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PRESIDENCY UNIVERSITY BENGALURU

**SET-B**

SCHOOL OF ENGINEERING

**END TERM EXAMINATION –MAY/ JUNE 2024**

**Semester:** Semester VI - 2021

**Course Code :** ECE3013

**Course Name :** - Antenna and Wave Propagation

**Program:** B. Tech.

**Date :** June 10, 2024

**Time :** 1:00 PM - 4:00 PM

# Max Marks : 100

**Weightage :** 50%

# Instructions:

1. *Read all questions carefully and answer accordingly.*
2. *Question paper consists of 3 parts.*
3. *Scientific and non-programmable calculator are permitted.*
4. *Do not write any information on the question paper other than Roll Number.*

## PART A

**ANSWER ANY THREE QUESTIONS (3 Q X 5 M = 15 M)**

1. Provide a graphical representation of the reflection of plane waves at oblique incidences for Perfect Dielectric.

(CO1) [Knowledge]

1. Provide a graphical representation of the reflection of plane waves at oblique incidences for Perfect Conductor.

(CO1) [Knowledge]

1. Establish the boundary conditions for electric and magnetic field intensities and the interference between two dielectric media.

(CO2) [Knowledge]

1. Establish how the boundary conditions for electric and magnetic field intensities between two dielectric media will be modified, if one of the media is a perfect conductor.

(CO2) [Knowledge]

1. A plane wave is incident normally on a good conductor, which can be considered flat and non-magnetic for all practical purposes. The velocity of the wave inside the conductor at a certain frequency is 3.142

× m/s, while the skin depth for this conductor at the same frequency is given as 0.04 mm. Determine (a) the wavelength inside the medium (λ) and frequency of the wave (f); (b) the conductivity of the material (σ).

(CO2) [Knowledge]

## PART B

**ANSWER ANY TWO QUESTIONS (2 Q X 20 M = 40 M)**

## 6.

The asymptotic evaluation of . Derive

The expressions for the constants , and .

(CO3) [Comprehension]

1. Determine the expression for electric field at far-field due to a rectangular aperture excited by a uniform time-varying electric field . You may assume the aperture dimensions to be  and. Your answer must have the expressions for
   1. vector amplitude of wave 
   2. the final expression of radiated electric field in terms of function

## 8.

(CO3) [Comprehension]

Show that the gaussian integral . Using this result, prove that .

(CO4) [Comprehension]

## PART C

**ANSWER ANY THREE QUESTIONS (3 Q X 15 M = 45 M)**

1. Consider an array comprising two isotropic radiators placed at a distance d apart excited by currents and .
   1. Derive the expression for array factor
   2. Sketch the pattern for and 

(CO3) [Application]

1. Derive the expression for array factor of an N element array. Find the value of for the maximum array factor and determine what happens when and .

(CO3) [Application]

1. Assume a broadcasting system, operating at , employing a half-wave dipole antenna, having a gain of 2.15 dBi. The power accepted by the transmit antenna is 1000 W. The minimum required power delivered by the receiving antenna is . When the maximum range is , what should be the minimum gain of the receiving antenna?

(CO4) [Application]

1. Consider a half-wavelength dipole antenna that is excited by a sinusoidal current that vanishes at the ends of the antenna. Derive the expressions of  of such a dipole antenna.

(CO4) [Application]