

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-IV (NEW) - EXAMINATION – SUMMER 2017

Subject Code: 2140909

Date: 08/06/2017

Subject Name: Field 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.

		MARKS
Q.1	Short Questions	14
1	The direction of vector normal to the plane containing two vectors is given by _____ of those two vectors. a) dot product b) cross product c) addition d) vector triple product	
2	A sharp beam in a cathode ray tube is an example of _____ a) Volume charge b) point charge c) line charge d) surface charge	
3	Choose equation which represents divergence theorem. a) $\oint_C \mathbf{F} \cdot d\mathbf{r} = \int_V (\nabla \cdot \mathbf{F}) dV$ b) $\oint_C \mathbf{F} \cdot d\mathbf{r} = \int_V (\nabla \times \mathbf{F}) \cdot d\mathbf{V}$ c) $\oint_C \mathbf{F} \times d\mathbf{r} = \int_V (\nabla \cdot \mathbf{F}) dV$ d) none of these.	
4	The differential volume in spherical co-ordinate system is a) $r^2 \sin \theta dr d\theta d\phi$ b) $r^2 \sin \theta dr d\phi d\theta$ c) $r^2 \sin \theta d\phi dr d\theta$ d) $r^2 \sin \theta d\theta dr d\phi$.	
5	At any point on spherical surface, $\mathbf{E}$ is always directed in the direction a) $\mathbf{a}_\phi$ b) $\mathbf{a}_\theta$ c) $\mathbf{a}_r$ d) $\mathbf{a}_\phi$.	
6	Work done along a path forming a closed contour is _____ a) Infinite b) maximum c) zero d) negative.	
7	The flow of charges under the influence of electric field intensity results in to _____ current a) drift b) diffusion c) displacement d) radiation	
8	Identify poisson's equation a) $\nabla^2 V = \rho$ b) $\nabla^2 V = -\rho$ c) $\nabla^2 V = \frac{\rho}{\epsilon_0}$ d) $\nabla^2 V = -\frac{\rho}{\epsilon_0}$	
9	The relation between $\mathbf{E}$ and $\mathbf{D}$ is a) $\mathbf{D} = \epsilon_0 \nabla \times \mathbf{E}$ b) $\mathbf{D} = \epsilon_0 \nabla \cdot \mathbf{E}$ c) $\mathbf{D} = \epsilon_0 \nabla \cdot \mathbf{E}$ d) $\mathbf{D} = \epsilon_0 \nabla \times \mathbf{E}$	
10	Divergence of vector field never be a) zero b) positive scalar c) negative scalar d) vector	
11	$\nabla \times \mathbf{H} = \mathbf{J}$ is a) Point form of Ampere's circuit law b) Integral form of Ampere's circuit law c) Maxwell's first equations d) Faraday's law	
12	The electric field can exert force on a) stationary charge only b) moving charge only c) stationary charge and moving charge d) none of above	
13	For time varying field a) $\nabla \times \mathbf{E} = 0$ b) $\nabla \times \mathbf{H} = 0$ c) $\nabla \times \mathbf{H} = \mathbf{J} + \frac{\partial \mathbf{D}}{\partial t}$ d) $\nabla \times \mathbf{E} = 0$	

14	The unit of attenuation constant α is a) neper/km b) rad/km c) degree/km d) decibel/km	
Q.2	(a) Define and Explain unit vectors in Cartesian and cylindrical co-ordinate systems.	03
	(b) Explain dot product and cross product of two vectors with their one application.	04
	(c) Derive the expression for E_z at point P on the axis of charged circular ring, carrying a charge uniformly along its circumference with density ρ_L	07
	OR	
	(c) An infinite uniform linear charge $\rho_L = 2.0 \text{ nC/m}$ lies along the x axis in free space, while point charge of 8.0 nC is located at (0, 0, 1) Find E at (2, 3, 4).	07
Q.3	(a) State Gauss's law. Also write limitations of Gauss's law	03
	(b) Find Divergence of $\vec{E} = \frac{1}{\sqrt{2}}(x\hat{a}_x + y\hat{a}_y + z\hat{a}_z)$ at point P (2,-1,3)	04
	(c) Obtain Expression for continuity in integral and differential form.	07
	OR	
Q.3	(a) Write Maxwell's equations for Static Electromagnetic field in point form and integral form.	03
	(b) Discuss properties of dielectric materials and define Dielectric strength.	04
	(c) Derive expression for electric field intensity and potential due to an electrical pole.	07
Q.4	(a) Define curl and write significance to decide types of field on bases of curl.	03
	(b) Derive the relation between I and J	04
	(c) Using Biot-savart law, find B due to infinitely long straight conductor carrying current of I amp.	07
	OR	
Q.4	(a) Classify magnetic materials.	03
	(b) Given the potential $V = 10 (X^2 + XY)$ and a point P (2, -1, 3) on a conductor to free space boundary. Find V and $\vec{E}$ at a point P.	04
	(c) Explain Stoke's theorem with its mathematics expression.	07
Q.5	(a) List out any four effects of EMI	03
	(b) Explain the terms conduction current density and displacement current density.	04
	(c) Discuss inductance. Explain self-inductance and mutual inductance.	07
	OR	
Q.5	(a) State the importance property of infinite transmission line.	03
	(b) Explain Magnetic dipole moment and magnetization.	04
	(c) A line with zero dissipation has $R = 0.006 \text{ ohms/m}$, $L = 2.5 \text{ } \mu\text{H/m}$ and $C = 4.45 \text{ pF/m}$ If line is operated at 10 Mhz. Find i) Characteristics impedance ii) attenuation constant iii) phase constant iv) velocity of propagation. v) wave length	07
