Enrollment No: _____ Exam Seat No: _____

C.U.SHAH UNIVERSITY
Summer Examination-2018

Subject Name: Electromagnetics

Subject Code: 4TE06ELM1 **Branch: B.Tech (Electrical)**

Semester: 6 **Date: 23/04/2018** **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 scalar has _____

A) Only Direction B) Only Magnitude

C) Both magnitude and direction D) None of the above

2) If r is a variable of a sphere, x ,y and z are Cartesian co-ordinates then_____

A) $\vec{r} = \sqrt{x^2 + y^2 + z^2}$ B) $\vec{r} = x^2 + y^2 + z^2$ C) $r = x + y + z$ D) None of the above

3) If A and B are the vectors, then A.B = B. A

A) True B) False

4) The equation for a line charge is given by_____

A) $\int p_v dv$ B) $\int p_L dL$ C) $\int p_S dS$ D) None of the above

5) If vector G=$2a_x - 3a_y - a_z$, the y component of the vector G is_____

A) 2 B)3 C)-1 D)-3

6) For vectors A and B, $A \times B = -(B \times A)$.

A) True B) False

7) The relation between Electric field intensity and force is _____

A) $E = FQ$ B) F=$\frac{F}{Q}$ C) $E = \frac{F}{Q}$ D) None of the above

8) The unit of electric field intensity is _____

A) Coulomb/NewtonB) Coulomb C) Newton D) Newton/Coulomb

9) If Q is the charge in a total volume v, then volume charge density $\rho =$ ___

A) Q B) $\frac{v}{Q}$ C) $\frac{Q}{v}$ D) $Q.v$

10) The cosine angle between $2a_x$ and $-a_x + 2a_y + 7a_z$ is_____

A) 0°B) 97.8° C) 84.8° D) 45.16°

11) The magnitude of vector $\vec{A} = 2\cos\alpha\vec{a}_x + 2\sin\alpha\vec{a}_y + 7\vec{a}_z$ =_____

A) 10 B) 0C) 3.87 D) 7.28

12) The unit of permittivity is given by_____

A) Farad/metre B) metre/FaradC) Farad D) Farad/metre^2

13) Curl of H =_____

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

14) For any vector A unit vector $\vec{a}_A.\vec{a}_A$ =_____

A) 0 B) 2C) 5 D) 1

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

Q-2 **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) If **A**and **B** are the vectors, explain its dot product and cross product operation. **07**

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

(a) Derive the equation for electric field intensity $\vec{E}$ for a finite volume charge with auniform charge density ρ_v. **07**

(b) Given the two points, C(-3,2,1) and D(r=5,θ=20°, ϕ=70°). Find **07**

i) The spherical co-ordinates of C.

ii) The rectangular co-ordinates of D.

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

(a) Derive the equation $W = -Q \int_{init}^{final} \vec{E}.d\vec{L}$, energy expended in moving a point charge in an electric field, where $\vec{E}$ =Electric Field, $d\vec{L}$ =distance,Q= point charge. **07**

(b) Given the vectors $\vec{M} = -10\vec{a}_x + 4\vec{a}_y - 8\vec{a}_z$ and $\vec{N} = 8\vec{a}_x + 7\vec{a}_y - 2\vec{a}_z$.Find **07**

i) A unit vector in the direction of $-\vec{M} + 2\vec{N}$.

ii) The magnitude of $\vec{N} - 3\vec{M}$.

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

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

(b) State Gauss Law. Show that electric flux $\psi = \oint \vec{D}_s.d\vec{S} = Q$, where Q=Point Charge $\vec{D}_s$ =Surface Flux Density. **07**

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

(a) Derive the equation of Electric field intensity $\vec{E} = \frac{Q}{4\pi \in_0 R^2}\vec{a}_R$, where Q= Charge located at a point where $\vec{E}$ is desired and $\vec{a}_R$ is a unit vector in the $\vec{R}$ direction, R is the magnitude of vector $\vec{R}$. **07**

(b) The field quantities are given by $\vec{P} = 2\vec{a}_x - \vec{a}_z$, $\vec{Q} = 2\vec{a}_x - \vec{a}_y + 2\vec{a}_z$ $\vec{R} = 2\vec{a}_x - 3\vec{a}_y + \vec{a}_z$ **07**

Determine i) $(\vec{P} + \vec{Q}) \times (\vec{P} - \vec{Q})$ ii) $(\vec{Q}.\vec{R}) \times \vec{P}$

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

(a) State and prove the divergence theorem. **07**

(b) A chargeof $Q_1 = 3\times10^{-4}$C is located at M(1,2,3) and a charge of $Q_2 = 10^{-4}$ C at N (2,0,5) in a vaccum.Find the force exerted on Q_2 by Q_1. **07**

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

(a) For a co-axial cable at high frequencies, give the equation for capacitance, **07**

conductance, inductance and resistance.

(b) Determine the following for the given vector fields. **07**

i) Find divergence $\vec{D}$ at the origin if $\vec{D} = e^{-x}\sin y\vec{a}_x - e^{-x}\cos y\vec{a}_y + 2z\vec{a}_z$ C/m^2

ii) Find divergence $\vec{D}$ at P(2,3,-1) if $\vec{D} = (2xyz - y^2)a_x + (x^2z - 2xy)a_y + x^2ya_z$ C/m^2.