Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–IV (NEW) EXAMINATION – WINTER 2020

Subject Code:3140912 Date:11/02/2021

Subject Name:Electromagnetic Fields

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)** Explain cylindrical coordinate system in brief.	**03**
	(b) Explain Electrical dipole.	**04**
	(c) Explain spherical coordinate system and give the relationship between Cartesian and spherical coordinate system.	**07**
Q. 2	**(a)** State and explain Coulomb's law.	**03**
	(a) State and explain the Gauss's law.	**04**
	(b) Obtain equation for flux density due to infinite line charge using Gauss's law.	**07**
Q.3	**(a)** Define displacement current and current density.	**03**
	(b) Derive the point form of the continuity equation.	**04**
	(c) Obtain the Expression for field intensity **H** at the center of a circular carrying current **I**, using Biot-Savart law.	**07**
Q.4	**(a)** Explain concept of dot product and cross product.	**03**
	(b) Explain phenomenon of polarization.	**04**
	(c) Discuss Poisson's and Laplace equation.	**07**
Q.5	**(a)** Classify magnetic materials.	**03**
	(b) Explain the physical significance of the term: Curl of a vector.	**04**
	(c) Derive Maxwell's equation in integral and Point form.	**07**
Q.6	**(a)** Explain difference between steady magnetic field and time varying magnetic	**03**
	(b) Define divergence.	**04**
	(c) Explain Stoke's theorem with its mathematical expression.	**07**
Q.7	**(a)** Explain concept of electric potential difference.	**03**
	(b) State and explain Ohm's law in point form.	**04**
	(c) Explain boundary conditions between two perfect dielectric materials.	**07**
Q.8	**(a)** Explain concept of scalar magnetic potential and magnetic vector potential.	**03**
	(b) Explain Electrical field as the Gradient of the electrical potential.	**04**
	(c) State and explain ampere's circuit law, both in integral differential form as used in magnetic field.	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (NEW) EXAMINATION – WINTER 2021

Subject Code:3140912 Date:01/01/2022

Subject Name:Electromagnetic Fields

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.**

			MARKS
Q.1	**(a)**	State and explain Coulomb's law.	**03**
	(b)	State and explain Gauss's law.	**04**
	(c)	Explain and draw the figure for the orthogonal system which has its spherical coordinate is angle made be cone and z-axis. Transform the spherical coordinate system to Cartesian coordinate system.	**07**
Q.2	**(a)**	State and Explain various types of charge distribution with mathematical equation.	**03**
	(b)	Derive relation between current density and Volume charge Density.	**04**
	(c)	Obtain the spherical co-ordinates of $10\bar{a}_x$ at the point P(x= -3,y=2,z=4).	**07**
		OR	
	(c)	An infinite uniform linear charge ρ_L=2 nC/m line along the x axis in free space, while charge of 8 nC is located at (0,0,1) find E at (2,3, - 4).	**07**
Q.3	**(a)**	Explain boundary conditions between two perfect dielectric materials.	**03**
	(b)	Explain phenomenon of polarization	**04**
	(c)	Evaluate both sides of the divergence theorem for the filed $\bar{D} = 2xy\bar{a}_x + x^2\bar{a}_y$ C/m^2 and the rectangular parallelopiped formed by the planes x=0 and 1, y=0and 2, z=0and3.	**07**
		OR	
Q.3	**(a)**	Define conservative field	**03**
	(b)	Explain Electrical field as the Gradient of the electrical potential	**04**
	(c)	Obtain the expression for field intensity H at the centre of a circular carrying current I, using Bio-Savart Law.	**07**
Q.4	**(a)**	Explain Characteristics impedance and propagation constant of the transmission line.	**03**
	(b)	State Maxwell's equation in point form and integral form for static electromagnetic field.	**04**
	(c)	A dielectric free space has equation 3x+2y+z=12 m, The origin side of the interface has εr1=3 and E1= $2\bar{a}_x + 5\bar{a}_z$ V/m. Find E_2.	**07**
		OR	
Q.4	**(a)**	Give examples of different capacitor configuration.	**03**
	(b)	Explain polarization with reference to dielectrics	**04**
	(c)	Obtain the Expression for field intensity H at the center of a circular carrying current I, using Biot-Savart law.	**07**
Q.5	**(a)**	Write Effect of Electromagnetic Interference.	**03**

	(b)	Explain magnetic dipole moment.	**04**
	(c)	Define potential difference and potential gradient. Also Establish relation between Electrical field and potential gradient.	**07**
		OR	
Q.5	**(a)**	Write Poisson's and Laplace equation. also state use of this equation and uniqueness theorem	**03**
	(b)	State and explain source of EMI.	**04**
	(c)	Derive transmission line equation with help of equivalent circuit.	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (NEW) EXAMINATION – SUMMER 2021

Subject Code:3140912 Date:04/09/2021

Subject Name:Electromagnetic Fields

Time:02:30 PM TO 05:00 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.**

			Marks
Q.1	**(a)**	If $\bar{A} = \bar{a}_x + \bar{a}_y - \bar{a}_z$ and $\bar{B} = \bar{a}_x - \bar{a}_y + \bar{a}_z$, Find dot product and Cross product of two vector.	**03**
	(b)	State and explain Coulomb's law Vector form.	**04**
	(c)	Explain Cylindrical coordinate system in brief. Also write the equations of unit vectors, differential length, differential surfaces and differential volume elements.	**07**
Q.2	**(a)**	If Cartesian coordinates are X=1, Y=1, Z= $\sqrt{2}$ Convert in to Cylindrical and Spherical Co-ordinates.	**03**
	(b)	Explain Electrical field as the Gradient of the electrical potential.	**04**
	(c)	Derive the expression for electric field due to infinite surface charge distribution in free space.	**07**
		OR	
	(c)	Obtain equation for flux density due to infinite line charge using Gauss's law	**07**
Q.3	**(a)**	Verify that the potential field given below satisfies the Laplace's equation. V=$2x^2$-$3y^2$+z^2	**03**
	(b)	Explain concept of absolute potential. Derive equation of it.	**04**
	(c)	Derive Poisson's and Laplace's equations. State and Explain Uniqueness Theorem.	**07**
		OR	
Q.3	**(a)**	Explain Procedure for solving Laplace's equations.	**03**
	(b)	Derive Relationship between Electric field intensity and Electric Flux density.	**04**
	(c)	With suitable example, Explain Capacitance calculation using Laplace's Equation.	**07**
Q.4	**(a)**	Calculate the inductance of a solenoid of 200 turns wound tightly on a cylindrical tube of 6 cm diameter. The legth of the tube is 60 cm and the solenoid is in air.	**03**
	(b)	With the help of an example prove that the value of scalar magnetic potential can be non-unique	**04**
	(c)	State and Explain Stoke's theorem. State and Explain Ampere's circuital Law.	**07**
		OR	
Q.4	**(a)**	Explain scalar and vector magnetic potentials.	**03**
	(b)	Explain Application of Ampere's circuital law as $\bar{H}$ due to a Co-axial cable.	**04**
	(c)	Explain force between two differential current elements.	**07**

Q.5	**(a)**	Define divergence and its physical significance.	**03**
	(b)	State and explain Biot-Savart's law	**04**
	(c)	State Maxwell's equation in point form and integral form for static electromagnetic field.	**07**

OR

Q.5	**(a)**	Explain physical Significance of Curl related to types of field	**03**
	(b)	Using Biot-savart's law, find due to infinitely long straight conductor carrying current of I amp.	**04**
	(c)	Explain the terms conduction current density and displacement current density. Find the displacement current density within a parallel plate capacitor where $\varepsilon = 10\ \varepsilon_o$, $A = 0.01 m^2$, d=0.05 mm and the capacitor voltage is 200 sin (200t) volts.	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (NEW) EXAMINATION – SUMMER 2022

Subject Code:3140912 Date:27-06-2022

Subject Name:Electromagnetic Fields

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.**

			Marks
Q.1	**(a)**	Define unit vectors of Cartesian, cylindrical and spherical coordinate systems.	**03**
	(b)	State and Explain various types of charge distribution with mathematical equation.	**04**
	(c)	Explain Cylindrical co-ordinate system along with the equations of differential length, differential surfaces and differential volume elements.	**07**
Q.2	**(a)**	Explain electric dipole. Derive the expression for E at any distinct point from dipole.	**03**
	(b)	Express Maxwell's first equation as applied to electrostatics, using Gauss's law.	**04**
	(c)	Point charges 1 mC and - 2 mC are located at (3, 2,-1) and (-1, -1,4), respectively. Calculate the electric force on a 10 nC charge located at (0, 3, 1) and The electric field intensity at (0, 3, 1).	**07**
		OR	
	(c)	Analyze the expression for potential difference due to infinite line charge.	**07**
Q.3	**(a)**	Develop examples of different capacitor configuration.	**03**
	(b)	Explain physical meaning of Divergence.	**04**
	(c)	Determine boundary condition between two perfect Dielectrics.	**07**
		OR	
Q.3	**(a)**	State uniqueness theorem.	**03**
	(b)	Write Poisson's and Laplace equation. Also state use of this equation.	**04**
	(c)	At a potential $V= 2xy^2z^3$ and $\varepsilon=\varepsilon 0$. Given point P(1,3,-1). Find V at point P. Also Solve if V satisfies Laplace equation.	**07**

Q.4	**(a)**	State and explain Ampere circuital law.	**03**
	(b)	Distinguish between steady magnetic field and time varying magnetic field.	**04**
	(c)	Find the vector magnetic field intensity in cartesian coordinates at P2 (1.5, 2, 3) caused by a current filament of 24 A in az direction on the z axis and extending from z=0 to z=6.	**07**

OR

Q.4	**(a)**	State and explain Biot Savart's law	**03**
	(b)	Define the physical significance of the term: Curl of a vector.	**04**
	(c)	A circular loop located on $x^2 + y^2 = 9$, Z=0 carries a direct current of 10 A along $\bar{a\phi}$. Determine $\bar{H}$ at (0,0,4) and (0,0,-4).	**07**

Q.5	**(a)**	Classify magnetic materials.	**03**
	(b)	Explain force between two differential current elements.	**04**
	(c)	State and Explain Lorentz force equation on charged particles.	**07**

OR

Q.5	**(a)**	What is the Significance of displacement current?	**03**
	(b)	How electromagnetic fields are represented in phasor form?	**04**
	(c)	State and Explain Maxwell's equation in point form and integral form for static electromagnetic field.	**07**

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