Code No: 57036 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech IV Year I Semester Examinations, December - 2014

MICROWAVE ENGINEERING

(Electronics and Communication Engineering)

Time: 3 Hours **Max. Marks: 75**

Answer any Five Questions

All Questions Carry Equal Marks

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1.a) Derive the wave equation for a TM wave and obtain all the field components in a rectangular waveguide.

b) A rectangular wave guide of cross section 5 cm × 2 cm is used to propagate TM_{11} mode at 9 GHz. Determine the cut off wave length and wave impedance.

2.a) Discuss the various types of losses in microstrip lines and write a note on quality factor of microstrip lines.

b) An air filled circular waveguide has a radius of 5cm and is used as a resonator for TE_{11} mode at 8GHz by placing two perfectly conducting plates at its two ends. Determine the minimum distance between the two end plates.

3.a) Write a short notes on different types of attenuators used in microwave frequency range.

b) Incident power to a directional coupler is 80watts. The directional coupler has coupling factor of 20dB, directivity of 30dB and insertion loss of 0.5dB. Find the output power at: i) main arm ii) coupled and iii) Isolated ports.

4.a) What is Magic Tee. Derive the S-matrix for Magic Tee.

b) What is farday rotation? Explain the operation of a circulator.

5.a) How is tuning achieved in reflex klystron oscillators? Mention the tuning range of such a device.

b) The parameters of a two cavity klystron are given by V_b=900V, f=3.2GHz and d=10^{-3}m. Determine electron velocity, transit angle and beam coupling coefficient.

6.a) What are cross field devices? How does a magnetron sustain its oscillations using this cross field? Assume π-mode for explaining the same.

b) The travelling wave tube is operated at a frequency of 10GHz with voltage V_0=3kV and beam current of 30mA. If the circuit length is 50 and characteristic impedance of helix is 10ohm then determine the following:
i) The gain parameter
ii) The output power gain in decibels
iii) All four propagation constants.

7. Explain the Gunn effect using Two-valley theory. Also explain several modes of operation and applications of Gunn diodes.

8.a) Draw the block schematic of a typical microwave bench and explain the functionality of each component.

b) Explain the measurement of Q of a cavity resonator.

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