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PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING
END TERM EXAMINATION - JAN 2023

Semester : Semester V - 2020
Course Code : ECE3009
Course Name : Sem V - ECE3009 - Transmission Lines and Waveguides
Program : B.Tech. Electronics and Communication Engineering

Date : 4-JAN-2023
Time : 9.30AM - 12.30PM
Max Marks : 100
Weightage : 50%

Instructions:
(i) Read all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and non-programmable calculator are permitted.

PART A

ANSWER ALL THE FIVE QUESTIONS **5 X 2 = 10M**

1. Write the equation for phase velocity for lossless transmission line?

(CO1) [Knowledge]

2. Find the reflection coefficient of a 70Ω transmission line when it is terminated by a load impedance of 50-j40 Ω.

(CO1) [Knowledge]

3. Characteristic impedance is an important parameter in the analysis and design of circuits and systems using transmission lines. If a transmission line of a characteristic impedance 100 Ω is terminated with a load impedance of 300+j200 Ω, then what will be the normalized load impedance?

(CO2) [Knowledge]

4. The electromagnetic wave equation is a second-order partial differential equation that describes the propagation of electromagnetic waves through a medium or in a vacuum. It is a three-dimensional form of the wave equation. Assuming source free region (no currents or charges are flowing), represent the Helmholtz wave equations in terms of Electric and Magnetic field intensity.

(CO3) [Knowledge]

5. Only TE and TM modes of wave propagation are supported by rectangular waveguides. The mode of propagation with the lowest cut-off frequency is called the dominant mode.Calculate the cut off frequency for the dominant mode in a rectangular waveguide of dimensions
4 cm X 2 cm.

(CO3) [Knowledge]

PART B

ANSWER ALL THE TWO QUESTIONS **2 X 15 = 30M**

6. In a distortion less transmission line, the attenuation constant is 0.005 Nepers/km, phase velocity is 1.6×10^5 km/sec, characteristic impedance is is 2000 Ω respectively and angular frequency 2500 rad/sec, Determine the primary constants.

(CO1) [Comprehension]

7. The observations made during Microwave lab experiment are as follows
(a) Frequencies greater than certain value is only propagating through the waveguide.
(b) TEM waves does not pass through rectangular waveguides.
Are the above statements true? If they are true, explain any one of them theoretical concepts.
[Hint: (i.) Waveguide consists of single conductor (ii.) Waveguide act as high pass filter]

(CO3) [Comprehension]

PART C

ANSWER ALL THE THREE QUESTIONS **3 X 20 = 60M**

8. The transmission line is terminated in its characteristic impedance. It was found that at a distance of 2.5 KM from the sending end, the voltage drops by 8% and there is a phase change of 25 degrees when the line is operated at a frequency of 1KHz. Calculate:
a. The attenuation constant per KM
b. The velocity of wave propagation.

(CO1) [Application]

9. The characteristics impedance of the transmission line of 50 Ω with a load impedance of ZL=60-j80 Ω is required to be matched with the help of a short circuited stub of length 'l' at a distance d from the load. If the wavelength is 1m determine d and l using Smith chart?

(CO2) [Application]

10. TE30 mode is propagated through the rectangular waveguide at a frequency of 4GHz. The phase conant at this frequency is measured to be 10 rad/m. Find (i) Cut-off frequency (ii) dimension of the rectangular waveguide (iii) Guide wavelength (iv) Cut-off wavelength?

(CO3) [Application]

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