Code No: 117FE **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech IV Year I Semester Examinations, November/December - 2016

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) Calculate the group and phase velocities for an angle of incidence of 33^0. [2]

b) Explain how the excitation of modes is done in rectangular waveguide? [3]

c) What is Q Factor? [2]

d) Write short notes on Waveguide Irises. [3]

e) What are the limitations of conventional vacuum tubes at microwave frequencies? [2]

f) What is the principle of working of Backward Wave Oscillator? [3]

g) What are the disadvantages of strapping? [2]

h) A magnetron has a cathode radius of 2.5 mm and an anode radius of 5 mm. What is the cut-off potential if a 0.27-Wb/m^2 magnetic field is applied? [3]

i) What is Q of a Cavity Resonator? [2]

j) Why the S-parameters are used in microwaves? [3]

PART-B

(50 Marks)

2.a) Discuss the significance and advantage of dominant mode in rectangular waveguide.

b) A rectangular waveguide with a width of 4 cm and a height of 2 cm is used to propagate an electromagnetic wave in the TE10 mode. Determine the wave impedance, phase velocity, and group velocity of the waveguide for the wavelength of 6 cm. [5+5]

OR

3.a) Distinguish between TE and TM modes of the propagation in rectangular waveguide.

b) A wave of frequency 6GHz is propagated in a parallel plane waveguide separated by 3cm. Calculate i) the cut-off wavelength for the dominant mode. ii) Wavelength in the waveguide. iii) the group and phase velocities. iv) Characteristic wave impedance. [6+4]

4.a) A 20mV signal is fed to the series arm of a lossless Magic Tee junction. Calculate the power delivered through each port when other ports are terminated with a matched load.

b) Explain coupling probes and coupling loops. [4+6]

OR

5.a) Explain the working of a two-hole directional coupler with a neat diagram and derive the expression for the coupling and directivity of a two-hole directional coupler.

b) For a directional coupler, the incident power is 550 mW. Calculate the power in the main and auxiliary arm. The coupling factor is 30 dB. [6+4]

6. Explain in detail bunching process and obtain expression for bunching parameter in a two cavity klystron. [10]

OR

7.a) The parameters of a two-cavity klystron are given by V_b = 900 V, f = 3.2 GHz, and $d = 10^{-3}$ m. Determine electron velocity, transit angle, and beam coupling coefficient.

b) Explain the principle of working of Travelling Wave Tube. [3+7]

8.a) Derive the Hartree anode Voltage equation for linear magnetron.

b) A normal circular magnetron has the following parameters: Inner radius 0.15 m, outer radius 0.45 m, Magnetic flux density 1.6 milli weber/m^2. (i) Determine Hull cut-off voltage (ii) Determine the Hull cut-off magnetic flux density if the beam voltage is 4000 V. [6+4]

OR

9.a) Explain Gunn Effect using two-valley theory? Also explain several modes of operation and applications of Gunn diodes.

b) Give the classification of solid state microwave devices. [6+4]

10.a) Find the S matrix for a matched isolator having an insertion loss of 0.5dB and isolation of 25dB.

b) Explain the S-matrix representation of a multiport microwave network and its significance. [4+6]

OR

11.a) Describe the blocks of microwave bench and their features.

b) Calculate the VSWR of a transmission system operating at 15 GHz.TE_{10} modes is propagating through the waveguide of dimensions 4.0 and 2.1 cm respectively. The distance between two successive minima is 1.5 mm. [7+3]

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