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B. TECH
(SEM-IV) THEORY EXAMINATION 2017-18
ELECTROMAGNETIC FIELD THEORY

*Time: 3 Hours**Max. Marks: 70*

Note: Be precise in your answer. In case of numerical problem assume data wherever not provided

SECTION – A

1. Attempt all parts of the following questions:

2×7=14

- (a) Write the Poisson's and Laplace equation.
- (b) State point form of ohms law & Gauss's law.
- (c) Explain Biot-Savart's Law.
- (d) Give Maxwell's equations in differential and integral form.
- (e) Give applications of Smith chart.
- (f) Transform the point P(5,3,6) in cylindrical coordinate system.
- (g) Explain Faraday's law.

SECTION B

2. Attempt any three parts of the following questions:

3×7=21

- (a) Calculate the capacitance formed by two back to back cones separated by infinitely small distance.
- (b) State and derive ampere circuital law. A single turn circle coil of 50 meters in diameter carries current 28×10^4 Amp. Determine the magnetic field intensity H at a point on the axis of coil and 100 meters from the coil. The relative permeability of free space surrounding the coil is unity.
- (c) Prove that magneto static energy is given by

$$W_m = \frac{1}{2} \int_V \epsilon H^2 dv.$$

- (d) Determine the magnetic flux density B at a distance d meter from an infinite straight wire carrying current I. Also find out when the length of the wire is semi-infinite.



- (e) A uniform plane wave propagating in good conductor. If the magnetic field intensity is given by $H = 0.1e^{-15} \cos(2\pi \times 10^8 t - 15z) i$ A/m, determine the conductivity and corresponding component of E field. Also calculate the average power loss in a block of unit area and thickness t.

SECTION C

3. Attempt any One part of the following questions: 7×1=7
- (a) State and explain Maxwell's equations for time varying fields in differential and integral forms and their significance.
- (b) (i) Find the divergence of a vector $A = 8x^2 i_x + 5x^2 y^2 i_y + xyz^3 i_z$ and $\text{del } \nabla$ of a scalar function $x^2 yz$.
(ii) Describe the gradient of a scalar field.
4. Attempt any One part of the following questions: 7×1=7
- (a) Point charges $Q_1 = 1nC, Q_2 = -2nC, Q_3 = 3nC$ and $Q_4 = -4nC$ are positioned one at a time in that order at (0,0,0), (1,0,0), (0,0,-1) and (0,0,1) respectively. Calculate the energy in the system after each charge is positioned.
- (b) Explain Skin effect. Derive the expression for α and β in a conducting medium.
5. Attempt any One part of the following questions: 7×1=7
- (a) Define propagation constant and characteristic impedance. Derive the boundary conditions for electric field between two dielectrics having different permittivity interfaces.
- (b) State Poynting theorem. Derive the mathematical expression for Poynting theorem.
6. Attempt any One part of the following questions: 7×1=7
- (a) A transmission line operating at 500 MHz has $z_0 = 80 \Omega$, $\alpha = 0.04 \text{ NP/m}$, $\beta = 1.5 \text{ rad/m}$. Find the line parameters R, L, G, C.
- (b) Explain the phenomena of polarization and its types.
7. Attempt any One part of the following questions: 7×1=7
- (a) Find the potential function and electric field intensity for the region between two concentric right circular cylinders where $V=V_0$ at $r=a$ and $V=0$ at $r=b$ ($b>a$)?
- (b) Explain the reflection of plane wave for normal indices. Discuss about Reflection and transmission coefficient for **F** and **H**.