## B.E. Electrical (Electronics & Power) Engineering Fourth Semester EP-405 - Electro Magnetic Fields

P. P Tim	Pages : ne : Th	2     GUG/W/18/155       ree Hours     * 1 2 2 2 *       Max. Marks : 8	/ <b>W/18/1553</b> x. Marks : 80	
	Note	<ol> <li>All questions carry equal marks. as per internal choice.</li> <li>Answer all questions.</li> <li>Due credit will be given to neatness and adequate dimensions.</li> <li>Assume suitable data wherever necessary.</li> <li>Use Electronics non programmable calculate Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.</li> </ol>		
1.	a)	The given vector field $ \sum_{i=1}^{n} \left[ 2 \cos \left( \left( \frac{2}{2} + \frac{2}{2} + \frac{2}{2} \right) \right) \right] $	8	
		$F = 0.4 (y - 2x)a_{x} - \lfloor 200/(x^{2} + y^{2} + z^{2}) \rfloor a_{z}:$		
		i) Evaluate $ F $ at P (- 4, 3, 5) and	8	
		ii) Find a unit vector specifying the direction of F at point P.		
	b)	Give the points A (x = 2, y = 3, z = -1) and (r = 4, $\theta = 25^{\circ}$ , $\Phi = 120^{\circ}$ ) find : i) The spherical coordinates of A, ii) The Cartesian coordinates of B and iii) The distance from A to B.	8	
2.	a)	What are the different types of coordinate systems to represent electromagnetic fields. Give the coordinates and unit vectors associate with them respectively?	8	
	b)	<ul> <li>A triangle is defined by the points A (2, - 5, 1), B (-3, 2, 4) and C (0,3,1), find :</li> <li>i) R<sub>BC</sub> x R<sub>BA</sub> the area of the triangle and</li> <li>ii) The direction vector normal to the plane in which points are located.</li> </ul>	8	
3.	a)	Determine the total charge inside each of the total volume given as: $P_v = 4 x y z^2$ , $0 \le \rho \le 2$ , $0 \le \Phi \le 90^\circ$ , $0 \le z \le 3$ .	6	
	b)	Derive a standard relation for the electric field intensity at the general point $P(x,y,z)$ due to an infinite uniform surface charge lie along any axis. Also mention suitable assumptions wherever necessary to derive the relation.	10	
		OR		
4.	a)	An infinitely long, uniform line charge is located at $y = 3$ , $z = 5$ , if $\rho_1 = 30 \text{ nC}/\text{m}$ . Find E at : i) Origin, ii) at $P_B(0,6,1)$ , and iii) $P_C(5,6,1)$ .	8	
	b)	State Coulombs Law and explain electric field intensity in brief.	8	
5.	a)	Write the Gauss's expressions in point form and integral form Separately. Also give and explain Divergence theorem.	8	
	b)	Surface charge densities 200, - 50 and $\rho_x \mu C/m^2$ are located at r = 3, 5, and 7 cm respectively. Find D at r = : i) 2 cm, ii) 4 cm, and iii) $\rho_{SX}$ if D = 0 at r = 7.32 cm.	8	
		OR		

6.	a)	Let $D = r a_r/3 nC/m^2$ in free space, find: i) E at $r = 0.2 m.$ , ii) The total charge within $r = 0.2 m$ , and iii) The total electric flux leaving the sphere $r = 0.3 m.$	8
	b)	Given the flux density $D = 10 \rho^3 a \rho C/m^2$ , evaluating both sides of the divergence theorem for the volume enclosed by $\rho = 1m$ , $\rho = 2m$ , $z = 0$ and $z = 10$ .	8
7.	a)	Calculate the work done in moving a 4 C charge from the B (1,0,0) to A (0,2,0) through the path $y = 2-2x$ , $z = 0$ in field E = i) $5 a_x V/m$ , ii) $5x a_x V/m$ , iii) $5x a_x + 5 y a_y V/m$ .	8
	b)	Let $E = (-6y/x^2)a_x + (6/x)ay + 5a_z V/m$ and calculate: i) $V_{PQ}$ given P (-7, 2, 1) and Q (4, 1, 2); ii) $V_P$ if $V = 0$ at Q; and iii) $V_P$ if $V = 0$ at $(2, 0, -1)$	8
		OR	
8.	a)	Define and explain Potential Gradient, also write the expression of Gradient in all the three coordinate systems.	10
	b)	If $V = (60 \sin \theta)/r^2 a_r V$ in free space and point P is located at $r = 3$ m, $\theta = 60^\circ$ , $\Phi = 25^\circ$ , find : i. $V_P$ ; ii. $E_P$ ; iii. $dV/dN$ at P; iv. $a_N$ at P; and iv. $\rho_V$ at P.	6
9.	a)	<ul> <li>Write short note on any two:</li> <li>i) Biot - Savart Law</li> <li>iii) Ampere's circuital law and</li> <li>iii) Stoke's theorem</li> </ul>	8
	b)	Given the field H = 6r sin $\Phi a_r + 18r sin \theta \cos \Phi a_{\Phi} A/m$ , evaluate the both sides of the Stoke's theorem for the portion of the cone $\theta = 0.1 \pi$ bounded by r = 2, r = 4, $\Phi = 0$ , and $\Phi = 0.3 \pi$ , Let the direction of dS, be + $a_0$ .	8
		OR	
10.	a)	<ul><li>Write Maxwell's four equations for Static Electric Fields and Steady Magnetic fields in;</li><li>i) Point form ; and ii) Integral form.</li></ul>	8
	b)	The magnetic field intensity of a uniform plane wave in air is 20 A/m, in the $a_y$ direction.	8
		The wave propagating in the $a_z$ direction at a frequency of $2x10^9$ rad/s. Find:i) The wavelength;ii) The frequency;iii) The period; andiv) The amplitude of E	

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