GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–IV (NEW) EXAMINATION – SUMMER 2024

Subject Code:3141009   **Date:03-07-2024**

Subject Name: Electromagnetic Theory

Time:10:30 AM TO 01:00 PM   **Total Marks:70**

Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

Q-1	**(a)**	Define; Field, DOT and CROSS product.	**3**
	(b)	Transform the following vectors to spherical coordinates at the points given: (a) $10\mathbf{a_x}$ at P(x = -3, y = 2, z = 4) (b) $10\mathbf{a_z}$ at M(r = 4, Θ = 110°, ϕ = 120°).	**4**
	(c)	Explain gradient of a scalar. Write fundamental properties of the gradient of a scalar field.	**7**
Q-2	**(a)**	State and explain Coulombs law.	**3**
	(b)	Explain Electric field intensity with necessary equations.	**4**
	(c)	Three infinite uniform sheets of charge are located in free space as follows: 3 nC/m^2 at z = -4, 6 nC/m^2 at z = 1, and -8 nC/m^2 at z = 4. Find **E** at the points; (a) P$_A$(2, 5, -5); (b) P$_B$(4, 2, -3); (c) P$_C$(-1, -5, 2); (d) P$_D$(-2, 4, 5).	**7**

OR

	(c)	Derive expression of Electric field intensity due to line charge along z-axis.	**7**
Q-3	**(a)**	Define potential and potential difference.	**3**
	(b)	An Electric field is expressed in rectangular coordinates by $\mathbf{E}=6x^2\mathbf{a_x}+6y\mathbf{a_y}+4\mathbf{a_z}$ V/m. Find: (a) V$_{MN}$ if points M and N are specified by M(2, 6, -1) and N(-3, -3, 2); (b) V$_M$ if V = 0 at Q(4, -2, -35).	**4**
	(c)	State and prove gauss's law.	**7**

OR

Q-3	**(a)**	What is equipotential surface?	**3**
	(b)	If 15 nC point charge is at the origin in free space. Calculate V$_1$ if point p$_1$ is located at P$_1$(-2, 3, -1) and : (a) V = 0 at (6, 5, 4); (b) V = 0 at infinity.	**4**
	(c)	State and prove divergence theorem.	**7**
Q-4	**(a)**	A uniform plane wave in air is normally incident onto a lossless dielectric plate of thickness $\lambda/8$ and of intrinsic impedance η = 260 Ω. Determine standing wave ratio of in front of the plate.	**3**
	(b)	Write Maxwell's equations in point and integral form.	**4**
	(c)	State and explain Faraday's law.	**7**

OR

Q-4	**(a)**	The electric field amplitude of a uniform plane wave propagating in the a$_z$ direction is 250 V/m. If $\mathbf{E}$ = E$_x\mathbf{a_x}$ and ω = 1.00 Mrad/s, find: (a) The frequency; (b) The wavelength; (c) The period.	**3**
	(b)	State Ampere's Circuital Law.	**4**
	(c)	Write short note on plane wave propagation in general dielectrics.	**7**

Q-5	**(a)**	Write applications of transmission lines.	**3**
	(b)	What do you mean by impedance matching? Explain.	**4**
	(c)	Explain voltage standing wave ratio (VSWR) with necessary equations.	**7**

OR

Q-5	**(a)**	What is skin effect?	**3**
	(b)	Write transmission line equations and their solutions in phasor form.	**4**
	(c)	Write short note on lossless and low-less propagation.	**7**

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