R15

Code No: 127FE

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech IV Year I Semester Examinations, November/December - 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) Why TEM mode is not possible for rectangular waveguides? [2]
b) A rectangular waveguide has the following values l=2.54 cm, b = 1.27 cm waveguide thickness = 0.0127. Calculate the cut-off frequency. [3]
c) What Magic is associated with a Magic Tee? [2]
d) A 20 dB coupler has a directivity of 30 dB. Calculate the value of isolation. [3]
e) What is slow wave structure? [2]
f) How oscillations are prevented in a Travelling Wave Tube? [3]
g) Write down the different types of magnetron. [2]
h) What are the Hull Cut-off and Hartree Conditions? [3]
i) Define scattering matrix. [2]
j) What is a VSWR meter and how will you determine the VSWR? [3]

PART-B **(50 Marks)**

2. Explain the wave impedance of a rectangular wave – guide and derive the expression for the wave impedance of TE, TM, and TEM mode? [10]

OR

3.a) A rectangular waveguide has the following dimensions: a=5.1cm, b=2.4cm. i) Calculate the cut-off frequency of the dominant mode. ii) Calculate the lowest frequency and determine the mode closest to the dominant mode.
b) Derive the expression for the characteristic impedance of microstrip lines. [4+6]

4.a) Incident power to a directional coupler is 80 watts. The direction coupler has coupling factor of 20 dB, directivity of 30 dB and insertion loss of 0.5 dB. Find the output power at i) main arm, ii) coupled and iii) isolated parts.
b) Explain Faraday rotation with a neat diagram. Explain the working of a ferrite isolator. [4+6]

OR

5.a) Explain the functioning of rotary vane attenuators.
b) A 30 dB directional coupler is used to sample incident and reflected power in a waveguide. The value of VSWR is 2, and the coupler sampling power = 4.5 mW. What is the value of reflected power? [6+4]

6.a) Explain about electronic and mechanical tuning of reflex klystron.

b) A TWT operates under following parameters: Beam Voltage V_o=3KV, Beam current I_o = 20 mA, characteristic Impedance of helix Z_o=10, circuit length, N=50 and frequency f =10 GHz. Determine: i) Gain parameter, ii) Output power gain in dB and iii) all Four propagation constants. [6+4]

OR

7.a) Explain how a helical TWT achieve amplification.

b) An O-type TWT operates at 2GHz. The slow wave structure has a pitch angle of 4.4^0 and attenuation constant of 2 Np/m. Determine the propagation constant of the travelling wave in the tube. [6+4]

8.a) Explain the *pi*-mode operation of magnetron.

b) A magnetron operates with following parameters: V_o = 25KV, I_o=1.25A, B_o= 0.4 wb/m^2, diameter of the cathode = 8cm, Radius of vane edge to center = 8cm. Find the cyclotron frequency and cutoff voltage. [6+4]

OR

9.a) Explain the construction of GUNN diode using RWH theory. [5+5]

b) Differentiate between TEDs and transistors.

10.a) Find the S matrix of isolator.

b) For the given scattering parameters for a two-port network calculate the equivalent impedance parameters if the characteristic impedance is 50Ω.

S_{11} = 0.4 + j0.7

S_{12} = S_{21} = j0.6

S_{22} = 0.3 - j0.8 [5+5]

OR

11.a) Calculate the SWR of a transmission system operating at 8 GHz. Assume TE_{10} wave transmission inside a waveguide of dimensions a =3.5 cm, b=2.1 cm. The distance measured between twice minimum power points (successive minima) is 1 mm on a slotted line. [4+6]

b) Explain how low power is measured using Bolometer technique.

--ooOoo--