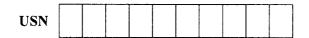
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## Fifth Semester B.E. Degree Examination, June/July 2017

## 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

- 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  $(Z_L)$ .
  - 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)

- What are microwave isolators? Explain the operation of a Faraday rotation ferrite isolator. 2 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)
- 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 Eth 2800V/cm Applied field E 3200V/cm Device length L 10 μm \_\_  $2 \times 10^{14} \text{ cm}^{-3}$ \_\_ Doping concentration n<sub>0</sub> Operating frequency f

- i) Compute the electron drift velocity
- ii) Calculate the current density
- iii) Estimate the negative electron mobility

(06 Marks) (07 Marks)

- Draw the schematic of an IMPATT diode and explain the its operation.
- What are S parameters of two part network? Why these parameters are preferred to Z and 4 a. Y parameters for operation in microwave frequencies?
  - 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. Mircrowave attenuator

(05 Marks)

c. Coaxial connectors

(07 Marks)

- 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 ∈<sub>rd</sub> 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  $50\Omega$ 
    - 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 (07 Marks) parallel strip line at microwave frequencies.
- a. Derive the radar range equation as governed by the minimum receivable echo power. 7
  - (08 Marks) (05 Marks) b. List the applications of Radar.
  - c. Draw a functional block diagram of a pulsed radar- and describe the function of each block. (07 Marks)
- a. With the aid of neat block diagram, explain the operation of an MTI system. (08 Marks) (05 Marks) b. What is blind speed? (07 Marks)
  - c. Describe digital MTI system.