[Total No. of Printed Pages:1] **CODE NO:- U-251**

FACULTY OF ENGINEERING AND TECHNOLOGY

Third Engg (ECT/E &C/IE) Examination - *DEC – 2014*

Electromagnetic Engineering (Revised)

[Time: THREE *Hours*] **[Max. Marks: 80]**

"Please check whether you have got the right question paper."

N.B
1) *Q 1 and Q 6 are compulsory.*
2) *Solve any two questions from Q.2,Q.3, Q.4 and Q.5 in section I*
3) *Solve any two questions from Q.7,Q.8,Q.9 and Q.10 in section II*
4) *Figures to the right indicate full marks.*
5) *Assume suitable data wherever necessary and mention it clearly.*

SECTION A

Q.1 Solve any 2 10

a) Derive electric field intensity expression for an infinity line charge along z axis.
b) Derive the mathematical expression of Gauss Law
c) Prove that the work done is independent of path taken in any electrostatic field
d) Derive the expression of potential field due to system of charges

Q.2 a) Express $\bar{B} = r^2 a_r + sin\,\theta a_\Phi$ in Cartesian coordinate system at point P(1,2,3) 07

b) A $2\mu C$ point charge is located at A(4,3,5) in free space. Find E_ρ, E_Φ, E_z at point (8,12,2). 08

Q.3 a) Four point charges each of 10μC are placed in free space at the points (1,0,0), (--1,0,0), (0,1,0) and (0,--1,0)m respectively. Determine the force $\bar{F}$ on a point charge of 30μC located at a point (0,0,1)m 07

b) Find D (in Cartesian coordinates) at point P(6,8,--10) caused by a point charge of 30mC at the origin and a uniform line $\rho_1 = 40\mu C/m$ on the z axis 08

Q.4 a) In cylindrical coordinates $J = 10_e^{-100\,r}\, a_\Phi\, A/m^2$. Find the current crossing the region $0.01 \leq r \leq\leq 0.02m, 0 < z \leq 1m$ and intersection of this region with the Φ= constant plane. 07

b) If three charges 3μC, --4μC, 5μC are located at (0.0.0)m (2,--1,3)m and (0.4.--2)m respectively. Find potential at (1,0.1)m assuming zero potential at infinity 08

Q.5 a) A point charge Q=10nC is at the origin in free space. Find electric flux density at P(1,0,1) 07

b) Four infinite uniform sheets of charge are located as follows: 20pC/m^2 at y=7 , --8pC/m^2 at y=3, 6 pC/m^2 at y=-1 and -18 pC/m^2 at y=-4. Find $\bar{E}$ at point 08

i) P_A(2,6,--4)
ii) P_B(0,0,0)
iii) P_C(--1,--1.1,5)

SECTION B

Q.6 Solve any 2 10

a) Using Biot Savart law derive the expression of $\bar{H}$ due to inifinitely long straight conductor along he z axis
b) Starting from Maxwell's equations derive the equation of magnetic field of uniform plane wave propagating in free space
c) Derive boundary conditions for static magnetic field
d) Derive the equation of total power in a uniform plane wave by poynting theorem.

Q.7 a) A rectangular loop of wire in free space joins points A(1,0,1) to B(3,0,1) to C(3,0,4) to D(1,0,4) to A. the wire carries a current of 6m A flowing in the a_z direction from B to C. a filamentary current of 15 A flows along the entire z axis in the a_z direction. Find $\bar{F}$ on side BC. 07

b) Region 1 is a semi- infinite space in which 2x—5y>0 while region 2 is defined by 2x—5y<0. Let $\mu_{R1} = 3, \mu_{R2} = 4\ and\ H_1 = 30\ a_z \frac{A}{m}$. 08
find a) $|B_1|$ b)$|B_{N1}|$ c) H_{t1} d) $|H_2|$

Q.8	a)	i)Within a certain region $\varepsilon = 10^{-11} F/m \;\; and\; \mu = 10^{-5}\; H/m$. if Bx = 2 X 10^{-4} cos (10^5t) sin (10^{-3}y)T i) Use $\nabla \times H = \in \frac{\partial E}{\partial t}\; to\; find\; \bar{E}$	07
		ii)find the total magnetic flux passing passing through the surface x=0, 0<y<40m,0<z<2m at t=1 μs	08
	b)	i)Find the amplitude of the displacement current density 1) in the air near a car antenna where the field strength of an FM signal is $\bar{E}$ = 80 cos (6.277 *10^8 t-2.092y)a_y V/m ii)In an air space within a large transformer where $\bar{H} = 10^6 \cos(377\, t + 1.2566 * 10^{--6} z)\; a_y A/m$	
Q.9	a)	Calculate the attenuation constant and phase constant for a uniform plane wave with frequency of 10GHz in polyethylene for which$\mu_r = 1, \varepsilon_r = 2.3\; and\; \sigma = 2.56\; X\; 10^{-4} S/m.$	07
	b)	Wet marshy soil is characterized by $\sigma = 10^{--2} S/m, \varepsilon_r = 15, \mu_r = 1.$ At 60 Hz calculate i) Skin depth ii) Intrinsic impedance iii) Propagation constant	08
Q.10	a)	Write short note on stokes theorem	07
	b)	Write short note on force and torque closed circuit	08