Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER–IV (NEW) EXAMINATION – WINTER 2020

Subject Code:3141009   **Date:19/02/2021**
Subject Name:Electromagnetic Theory
Time:02:30 PM TO 04:30 PM   **Total Marks:56**
Instructions:
1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			MARKS
Q.1	**(a)**	Differentiate between position and distance vector with appropriate example	**03**
	(b)	Given vectors $A = 3a_x + 4a_y + a_z$ and $B = 2a_y - 5a_z$, find angle between vector **A** and **B**	**04**
	(c)	Derive an equation of electric field due to surface charge distribution.	**07**
Q.2	**(a)**	Derive a relation between electric flux and electric flux density.	**03**
	(b)	How electric dipole is formed? Derived an equation of electric field due to electric dipole.	**04**
	(c)	A parallel-plate capacitor with plate area of 5 cm^2 and plate separation of 3 mm has a voltage $50\sin 10^3 t$ V applied to its plates. Calculate the displacement current, assuming $\varepsilon = 2\varepsilon_0$.	**07**
Q.3	**(a)**	Derive an equation for variation in flux by stationary loop in time varying magnetic field.	**03**
	(b)	State and explain the Faraday's law in detail	**04**
	(c)	What is the application of Poynting's Theorem? Derive its equation for total power leaving the volume.	**07**
Q.4	**(a)**	Derive an equation for variation in flux by moving loop in static magnetic field.	**03**
	(b)	Briefly describe point and integral form of Maxwell's equation.	**04**
	(c)	Explain the significance of skin depth. Also derive an equation of intrinsic impedance of good conductor.	**07**
Q.5	**(a)**	The electric field in free space is given by $\mathbf{E} = 50 \cos (10^8 t + \beta x)$ a_y V/m Calculate β and the time it takes to travel a distance of $\lambda/2$	**03**
	(b)	Describe characteristics of different medias for EM wave propagation.	**04**
	(c)	Derive an equation of Reflection Coefficient in terms of intrinsic impedance of two different media.	**07**
Q.6	**(a)**	In free space, $H = 0.1 \cos (2 \times 10^8 t - kx)$ a_y A/m. Calculate K, λ and time period T.	**03**
	(b)	Explain vector wave equation with its importance in plane wave propagation.	**04**
	(c)	Derive and sketch the standing wave pattern when the intrinsic impedance of medium 1 is less than medium 2 ($\eta_1 < \eta_2$).	**07**

Q.7 **(a)** Define following   **03**
             1. Propagation Vector
             2. Angle of Incident

(b) Explain and sketch any four types of Transmission Line   **04**

(c) An air line (lossless) has characteristic impedance of 70 Ω and phase **07**
constant of 3 rad/m at 100 MHz. Calculate the inductance per meter and
the capacitance per meter of the line.

Q.8 **(a)** Define following   **03**
             1. Plane of Incidence
             2. Polarizing Angle

(b) Derive characteristic equation of lossless transmission line   **04**

(c) An EM wave travels in free space with the electric field component **07**
$E_s = 100\, e^{j(0.866y+0.5z)}a_x$ V/m, Determine ω and λ

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