Student Exam No._____

GANPAT UNIVERSITY

B. Tech. Semester: V (Electronics & Communication Engineering)

CBCS Regular Examination Nov-Dec 2015

Subject: 2EC502 Electromagnetic Theory and Wave Propagation

Time: 3 Hours **Total Marks: 70**

Instructions: 1. All questions are compulsory.
2. Write answer of each section in separate answer books.
3. Figures to the right indicate full marks. Assume suitable data, if necessary.

Section – I

Que. – 1	**(A)**	Derive the point form of Ampere's law.	6
	(B)	What is Poynting theorem? Derive an expression for the value of instantaneous power flow in a given system of total volume V.	6
		OR	
Que. – 1	**(A)**	Define and explain the physical significance of divergence and the curl.	4
	(B)	State and prove the Stoke's theorem.	4
	(C)	What is skin effect? Explain in detail.	4
Que. – 2	**(A)**	Derive the relation between the normal and the tangential components of a vector when it is changing the medium.	6
	(B)	Derive the Maxwell's equations for a time varying field.	5
		OR	
Que. – 2	**(A)**	Derive the solution of the wave equation.	4
	(B)	Differentiate between Transformer EMF and Motional EMF.	4
	(C)	If $\vec{E} = 200\, e^{(4x-kt)}\, \overline{a_y}$ (v/m) in free space, find $\vec{H}$ using Maxwell's equations.	3
Que. – 3	**(A)**	Answer the Following i) What type of wavefront does a uniform plane wave have? ii) Which is the lowest layer of Ionosphere? iii) Define Lenz law. iv) How does the frequency affect the skin depth? v) Write down the Lorentz force equation. vi) What is Magnetization vector?	6
	(B)	Find the curl of $\vec{G}$ at (3, 2, 1) if $\vec{G} = xyz\,(\overline{a_x} + \overline{a_y})$ and conclude whether $\vec{G}$ is rotational or not.	4
	(C)	What are the factors that influence the propagation of EM wave traveling from transmitter to receiver?	2

Section - II

Que. – 4 (A) Explain the vector projection and scalar projection in terms of dot product between two vectors. 4

(B) Convert A= $6\bar{a}_x + 8\bar{a}_y + 10\bar{a}_z$ at the point in spherical coordinates (6, 8, 10). 4

(C) Express the field $\bar{F}=2xyz\bar{a}_x - 5(x+y+z)\bar{a}_z$ in cylindrical coordinates. Find $|\overline{F}|$ at p(r=2, $\phi=60^o$,z=3) 4

OR

Que. – 4 (A) Explain following terms 6

1. volume charge density
2. potential gradient
3. electrical flux density

(B) Given points A(6,-1,2) ,B(-2,3,-4) and C(-3,1,5) find 6

a) $\bar{R}_{AB}.\bar{R}_{AC}$
b) The angle between $\bar{R}_{AB}$ and $\bar{R}_{AC}$
c) The length of Projection of $\bar{R}_{AB}$ on $\bar{R}_{AC}$
d) The vector Projection $\bar{R}_{AB}$ on $\bar{R}_{AC}$

Que. – 5 (A) Explain the line charge density. Derive the expression of electric field intensity for the line charge configuration 6

(B) Three point charges $q_1 = 10^{-6}$ C, $q_2 = 10^{-6}$ C $q_3 = 0.5 \times 10^{-6}$ C are located at the corners of an equilateral triangle of 50cm side. Determine the magnitude and direction of force on q_3 5

OR

Que. – 5 (A) Derive the relation ,E– -grad V 4

(B) A Uniform line charge density of 5nc/m is at y=0, z=2m in free space, while -5nC/m is located y=0, z= -2m. A uniform surface charge density of 0.3nC/m^2 is at y= -2m. Find $|\overline{E}|$ at the origin. 4

(C) A point of 20nC is located at (4,-1, -3) and a uniform line Charge of -25nc/m is lies along the intersection of plane X=-3 and Z =6. Calculate the $\bar{D}$ at (3, 1, 0). 3

Que. – 6 (A) Discuss about the current density in terms of current. Find the relationship between $\bar{J}$, ρ_V *and* $\bar{V}$. 6

(B) Given the flux density $\bar{D} = (2\cos\theta/r^3)\bar{a}_r + 2\sin\theta/r^3\bar{a}_\theta$ C/m^2 evaluate both side of the divergence theorem for the given region defined by $0 < r < 2, 0 < \theta < \pi/2, 0 < \emptyset < \pi/2$. 4

(C) Differentiate the convection current and conduction current. 2

END OF PAPER