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Fifth Semester B.E. Degree Examination, June/July 2017

Microwaves and Radar

Time: 3 hrs.

Max. Marks:100

Note: 1. Answer FIVE full questions, selecting at least TWO questions from each part.
2. Usage of Smith chart is permitted.

PART – A

- 1
 - a. Define standing wave ratio. Why the high value of SWR is undesirable? (05 Marks)
 - b. Deduce the expression for reflection co-efficient when the transmission line is terminated by load impedance (Z_L). (08 Marks)
 - c. A transmission line of 100m length and a characteristic impedance of 100 ohms is terminated by a load $Z_L = 100 - j200$ ohms. Using the Smith chart, determine the line impedance and also admittance at 25m from the load end at a frequency of 10MHz. (07 Marks)

- 2
 - a. What are microwave isolators? Explain the operation of a Faraday rotation ferrite isolator. List applications of an isolator. (10 Marks)
 - b. What are cavity resonators? What applications do they have? (05 Marks)
 - c. With the aid of neat sketch, explain the operation of a two-hole wave guide directional coupler. (05 Marks)

- 3
 - a. With the aid of energy band diagram, explain two-valley model theory for Gunn diodes. (07 Marks)
 - b. A typical n-type GaAs Gunn diode has the following parameters :
 - Threshold field $E_{th} = 2800\text{V/cm}$
 - Applied field $E = 3200\text{V/cm}$
 - Device length $L = 10\ \mu\text{m}$
 - Doping concentration $n_0 = 2 \times 10^{14}\ \text{cm}^{-3}$
 - Operating frequency $f = 10\ \text{GHz}$
 - i) Compute the electron drift velocity
 - ii) Calculate the current density
 - iii) Estimate the negative electron mobility (06 Marks)
 - c. Draw the schematic of an IMPATT diode and explain the its operation. (07 Marks)

- 4
 - a. What are S – parameters of two part network? Why these parameters are preferred to Z and Y parameters for operation in microwave frequencies? (08 Marks)
 - b. State the properties of S – parameters. Prove the unitary property of S – parameters. (08 Marks)
 - c. Write the S – matrix for E – plane Tee. (04 Marks)

PART – B

- 5 Write note on :
 - a. Hybrid – Tee and its applications (08 Marks)
 - b. Microwave attenuator (05 Marks)
 - c. Coaxial connectors (07 Marks)

- 6 a. A lossless parallel strip line has a conducting strip width W . The substrate dielectric separating the two conducting strips has a relative dielectric constant ϵ_{rd} of 6 (Beryllium oxide BeO) and a thickness d of 4mm.
Compute :
- i) The required width ' W ' of the conducting strip in order to have a characteristic impedance of 50Ω
 - ii) The strip line capacitance
 - iii) The strip line inductance
 - iv) The phase velocity of the wave in the parallel strip line. (08 Marks)
- b. What are the advantages of coplanar strip lines over parallel strip lines? (05 Marks)
- c. Derive the expression for attenuation constants for the conductor and dielectric losses of a parallel strip line at microwave frequencies. (07 Marks)
- 7 a. Derive the radar range equation as governed by the minimum receivable echo power. (08 Marks)
- b. List the applications of Radar. (05 Marks)
- c. Draw a functional block diagram of a pulsed radar- and describe the function of each block. (07 Marks)
- 8 a. With the aid of neat block diagram, explain the operation of an MTI system. (08 Marks)
- b. What is blind speed? (05 Marks)
- c. Describe digital MTI system. (07 Marks)

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