Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering

End Sem (Even) Examination May-2018

EC3CO08 Engineering Electromagnetic

Programme: B.Tech. Branch/Specialisation: EC

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. The point P (-3, 4, 1) is given in Cartesian coordinate, which of one is incorrect? **1**

(a) $\rho = -5$ (b) r=$\sqrt{26}$

(c) $\theta = \tan^{-1}\frac{5}{1}$ (d) $\emptyset = \tan^{-1}\frac{4}{-3}$

ii. The force between two point charges of 1nC each with a 1mm separation in air is **1**

(a) $9\times 10^{-3}N$ (b) $9\times 10^{-6}N$ (c) $9\times 10^{-9}N$ (d) $9\times 10^{-12}N$

iii. If the potential, V=5y + 2 volts, the electric field is **1**

(a) 7 V/m (b) 2 V/m (c) -5 V/m (d) -5a_yV/m

iv. What is the magnetic field intensity vector $\bar{H}$ between two parallel sheet with separation'd' along z-axis, both sheets are carrying surface current $\bar{k} = k_y a_y$? **1**

(a) $-k_y a_y$ (b) $+k_y a_y$ (c) $-k_y a_x$ (d) Zero

v. The energy stored per unit volume in an electric field is given by **1**

(a) $\frac{1}{2}\varepsilon H^2$ (b) $\frac{1}{2}\varepsilon E^2$ (c) $\frac{1}{2}\varepsilon E$ (d) εE^2

vi. A time varying magnetic flux linking a coil is given by φ=1/3(αt^3) wb. At t=3s, the emf induced is 9v, then the value of α is **1**

(a) Zero (b) 1 wb/s^2 (c) -1 wb/s^2 (d) 9wb/s^2

vii. The concept of displacement current was a major contribution attributed to **1**

(a) Faraday (b) Lenz (c) Maxwell (d) Lorentz

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viii. The Poynting vector $\bar{P}= \bar{E} \times \bar{H}$ has the dimensions of **1**
(a) Power /unit area (b) Volt
(c) Power (d) Volt /unit length

ix. Which of the following statement is not true for waves in general? **1**
(a) It may be a function of time only.
(b) It must be sinusoidal.
(c) It must be a function of time and space.
(d) For practical reasons, it must be finite in extent.

x If for the transmission of a parallel polarized wave from a dielectric medium of permittivity ε_1 into a dielectric medium of permittivity ε_2 there exists a value of the angle of incidence θ_p for which reflection coefficient is zero, then **1**
(a) $\tanh \theta_p=\sqrt{\varepsilon 1/\varepsilon 2}$ (b) $\tan\theta_p=\sqrt{\varepsilon 1/\varepsilon 2}$
(c) $\tanh \theta_p=\sqrt{\varepsilon 2/\varepsilon 1}$ (d) $\tan\theta_p=\sqrt{\varepsilon 2/\varepsilon 1}$

Q.2 i. The point P (2, 3, -5) is given in Cartesian coordinate convert it into cylindrical $(\rho, \emptyset, Z)$ and spherical coordinate (r,$\theta, \emptyset$). **2**

ii. Define the Divergence and Stoke's theorem. **3**

iii. Given the two vectors $R_A = -a_x - 3a_y - 4a_z$ and$R_B= 2\ a_x + 2\ a_y + 2\ a_z$ and point C (1, 3, 4). Find : **5**
(a) R_{AB}; (b) $|\ R_B\ |$; (c) a_B ; (d) a_{AB} ; (e) unit vector directed from C towards A.

OR iv. Convert A = ($2a_x$ + 4a_y + 5a_z) at the point (3, 4, 5) in spherical coordinates. **5**

Q.3 i. Four point charges of 3nC each are placed at four corners of square 2m in side. Find force acting on each charge? **4**

ii. Two concentric charged spherical cell of inner radius '**a**' and outer radius '**b**' find: **6**
(a) E everywhere.
(b) Potential difference between spherical cell i.e.V_{ab}
(c) Capacitance (Assume as required)

OR iii. Derive the boundary condition for electrostatic field for both tangential as well as normal component between to dielectric medium. **6**

Q.4 i. Find the magnetic field intensity due to infinite long straight conductor wire using Biot Savert's law. **4**

ii. Evaluate both sides of the Stoke's theorem for the field $\bar{H}= 6xy a_x - 3y^2 a_y$ A/m and the rectangular path around the region, $2\leq x \leq 5, -1 \leq y \leq 1, z = 0$. let the positive direction of d$\bar{S}$ be a_z **6**

OR iii. Define: (a) Magnetic vector potential. **6**
(b) Poisson's and Laplace equation for magnetic field.

Q.5 i. Define: (a) Faraday's law. **4**
(b) Displacement current

ii. State Maxwell's Equation in integral and differential form for: **6**
(a) Free space
(b) Lossy Medium
(c) Time harmonically varying fields.

OR iii. A 300 MHz uniform plane wave propagates through a conducting medium for which $\sigma=10^{-2}$S/m, μ_r=1 and ε_r=64. Calculate attenuation constant, phase constant, skin depth and intrinsic impedance. **6**

Q.6 i. What is wave polarization? Define linear, circular and elliptical polarization. **4**

ii Determine the amplitudes of reflected and transmitted field (electric and magnetic both) at the interface of two region, if E_i=1.5mV/m in region 1 for which ε_{r1}=8.5, μ_{r1}=1 and σ=0 and region 2 is free space. **6**

OR iii Derive equation for reflection and transmission coefficient for perpendicular polarization. **6**

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EC3CO08 Engineering Electromagnetic

Marking Scheme

Q.1	i.	At Cartesian point (-3, 4,1), which of these is incorrect? (a) $\rho = -5$	**1**
	ii.	The force between two point charges of 1nC each with a 1mm separation in air is (a) $9\times 10^{-3}N$	**1**
	iii.	If the potential, V=5y + 2 volts, the electric field is (d) -5a_yV/m	**1**
	iv.	What is the magnetic field intensity vector $\bar{H}$ between two parallel sheet with separation'd' along z-axis both sheet carrying surface current$\bar{k} = k_y a_y$? (d) Zero	**1**
	v.	The energy stored per unit volume in an electric field is given by (b) $\frac{1}{2}\varepsilon E^2$	**1**
	vi.	A time varying magnetic flux linking a coil is given by φ=1/3(αt^3) wb. At t=3s, the emf induced is 9v, then the value of α is (c) -1 wb/s^2	**1**
	vii.	The concept of displacement current was a major contribution attributed to (c) Maxwell	**1**
	viii.	The Poynting vector $\bar{P}= \bar{E} \times \bar{H}$ has the dimensions of (a) Power /unit area	**1**
	ix.	Which of the following statement is not true for waves in general? (a) It may be a function of time only.	**1**
	x.	If for the transmission of a parallel polarized wave from a dielectric medium of permittivity ε_1 into a dielectric medium of permittivity ε_2 there exists a value of the angle of incidence θ_p for which reflection coefficient is zero, then (d) tanθ_p=$\sqrt{\varepsilon 2/\varepsilon 1}$	**1**

Q.2	i.	For each conversion 1 marks	(1 mark *2)	**2**
	ii.	Divergence	1.5 marks	**3**
		Stoke's theorem.	1.5 marks	
	iii.	(a) R_{AB}	1 mark	**5**
		(b) $\mid R_B \mid$	1 mark	
		(c) a_B	1 mark	
		(d) a_{AB}	1 mark	
		(e) Unit vector directed from C towards A.	1 mark	
OR	iv.	Correct formula including unit vector table Complete marks for correct result only	3 marks	**5**
Q.3	i.	1 mark for each correct result	(1 mark * 4)	**4**
	ii.	(a) E everywhere. (b)potential difference between spherical cell i.e.V_{ab}	3 marks 3 marks	**6**
OR	iii.	3 marks for each component	(3 marks * 2)	**6**
Q.4	i.	Magnetic field intensity due to infinite long straight conductor wire using Ampere's circuital law Step wise marking		**4**
	ii.	Each side having 3 marks	(3 marks * 2)	**6**
OR	iii	Define: (a) magnetic vector potential. (b) Poisson's and Laplace equation for magnetic field.	3 marks 3 marks	**6**
Q.5	i.	Define: (a) Faraday's law. (b) Displacement current	2 marks 2 marks	**4**
	ii.	Each correct equation having equal marks		**6**
OR	iii.	Calculate attenuation constant Phase constant Skin depth Intrinsic impedance	1.5 marks 1.5 marks 1.5 marks 1.5 marks	**6**
Q.6	i	Definition of wave polarization Definition linear Circular Elliptical polarization	1 mark 1 mark 1 mark 1 mark	**4**
	ii	Determine the amplitudes of reflected Determine the amplitudes of transmitted field	3 marks 3 marks	**6**
OR	iii	Derive equation for reflection and transmitted coefficient for a perpendicular polarization. 3 marks for each derivation	(3 marks * 2)	**6**

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