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Name:

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh Semester B. Tech Degree (S, FE) Examination January 2023 (2015 Scheme)

Course Code: EC403

Course Name: MICROWAVE & RADAR ENGINEERING

Max. Marks: 100

Duration: 3 Hours

Pages: 2

PART A

	Answer any two full questions, each carries 15 marks.	Marks
a)	List the advantages of microwaves.	(3)
b)	Illustrate that the coaxial re-entrant cavities can support infinite number of resonant	(5)
	frequencies.	
c)	The parameters associated with a reflex klystron oscillator are:	(7)
	$V_0 = 800V$, Rsh = 25K Ω , fr= 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	
	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.	
a)	With the diagram of a 2 cavity Klystron amplifier derive the expression for	(7)
	optimum distance at which the bunching occurs.	
b)	Derive the expression for cyclotron angular frequency of a cylindrical magnetron	(8)
a)	With the help of Applegate diagram describe the operation of a reflex klystron	(8)
	oscillator.	
b)	The parameters of a two cavity Klystron are:	(7)
	Input power = 10 mW	•

Voltage gain = 20 dB $R_{sh}(Input cavity) = 25 k\Omega$ $R_{sh}(Output cavity) = 35 k\Omega$ Load resistance = 40 k Ω

Calculate:

- 1. Input voltage
- 2. Output voltage
- 3. Power output

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PART B

Answer dny two full questions, each carries 15 marks.

4	a)	Prove that there are four waves existing in a travelling wave tube.	(8)
	b)	Explain the operation of hybrid rings. Derive its S matrix. How it differs from magic tee?	(7)
5	a)	Define S matrix. Explain the properties of S matrix. With the aid of a figure explain how logical variables are used to represent mathematically	(8)
	b)	List the major differences between TWT and Klystron amplifiers. Explain the performance characteristics and applications of TWT.	(7)
6	a)	Explain the methods used to measure low microwave powers.	(8)
	b)	Explain Faraday's rotation isolator.	(7)

PART C

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Answer any two full questions, each carries 20 marks.

7	a)	Explain Ridley–Watkins–Hilsum theory with the help of two valley model.	(10)
	b)	What is Doppler effect? Derive the equation for Doppler frequency.	(5)
	c)	Explain the filter characteristics of the delay-line canceller.	(5)
8	a)	Explain the tunnel diode characteristics with the aid of energy band diagram.	(10)
	b)	Explain the operation of CW radar with neat block diagram.	(7)
	c)	Differentiate MTI radar and pulsed Doppler radar.	(3)
9	a)	Explain the principle and working of MTI radar with neat block diagram.	(10)
	b)	Explain the operation of microwave transistors giving emphasis on their	(10)
		performance parameters.	