Date - 13/12/19

Paper / Subject Code: 39204 / WAVE THEORY AND PROPAGATION

S.E. (EXTC) (Sem IV) (CBSGS) (R-2012)

(3 Hours) **(Total Marks : 80)**

N. B. : 1. Question No. 1 is compulsory.
2. Attempt **any three** out of the remaining **five**.
3. Draw **neat diagrams** wherever **necessary**.
4. Assume **data**, if missing, with **justification**.
5. **Figures** to the **right** indicate **full marks**.

Q1. Attempt ANY FOUR out of the FIVE

(a) What is the importance of Maxwell's equations in Electromagnetism? Name and state the laws that form Maxwell's equations. **[5]**

(b) Explain Coulomb's law in vector form. **[5]**

(c) "Ground Wave propagation supports vertical polarization" Comment on the statement, whether true or false with justification. **[5]**

(d) Explain the terms : i) Ray Path and ii) Critical Frequency **[5]**

(e) Explain Super Refraction. **[5]**

Q2. (a) State and prove Poynting theorem. Explain its physical significance **[10]**

(b) State and explain Gauss' Law. List the applications of Gauss' law. Prove that the electric field intensity of a long positively charged wire does not depend on length of the wire but on the radial distance r of points from the wire. **[10]**

Q3 (a) What is the significance of numerical techniques? Compare FDM, FEM and MOM with respect to the significant points. **[10]**

(b) For normal incidence, determine the amplitudes of reflected and transmitted E and H at interface of two regions at $z = 0$. Given: Incident $E_i = 1.5 \times 10^{-3}$, $\varepsilon_{r1} = 8.5$, $\mu_{r1} = 1$, $\sigma_1 = 0$. Region 2 is a free space. **[10]**

Q 4 (a) Define loss tangent. How does it classify lossless dielectrics, lossy dielectrics and good conductors? **[5]**

(b) A 10 GHz plane wave travelling in free space has an amplitude of $Ex = 10$ V/m. Find v, λ, β, η and the amplitude and direction of H. **[5]**

(c) Define a uniform Plane Wave. Derive the Helmholtz equation for the wave. **[10]**

Q 5 (a) State the boundary conditions for Electric and Magnetic fields. Explain their significance in electromagnetism **[10]**

(b) Describe space wave propagation and derive relation for maximum distance between transmitting and receiving antenna. Assume the earth to be flat. **[5]**

(c) Explain the working of an ink jet printer. **[5]**

Q 6 (a) Obtain reflection and transmission coefficient of perpendicularly polarized wave incident on a dielectric-dielectric boundary with oblique incidence. **[10]**

(b) Explain the phenomenon of duct propagation **[5]**

(c) Find the depth of penetration if for copper $\mu r = 1$, $\sigma = 58$ Mmho/m at frequencies f = 60 Hz, 1 MHz and 30 GHz. **[5]**
