

Code No: 09A70402

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD****B. Tech IV Year I Semester Examinations, June/July - 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  $TM_{mn}$  mode field equation in rectangular waveguide.
- b) What are dominated and degenerate modes? What is the significance of dominant modes? Indicate the dominant mode in rectangular wave guide and calculate  $f_c$  for the same.
- 2.a) Derive the expression for Rectangular cavity resonator.
- b) A rectangular waveguide has dimensions  $2.5 \times 5$  cms. Determine the guide wavelength, phase constant and phase velocity at a wavelength of 4.5 cms for dominate mode.
- 3.a) Explain Coupling factor , Directivity, and Isolation using Directional coupler.
- b) What is meant by Microwave Attenuator? Explain the functioning of flap and vane Attenuators.
- 4.a) Explain E-H plane Tee junction. Why a hybrid E-H plane Tee referred to as Magic Tee .Derive the scattering matrix for all these Tees.
- b) Determine the [S] matrix of a 3-port circulator given insertion loss of 0.5 dB, isolation of 20 dB, and VSWR of 2.
- 5.a) Draw the equivalent circuit of a reflex klystron and discuss electronic admittance in detail. Use relevant expression and plots. Mention the performance characteristics of reflex klystron?
- b) Two cavity klystron is operated at 10 GHz with  $V_0=1200$  V,  $I_0=30$  mA,  $d=1$  mm,  $L=4$  cm, and  $R_{sh}=40$  K $\Omega$ . Neglecting beam loading .Calculate
  - i) input RF voltage  $V_1$  for a maximum output voltage,
  - ii) Voltage gain and
  - iii) Efficiency
- 6.a) What is meant by Avalanche Transit Time Devices? Explain the operation, construction and Applications of IMPATT.
- b) The helical TWT has diameter of 2 mm with 50 turns per cm. Calculate axial phase velocity and A node Voltage at which the TWT can be operated for useful gain.
- 7.a) Draw the neat block diagram and its operation for Attenuation measurement using power ratio method?
- b) Explain the measurements of power using bolometer technique.
8. Write short notes on:
  - a) Gunn diode
  - b) Measurement of voltage standing wave ratio.