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10EC54

Fifth Semester B.E. Degree Examination, June/July 2019
Microwave and Radar

Time: 3 hrs.

Max. Marks:100

- Note: 1. Answer any FIVE full questions, selecting atleast TWO questions from each part.**
2. Use of Smith chart to be provided.

PART – A

- 1 a. Starting from the fundamentals, derive expressions for voltage and current at any point on a microwave transmission line, by the method of distributed circuit theory. (10 Marks)
b. A telephone line has the primary constants, $R = 6 \Omega/\text{km}$, $L = 2.2 \text{ mH}/\text{km}$, $c = 0.005 \mu\text{F}/\text{km}$ and $G = 0.05 \mu\text{S}/\text{km}$. Determine Z_0 , α , β , V_p and λ at 1 kHz. (10 Marks)
- 2 a. Define : (i) Reflection coefficient (ii) Standing wave Ratio (iii) Transmission coefficient and (iv) Derive the relationship between reflection coefficient and standing wave ratio and the relation between Reflection coefficient and Transmission coefficient. (10 Marks)
b. A line of characteristic resistance $R_0 = 400 \Omega$ is terminated in a load impedance $Z_L = (200 + j300)\Omega$ and is excited by a matched generator at 800 MHz. Using Smith chart determine the location and length of a single stub nearest the load, to produce an impedance match. (10 Marks)
- 3 a. Explain various modes of operation of a Gunn Diode. Explain Ridley Watkin Hilsum theory. (10 Marks)
b. With a neat diagram, explain the working of a Two-Hole directional coupler. Derive the scattering matrix of the same. (10 Marks)
- 4 a. List various properties of S-matrix and starting from the impedance matrix equation prove the symmetry property of a reciprocal network. (10 Marks)
b. Obtain the relationship between the scattering parameters and ABCD parameters. (10 Marks)

PART – B

- 5 a. With a neat sketch, explain the characteristics and working of a Magic Tee. Derive its matrix. (10 Marks)
b. A 20 mW signal is fed into one of collinear port 1 of a lossless H-plane Tee junction. Calculate the power delivered through each port when other ports are terminated in matched loads. (05 Marks)
c. "Hybrid Ring (Rat-Race circuit) performs similar functions as that of a magic tee, constructionally different". Substantiate the working of a Rat-Race circuit with a neat sketch and arrive at the scattering matrix. (05 Marks)
- 6 a. With a neat sketch, explain the construction of a microstrip line. Derive expression for attenuation constants and dielectric losses of a Parallel strip line. (12 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- b. A lossless parallel strip line has a conducting strip 'W'. The substrate dielectric separating the two conducting strips has a relative dielectric constant ϵ_{rd} of 6 (beryllia or beryllium oxide BeO) and a thickness of 4 mm calculate:
- The required width (w) of the conducting strip in order to have a characteristic impedance of 50 Ω .
 - The strip-line capacitance
 - The strip-line inductance
 - The phase velocity of the wave in the parallel strip line. (08 Marks)
- 7 a. With a neat block diagram, explain the operation of a basic Radar system. (10 Marks)
b. Derive the basic Radar Range equation as governed by the minimum receivable echo power P_{min} . (10 Marks)
- 8 a. With a neat block diagram, explain the working of the Moving Target Indicator (MTI) Radar. (12 Marks)
b. Write explanatory notes on 'Doppler Effect', employed in Doppler Radar systems. (04 Marks)
c. For an MTI Radar determine the first three Blind speeds at 2 GHz, when the Pulse Repetition Frequency (PRF) is 1 kHz. (04 Marks)

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