Registration No : | | | | | | | | | | |

Total Number of Pages : 02 **B.Tech**
PEI3I001

3rd Semester Regular / Back Examination 2018-19
ELOCTROMAGNETIC FIELD THEORY
BRANCH : AEIE, EIE, IEE
Time : 3 Hours
Max Marks : 100
Q.CODE : E886

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part- I

Q1 **Short Answer Type Questions (Answer All-10)** **(2 x 10)**

a) Find the constant 'p' so that vector V = (x + 3y)a_x + (y – 2x)a_y + (x + pz)a_z is solenoidal.
b) What is the significance of Stoke's theorem?
c) What is Polarization ?What are its types.?
d) State uniqueness theorem.
e) Define skin depth. Derive its relation with attenuation constant.
f) Define phase velocity and group velocity and obtain relation between them.
g) What are the characteristics of TE waves?
h) What is the significance of Gauss's divergence Theorem?
i) What is the inconsistency of Ampere's circuital law?
j) What are the conditions a line to be lossless?

Part- II

Q2 **Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Find conduction & displacement current densities in a material having conductivity of 10^{-3} S/m &ϵ_r= 2.5 if the electric field in the material is E = 5.0 × 10^{-6}sin (9.0 × 10^9t) V/m.
b) Discuss the reflection of plane wave at the interface of conductor for oblique incidence.
c) Derive the equation of continuity for time varying fields.
d) Write Maxwell's equation in free space for the time varying fields both in differential and integral form. Why these equations are not completely symmetrical?
e) Define uniform plane wave propagation. Discuss its properties. A uniform plane electromagnetic wave propagating in air is given by $E = ix\cos[wt - \frac{2\pi}{\lambda}y]$.
Derive by using the Maxwell's equations, the expression for the vector magnetic field.
f) State Coulomb's law. Four like charges of 30 J/C each are located at the four corners of a square, the diagonal measures 8m. Find the force on a 100 J/C located 3m above the center of the square.
g) What do you mean by transmission line? Derive an expression for transmission line equations.
h) State Poynting Theorem. Give an expression for Poynting Theorem.
i) State and explain the electrostatic boundary conditions existing at the boundary between two dielectrics.
j) Derive the expression for capacitance and inductance per unit length for a coaxial cable.
k) The positive Y-axis carries a filamentary current of 2A in the –a_y direction. Assume it is a part of a large circuit, Find 'H' at (3,12,-4)
l) The finite sheet $0 \le x \le 1, 0 \le y \le 1$ on the z=0 plane has a charge density $\rho_s = xy(x^2 + y^2 + 25)^{3/2}\, nC/m^2$. Find
i. The total charge on the sheet
ii. The electric field at (0,0,5)
iii. The force experienced by a -1mC charge located at (0,0,5)

Part-III

Long Answer Type Questions (Answer Any Two out of Four)

Q3

a) It is found that $E = 60a_x + 20a_y - 30a_z mV/m$ at a particular point on the interface between air and a conducting surface. Find D and ρ_s at that point. **(16)**

b) Let $V = (A\cos nx + B\sin nx)(Ce^{ny} + De^{-ny})$, where A, B, C and D are constants. Show that V satisfies Laplace's equation.

Q4

a) Plane x = 10 carries a current of 100mA/m along a_z , while x=1, y=-2 carries a filamentary current of 20π mA along a_z , Determine **H** at (4,3,2). **(16)**

b) An electric field in free space is given by $E = 50\cos(10^8 t + \beta x)a_y V/m$,

i. Find the direction of wave propagation

ii. Calculate β and the time it takes to travel a distance of $\lambda/2$.

Q5

a) Let $A = 4x^2 e^{-y} a_x + 8xe^{-y} a_y$. Determine $\nabla \times [\nabla(\nabla . A)]$. **(16)**

b) Given the vector field $G = (16xy - z)a_x + 8x^2 a_y - xa_z$,

i. Is G irrotational or conservative?

ii. Find the net flux of G over the cube 0<x, y, z<1.

iii. Determine the circulation of G around the edge of the square z=0, 0<x, y<1. Assume anticlockwise direction.

Q6 Apply Ampere's Circuit law to determine H for infinitely long Coaxial Transmission line. **(16)**