Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh Semester B.Tech Degree Examination (Regular and Supplementary), December 2020

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 with figure rectangular waveguide resonator. Derive the resonant frequency of rectangular cavity resonator. (8)

   b) With the help of figures explain the bunching process of an 8-cavity cylindrical magnetron. (7)

2 a) Given the parameters of a two-cavity klystron amplifier: (8)

Beam Voltage = 1000V, Beam current = 50mA, Operating frequency = 10GHz, Gap spacing=1mm, Spacing between two cavities = 5cm, R_o= 40KΩ, R_s = 30KΩ

Calculate

       a. Input signal to generate maximum output voltage

       b. Voltage gain

       c. Efficiency

   b) With admittance diagram explain the condition required for oscillation in a reflex Klystron. (7)

3 a) Explain how velocity modulation changes to current density modulation in Klystron amplifier. (7)

   b) The parameters associated with a reflex klystron oscillator are: (8)

V_0 =800V, R_{sh} =25KΩ, f_r= 15 GHz, L =1.5 mm, e/m = 1.759 x 10^{11} (MKS system). The tube is oscillating at n = 2 mode or $1\frac{3}{4}$ mode. Assume that the transit time through the gap and beam loading can be neglected.

Determine

       a) The value of the repeller voltage V_r.

       b) The direct current necessary to give a microwave gap voltage of 200 V.

       c) The electronic efficiency under this condition.

PART B
Answer any two full questions, each carries 15 marks.

4 a) Explain the amplification process of Travelling Wave Tubes (TWT) and define its gain parameter. (7)

 b) Explain the constructional features of two-hole directional coupler and derive S Matrix. (8)

5 a) Explain how impedances are measured using slotted line and reflectometer. (8)

 b) Define a microwave junction. Deduce the scattering matrix relation between the input and output of an n X n junction starting with an analogy of a transmission line. (7)

6 a) Show that the magnitude of the velocity fluctuation of the electron beam is directly proportional to the magnitude of the axial electric field in a helix TWT. (8)

 b) Explain with figure a ferrite isolator can support only forward direction waves. (7)

PART C
Answer any two full questions, each carries 20 marks.

7 a) Discuss the various limitations of microwave transistors. What are the main assumptions made in power frequency limitations? (10)

 b) Explain with block diagram the principle of operation of a pulsed Radar. (10)

8 a) Prove that decrease in drift velocity with increasing electric field can lead to the formation of a high field domain for microwave generation and amplification. (10)

 b) Explain low noise front ends? Describe in detail the utility of low noise front ends. (10)

9 a) With neat diagram explain serial loading and parallel loading in tunnel diode. How tunnel diode can be used as an oscillator? (10)

 b) Explain the operation of commonly used Radar displays. (10)

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