Paper Id: | **131289** | **Roll No.** [   ]

B.TECH
(SEM IV) THEORY EXAMINATION 2018-19
ELECTROMAGNETIC FIELD THEORY

Time: 3 Hours   *Total Marks: 70*

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1.   **Attempt *all* questions in brief.**   **2 x 7 = 14**

a) Convert the point (-2,6,3) into spherical coordinate system.

b) Find the gradient of the scalar field $f(x,y,z)= x^2+y+z$ at a point P(2,0,1)

c) Prove line integral of static electric field in a close path is zero.

d) Explain reflection and transmission coefficients.

e) Explain relaxation time constant.

f) Write an equation of EM wave.

g) Explain Ampher's circuital Law in statics magnetic field.

SECTION B

2.   **Attempt any *three* of the following:**   **7x3=21**

a) Transform the **A**= r **a$_r$** into Cartesian and cylindrical coordinate system.

b) Evaluate the electric field intensity in space due to charged finite length wire having uniform charge density.

c) A plane electromagnetic wave propagating in z direction in a dielectric medium of permittivity $\varepsilon_r = 5$, the electric field is in x- direction and as a RMS value 0.1 v/m. What is the direction and magnitude of magnetic field. Also calculate the frequency of wave.

d) Evaluate magnetic field intensity in space due to current wire.

e) Derive a general expression of voltage and current of a Transmission line.

SECTION C

3.Attempt any *one* part of the following: **7x1=7**

a) Determine close path line integral of $\mathbf{A} = \rho \cos \varnothing \, \mathbf{a_\rho} + \sin \varnothing \, \mathbf{a_\varnothing}$ around a circle which is placed in x-y plane with origin as a center.

b) Explain a point coordinate and all possible surfaces in vector form in cylindrical Coordinate system.

4. Attempt any *one* part of the following: 7x1=7

a) Two point charges -4nC and 5nC are placed at (2, -1,3) and (0,4, -2) respectively, find
The potential at (1,0,1), assuming zero potential at infinity. Right-angle triangle. Find
electric forces at the corners of the tringle.

b) Derive and explain continuity equation for electrostatic in detail.

5.   Attempt any *one* part of the following: 7x1=7

a) Explain all forms of Maxwell's equations in time varying conditions with its
physical significance.   .

b) Explain Biot-Savart's Law. Also derive an expression for a magnetic field intensity in space
due to an infinite uniform current carrying wire.

6.   Attempt any *one* part of the following: 7x1=7

a) Derive an expression for a magnetic field intensity in solenoid having length L, N
numbers of turns of wire carrying I current. While the length of solenoid is much larger
then it's radius.

b) (i) A charged particle moves with a uniform velocity 4 m/s in x direction in a region
where E=20 $\mathbf{a_y}$ V/m and B= B_0 $\mathbf{a_z}$ Wb/m^2. Determine B_0 such that the velocity
of the particle remains constant.

   (ii)write a short note on-
magnetic scalar and vector potential, Faraday law of electromagnetic induction

7.   Attempt any *one* part of the following: 7x1=7

a) Derive an expression for attenuation constant, propagation constant and intrinsic impedance
of an EM wave when it is propagating through a lossy dielectric medium.

b) Explain Poynting Vector. Derive an expression of Poynting theorem for EM wave. Also
explain the significance of each term of the expression.