Q. Code:556649

Reg. No. | | | | | | | | | | | | | |

B.E./ B. TECH.DEGREE EXAMINATIONS, MAY 2024

Third Semester

EE18302 – ELECTROMAGNETIC THEORY

(Electrical and Electronics Engineering)

(Regulation 2018 / 2018A)

TIME: 3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Implement vector calculus in electromagnetic field.	**3**
CO 2	Understand the fundamentals of electrostatics & magnetostatics.	**2**
CO 3	Analyze electromagnetic fields and potentials.	**4**
CO 4	Derive different forms of Maxwell's equation.	**4**
CO 5	Solve electromagnetic wave equations and analyze electromagnetic parameters.	**4**

PART- A(10x2=20Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Given two vectors P = 3 i +5 j + 2 k and Q = 2 i – 4 j +3 K. Determine the angular separation between them.	**1**	**4**
2.	Show that vector $\overrightarrow{H} = 3y^4 z^2 \overrightarrow{a_x} + 4x^3 z^2 \overrightarrow{a_y} + 3x^2 y^2 \overrightarrow{a_z}$ is solenoidal.	**1**	**4**
3.	Point charge Q1=300μC is located at (1,-1,-3) m experiences a force $F_1 = 8\ \overline{a_x} - 8\ \overline{a_y} + 4\ \overline{a_z}$ N, due to point charge Q2 at (3, -3,-2) m. Determine Q2.	**2**	**4**
4.	Write the relationship between potential gradient and electric field intensity.	**2**	**2**
5.	State Biot Savart's law.	**3**	**2**
6.	Analyze Poisson's equation and Laplace equation.	**3**	**4**
7.	Distinguish transformer and motional emf.	**4**	**4**
8.	Compare field theory and circuit theory.	**4**	**4**
9.	What is the electromagnetic wave?	**5**	**2**
10.	What will happen when the wave is incident obliquely over dielectric –dielectric boundary	**5**	**2**

PART- B (5x 14=70Marks)

			Marks	CO	RBT LEVEL
11. (a)	**(i)**	Define Gradient, Divergence and Curl. Explain their significance.	**(8)**	**1**	**4**

	(ii)	Determine the Divergence of these vector fields	**(6)**	**1**	**4**

(a) $P = x^2\, yz\, \overline{a_x} + xz\, \overline{a_z}$

(b) $Q = \rho sin\varphi\, \overline{a_\rho} + \rho^2\, z\, \overline{a_\varphi} + z cos\varphi\, \overline{a_z}$

(c) $T = \frac{1}{r^2} cos\theta\, \overline{a_r} + r sin\theta cos\varphi\, \overline{a_\theta} + cos\theta\, \overline{a_\varphi}$

(OR)

(b)	**(i)**	Transform the vector A = $4\vec{a}_x - 2\vec{a}_y - 4\vec{a}_z$., at P (x=2, y=3, z=4) to cylindrical coordinate system.	**(10)**	**1**	**4**
	(ii)	Derive Coulomb's law in vector form.	**(4)**	**1**	**4**
12. (a)		A line of charge density ρ_L is uniformly distributed over an infinite length conductor. Derive its field intensity	**(14)**	**2**	**4**

(OR)

(b)		Consider the interface separating dielectric 1 (ε_{r1}) and dielectric 2 (ε_{r2}), Derive the relationships of the tangential components and normal components of Electric field intensity and electric flux density across the interface.	**(14)**	**2**	**4**
13. (a)		Derive an expression of magnetic field intensity and magnetic flux density at any point along the axis of circular coil.	**(14)**	**3**	**4**

(OR)

(b)	**(i)**	Derive the energy stored in magnetic field and energy density.	**(8)**	**3**	**4**
	(ii)	Distinguish between scalar and vector magnetic potential.	**(6)**	**3**	**4**
14. (a)		Derive and explain Maxwell's equations both in integral and point forms.	**(14)**	**4**	**4**

(OR)

(b)		State and explain the Faraday's law of electromagnetic induction. Also derive the statistically and dynamically induced emf equations.	**(14)**	**4**	**4**
15. (a)		Derive the Poynting theorem from Maxwell's equation.	**(14)**	**5**	**4**

(OR)

(b)		Define the wave and derive the wave equation for non-dissipative medium.	**(14)**	**5**	**4**

PART- C (1x 10=10Marks)

(Q.No.16 is compulsory)

		Marks	CO	RBT LEVEL
16.	In a lossless dielectric for which $\eta = 60\pi$, $\mu_r = 1$, and $\vec{H} = -0.1\cos(\omega t - z)\vec{a}_x + 0.5\sin(\omega t - z)\vec{a}_y\, A/m$. Calculate ε_r, ω and $\vec{E}$.	**(10)**	**5**	**4**

****