

**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.

	<b>MARKS</b>
<b>Q.1</b> (a) Explain cylindrical coordinate system in brief.	<b>03</b>
(b) Explain Electrical dipole.	<b>04</b>
(c) Explain spherical coordinate system and give the relationship between Cartesian and spherical coordinate system.	<b>07</b>
<b>Q. 2</b> (a) State and explain Coulomb's law.	<b>03</b>
(a) State and explain the Gauss's law.	<b>04</b>
(b) Obtain equation for flux density due to infinite line charge using Gauss's law.	<b>07</b>
<b>Q.3</b> (a) Define displacement current and current density.	<b>03</b>
(b) Derive the point form of the continuity equation.	<b>04</b>
(c) Obtain the Expression for field intensity <b>H</b> at the center of a circular carrying current <b>I</b> , using Biot-Savart law.	<b>07</b>
<b>Q.4</b> (a) Explain concept of dot product and cross product.	<b>03</b>
(b) Explain phenomenon of polarization.	<b>04</b>
(c) Discuss Poisson's and Laplace equation.	<b>07</b>
<b>Q.5</b> (a) Classify magnetic materials.	<b>03</b>
(b) Explain the physical significance of the term: Curl of a vector.	<b>04</b>
(c) Derive Maxwell's equation in integral and Point form.	<b>07</b>
<b>Q.6</b> (a) Explain difference between steady magnetic field and time varying magnetic	<b>03</b>
(b) Define divergence.	<b>04</b>
(c) Explain Stoke's theorem with its mathematical expression.	<b>07</b>
<b>Q.7</b> (a) Explain concept of electric potential difference.	<b>03</b>
(b) State and explain Ohm's law in point form.	<b>04</b>
(c) Explain boundary conditions between two perfect dielectric materials.	<b>07</b>
<b>Q.8</b> (a) Explain concept of scalar magnetic potential and magnetic vector potential.	<b>03</b>
(b) Explain Electrical field as the Gradient of the electrical potential.	<b>04</b>
(c) State and explain ampere's circuit law, both in integral differential form as used in magnetic field.	<b>07</b>

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**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
<b>Q.1</b>	(a) State and explain Coulomb's law.	<b>03</b>
	(b) State and explain Gauss's law.	<b>04</b>
	(c) Explain and draw the figure for the orthogonal system which has its spherical coordinate is angle made by cone and z-axis. Transform the spherical coordinate system to Cartesian coordinate system.	<b>07</b>
<b>Q.2</b>	(a) State and Explain various types of charge distribution with mathematical equation.	<b>03</b>
	(b) Derive relation between current density and Volume charge Density.	<b>04</b>
	(c) Obtain the spherical co-ordinates of $10\vec{a}_x$ at the point P(x= -3, y=2, z=4).	<b>07</b>
	OR	
	(c) An infinite uniform linear charge $\rho_L=2$ 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).	<b>07</b>
<b>Q.3</b>	(a) Explain boundary conditions between two perfect dielectric materials.	<b>03</b>
	(b) Explain phenomenon of polarization	<b>04</b>
	(c) Evaluate both sides of the divergence theorem for the field $\vec{D} = 2xy\vec{a}_x + x^2\vec{a}_y$ C/m <sup>2</sup> and the rectangular parallelepiped formed by the planes x=0 and 1, y=0 and 2, z=0 and 3.	<b>07</b>
	OR	
<b>Q.3</b>	(a) Define conservative field	<b>03</b>
	(b) Explain Electrical field as the Gradient of the electrical potential	<b>04</b>
	(c) Obtain the expression for field intensity H at the centre of a circular carrying current I, using Bio-Savart Law.	<b>07</b>
<b>Q.4</b>	(a) Explain Characteristics impedance and propagation constant of the transmission line.	<b>03</b>
	(b) State Maxwell's equation in point form and integral form for static electromagnetic field.	<b>04</b>
	(c) A dielectric free space has equation $3x+2y+z=12$ m, The origin side of the interface has $\epsilon_r=3$ and $E_1=2\vec{a}_x + 5\vec{a}_z$ V/m. Find $E_2$ .	<b>07</b>
	OR	
<b>Q.4</b>	(a) Give examples of different capacitor configuration.	<b>03</b>
	(b) Explain polarization with reference to dielectrics	<b>04</b>
	(c) Obtain the Expression for field intensity H at the center of a circular carrying current I, using Biot-Savart law.	<b>07</b>
<b>Q.5</b>	(a) Write Effect of Electromagnetic Interference.	<b>03</b>

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

- 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  $\epsilon = 10 \epsilon_0$ ,  $A = 0.01 \text{m}^2$ ,  $d = 0.05 \text{ mm}$  and the capacitor voltage is  $200 \sin(200t)$  volts. **07**

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**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.

	<b>Marks</b>
<b>Q.1</b> (a) Define unit vectors of Cartesian, cylindrical and spherical coordinate systems.	<b>03</b>
(b) State and Explain various types of charge distribution with mathematical equation.	<b>04</b>
(c) Explain Cylindrical co-ordinate system along with the equations of differential length, differential surfaces and differential volume elements.	<b>07</b>
<b>Q.2</b> (a) Explain electric dipole. Derive the expression for E at any distinct point from dipole.	<b>03</b>
(b) Express Maxwell's first equation as applied to electrostatics, using Gauss's law.	<b>04</b>
(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).	<b>07</b>
<b>OR</b>	
(c) Analyze the expression for potential difference due to infinite line charge.	<b>07</b>
<b>Q.3</b> (a) Develop examples of different capacitor configuration.	<b>03</b>
(b) Explain physical meaning of Divergence.	<b>04</b>
(c) Determine boundary condition between two perfect Dielectrics.	<b>07</b>
<b>OR</b>	
<b>Q.3</b> (a) State uniqueness theorem.	<b>03</b>
(b) Write Poisson's and Laplace equation. Also state use of this equation.	<b>04</b>
(c) At a potential $V = 2xy^2z^3$ and $\epsilon = \epsilon_0$ . Given point P(1,3,-1). Find V at point P. Also Solve if V satisfies Laplace equation.	<b>07</b>

- 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  $\vec{a}_\phi$ . Determine  $\vec{H}$  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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