

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 TE_{10} 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 TE_{10} wave at 10 GHz propagates in a rectangular wave guide of 1.5 cm \times 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.
- b) List and explain the characteristics of Ferrites. [5+5]

6.a) With the help of Applegate diagram, explain the bunching process and hence the velocity modulation in Klystron amplifier.

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.

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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