Reg. No.																

Question Paper Code	14587

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2026

Third Semester

Electrical and Electronics Engineering

24EEPC301 - ELECTROMAGNETIC FIELDS

Regulations - 2024

Duration: 3 Hours | Max. Marks: 100

PART – A (i) (MCQ)
(16 × 1 = 16 Marks)
Answer ALL Questions

		Marks	K – Level	CO
1.	Analyze the two vectors, $\bar{A} = 2\bar{a}_x - 5\bar{a}_y - 4\bar{a}_z$ and $\bar{B} = 3\bar{a}_x + 5\bar{a}_y + 2\bar{a}_z$ Identify the dot product. a) -48 b) -27 c) -39 d) -16	1	K3	CO1
2.	Which of the following are the Human-made sources of electromagnetic fields? a) vacuum cleaners b) hair-dryers c) refrigerators d) All of the mentioned	1	K2	CO1
3.	What is the value of total electric flux coming out of a closed surface? a) Equal to the total charge enclosed by the surface b) Equal to the surface charge density. c) Equal to volume charge density d) Zero	1	K1	CO1
4.	Boundary conditions at the surface of a dielectric ensure continuity of a) Electric field only b) Electric displacement only c) Both electric field and electric displacement. d) Neither electric field nor electric displacement.	1	K2	CO2
5.	Electric field in free space is characterized by a) High dielectric constant. b) No free charges c) Presence of conductive materials d) Presence of dielectric materials.	1	K2	CO2
6.	What is the physical significance of the divergence of an electric field? a) It represents the net electric charge density within a volume. b) It indicates the magnetic flux density leaving a volume. c) It determines the potential at a point due to a charge. d) It measures the resistance to electric flow in a material.	1	K1	CO2
7.	What is the direction of the magnetic field at the center of a circular current-carrying loop? a) Tangential to the loop. b) Radial to the loop. c) Perpendicular to the plane of the loop. d) Parallel to the plane of the loop.	1	K1	CO3
8.	What does Biot-Savart's Law enable one to calculate? a) The magnetic field created by a moving charged particle b) The force between two parallel conductors c) The inductance of a closed circuit. d) The capacitance between two plates	1	K3	CO3

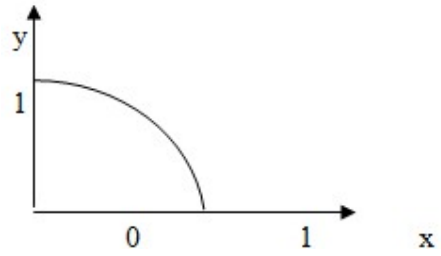
9.	A loop is rotating about the y – axis in a magnetic field $\vec{B} = B_0 cos(\omega t + \varphi)\overrightarrow{a_x} T$. The voltage in the loop is a) zero b) due to rotation only c) due to transformer action only d) due to both rotation and transformer action	*1*	*K3*	*CO3*
10.	Which component is essential for the functioning of magnetic circuits but not electrical circuits? a) Resistor b) Capacitor c) Core material d) Inductor	*1*	*K2*	*CO4*
11.	Which application directly utilizes Faraday's law of electromagnetic induction? a) Electric motors b) Capacitors c) Generators d) Resistors	*1*	*K3*	*CO4*
12.	What is motional EMF? a) EMF generated due to the motion of a conductor in a magnetic field. b) EMF generated due to motion of charges in a circuit. c) EMF induced in a stationary conductor. d) A constant voltage source in a circuit.	*1*	*K1*	*CO4*
13.	Which component does not change when electromagnetic waves transition from one medium to another? a) Wavelength b) Speed c) Frequency d) Phase	*1*	*K2*	*CO5*
14.	In which medium do electromagnetic waves travel the fastest? a) Vacuum b) Air c) Glass d) 8.85 ohms	*1*	*K1*	*CO5*
15.	The main cause of ESD damage in ICs is a) Overheating b) High current surge c) Low voltage d) Aging	*1*	*K3*	*CO6*
16.	RF MEMS device are primarily used in a) Power Generation b) Communication system c) Automotive breaking system d) Lighting system	*1*	*K2*	*CO6*

PART – A (ii) (Short Answer Questions)
(6 × 3 = 18 Marks)
Answer ALL Questions

17.	Analyze and Utilize in the Cylindrical Co-ordinate System the Gradient of the function: $f(r,\theta,z)=5r^4 z^3 Sin\ \theta$.	*3*	*K4*	*CO1*
18.	Compare the relation between electric field intensity and potential.	*3*	*K4*	*CO2*
19.	Solve the value of magnetic field intensity at the centre of a circular loop of radius 1m carrying a current of 10 A.	*3*	*K3*	*CO3*
20.	Estimate the mutual inductance of the two inductively coupled coils with self-inductance of 25mH and100 mH.	*3*	*K3*	*CO4*
21.	Compare between reflection and refraction of an EM wave.	*3*	*K4*	*CO5*
22.	Identify a super capacitor and how it differs from conventional capacitor.	*3*	*K3*	*CO6*

PART - B (Descriptive Answer Questions)
(6 × 11 = 66 Marks)
Answer ALL Questions

23.	a)	Write short notes on gradient, divergence, curl and stokes theorem.	*11*	*K3*	*CO1*
		OR			
	b)	Make use of Stokes theorem and verify for given a vector A= 2r Cosφ I_r+ r I_φ, In cylindrical coordinate system for the contour shown figure. Verify Stokes Theorem.	*11*	*K3*	*CO1*



24.	a)	A circular disc of 10 cm radius is charged uniformly with a total charge10c. Identify the electric field at a point 30 cm away from the disc along the axis.	*11*	*K3*	*CO2*
		OR			
	b)	Apply Gauss's law to determine the electric field intensity at a point P distant 'h' m from an infinite line of uniform charge ρ_l C/m.	*11*	*K3*	*CO2*
25.	a)	Develop the expression for energy stored in the magnetic field and also derive the expression for magnetic energy density.	*11*	*K3*	*CO3*
		OR			
	b)	Make use of Bio- Savart's law, drive an expression for the magnetic flux density and field intensity due to finite long current carrying conductor.	*11*	*K3*	*CO3*
26.	a)	Analyze and develop the Maxwell's equations in point form and integral form using Ampere's circuital law and gauss's law.	*11*	*K4*	*CO4*
		OR			
	b)	The one Ampere conductor current in copper wire. Examine the corresponding displacement current at 100 mega hertz. Assume that for copper $\sigma=5.8*10^7\ \Omega^{-1}/m$.	*11*	*K4*	*CO4*
27.	a)	Contrast the reflection coefficient of oblique incidence in perfect dielectric for parallel polarization.	*11*	*K4*	*CO5*
		OR			
	b)	Analyze the relation between E and H.	*11*	*K4*	*CO5*
28.	a)	Identify the equivalent circuit model to analyze the charge-discharge behavior of super capacitor.	*11*	*K3*	*CO6*
		OR			
	b)	Apply the working principle of RF MEMS switches and RF based communication systems.	*11*	*K3*	*CO6*