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MANIPAL INSTITUTE OF TECHNOLOGY Manipal University

## SIXTH SEMESTER B.TECH (E & C) DEGREE END SEMESTER EXAMINATION MAY/ JUNE 2016 SUBJECT: MICROWAVE COMPONENTS & DEVICES (ECE - 304)

## TIME: 3 HOURS

## MAX. MARKS: 50

## Instructions to candidates

- Answer **ANY FIVE** full questions.
- Missing data may be suitably assumed.
- 1A. Starting from the voltage and current equation for a lossless line at radio frequency, sketch the voltage and current waveforms for a line of length  $3 \lambda / 2$  when
  - (i)  $Z_R = R_0$  ii)  $Z_R = 3R_0$  iii)  $Z_R = R_0 / 3$  iv)  $Z_R = 0$  v)  $Z_R = \infty$
- 1B. A transmission line of characteristic impedance 50  $\Omega$  is terminated by an impedance  $Z_{R.}$  The voltage standing-wave maximum and minimum are found 2.5V and 1V, respectively and the distance between successive minima is 5cm. The first voltage minima occur 1.25 cm from the load. Determine the load impedance and admittance using Smith chart.
- 1C. With an equivalent circuit, discuss the primary and secondary parameters of transmission line.

(5+3+2)

- 2A. Analyse the transmission line at radio frequency and obtain the expression for voltage and current at any point on the transmission line in exponential form.
- 2B. What is impedance matching? Explain the various methods of impedance matching

(7+3)

- 3A. Starting from fundamental equations, derive the expression of field components for a TE wave in parallel plate waveguide and also derive the expression for  $Z_{TE}$ .
- 3B. When a dominant TE wave is propagated through a rectangular waveguide of dimension 4cm x 2.4 cm, the wave impedance was measured to be 480  $\Omega$ . Determine the frequency of microwave signal and also find the waveguide wavelength, cut-off frequency and phase constant.
- 3C. Discuss the impossibility of TEM waves inside a rectangular waveguide.

(5+3+2)

- 4A. With proper diagram explain the working Isolator employing Faraday rotation Principle. Also write the "S" matrix of an Ideal two port Isolator.
- 4B. A 3 port circulator has insertion loss = 1dB. Isolation = 30 dB and VSWR = 1.5. Find its "S" matrix.
- 4C. Draw the diagram of an E plane tee and explain its working

(5+3+2)

- 5A. Discuss construction of Hybrid tee with its S- matrix.
- 5B. With the help of diagram, describe working of TWT amplifier.

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5C. With necessary sketches, describe basic principles of magnetron. Also analyze  $\pi$  mode oscillations and phase focusing effect in magnetron oscillator with necessary diagrams.

(2+3+5)

- 6A. With the help of a neat diagram explain the construction of Two cavity Klystron. Derive the equation of velocity modulation in terms of exit time.
- 6B. Explain two valley model theory of Gunn Diode with necessary diagrams and mathematical equations.

(5+5)