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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: EC403

Course Name: MICROWAVE & RADAR ENGINEERING

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) Explain the Transit angle effects in a conventional vacuum tube at microwave frequencies. (5)

b) Show that a coaxial re-entrant cavity support infinite number of resonant frequencies (10)

2 a) Draw the Applegate diagram with gap voltage for a reflex klystron (8)

b) A two cavity klystron amplifier has the following parameters (7)

V_0=1000 R_0=100 KΩ I_0=30mA f=5GHz

Gap spacing in either cavity d=1mm, spacing between the two cavities L=5cm

shunt impedance R_{sh}=50KΩ

a) Find the input gap voltage to give maximum voltage V_2

b) voltage gain , neglecting the beam loading in the output cavity

c) Find the efficiency of the amplifier, neglecting beam loading.

3 a) What are Cavity Resonators? Derive the equation for resonant frequency for a rectangular cavity resonator (5)

b) Draw the structure of 8 cavity magnetron and explain its bunching process. (10)

PART B

Answer any two full questions, each carries 15 marks.

4 a) Explain the various types of slow wave structures. (5)

b) A helix travelling wave tube operates at 4 GHz, under a beam voltage of 10 KV and beams current of 500mA. If the helix is 25Ω and interaction length is 20cm, find the gain parameter. (10)

5 a) Define the S matrix of a two port network. Represent the logical variables used mathematically and with the aid of a figure. (5)

b) Based on the principle of working list the different types of wave meters used for measurement of microwave frequency. With a diagram explain the method of measurement of frequency with any one type of wave meter. (10)

6 a) Determine the coupling, directivity and isolation (in dBs) of a lossless directional coupler carrying the following: Incident power: 40mW, power at the coupling port: 10mW, and power at the decoupled port: 0.1mW. (5)

b) Derive the expression for axial electric field in the TWT. (10)

PART C

Answer any two full questions, each carries 20 marks.

7 a) Compare the peak power levels achieved by microwave diodes (5)

b) A typical n-type GaAs Gunn diode has the following parameters .Threshold field E_{th}=2800V/cm, Applied field E=3200V/cm, Device Length L=10μm, Doping concentration n_o=2x$10^{14}$$cm^{-3}$, operating frequency f=10GHz. (7)

a) Compute electron drift velocity.

b) Calculate current density

c) Estimate negative electron mobility

c) What are the main assumptions made in power frequency limitations and what are the power frequency limitations of a microwave transistor? (8)

8 a) List the difference between microwave transistors and TEDs. (5)

b) With neat diagram explain series and parallel loading in tunnel diode. (7)

c) Describe the Ridley -Watkins -Hilsum theory and derive the condition for negative resistance. (8)

9 a) What are the different geometries of microwave power transistor and their figure of merit (5)

b) Explain with neat diagram, the working of CW radar with non zero IF. (7)

c) (i) Show that how the tunnel diode can be utilized as bistable, astable, monostable circuits. (4)

(ii) A tunnel diode can realize a negative resistance amplifier? Justify your answer (4)

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