USN | | | | | | | | | | |

10TE64

Sixth Semester B.E. Degree Examination, Dec.2016/Jan.2017
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 is permitted.

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.

CMRIT Library

PART – A

1 a. Starting from the definition of reflection coefficient in terms of normalized load impedance, deduce the equations that define the family of constant resistance and reactance circles in Smith chart. Give neat sketches for each. **(10 Marks)**

b. A single stub is used in shunt to match a lossless line of 400 Ω to a load of 800 – j300. The frequency of operation is 3 GHz. Determine the location of the stub from the load and the length of the stub. Give analytical formulae for both and verify using smith chart. Give step-by-step procedure. **(10 Marks)**

2 a. Deduce the field expressions for a TE_{mn} wave in a rectangular waveguide of dimensions a × b cm. Give expressions for the cutoff frequencies, phase velocity, guide wavelength and guide impedance. **(10 Marks)**

b. Describe the construction of a rectangular waveguide coupler. Define coupling, directivity, transmission loss and return loss. Deduce the S matrix for the coupler. **(06 Marks)**

c. A directional coupler of 10 dB coupling and 40 dB directivity produces a transmission loss of 1 dB. Calculate the power at all other ports when input power at port 1 is 10 mw. **(04 Marks)**

3 a. Explain the principle of operation of read diode with neat diagram. **(08 Marks)**

b. Derive expression for the power output and efficiency of Impatt Diode. **(06 Marks)**

c. Draw the equivalent circuit of a parametric amplifier. Explain parametric upconverter. Give formulae for gain, noise figure and band width. **(06 Marks)**

4 a. For a 4 port network, define and give the S matrix. Discuss some properties of S matrix. **(08 Marks)**

b. Two transmission lines of characteristic impedances Z_1 and Z_2 are coupled to form a two port network. Deduce the S matrix in terms of Z_1 and Z_2. **(06 Marks)**

c. Derive expressions for the reflection coefficients at input and output in terms of S parameters under mismatched load conditions. **(06 Marks)**

PART – B

5 a. With a neat diagram, explain the constitution and functioning of a precision rotary type phase shifter. **(06 Marks)**

b. With a neat diagram, explain the function of the magic tee. Deduce its S matrix. **(08 Marks)**

c. Explain with a neat diagram faraday rotation based isolator. **(06 Marks)**

6 a. Explain with neat diagrams the structure and field pattern of a microstripline. Give expression for characteristic impedance, dielectric and Ohmic losses. **(08 Marks)**

b. Explain with a diagram the construction of a parallel stripline. Give expressions for the distributed parameters of the line. **(06 Marks)**

c. A shield stripline has the following parameters :
Relative dielectric constant = 2.25 Strip width = 2 mm
Strip thickness = 0.5 mm Strip Depth = 4 mm
Calculate: (i) K factor (ii) Fringe capacitance (iii) Characteristic impedance. **(06 Marks)**

7 a. Derive expression for the basic radar equation explaining all the parameters. **(10 Marks)**

b. With a neat block diagram, explain the fu7nctional blocks of a moving target detection. **(10 Marks)**

8 a. Derive an expression for the frequency response of a three pulse digital canceller. Plot the response characteristic. **(10 Marks)**

b. Write brief notes on:
i) Blind speeds and techniques to avoid blind speeds.
ii) Radar frequencies and various applications. **(10 Marks)**

* * * * *

CMRIT Library