[Total No. of Printed Pages:2] **CODE NO:- Z-04**

FACULTY OF ENGINEERING AND TECHNOLOGY

T.E(EC/ECT/E&C) Examination – MAY-2015

Electromagnetic Engineering

(Revised)

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

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

N.B
i) Q.No.1 from section A and Q.No.6 from section B are compulsory.
ii) Solve any two questions from Q.2, Q.3, Q.4 and Q.5 in section A.
iii) Solve any two questions from Q.7, Q.8, Q.9 and Q.10 in section B.
iv) Figures to the right indicate full marks.
v) Assume suitable data wherever necessary and mention it clearly.

SECTION A

Q.1 Solve any two 10

a) Derive the expression of capacitance of coaxial capacitor.
b) State & explain Divergence Theorem.
c) Derive the expression of potential difference between two points at a radial distance from a Infinite line charge along the z axis.
d) Derive the expression of potential of a point charge.

Q.2 A) If a line charge $p_1 = 50nC/m$ is located along the line x =2m, y = 5m in free space Find $\overline{E}$ at P (1, 3, -4) 07

B) i) If $\overline{A} = a_x$ at p (3, --4, 5). Convert $\overline{A}$ in spherical component at p. 04

ii) If $\overline{B} = a_\theta$ at p (3, --4, 5). Convert $\overline{B}$ in Cartesian components at p. 04

Q.3 A) Given a 60 μC point charge located at the origin. Find the total electric flux passing through that portion of the sphere r = 26 cm bounded by $0 < \theta < {}^{\pi}/_{2}$ and$0 < \emptyset < {}^{\pi}/_{2}$. 07

B) Uniform line charges of 20nC/m each lie in the z =0 at $x = 0, \pm1, \pm2, \pm3, \pm4, \pm5,$ Find $\overline{D}$ at P (0, 2.5, 4) 08

Q.4 A) Explain in detail continuity of current. 07

B) A point charge of 16nC is located at Q (2, 3, 5) in free space and a uniform line charge of 5nC/m is at the intersection of the planes at x =2m and y = 4. If the potential at the origin is 100V find V at p (4, 1, 3). 08

Q.5 A) The polarization within a region having $E_R = 2.7$ has the uniform value $\overline{P} = -0.2\ a_x + 0.7a_y + 0.3a_z\ \mu C/m^2$ find a) $\overline{E}$ b) $\overline{D}$ 07

B) In cylindrical coordinates$J = 10e^{-100\,r}a_\emptyset A/m^2$. Find the current crossing the region $0.01 \le r \le 0.02m, 0 < z \le 1m$ and intersection of this region with the$\emptyset = constant\ plane$. 08

SECTION B

Q.6 Solve any two 10

a) State and prove stokes theorem.
b) Derive the equation of reflection coefficient when the uniform plane wave is incident on boundary between regions composed of two different materials.
c) Explain standing wave ratio.
d) Derive boundary conditions for static magnetic field.

Q.7 A) A current filament carrying 16 A in $a_z$directions lies along the entire z axis. Find $\overline{H}$ in Cartesian coordinates at a) $P_A(\sqrt{20}, 0, 4)$ b) $P_B(2, -4, 4)$ 07

B) A current filament carries a current of 10 A in the a_z direction on the z axis. Find the magnetic field intensity $\overline{H}$ in Cartesian coordinates at a point P (1, 2, 3) due to this filament if it extends from i) z = 0 to 5m ii) z = 5 to infinity. 08

Q.8 A) Given the magnetic flux density $\overline{B} = 8 * \cos 10^6\ t \sin 0.01 \times a_z$m T find 07

i) the magnetic flux through the surface $z = 0, 0 < x < 20m, 0 < y < 3m$ at $t\ = 2\mu s$

ii) the value of the closed line integral of E around the perimeter of the surface specified above at $t = 1\mu s$.

B) Given $\overline{H} = 300 \cos(3 * 10^8\ t - y) a_z A/m$ in free space find the emf developed in the $\boldsymbol{a}_\emptyset$ direction about the closed path having corners at (0, 0, 0) (1, 0, 0) (1, 1, 0) and (0, 1, 0). 08

Q.9 A) Determine $\alpha, \beta, \gamma, \lambda$ ń for damp soil at a frequency of 2 MHz given that 07

$E_R = 12, \mu_R = 1\ and\ \sigma = 2\ milli\ mho/m$

B) Given a non magnetic material having $E_R = 2.25\ and\ \sigma = 10^{-4}$ mho/m find numerical values at 2.5 MHz for i) loss tangent ii) attenuation constant. 08

Q.10 A) Given $\overline{E} = E_m \sin(10^6 t - \beta z) a_y$ V/m in free space. Find the expressions for 07

$\overline{D}, \overline{B}, \overline{H}\ at\ t = 1\mu sec$

B) Assume $\mu_1 = 4\mu H/m$ in region 1 where z >0 While $\frac{7\mu H}{m}$ in region 2 where z <0 . $\overline{K}$=80a_x A/m on the surface z=0.We establish a field $\overline{B}_1 = 2\ a_x - 3\ a_y + 6\ a_z mT$ in region 1` find the value of $\overline{B}_2$ 08