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Fifth Semester B.E. Degree Examination, December 2012
Microwaves and Radar

Time: 3 hrs.

Max. Marks:100

Note: *1. Answer FIVE full questions, selecting*
atleast TWO questions from each part.
2. Use of smith chart is permitted.

PART – A

1 a. Derive transmission – line equations by the methods of distributed circuit theory. **(09 Marks)**
   b. A single stub turner is to match a lossless line of 400 Ω to a load of (800 + j300)Ω. The frequency is 3 GHz
      i) Find the distance in meters from the load to the turning stub
      ii) Determine the length in meters of the short – circuited stub. **(06 Marks)**
   c. Define reflection coefficient and derive an expression for reflection coefficient at load in terms of load impedance. **(05 Marks)**

2 a. Using the Helmholtz equation, derive the field equations for TE modes in rectangular waveguides. **(09 Marks)**
   b. With a neat sketch, explain the four – port microwave circulator and also obtain the S – matrix. **(08 Marks)**
   c. An air – filled rectangular waveguide of inside dimensions 7 × 3.5 cm operates in the dominant TE_{10} mode. Find
      i) the cutoff frequency
      ii) the phase velocity of the wave in the guide at a frequency of 3.5 GHz
      iii) the guided wavelength at the same frequency. **(03 Marks)**

3 a. With neat sketches, explain the IMPATT diode and draw the negative resistance curve. **(10 Marks)**
   b. Explain the parametric amplifier with equivalence circuit. **(10 Marks)**

4 a. For a two port network, explain the S – parameters and properties of S – parameters. **(10 Marks)**
   b. Explain the phase shifter, with neat sketches. **(10 Marks)**

PART – B

5 a. With neat sketch, explain the operation of E – plane tee and also obtain its S- matrix. **(10 Marks)**
   b. With neat sketch, explain the operation of magic tee and mention its application. **(10 Marks)**

6 a. With neat schematic diagram, explain the coplanar strip lines. **(06 Marks)**

b. A lossless parallel strip line has a conducting strip width ω. The substrate dielectric separating the two conducting strips has a relative dielectric constant ϵ_{rc} of 6 and a thickness of 4 mm. Calculate :
   i) The required width ω of the conducting strip in order to have a characteristics 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)**

c. Write a note on shielded strip lines. **(06 Marks)**

7 a. Derive an expression for simple form of the radar range equation. **(05 Marks)**

b. With a neat block diagram, explain the conventional pulse radar with a super heterodyne receiver. **(08 Marks)**

c. Explain the applications of radar. **(07 Marks)**

8 a. Explain single delay – line canceller and frequency response of the single delay – line canceller, and also obtain the expression for blind speeds. **(10 Marks)**

b. A VHF radar at 220 MHz has a maximum unambiguous range of 180 nmi. What is its first blind speed? **(04 Marks)**

c. With neat block diagram, explain the original moving target detector signal processor. **(06 Marks)**

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