Code No: RT32044 **R13** SET - 1

III B. Tech II Semester Regular/Supplementary Examinations, April -2018

MICROWAVE ENGINEERING

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1	a)	List out the various IEEE Microwave frequency bands.	[3M]
	b)	What are the applications of Micro strip lines?	[4M]
	c)	Write the properties of S-parameters.	[4M]
	d)	What is meant by velocity modulation?	[3M]
	e)	Draw the ω-β diagram for a helical structure and explain its significance.	[4M]
	f)	Write short notes on two-valley theory.	[4M]

PART -B

2	a)	Derive the TE_{mn} field equations in rectangular waveguide.	[8M]
	b)	Write short notes on phase velocity and group velocity.	[8M]
3	a)	Derive the expressions for field equations of TM modes in circular waveguide.	[8M]
	b)	With necessary equations, explain about rectangular cavity resonator.	[8M]
4	a)	What is magic tee? Derive the S matrix of a Magic Tee.	[8M]
	b)	Explain the various construction methods and applications of circulator.	[8M]
5	a)	What are the limitations of conventional tubes at microwave frequencies? Explain.	[8M]
	b)	A reflex klystron operates under the following conditions: V_0 = 600 V, L = 1 mm, R_{sh} = 15 kΩ, e/m = 1.759 x 10^{11} , f_r = 9 GHz. The Tube is oscillating at f_r at the peak of the n = 2 mode or $1\frac{3}{4}$ mode. Assume that the transit time through the gap and beam loading can be neglected. i) Find the value of the repeller voltage V_r. ii) Find the direct current necessary to give a microwave gap voltage of 200 V. iii) What is the electronic efficiency under this condition?	[8M]
6	a)	Derive the expression for Axial Electric field in helix type travelling wave tube.	[8M]
	b)	Explain the operation of Magnetron and write its applications.	[8M]
7	a)	Discuss about construction and operation of TRAPATT diode.	[8M]
	b)	Draw the general set-up of microwave bench and explain the purpose of each block.	[8M]

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Code No: RT32044 **R13** SET - 2

III B. Tech II Semester Regular/Supplementary Examinations, April -2018

MICROWAVE ENGINEERING

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1	a)	List out the applications of microwaves.	[3M]
	b)	Sketch the schematic diagram of strip lines.	[3M]
	c)	Write short notes on tuning screws.	[4M]
	d)	Draw the Applegate diagram with gap voltage for a reflex klystron and explain it.	[4M]
	e)	Write the advantages of travelling wave tubes.	[4M]
	f)	Write the differences between transferred electron devices and avalanche transit time devices.	[4M]

PART -B

2	a)	Derive the equation for the solution to the Helmholtz equation in rectangular coordinates.	[8M]
	b)	Discuss about the impossibility of TEM mode in Waveguides.	[8M]
3	a)	Explain about quality factor of Micro strip lines.	[8M]
	b)	With necessary expressions, explain about circular cavity resonator.	[8M]
4	a)	What are the various applications of Magic Tee? Explain.	[8M]
	b)	What are ferrites? How they are useful in microwaves? Explain faradays rotation?	[8M]
5	a)	With necessary equations, explain the velocity modulation process in two cavity klystron amplifier.	[8M]
	b)	Define Electronic Admittance of a reflex klystron and explain it with necessary equations.	[8M]
6	a)	Discuss about Helical slow-wave structure in microwave tubes.	[8M]
	b)	Derive the Hull cutoff magnetic equation and Hull cutoff voltage equation.	[8M]
7	a)	Explain the operation of IMPATT diode.	[8M]
	b)	Define VSWR and explain the procedure for measurement of VSWR.	[8M]

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Code No: RT32044 **R13** SET - 3

III B. Tech II Semester Regular/Supplementary Examinations, April -2018

MICROWAVE ENGINEERING

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1	a)	What is meant by mode of a electromagnetic wave in waveguide?	[3M]
	b)	Write the applications of circular waveguide.	[4M]
	c)	Define Coupling Factor and Directivity of a Directional Coupler.	[3M]
	d)	List out the characteristics of two-cavity klystron amplifier.	[4M]
	e)	What is the purpose of slow-wave structures in microwave tubes? Explain.	[4M]
	f)	Write short notes on Low Frequency Measurement versus Microwave Measurements.	[4M]

PART -B

2	a)	Derive the wave equation for a TM wave and obtain all the field components in a rectangular waveguide.	[8M]
	b)	An air filled rectangular waveguide of inside dimensions 7 x 3.5 cm operates in the dominant TE_{10} mode. (i) Find the cut off frequency. (ii) Determine the phase velocity of the wave in the guide at a frequency of 3.5 GHz.	[8M]
3	a)	Discuss about ohmic losses in Micro strip lines.	[8M]
	b)	Explain about Q factor of a Cavity Resonator.	[8M]
4	a)	Derive the S-Matrix of H-Plane Tee.	[8M]
	b)	Explain the different types of Microwave attenuators.	[8M]
5	a)	What is meant by Reentrant Cavities? How they are useful in microwaves? Explain.	[8M]
	b)	Explain the operation of reflex klystron and write its performance characteristics.	[8M]
6	a)	Explain the nature of four propagation constants in helix travelling-wave tube.	[8M]
	b)	Discuss about power output and efficiency of magnetron.	[8M]
7	a)	Explain about Gunn Oscillation modes.	[8M]
	b)	Explain the procedure for measurement of Attenuation.	[8M]

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Code No: RT32044 **R13** SET - 4

III B. Tech II Semester Regular/Supplementary Examinations, April -2018

MICROWAVE ENGINEERING

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1	a)	Define cutoff frequency and write its significance.	[3M]
	b)	Write the expressions for resonant frequencies in rectangular and circular cavity resonators.	[3M]
	c)	Write short notes on Microwave Isolator.	[4M]
	d)	What are the applications of reflex klystrons?	[4M]
	e)	Write the major differences between the TWT and the Klystron.	[4M]
	f)	List out the performance characteristics of IMPATT diode.	[4M]

PART -B

2	a)	Derive the expressions for the characteristic impedance and wavelength in the guide for TE and TM modes.	[8M]
	b)	Discuss about the power losses in rectangular waveguide.	[8M]
3	a)	Derive the expression for the solution of Helmholtz equation in cylindrical coordinates.	[8M]
	b)	Explain about Dielectric losses in Micro strip lines.	[8M]
4	a)	Define a Microwave junction. Explain how it is described by using S-Parameters.	[8M]
	b)	Derive the S-Matrix of a Directional Coupler.	[8M]
5	a)	With necessary equations, explain the bunching process in 2 – cavity klystron amplifiers.	[8M]
	b)	Derive the expression for power output and efficiency of reflex klystron.	[8M]
6	a)	Draw the diagram of helix travelling-wave tube and explain its operation.	[8M]
	b)	An X-band pulsed cylindrical magnetron has the following operating parameters: Anode voltage = 26 kV, Beam current = 27 A, magnetic flux density = 0.336 Wb/m^2, radius of cathode cylinder = 5 cm, Radius of vane edge to center b = 10 cm. compute i) The cyclotron angular frequency ii) The cutoff voltage for a fixed B_0 iii) The cutoff magnetic flux density for a fixed V_0.	[8M]
7	a)	Explain the concept of Gunn effect with necessary figures.	[8M]
	b)	Explain the procedure for impedance measurement.	[8M]