Q. Code: 600304

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

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

Third Semester

EC18302 – ELECTROMAGNETIC FIELDS AND WAVES

(Electronics and Communication Engineering)

(Regulation 2018/2018A)

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

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Apply different coordinate systems and vector calculus for understanding different concepts in electromagnetic Engineering.	**3**
CO 2	Evaluate the physical quantities of electromagnetic fields in different media.	**4**
CO 3	Design storage devices like capacitor, inductor used in electrical system and materials required to assemble energy storage devices.	**5**
CO 4	Justify concepts of electromagnetic waves means of transporting energy in the form of radio waves, TV signals, Radar beams.	**6**
CO 5	Determine the electromagnetic force exerted on charged particles, current elements, working principle of various electric and electromagnetic energy conversion devices are based on this force.	**3**

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Given a vector $\vec{A}=3x\,\vec{a}_x+y\,\vec{a}_y+5z\,\vec{a}_z$, find the divergence of A.	**1**	**3**
2.	Give the principle of Superposition.	**1**	**1**
3.	Compare Magnetic flux density and Electric flux density.	**2**	**2**
4.	If a magnetic field intensity $\vec{H}=8\vec{a}_x+3\vec{a}_y$, A/m exists at a point in free space, What is the magnetic flux density at that point.	**2**	**2**
5.	A current of 3 A flows through an inductor of 100 mH. What is the energy stored in the inductor?	**3**	**2**
6.	Write the expression of Ohm's law in point form.	**3**	**2**
7.	Write the point form of Maxwell's equation derived from Ampere's Circuital Law.	**4**	**1**
8.	State the significance of Faraday's law.	**4**	**2**
9.	Evaluate the value of intrinsic impedance in free space.	**5**	**2**
10.	Find the velocity of a plane wave in a lossless medium with a relative permittivity of 6 and a relative permeability of 3.	**5**	**2**

PART- B (5 x 14 = 70 Marks)

			Marks	CO	RBT LEVEL
11. (a)		Determine the electric field intensity of an infinitely long, straight, line charge of a uniform density ρ_L in air.	**(14)**	**1**	**3**
		(OR)			
(b)		State and Prove Gauss law and explain any one of its application.	**(14)**	**1**	**3**
12. (a)		Derive an expression for magnetic field intensity due to a finite long conductor carrying current I at a distant point P. Assume R to be the distance between conductor and point P. Use Biot Savart's law.	**(14)**	**2**	**3**
		(OR)			
(b)		Derive the magnetic field intensity in the different regions of co-axial cable by applying Ampere's circuital law.	**(14)**	**2**	**3**
13. (a)		Derive the capacitance between two concentric spheres by using Laplace Equation.	**(14)**	**3**	**3**
		(OR)			
(b)	**(i)**	Derive the expressions for boundary conditions in Electric fields.	**(8)**	**3**	**3**
	(ii)	A toroid has air core and has a cross-sectional area of $10mm^2$. It has 1000 turns and its mean radius is 10 mm. Find its inductance.	**(6)**	**3**	**3**
14. (a)		Derive the integral and point form of all the four Maxwell's equations.	**(14)**	**4**	**4**
		(OR)			
(b)	**(i)**	Check the fields E = Em sinx sint $\vec{a}_y$ V/m and H = Em/μ_0 cosx cost $\vec{a}_y$ A/m satisfy Maxwell's first and second equations or not.	**(8)**	**4**	**4**
	(ii)	State the Maxwell's equation for free space in integral form and give the expression for Maxwell's equation in time varying form.	**(6)**	**4**	**4**
15. (a)		State and Prove Poynting theorem. Describe the Poynting vector, average power, complex power and instantaneous power.	**(14)**	**5**	**3**
		(OR)			
(b)	**(i)**	Derive wave equation for the conducting medium and express it in phasor form.	**(8)**	**5**	**3**
	(ii)	If a wave with 200 MHz frequency propagates in free space, find the propagation constant and velocity of propagation.	**(6)**	**5**	**3**

PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

			Marks	CO	RBT LEVEL

16. Determine whether the following potential fields satisfy the Laplace's equation. **(10) 3 5**

a) $V = 2x^2 - 3y^2 + z^2$

b) $V = 8\rho^2 \sin 2\varphi$

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