

Exam. Code: 0927
Sub. Code: 6897

2021
B.E. (Electronics and Communication Engineering)
Third Semester
EC-301: Electromagnetic Theory

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Unit.

x-x-x

I. Answer the following:-

- Define electric field intensity. Write electric field intensity due to charged ring.
- Justify that there cannot be any isolated magnetic pole.
- Differentiate Poisson's and Laplace's equation.
- What is the difference between Faraday's theory of magnetic field and Ampere's theory of magnetic field?
- Distinguish between finite and infinite transmission line. (5x2)

UNIT – I

II. a) Calculate the total flux coming outside the cube having 0.5 m side with two faces parallel to yz plane. The electric field strengths through a dielectric of relative permittivity are $E_x = \frac{10^4}{x^2}$ and $E_y = 0$, $E_z = 0$

b) Find the vector potential and hence the magnetic flux density B due to an infinite wire carrying a current at point outside the wire. (2x5)

III. a) Calculate the displacement current at a frequency of 1 GHz. The cross-sectional area of a straight copper wire is $1.5 \times 10^{-5} \text{ m}^2$, conduction current is 2

$$\text{A and parameters } \mu = 4\pi \times 10^{-7} \text{ H/m, } \epsilon = \frac{10^{-9}}{36\pi} \text{ F/m and } \sigma = 5.8 \times 10^7 \text{ mho/m.}$$

b) Discuss the boundary conditions at the surface of discontinuity. (2x5)

P.T.O.

(2)

- IV. a) Calculate the average power passing through a circular area having radius 2.5 m in the z-plane, if \vec{E} in free space is $\vec{E} = 50 \cos(\omega - \beta z) \hat{a}_x$ V/m.
- b) Discuss the reflection of a plane wave by a perfect dielectric at oblique incidence. (2x5)
- V. a) The cut-off frequency of an air filled rectangular waveguide is 2.4 GHz for the TE_{10} mode. What would be the cut-off frequency if the same guide were filled with a lossless nonmagnetic material whose dielectric permittivity is six times that of air?
- b) What are the TE, TM and TEM mode waves? Outline the principle of operation of waveguide. (2x5)
- VI. a) Show how wave impedance for TE and TM wave between parallel planes varies as a function of frequency.
- b) A lossless transmission line having a characteristic impedance of 50 ohms (resistive) and of length 50 meters is left open circuited at the far end. If the open-circuit voltage is $100 \angle 0^\circ$ volts. Calculate the voltage and current at a distance of 10 meters away from the open circuit, assuming the generator frequency to 20 MHz. (2x5)
- VII. a) Define quality factor. Derive the quality factor of a rectangular waveguide.
- b) Find the cut-off wavelength in a standard rectangular waveguide for the TE_{11} mode. (2x5)