Q. Code:518220

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

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

Third Semester

EC22303 – ELECTROMAGNETIC FIELDS AND WAVES

(Electronics and Communication Engineering)

(Regulation 2022)

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

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Apply the fundamentals of different coordinate systems to relate the electromagnetic concepts in Engineering.	**3**
CO 2	Evaluate the physical quantities of electromagnetic fields in different media.	**4**
CO 3	Analyze the boundary conditions for different media and to design the storage devices.	**3**
CO 4	Justify concepts of electromagnetic waves means of transporting energy in dielectric medium.	**4**
CO 5	Analyze the concept of Plane waves in homogeneous medium.	**3**

PART- A (20 x 2 = 40 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Give the Cartesian co-ordinates of a point whose cylindrical co-ordinates are $(1,45^0,2)$.	**1**	**3**
2.	An infinite sheet in X-Y plane extending from -∞ to ∞ in both directions has a uniform charge density of 10 nC/m^2. Find the electric field at z=1.0 cm.	**1**	**3**
3.	Given a vector $\vec{A}=3x\,\vec{a}_x+y\,\vec{a}_y+5z\,\vec{a}_z$, find the divergence of A.	**1**	**3**
4.	Give the principle of Superposition.	**1**	**2**
5.	Write the expression of differential magnetic field intensity due to differential current element according to Biot-Savart Law.	**2**	**2**
6.	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**	**3**
7.	Give the relationship between Magnetic field intensity and Magnetic flux density.	**2**	**2**
8.	State Ampere's Circuital Law and write the expression in differential form.	**2**	**2**
9.	State the boundary conditions in Magnetic field.	**3**	**2**
10.	Calculate the capacitance of parallel plate capacitor if A=80cm^2, d=3mm and relative permittivity =14.	**3**	**3**
11.	Check and verify Laplace's equation for the following vector $V=3x^2+5y^2-8z^2$.	**3**	**3**
12.	Express the continuity equation in integral and differential form.	**3**	**3**
13.	Examine the importance of Faraday's law of electromagnetic induction.	**4**	**2**
14.	Brief about the Gauss law for electric field.	**4**	**2**
15.	Write the point form of Maxwell's equation derived from Ampere's Circuital Law.	**4**	**2**
16.	What is the significance of displacement current density?	**4**	**2**

17.	Calculate the velocity of a plane wave in a lossless medium having a relative permittivity of 4 and a relative permeability of 1.2.	**5**	**3**
18.	What is meant by uniform plane wave?	**5**	**2**
19.	Calculate the intrinsic impedance of free space.	**5**	**3**
20.	Write expressions for instantaneous and complex poynting vector.	**5**	**2**

PART- B (5 x 10 = 50 Marks)

		Marks	CO	RBT LEVEL
21. (a)	Determine the electric field intensity of an infinitely long, straight, line charge of a uniform density ρ_L in air.	**(10)**	**1**	**3**
	(OR)			
(b)	State and Prove Gauss law and explain any one of its application.	**(10)**	**1**	**3**
22. (a)	Derive the magnetic field intensity in the different regions of co-axial cable by applying Ampere's circuital law.	**(10)**	**2**	**3**
	(OR)			
(b)	Derive an expression for magnetic field intensity due to a linear conductor of finite length carrying current I at a distant point P. Assume R to be the distance between conductor and point P. Use Biot Savart's law.	**(10)**	**2**	**3**
23. (a)	Derive the expressions for Poisson's and Laplace Equation and determine whether the potential field $V = 8\rho^2 \sin 2\varphi$ satisfy the Laplace's equation or not.	**(10)**	**3**	**3**
	(OR)			
(b)	Derive the expressions for boundary conditions in Magnetic fields.	**(10)**	**3**	**3**
24. (a)	Derive the Maxwell's first and second equations in the integral and differential forms.	**(10)**	**4**	**4**
	(OR)			
(b)	An electric field in a medium which is source free is given by $E = 1.5\cos(108t - \beta z)\vec{a}_x$ V/m. Find B,H and D. Assume $\varepsilon_r = 1, \mu_r = 1$ and $\sigma = 0$.	**(10)**	**4**	**4**
25. (a)	State and Prove poynting theorem.	**(10)**	**5**	**3**
	(OR)			
(b)	Derive the wave equations for conducting medium in phasor form.	**(10)**	**5**	**3**

PART- C (1 x 10 = 10 Marks)

(Q.No.26 is compulsory)

		Marks	CO	RBT LEVEL
26.	Find curl H and gradient of H, if $H = 2r\cos\phi\ \vec{a}_r - 4r\sin\phi\ \vec{a}_\phi + 3\ \vec{a}_z$	**(10)**	1	**5**

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