

R09

Code No: 09A70402

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech IV Year I Semester Examinations, November - 2013

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) Explain the wave impedance of a rectangular waveguide and derive the expression for the wave impedance of TE and TM modes.
- b) Calculate the cut-off frequency of the following modes in a square waveguide  $4\text{ cm} \times 4\text{ cm}$  TE<sub>10</sub>, TM<sub>11</sub> and TE<sub>22</sub>. [7+8]
- 2.a) Derive the expression for the characteristic impedance of micro strip lines.
- b) Find the first five resonances of an air-filled rectangular cavity with dimensions of  $a = 5\text{ cm}$ ,  $b = 4\text{ cm}$  and  $c = 10\text{ cm}$  ( $d > a > b$ ). [8+7]
- 3.a) Explain coupling probes and coupling loops.
- b) What is phase shifter? Explain its principles of operation with a neat sketch. Give its applications. [7+8]
- 4.a) Derive the scattering matrix of H- plane Tee?
- b) What are the properties of S matrix? Derive the scattering matrix for a 3 port circulator? [7+8]
- 5.a) Explain the principle of operation of a two cavity klystron with a neat diagram?
- b) The operating frequency of a reflex klystron is 5 GHz, it has a DC beam of 250V, a repeller spacing of 0.1 cm for  $1\frac{3}{4}$  mode. Determine the maximum value of power and the corresponding repeller voltage for a beam current of 60mA. [9+6]
- 6.a) Explain why there are four propagation constants in TWT and derive equations to these propagation constants.
- b) Explain the  $\pi$  mode operation of magnetron. How to separate it from other modes? [10+5]
- 7.a) Explain the construction of GUNN diode using RWH theory.
- b) What is TRAPATT diode and explain the principle of operation? [7+8]
- 8.a) How to measure an attenuation of a given microwave signal?
- b) What is VSWR? Explain the method measurement for low and high VSWR? [7+8]

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