B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E   Semester: VI

Branch: Electronics and Telecommunication Engineering   Duration: 3 hrs.

Course Code: 19ET6PCMWR   Max Marks: 100

Course: Microwave and Radar   Date: 21.09.2023

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
           2. Missing data, if any, may be suitably assumed.

UNIT - I

1 a) The primary constants of a transmission line/KM are R=6Ω, G=0.25μ℧, L=2.2mH, C=0.005μF. Calculate, at a frequency of 1000Hz, the terminating impedance for which no reflection will be setup in the transmission line. **06**

 b) Obtain the four basic equations for transverse field components E_x, E_y, H_x and H_y in terms of the components E_z and H_z along Z direction. **10**

 c) A lossless parallel stripline has copper conducting strips each of width 18mm separated by quartz dielectric of dielectric constant 3.8 having thickness of 2.5mm. The conductivity of copper is 5.8×10^7 ℧/m and that of quartz is 2×10^{-4} ℧/m. The frequency of operation is 12GHz. Determine **04**
     (i) Characteristic impedance of parallel strip line,
     (ii) Phase velocity of the propagating wave,
     (iii) Strip-line Inductance and capacitance,
     (iv) Series resistance for both strips.

UNIT - II

2 a) Design a three section binomial transformer to match a 50Ω load to a 100Ω line and calculate the band width for Γ_m=0.05. Plot the reflection co-efficient magnitude versus normalized frequency for the exact design using 1,2,3,4 and 5. **08**

 b) Explain in detail S-matrix representation of multiport networks. **12**

OR

3 a) Design an L-section matching network to match a series RC load with an impedance Z_L=(200-j100)Ω to a 100Ω line at a frequency of 500MHz. **10**

 b) Compare [S],[Z] and [Y] matrices of N-port network and also obtain relations of Z,Y with S parameters. **10**

UNIT - III

4 a) Design a 4 hole Chebyshev coupler in an X-band waveguide using round apertures located at S=a/4. The center frequency is 9 GHz, the coupling is 20dB and the minimum directivity is 40dB. Plot the coupling and directivity response from 7 to 11GHz. **10**

 b) Explain in detail the filter design process by insertion loss methods. **10**

<center>**OR**</center>

5 a) Design a Bethe hole coupler for an X-band waveguide operating at 9GHz, with a coupling of 20dB. Calculate and plot the coupling and directivity from 7 to 11 GHz. Assume a round aperture. **10**

    b) Explain in detail the even mode and odd mode of Wilkinson power divider. **10**

<center>**UNIT - IV**</center>

6 a) With the help of a block diagram, explain the operation of a radar system. **08**

    b) A Doppler radar set operates at 12GHz and is used for traffic speed measurements. What are the Doppler frequencies for the speed of 40 km/h and 100 km/h? **04**

    c) What is Clutter attenuation? Derive an expression for the same. **08**

<center>**UNIT - V**</center>

7 a) Explain the matched filter. **05**

    b) Define the probability of false alarm and detection. **05**

    c) The bandwidth of an IF amplifier is 1 MHz and average false alarm time tolerated is 10 minutes. Find the probability of false alarm. If the threshold to noise ratio is 15.2dB, Calculate the false alarm rate. **10**

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