B.E./B.TECH. Degree Examination, December 2020

Third Semester

EC18302-ELECTROMAGNETIC FIELDS AND WAVES

(Regulation 2018)

Time: Three hours Maximum : 80 Marks

Answer **ALL** questions

PART A - (8 X 2 = 16 marks)

1. Potential at all the points on the surface of a conductor is

   (a) the same (b) not the same (c) zero (d) infinity

2. If $\varepsilon_r = 2$ for a dielectric medium, its electric susceptibility is

   (a) 1 (b) 2 (c) 3 (d) $2\varepsilon_0$

3. A charge of 2 Coulombs is placed in an electric field of 2 V/m, Determine the force on the charge is

   (a) 4 N (b) 1 N (c) 2 N (d) zero

4. The electric field E = 2 V/m, of a wave in free space, calculate the value of H

   (a) $1/60\pi$ A/m (b) 60π A/m (c) 120π A/m (d) 240π A/m

5. Formulate the Biot -Savart law with suitable diagram.
6. Examine the importance of Faraday's law of electromagnetic induction.
7. Give boundary conditions in between a conductor and free space.
8. Write the maxwell's equation in Phasor form.

PART B - (4 X16 = 64 marks)

09. (a) (i) Derive the expression for electric field intensity due to infinite sheet of charge placed in XY plane having surface charge density ρ_s C/m^2. **(12)**

    (ii) A point charge Q = 30 nC is located at origin in Cartesian coordinates system. Calculate electric flux density at (1, 3, -4) **(4)**

(OR)

(b) State and prove Gauss's law. Also in brief explain about the applications of Gauss Law. **(16)**

10. (a) Derive an expression for magnetic field intensity due to a linear conductors of finite and infinite length carrying current I at a distance point P. Assume R to be the distance between conductor and point P. Use Biot-Savart law. **(16)**

(OR)

(b) (i) Explain the magnetic field intensity using Ampere circuital law for different regions of co-axial cable. **(12)**

    (ii) Distinguish Scalar and Vector Magnetic potentials. **(4)**

11. (a) (i) Demonstrate Poisson's and Laplace's equation. **(6)**

(ii) Solve one dimensional Laplace's equation to obtain the field inside a parallel plate capacitor and also find the expression for the surface charge density at two plates. **(10)**

(OR)

(b) Illustrate the boundary conditions of the normal and tangential components of electric field at the interface of two media with different dielectrics. **(16)**

12. (a) Derive Maxwell's equation in point form and integral form and examine the significance of point form. **(16)**

(OR)

(b) (i) Develop the general wave equation of uniform plane waves. **(8)**

(ii) A uniform plane wave in a medium having $\sigma = 10^{-3}$ S/m, $\varepsilon = 80\ \varepsilon_0$ and $\mu = \mu_0$ with a frequency of 10 KHz. Calculate the attenuation constant, phase constant, Intrinsic impedance and velocity of propagation. **(8)**