

Paper Id: 

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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.

**4. Attempt any one part of the following:**

7x1=7

- a) Two point charges  $-4\text{nC}$  and  $5\text{nC}$  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  $4\text{ m/s}$  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.