Enrollment No: _____ Exam Seat No: _____

C.U.SHAH UNIVERSITY
Summer Examination-2017

Subject Name: Electromagnetics

Subject Code: 4TE06ELM1 **Branch: B.Tech (EE,EEE)**

Semester: 6 **Date: 11/04/2017** **Time: 02:30 To 05:30** **Marks: 70**

Instructions:

(1) Use of Programmable calculator & any other electronic instrument is prohibited.
(2) Instructions written on main answer book are strictly to be obeyed.
(3) Draw neat diagrams and figures (if necessary) at right places.
(4) Assume suitable data if needed.

Q-1 **Attempt the following questions:** **(14)**

1) A unit vector has _____

A) Only Direction B) Only Magnitude
C) Both magnitude and direction D) None of the above

2) If A and B are the vectors, then $A \times B = B \times A$

A) True B) False

3) If ρ is a variable of Cylindrical co-ordinates, x and y are Cartesian co-ordinates, then _____

A) $\rho = x + y$ B) $\rho = \sqrt{x^2 + y^2}$ C) $\rho = x^2 + y^2$ D) $\rho = x - y$

4) If A is a vector, then_____

A) $A.A = 1$ B) $A.A = 0$ C) $A.A = A^2$ D) $A.A = A$

5) The gradient of a scalar ***V*** can be written as_____

A) $\nabla^2 V$ B) V C) ∇V D) $\nabla^2 V^2$

6) The divergence of vector A can be written as_____

A) ∇A^2 B) $\nabla^2 A$ C) $\nabla \times A$ D) ∇A

7) For point P(-2, 6, 3), cylindrical co-ordinates are_____

A) P (6.31, 108.43°,3) B) P (7, 64.62°, 108.43°)
C) (10, 90° , 75°) D) None of the above

8) Gauss Law is applicable to _____

A) Open surface B) Open and Closed Surface

C) Closed Surface D) None of the above

9) Laplace equation of a scalar V is given as_____

A) $\nabla^2 V$ B) ∇V C) $-\nabla V$ D) None of the above

10) The equation for magnetic flux density is given by B= _____

A) $\frac{H}{\mu^2}$ B) $\frac{H}{\mu}$ C) $\frac{\mu}{H}$ D) $B = \mu H$

11) Points P and Q are located at P (10,2,4) and Q (-3,1,5) then distance between P and Q is _____

A) 13 B) 5.2C) 0 D) 10

12) The relation between current density and electric field intensity is given by_____

A) $J = \frac{\sigma}{E}$ B) $J = \sigma E$ C) $J = \frac{E}{\sigma}$ D) $J = \sigma E^2$

13) For a cross product $a_x \times a_y$ =_____

A) a_z B) 0C) a_x D) 1

14) Curl of H =_____

A) ∇H B) $\nabla \times H$ C) $\nabla^2 H$ D) ∇H^2

Attempt any four questions from Q-2 to Q-8

Q-2 **Attempt all questions** **(14)**

(a) If $\vec{A}$ is a vector, give the equation for vector $\vec{A}$ in circular cylindrical co-ordinates. Give the relationship between Cartesian co-ordinates (x, y, z) and cylindrical co-ordinates $(\rho, \emptyset, z)$. **07**

(b) Express the DEL (∇) operator in Cartesian and Circular cylindrical co-ordinates. **07**

Q-3 **Attempt all questions** **(14)**

(a) If Q_1 and Q_2 are the point charges are located at points having position vectors $\vec{r}_1$ and $\vec{r}_2$, derive the equation of force $\vec{F}_{12}$ on charge Q_2 due to Q_1. **07**

(b) Derive the equation for electric field intensity $\vec{E}$ for a finite line charge with a uniform charge density ρ_L. **07**

Q-4 **Attempt all questions** **(14)**

(a) Derive the equation for electric flux density $\vec{D} = \frac{Q}{4\pi r^2}\vec{a}_r$, where Q is the point charge. **07**

(b) Explain the divergence theorem. **07**

Q-5 **Attempt all questions** **(14)**

(a) Derive the equation for magnetic field intensity with the help of Bio-Savart's law. **07**

(b) Derive the equation of force $\vec{F} = Id\vec{L} \times \vec{B}$, where $d\vec{L}$ =Length of differential element, $\vec{B}$ =magnetic flux density, I= current through differential element **07**

Q-6 **Attempt all questions** **(14)**

(a) Derive the equation of force $\vec{F}_2 = \frac{\mu_0 I_1 I_2}{4\pi} \oint [\oint \frac{\vec{a}_{R_{12}} \times d\vec{L}_1}{R_{12}^2}] \times d\vec{L}_2$ between two differential current elements. Where, **07**

$\vec{F}_2$ = Force on element 2, $d\vec{L}_1$ =Differential length of element 1

$d\vec{L}_2$ = Differential length of element 2, I_1 = Current through element 1

I_2 = Current through element 2, R_{12} = Distance between element 1 and 2

(b) If $\vec{A} = 10\vec{a}_x - 4\vec{a}_y + 6\vec{a}_z$, $\vec{B} = 2\vec{a}_x + \vec{a}_y$, Find **07**

i) The component $\vec{A}$ along $\vec{a}_y$

ii) The magnitude of $3\vec{A} - \vec{B}$

iii)A unit vector along $\vec{A} + 2\vec{B}$

Q-7 **Attempt all questions** **(14)**

(a) For a co-axial cable at high frequencies, give the equation for capacitance, conductance, inductance and resistance. **07**

(b) Find the gradient of the following scalar fields: **07**

i) $V = e^{-z} \sin 2x \cosh y$ ii) $U = p^2 z \cos 2\phi$ iii) $W = 10r \sin^2 \theta \cos \phi$

Q-8 **Attempt all questions** **(14)**

(a) Explain various types of antennas used for launching waves into space. **07**

(b) Determine the divergence of the given vector fields. **07**

i) $P = x^2 yz a_x + xz a_z$ ii) $Q = \rho \sin \phi a_p + \rho^2 z a_\phi + z \cos \phi a_z$