c)	Define electric potential and potential difference.	L1	CO1
1.d)	Classify the applications of Laplace's equation?	L2	CO1
1.e)	Explain Magnetic dipole.	L2	CO3
1.f)	Express point form of Ampere's circuital law.	L2	CO3
1.g)	Express the relation between magnetic flux and magnetic flux density.	L2	CO3
1.h)	Define self and mutual inductances.	L1	CO4
1.i)	List the significance of displacement current.	L1	CO4
1.j)	Define the dynamically induced EMF.	L1	CO5

PART – B

			BL	CO	Max. Marks
UNIT-I					
2		Derive an expression for the electrical field intensity due to an infinite line charge and a circular disk charge distribution.	L3	CO1	10 M
OR					
3	a)	State and explain Maxwell's first equation.	L2	CO1	5 M
	b)	A point charge Q_1=2μC located at origin and another point charge Q_2=-5μC is at (3,4,0) m. Calculate the electric force on charge Q_1.	L3	CO1	5 M
UNIT-II					
4		Three-point charges, Q_1 = 1 mC, Q_2 = -2 mC, and Q_3 = 3 mC, are located at (0, 0, 4), (−2, 5, 1), and (3, −4, 6), respectively. (i) Find the electric field E and potential V_P at P (−1, 1, 2). (ii) Calculate the potential difference V_{PQ} if Q is (1, 2, 3).	L3	CO1	10 M
OR					
5	a)	Obtain an expression for the electric potential due to an electric dipole.	L2	CO2	5 M
	b)	Explain the concept of an electric dipole and dipole moment in detail.	L2	CO2	5 M

UNIT-III					
6	a)	Explain Biot-Savart's law in detail.	L2	CO3	5 M
	b)	Derive an expression for the magnetic field intensity due to an infinite sheet.	L3	CO3	5 M
OR					
7	a)	Produce the expressions for the capacitance of a parallel plate capacitor and the energy stored in it.	L3	CO2	5 M
	b)	Two current elements $I_1dl_1 = 4\times10^{-5}a_x$ A.m at (0, 0, 0) and $I_2dl_2 = 6\times10^{-5}a_y$ A.m at (0, 0, 1) are in free space. Calculate H at (3, 1,−2).	L3	CO3	5 M
UNIT-IV					
8	a)	Discuss the self-inductance of a solenoid with a neat schematic diagram.	L2	CO4	5 M
	b)	Summarize the force between two long and parallel current-carrying conductors in a magnetic field.	L2	CO4	5 M
OR					
9	a)	Solve the self-inductance of a coaxial cable with a neat schematic diagram.	L3	CO4	5 M
	b)	Derive an expression for the force on a current element in a magnetic field.	L3	CO3	5 M
UNIT-V					
10	a)	Solve an expression for the statically induced EMF in a time-varying field.	L3	CO5	5 M
	b)	Compare static fields and time-varying fields.	L4	CO5	5 M

OR					
11	a)	State and explain Maxwell's fourth equation.	L2	CO5	5 M
	b)	Explain the Poynting theorem in detail.	L2	CO5	5 M