Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019

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) Derive the resonant frequency of a rectangular cavity resonator. (4)

b) Determine the resonant frequency of an air filled rectangular cavity operating in the dominant mode with dimensions as a=4cm, b=5cm and d=6cm. (3)

c) Assuming pi mode of oscillations explain how a magnetron can sustain its oscillations using the cross field. (8)

2 a) With the help of Applegate diagram describe the bunching process in a two cavity klystron amplifier and derive the bunching parameter. (8)

b) A reflex klystron operates under the following conditions: (7)

V_o=500V, R_{sh} =10KΩ, f_r= 8 GHz, L =1 mm, e/m = l.759 x 10^{11} (MKS system)

The tube is oscillating at f_r at the peak of the n = 2 or $1\frac{3}{4}$ mode. Assume that the transit time through the gap and beam loading to be neglected. Determine:-

1. The value of the repeller voltage Vr.
2. The direct current necessary to give a microwave gap voltage of 200 V.
3. The electronic efficiency under this condition.

3 a) Explain the electronic admittance of the gap in the case of reflex klystron. With admittance diagram explain the condition required for oscillation in a reflex Klystron. (7)

b) 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,
Ro= 40KΩ, Rs = 30KΩ

Determine:

1. Input signal to generate maximum output voltage.
2. Voltage gain.
3. Efficiency.

PART B

Answer any two full questions, each carries 15 marks.

4	a)	With neat diagrams explain any two methods to measure impedance at microwave frequencies.	(8)
	b)	Explain with figure a two hole directional coupler and derive its S matrix.	(7)
5	a)	With neat diagram explain the operation of a travelling wave tube.	(7)
	b)	Discuss the constructional features of magic tees and derive its S Matrix. Why are they called so?	(8)
6	a)	Derive the expression of axial electric field of Helix TWT.	(8)
	b)	With a schematic describe the operation of a four port circulator. Obtain the simplified S matrix of a perfectly matched, lossless four port circulator.	(7)

PART C

Answer any two full questions, each carries 20 marks.

7	a)	What is tunnelling? Explain the operation of a tunnel diode with aid of energy band diagram.	(10)
	b)	Derive Radar range equation.	(5)
	c)	A simple MTI delay line canceller is an example of time domain filter. Explain Why?	(5)
8	a)	Discuss the various limitations of microwave transistors.	(10)
	b)	Explain the more commonly used radar displays.	(5)
	c)	Explain how the noise figure of a radar receiver is monitored.	(5)
9	a)	Explain with neat diagram, the working of CW radar with non zero IF.	(10)
	b)	Explain with the help of figures different modes of operation of Gunn diodes.	(10)

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