Roll No											

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING
END TERM EXAMINATION - JUN 2023

Semester : Semester VI - 2020
Course Code : ECE3112
Course Name : Sem VI - ECE3112 - Antenna and Microwave Engineering
Program : ECE

Date : 19-JUN-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.
(iv) Do not write any information on the question paper other than Roll Number.

PART A

ANSWER ALL THE QUESTIONS **(15 X 2 = 30M)**

1. What is the frequency band of ionosphere? (CO2) [Knowledge]

2. What is the difference between simple and folded dipole antenna? (CO1) [Knowledge]

3. What is the name of the property by the virtue of which $S_{ij} = S_{ji}$? (CO3) [Knowledge]

4. What is the reciprocity theorem in antenna theory? (CO1) [Knowledge]

5. Draw the radiation pattern for resonant and non-resonant V antenna. (CO1) [Knowledge]

6. If wave of critical frequency 30 MHz is departing at an angle of 60°, then what is the MUF? (CO2) [Knowledge]

7. Define Maximum usable frequency. (CO2) [Knowledge]

8. Distinguish between near field and far field. (CO1) [Knowledge]

9. List out the three regions of the space surrounding an antenna. (CO1) [Knowledge]

10. List any four applications of Microstrip antenna. (CO1) [Knowledge]

11. What happens to S_{13} and S_{31} of a microwave device when ports 1 and 3 are isolated? (CO3) [Knowledge]

12. Name the three different modes of propagation of electromagnetic waves. (CO2)[Knowledge]

13. When does a waveguide become lossless? (CO3)[Knowledge]

14. What is the relationship between Maximum Usable Frequency and skip distance? (CO2)[Knowledge]

15. If the VSWR at port n of a matched circuit is found to be 1.5, find S_{nn}. (CO3) [Knowledge]

PART B

ANSWER ALL THE QUESTIONS **(2 X 20 = 40M)**

16. A Yagi-Uda antenna was seen on top of almost every house during the past decades. The parasitic elements and the dipole together form this Yagi-Uda antenna.
Design a 3-element Yagi-antenna to resonate at 200 MHz.
(a) Illustrate the Yagi antenna with a neat diagram
(b) Mention all the related equations for the dimensions of the various elements and the inter-element spacing.
(c) Find the dimensions of all the elements

(CO1) [Comprehension]

17. Radio Wave Propagation deals with the behaviour of radio waves when the waves travel from one point to another point and get reflected by ionospheric layers at a certain height from the ground.
(a) Derive the relation between Maximum usable frequency (MUF) and skip distance for flat earth.
(b) Calculate the skip distance for flat earth with MUF of 10 MHz if the wave is reflected from a height of 300 km where the maximum value of n is 0.9.
(c) Describe the Virtual height for flat earth surface.

(CO2) [Comprehension]

PART C

ANSWER ALL THE QUESTIONS **(2 X 15 = 30M)**

18. A Π−network is used to match high impedance source to low impedance load. In microwave engineering, Π filters present very-low impedances at high frequencies at both ends due to the capacitive shunting. Consider the Π−network shown below consisting of purely resistive elements so that R1 = 100 Ω,R2 = 25 Ωand R3 = 50 Ω. Find the S−parameters of this network when the output terminals (Port 2) are terminated by a 50 Ω resistor.

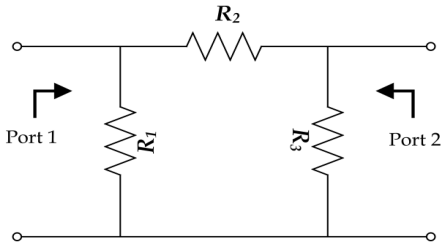

Figure 1: Π−network

(CO3) [Application]

19. A directional coupler is a 4-port passive device generally used to design important circuit elements such as phase shifters, variable impedance, and balanced duplexers. Consider the case of an ideal directional coupler where all the ports are perfectly matched. Using the properties of S−parameters, arrive at the final S-matrix configuration for such a device.

(CO3) [Application]