

R13

Code No: 117FE

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech IV Year I Semester Examinations, April/May - 2018

MICROWAVE ENGINEERING

(Electronics and Communication Engineering)

Time: 3 Hours

Max. Marks: 75

Note: This question paper contains two parts A and B. Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

- 1.a) Draw the field pattern of TE₁₀ mode in rectangular waveguide. [2]
- b) Sketch microstrip line diagram and indicate important features. [3]
- c) Draw the E-plane Tee junction diagram. [2]
- d) Find the resonant frequency of an air-filled cavity resonator with dimensions a=5 cm, b=3 cm and d=4 cm. [3]
- e) Draw typical Applegate diagram. [2]
- f) Explain transit time effect in conventional tubes. [3]
- g) What is mode jumping in cavity magnetron / how this can be avoided? [2]
- h) Draw the diagram of IMPATT diode and carrier concentration. [3]
- i) State the significance of S-Parameters at high frequencies. [2]
- j) What are the possible errors in high frequency measurements? [3]

PART-B

(50 Marks)

- 2.a) Why TEM modes are not possible in hollow rectangular wave guides ?
- b) A TE₁₀ wave at 10 GHz propagates in a rectangular wave guide of 1.5 cm × 0.6 cm dimensions filled with medium air. Determine guided wave length and wave impedance. [5+5]

OR

3. Derive the expressions for the field components due to TM waves in a rectangular waveguide. [10]

- 4.a) Describe the working of H-plane Tee and state why it is called shunt Tee.
- b) A directional coupler is having coupling factor = 10 dB and directivity = 40dB. Determine the power coupled in forward and reverse direction when input power is 10 W assuming the coupler is lossless. [5+5]

OR

- 5.a) With the help of diagram, explain principles and operation of a 3-port circulator. [5+5]
- b) List and explain the characteristics of Ferrites.

- 6.a) With the help of Applegate diagram, explain the bunching process and hence the velocity modulation in Klystron amplifier. [5+5]
b) State the limitations of conventional tubes at high frequencies. [5+5]

OR

- 7.a) Classify the various microwave tubes with respect to the orientation of electric and magnetic fields.
b) Explain with neat sketch, the principle of operation of a TWT amplifier and write the equations for the maximum voltage gain and efficiency. [5+5]

- 8.a) Derive equation for Hull cut-off voltage in a Magnetron.
b) Explain the principle of operation of cavity magnetron and discuss phase focusing effect? [5+5]

OR

- 9.a) Discuss in detail the principle of operation of GUNN diode considering the two valley model theory and sketch its volt-ampere characteristics.

- b) An n-type GaAs GUNN diode has the following specifications:

Threshold field	3kV/cm
Applied field	3.5 kV/cm
Device length	10 micrometers
Doping constant	10^{14} electrons/cm ³
Operating frequency	10 GHz

Calculate the current density (-ve) and electron mobility in the device. [5+5]

- 10.a) Find the S-matrix of a magic Tee. [5+5]
b) Explain the double minima method of measuring VSWR. [5+5]

OR

- 11.a) Describe how the frequency of a given microwave source can be measured Using two different methods.
b) What are the different possible errors that will effect VSWR measurements? [5+5]

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