

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER– IV(NEW) EXAMINATION – SUMMER 2023****Subject Code:3141009****Date:19-07-2023****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.

	Marks
Q.1 (a) Explain the difference between vector and vector field with example.	03
(b) Write the various applications of Dot Product and Vector Product.	04
(c) What is electric field intensity? Write the expression of electric field intensity due to infinite line charge and explain its significance.	07
Q.2 (a) Transform the vector $A = 20 a_z$ into spherical coordinate system at point P (4, 110° , 120°)	03
(b) Derive mathematical equation of electric field intensity due to a continuous volume charge distribution and explain the dependency of field on various parameters of the field.	04
(c) Find the volume charge density that is associated with $D = \rho z^2 \sin^2 \phi a_\rho + \rho z^2 \sin \phi \cos \phi a_\phi + \rho^2 z \sin^2 \phi a_z$ C/m ²	07
OR	
(c) Given the field $D = 6\rho \sin(\phi/2) a_\rho + 15\rho \cos(\phi/2) a_\phi$ c/m ² , evaluate both sides of the divergence theorem for the region defined $\rho = 2$, $0 < \phi < 180^\circ$, $0 < z < 5$.	07
Q.3 (a) What is the use of coordinate system? Write the expressions of unit surfaces and unit volume of cylindrical coordinate system.	03
(b) State and explain divergence.	04
(c) Find E at P(1,5,2) m in free space if a point charge of 3 μ C is located at (0,0,1), the uniform line charge density is 90 nC/m along x-axis and uniform sheet of charge density 50 nC/m ² over the plane $z = -1$.	07
OR	
Q.3 (a) State and explain Gauss's Law in brief.	03
(b) Explain the potential gradient and the conservative field.	04
(c) Given the potential field in cylindrical coordinate $V = 500 \phi + 25$ V. Calculate the value at P (5, 30° , 1) in air (i) E (ii) D and (iii) ρ_v	07
Q.4 (a) Write and explain Lorentz Force equation.	03
(b) Explain the reflection of uniform plane wave at normal incidence.	04
(c) A filamentary current of 20A is directed in from infinity to the origin on the positive x axis, and then back out to infinity along the positive y axis. Use the Biot-Savart law to find H at P (0,0,1)	07
OR	
Q.4 (a) Compare magnetic scalar and vector potential.	03
(b) Explain the curl.	04
(c) A surface current density, $K = 10 a_x$ A/m, flows in the $y = 0$ plane throughout the region, $-5 < z < 5$, $-\infty < x < \infty$, Find H at P (0,10,0) in free space.	07
Q.5 (a) Write and explain the Maxwell's equations in point form.	03

- (b) Explain double stub lines impedance matching method of transmission line. **04**
(c) Write short note on electromagnetic waves in perfect dielectric. **07**

OR

- Q.5** (a) Explain skin effect. **03**
(b) Define and explain wave polarizations. **04**
(c) What are the applications of transmission line? Write the equations of transmission lines and their solutions in phasor form. **07**