B.E.(with Credits)-Regular-Semester 2012-Electrical (Electronics & Power) Engineering Sem IV EP-405 - Electro Magnetic Fields

P. Pages : 3 Time : Three Hours		3 ee Hours		GUG/W/16/3891 Max. Marks : 80	
	Notes	s: 1. 2. 3. 4.	All questions carry equal marks. Assume suitable data wherever necessary. Illustrate your answers wherever necessary with the help of neat Solve the questions as per internal choice.	sketches.	
1.	a)	The poi Determi i) Ar ii) Un iii) Un	nts M (6, 2, -3), N (-2, 3, 0) and P (-4, 6, 5) are the vertices of the ine: ea of the triangle. hit vector, perpendicular to the plane of the triangle MNP and hit vector bisecting the interior angle of the triangle at M.	triangle MNP. 9	
	b)	Given the coordinate	he vector field $F=[(\cos\theta)/r^2] a_r + [(\sin\theta)/r] a_{\theta}$. Transform F intates. Hence evaluate F at (1,2,3).	to rectangular 7	
			OR		
2.	a)	A = 3 a i) Th ii) Th iii) Ho	$x + 4 a_y - a_z$ and $B = -4 a_x + 2 a_y + 3 a_z$. Find: e vector component of A along the direction of B, e vector component of A along the direction perpendicular to B. w would you confirm the correctness of the answers of (i) & (ii).	8	
	b)	A close Φ < 1.0 i) the ii) the	d surface is defined in spherical coordinated by $3 < r < 5, 0.1 \pi < 5\pi$. Find: e volume enclosed e distance from P ₁ (3, 18 ⁰ , 216 ⁰) to P ₂ (5,54 ⁰ , 288 ⁰)	$\theta < 0.3 \pi , 1.2 \pi < 8$	
3.	a)	Derive a infinitel	an expression for the intensity of an electric field at any general po y extended uniform surface charge.	pint due to an 7	
	b)	Calcula i) a p ii) a u iii) a u	te D in rectangular coordinates at point P (2,-3,6) produced by: point charge $Q_A = 55 \text{ mC}$ at Q (-2,3,-6), uniform line charge $p_L = 20\text{mC} / \text{m}$ on X-axis, uniform surface charge density $p_s = 120 \mu \text{ C/m}^2$ on the plane z=-5.	9	
			OR		
4.	a)	Three p corners magnitu	oint charges $q_1 = 10^{-6}$ C, $q_2 = -10^{-6}$ C and $q_3 = 0.5$ X 10^{-6} C are loc of an equilateral triangle of 50 cm side placed on x=0 line. Determine and direction of force on the point charge q_3 .	ated at the 7 nine the	
	b)	Evaluat	e a numerical value for the divergence of D at the point indicated	for: 9	
		i) D	= 20 x y ² (1+z) a x + 20 x ² y (1+z) a y + 10 x ² y ² a z C/m ² at P _A (0.3)	5,0.4,0.5)	

- ii) $D = p z \sin \Phi a_p + 2 p z \cos \Phi a_{\Phi} + 2 p^2 \sin \Phi a_z C/m^2 at P_B (1, \pi/2, 2)$
- iii) $D = \sin \theta \cos \Phi a_r + \cos \theta \cos \Phi a_{\theta} \sin \Phi a_{\Phi} C/m^2 at P c (2, \pi/3, \pi/6)$

OR

5. a) Write notes on any three.

- i) Energy and Potential,
- ii) Gradient.
- iii) Dipole & Dipole Moment and
- iv) Divergence.
- b) Give your comment (essential) comparing the results in evaluation of the work done in moving a 5 μ C charge from origin to P(2,-1,4) through the field

 $E = 2 x y z a_x + x^2 z a_y + x^2 y a_z V / m$ via the paths:

- i) Line segments (0, 0, 0) to (2, 0, 0) to (2, -1, 0) to (2, -1, 4)
- ii) Straight lines x = -2 y, z = 2 x
- iii) Curve $x = -2 y^3$, $z = 4 y^2$

OR

- 6. a) Given the electric field $E = (1 / z^2) (16 x y z a_x + 8 x^2 z a_y 8 x^2 y a_z) V / m$. find the differential amount of work done in moving a 12 Nc charge, a distance 4 μ m starting at P(2, -2, 3) and proceeding in the direction $a_L =$
 - i) $(-6/7 a_x + 3/7 a_y 2/7 a_z)$,
 - ii) $(+6/7 \text{ a}_x 3/7 \text{ a}_y 2/7 \text{ a}_z)$ and
 - iii) $(+3/7 a_x + 6/7 a_y 2/7 a_z)$.
 - b) For the point P (3, 60⁰, 2) and the potential field V = 10 (p + 1) $z^2 \cos \Phi V$ in free space. 8 Find at P:

i)	V,	ii)	D,
iii)	dv/dn.	iv)	$\mathbf{p}_{\mathbf{v}}$

- **7.** a) What are the different types of capacitance normally considered as electro magnetic fields? Only give expressions for them.
 - b) $J = 20 y^2 z a_x 4 x^2 y a_y + 4 x^2 z a_z A/m^2$. Find:
 - i) The total current passing through the spherical cap x = 4, $3 \le y \le 5, 2 \le z < 6$ in the a x direction.
 - ii) Magnitude of J at the centre of the surface mentioned above.

OR

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boundary of perfect conductor. The region y < 0 contains a dielectric material for which $\in \mathbb{R}_{1}=2.5$, while the region b) y > 0 characterised by $\in R_2 = 4$. Let E₁ = -30 $a_x + 50 a_y + 70 a_z V/m$, find : i) Ε_{N1}, Εt1. ii) iv) $mod E_1$ and iii) $mod E_{t1}$, v) θ_1 9. Write short notes on any three. a) i) Biot Savart's Law, Curl, ii) Stokes Theorem, iii) iv) Vector Magnetic Potential.

Explain the properties of perfect perfect conductors and derive the conditions at the

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b) A 9.4 x 10^9 Hz uniform plane wave is propagating in a lossless medium which has $\epsilon_R = 2.5$. if the amplitude of magnetic intensity is 7 mA/m, Find : The velocity of propagation, the wavelength and the intrinsic impedance.

OR

- 10. a) Write Maxwell's equations for non time varying fields as well as for only time varying fields in point and integral forms, separately.
 - b) The E field in a perfect dielectric is given by $E = 10 \sin (10^6 t 0.01 z)$ and $H = 0.25 \sin (10^6 t 0.01 z) V/m$. find $\in R$ and μR .

8.

a)