Code No: 153AR

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year I Semester Examinations, August/September - 2022
ELECTROMAGNETIC FIELDS
(Electrical and Electronics Engineering)

Time: 3 Hours **Max.Marks:75**

Answer any five questions
All questions carry equal marks
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1.a) Determine the electric field intensity at a point P(0,0,h)m due to a standard surface charge distribution lying in z = 0 plane.
b) If V=x-y+xy+2z volts, determine Electric field intensity at (1,2,3) and the electrostatic energy stored in a cube of side 2 m centred at the origin. [7+8]

2.a) Derive the expressions for electrostatic energy and energy density.
b) Explain the process of vector conversion from cylindrical coordinate system to spherical coordinate system. [7+8]

3.a) State and derive the current continuity equation.
b) Explain about current density and derive its equation. [8+7]

4.a) Derive the expressions for Poisson's equation, Laplace's equation.
b) A cylindrical capacitor has radii a=1 cm and b=2.5 cm. If the space between the plates is filled with an inhomogeneous dielectric with $\varepsilon_R = \frac{(10+\rho)}{\rho}$ where ρ is in cm. Calculate the capacitance per meter of the capacitor. [8+7]

5.a) Define Magnetic flux density and prove that div(B)=0. [7+8]
b) An infinitely long conductor is bent in to an L shape as shown in figure.
If a direct current of 5 A flows in the current, find the magnetic field intensity at
(i) (2, 2, 0) and (ii) (0, 0, 2)

6.a) Differentiate between self and mutual inductances.
b) Plane y=1 carries current **K**= 50 $\mathbf{a_z}$ mA/m . Find **H** at (i) (0, 0, 0) (ii) (1, -5, 5). [6+9]

7.a) Express Maxwell's equations for time varying fields both in point form and integral form and also make their word statements.
b) In a dielectric, $\sigma = 10^{-4}$ S/m, $\mu_r = 1$, $\varepsilon_r = 4.5$, the conduction current density is given as $J_c = 0.4 \cos(2\pi \times 10^8 t)$ A/m^2. Determine the displacement current density. [9+6]

8.a) Explain wave propagation in free space and derive the necessary equations.
b) An electromagnetic wave in free space has a phase shift constant of 0.524 rad/m. The same wave has a phase shift constant of 1.81 rad/m upon entering a perfect dielectric. Assuming $\mu_r = 1$, find ε_r and the velocity of the propagation. [8+7]

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