H.T.No. | | | | | | | | | | |

Code No: EE1511 **GEC-R14**

II B. Tech I Semester Supplementary Examinations, January 2017

ELECTRO MAGNETIC FIELDS

(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 60**

Note: All Questions from **PART-A** are to be answered at one place.
Answer any **FOUR** questions from **PART-B.** All Questions carry equal Marks.

PART-A

6 × 2 = 12M

1. State Coulomb's law.
2. Difference between conduction and convection current densities.
3. A certain magnetic field intensity is given in free space as $\overline{H}=\overline{20}(x\overline{a}_x + y\overline{a}_y)/(x^2+y^2)A/m$. Find $\overline{B}$.
4. Define magnetic dipole and dipole moment.
5. Write Neumann's formulae.
6. Define Displacement current.

PART-B

4 × 12 = 48M

1. a) Volume charge density is given as $\rho_v=10^{-5}e^{-100r}\sin\theta$ C/m^3 for $0\le r \le 1$cm, and $\rho_v=0$ for r> 1cm. Estimate $\overline{E}$ at r=1m, $\theta=90^0$, $\emptyset=0$ by thinking in terms of a point charge. (6M)

   b) A sheet of charge ρ_s =2nC/m^2 is present at the plane x=3 in free space, and a line charge ρ_L =20nC/m, is located at x=1, z=4 Find magnitude of Electric Field Intensity at origin. (6M)

2. a) State and prove the boundary conditions at the boundary between conductor and dielectric. (6M)

   b) Given the field $\overline{D}$ = $(20/\rho^2)(-\sin^2\emptyset\ \overline{a}_p + \sin 2\emptyset\ \overline{a}_\emptyset)$ C/m^2. Find the total charge lying within the volume $1<\rho<2$, $0<\emptyset<\pi/2$, $0<z<1$ using Gauss law. (6M)

3. a) Derive an expression for Magnetic Field Intensity due to circular current carrying wire. (6M)

   b) A current element $I\overline{dL}=10^{-3}(2\overline{a}_x+4\overline{a}_y-4\overline{a}_z)$A-m located at A (-5, 3,-2) produces a field $\overline{dH}$ at B(3,-4,3). Find unit vector in the direction of $\overline{dH}$ at B. (6M)

4. a) Two infinitely long parallel filaments each carry 50A in the $\overline{a_z}$ direction. If 2cm is spacing between filaments, find vector force per meter on each filament. (6M)

b) A differential current loop has dimensions of 1m by 2m and lies in uniform field $\overline{B0}$ = - $0.6\overline{a_y}$+$0.8\overline{a_z}$ T. The loop current is 4mA. Find torque on loop and also on the sides of loop. (6M)

5. a) Derive an expression for energy stored and density in a magnetic field. (6M)

b) Obtain the self inductance of a toroid of circular cross section of radius a and mean radius R with N uniformly and closely spaced turns around the coil. (6M)

6. a) Modify Maxwell's equations for time varying fields. (6M)

b) Consider a region where $\varepsilon=\varepsilon_0$, $\mu=\mu_0$, $\sigma=0$, $\bar{J}=0$ and $\rho_v=0$. Use Maxwell's equations in Cartesian co-ordinates and assume that $\overline{E}$ =E $\overline{a}_x$ and $\overline{H}$ =H_y $\overline{a}_y$ .Find the second partial differential equation that E_x must satisfy. (6M)

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