

Printed Pages:2

Sub Code:REC402

Paper Id: **131289**Roll No.

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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 $\mathbf{A} = r \mathbf{a}_r$ 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 $\epsilon_r = 5$, 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 $\mathbf{A} = \rho \cos \theta \mathbf{a}_\rho + \sin \theta \mathbf{a}_\theta$ 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.

Printed Pages:2

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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 triangle.
- 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 than its radius.
- b) (i) A charged particle moves with a uniform velocity 4 m/s in x direction in a region where $E=20\text{ a}_y\text{ V/m}$ and $B=B_0\text{ a}_z\text{ Wb/m}^2$. 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.