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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, $R_o = 40K\Omega$, $R_s = 30K\Omega$
 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)
 $V_0 = 800V$, $R_{sh} = 25K\Omega$, $f_r = 15 GHz$, $L = 1.5 mm$, $e/m = 1.759 \times 10^{11}$ (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 $n \times n$ 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)
