Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC– SEMESTER III– • EXAMINATION –WINTER- 2016

Subject Code: X31102 **Date:02/01/2017**

Subject Name: Engineering Electromagnetic

Time:10:30 AM to 1:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	With neat sketches, briefly explain the cylindrical coordinate system.	**07**
	(b)	Define the term scalar & vector. For the given points M(-1,2,1), N(3,-3,0) and P(-2,-3,-4). Find the unit vector directed from point M to Point P ($\mathbf{a_{MP}}$), $\mathbf{R_{MN}}$ and $\lvert 2\mathbf{r_P} - 3\mathbf{r_N} \rvert$.	**07**
Q.2	**(a)**	Define electric field intensity. Also derive the expression for the electric field intensity due to a sheet charge.	**07**
	(b)	State Coulomb's law. Determine the electric field intensity **E** at P(1,1,1) caused by four identical 3-nC charges located at A(1,1,0), B(-1,1,0), C((-1,-1,0) and D(1,-1,0).	**07**
		OR	
	(b)	The three vertices of a triangle are located at Points A (6,-1,2), B(-2,3,-4), and C(-3,1,5). Find the area of the triangle and a unit vector perpendicular to the plane in which the triangle is located.	**07**
Q.3	**(a)**	Explain the experimental set up of Faraday's Law. State and prove Gauss's Law.	**07**
	(b)	Define gradient of a scalar. For given scalar quantity, $W = x^2y^2 + xyz$, compute gradient of W and the directional derivative dW/dl in the direction $3\mathbf{a_x} + 4\,\mathbf{a_y} + 12\,\mathbf{a_z}$ at point P(2,-1,0)	**07**
		OR	
Q.3	**(a)**	Define divergence of a vector quantity. State and prove the divergence theorem with due mathematics.	**07**
	(b)	A wire of diameter 1 mm and conductivity 5×10^7 S/m has 10^{29} free electrons per cubic meter when an electric field of 10 mV/m is applied. Determine the charge density of free electrons, the current density, the current in the wire and the drift velocity of the electrons.	**07**
Q.4	**(a)**	What is an electric dipole? Derive the expression for electric field intensity **E** at distant point due to +Q and –Q coulomb charges located d/2 unit apart from the origin on the z-axis.	**07**
	(b)	Derive the necessary equations for the boundary conditions for perfect dielectric materials having permittivity's ε_1 and ε_2 in region 1 and region 2 respectively.	**07**
		OR	
Q.4	**(a)**	State Bio-Savart law and derive the expression for the magnetic field intensity for infinitely long wire carrying current I located on the z axis.	**07**
	(b)	Write Poisson's equation and Laplace's equation in Cartesian coordinate system. Also explain Uniqueness theorem in brief.	**07**

Q.5	**(a)**	State and prove Poynting's theorem relating to the flow of energy at a point in space in an electromagnetic field.	**07**
	(b)	Write a brief note on wave propagation in a good conductor.	**07**

OR

Q.5	**(a)**	Write Maxwell's equations in point form and in integral form and explain the physical significance of the equations.	**07**
	(b)	Write a brief note on the retarded potentials.	**07**