Reg. No.					



MANIPAL INSTITUTE OF TECHNOLOGY Manipal University SIXTH SEMESTER B.TECH (E & C) DEGREE END SEMESTER EXAMINATION - APRIL / MAY 2017 SUBJECT: MICROWAVE COMPONENTS & DEVICES (ECE - 304)

TIME: 3 HOURS

MAX. MARKS: 50

Instructions to candidatesAnswer ANY FIVE questions.

- Missing data may be suitably assumed.
- Smith charts will be supplied
- 1A. Starting from the fundamentals, derive the line equation for transmission line at high frequency in trigonometric form.
- 1B. What is impedance matching? Explain the various methods of impedance matching.

(6+4)

- 2A. A rectangular wave guide has cross section of 7cm X 4cm. Determine all the possible TE & TM modes which propagates at a frequency of a) 3GHz b) 5GHz c) find f_c , λ_c , v_{ph} , α , λ , β for 3GHz fundamental mode of TE waves.
- 2B. A reflex klystron with perfect coupling, operates under following conditions.

$$V_o = 600 V$$
, $L = 1 mm$, $R_{sh} = 15 K \Omega$, $\frac{e}{m} = 1.759 \times 10^{11}$, $f_r = 9 \text{ GHz}$.

The tube is oscillating at f_r at the peak of n = 2. Assume that transit time through the gap and beam loading can be neglected.

- a) Find repeller voltage
- b) Direct current necessary to give a microwave gap voltage of 200 V.

Electronic efficiency under this condition.

(6+4)

- 3A. How sustained oscillations can be achieved in the Cyclotron magnetron if phase difference between the adjoining anode poles is 180 degrees? Justify with the support of diagram. Also find mathematical expressions for Hull cut off voltage equation.
- 3C. Draw and explain RF amplification using TWT amplifier.

(6+4)

- 4A. A symmetric directional coupler with coupling factor of 20dB is used to monitor the power delivered to a load Z_1 . As shown in **Fig.3A** Bolometer1 introduces a VSWR of 3 on arm4. Bolomete2 is matched to arm3. If bolometer 1 reads 6mW and bolometer2 reads 4mW. Find
 - a) The amount of power dissipated in the load Z_L .
 - b) The VSWR on arm2.



4B. With a neat diagram, obtain S matrix of 4 port circulator constructed using two 3dB directional couplers and phase shifter.

(6+4)

- 5A. With necessary diagrams and analysis, demonstrate how to achieve velocity modulation in terms of entry time in a two cavity Klystron amplifier.
- 5B. Analyse working of an H-plane Tee junction with the support of a diagram and its S- matrix.

(6+4)

- 6A. With the help of two valley band theory, explain how n –type GaAs Gunn diode exhibits negative differential resistance.
- 6B. Design a single stub matching network to match a load (200-j150) Ω to a line of characteristic impedance 100 Ω . The operating frequency is 30MHz.

(6+4)