Code No: R203204A **R20** SET -1

III B. Tech II Semester Regular Examinations, July -2023
MICROWAVE ENGINEERING
(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
*****

UNIT-I

1. a) Derive the field equations of rectangular waveguide in TM mode, starting from Maxwell's equations. [7M]
   b) Calculate the guide wavelength (in cm) at 4 and 10GHz for an air filled waveguide with a=4.54 cm, b=2.5cm. [7M]

(OR)

2. a) Why the TEM wave is not possible in rectangular waveguide? Explain. [7M]
   b) A rectangular waveguide has the following characteristics: b=1.5cm, a=3.0cm, μ_g = 1, and ε_g=2.25. Calculate cutoff wavelength, frequency, λ_g, Z_o and attenuation constant at 4.0 GHz. [7M]

UNIT-II

3. a) List out different Microwave tubes and explain each one in detail. [7M]
   b) What is Velocity Modulation Process? Explain the Velocity Modulation Process in Klystron in detail. [7M]

(OR)

4. a) Derive the expression for bunching process, output power and efficiency of reflex klystron. [7M]
   b) Explain the limitations and losses of conventional tubes at microwave frequencies. [7M]

UNIT-III

5. a) Explain how gain of TWT amplifier is more compared to Klystron amplifiers. [7M]
   b) Explain how cross field is used to generate oscillations in Magnetron. [7M]

(OR)

6. a) Explain about modes of operation and PI-mode in magnetrons. [7M]
   b) Explain the operation of TWT with neat sketches. [7M]

UNIT-IV

7. a) Explain in detail about waveguide irises, tuning screws and posts, waveguide attenuators with neat diagram. [7M]
   b) Explain the operation of Four-port circulator with suitable diagrams. [7M]

(OR)

8. a) Derive the expressions for Directivity, Coupling factor and S-matrix for a directional coupler. [7M]
   b) Derive the S-parameters for 10dB directional coupler, Directivity D=30dB. Assume that it is lossless and VSWR at each port is 1.0 under matched conditions. Designate the ports in main guide as 1 and 2, in the auxiliary guide as 3 and 4. [7M]

UNIT-V

9. a) Explain the operation, basic modes of operation and oscillating modes in a Gunn diode. [7M]
   b) Explain different methods of measurement of impedance using microwave bench. [7M]

(OR)

10. a) Explain the principle of operation and characteristics of IMPATT diode. [7M]
    b) Explain the process of Frequency measurement using microwave bench. [7M]

Code No: R203204A **R20** SET -2

III B. Tech II Semester Regular Examinations, July -2023
MICROWAVE ENGINEERING
(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
*****

UNIT-I

1. a) Derive the field expression for TE & TM modes in rectangular waveguide. [7M]
   b) Briefly explain the applications of microwave signal. [7M]

(OR)

2. a) Explain and derive the expressions for dominant and degenerate modes in a rectangular waveguides. [7M]
   b) A rectangular waveguide is designed to propagate the dominant mode TE_{10} at a frequency of 5 GHz, Cut-off frequency is 0.8 of the signal frequency. The ratio of guide height to width is 2. The time-average power flowing through the guide is 1KW. Determine the magnitudes of Electric and Magnetic intensities in the guide and indicate where these will occur in the guide. [7M]

UNIT-II

3. a) Explain the bunching process of reflex klystron and also derive the equation for efficiency. [7M]
   b) Why multi cavities are used in Klystron amplifiers? Explain. [7M]

(OR)

4. a) Explain the limitations of conventional tubes at UHF and at microwave. [7M]
   b) What is meant by Applegate diagram? Explain about bunching in two cavity klystron. [7M]

UNIT-III

5. a) What is Hartree condition in Magnetron? Derive the equation for Hartree voltage of it. [7M]
   b) Draw the structure of TWT and explain its amplification process. [7M]

(OR)

6. a) What is Hull cut off condition? Derive the equation for Hull cut off voltage. [7M]
   b) Draw the structure of 8 cavity magnetron and explain its bunching process. [7M]

UNIT-IV

7. a) Explain the working of Rotary Vane type phase shifter with neat diagram. [7M]
   b) What are the different types of Directional couplers? Explain the working of two hole directional coupler. [7M]

(OR)

8. a) Derive the S-matrix of E-plane Tee and also write its characteristics. [7M]
   b) What is the principle of Faraday's rotation? How this is used in isolator? Explain. [7M]

UNIT-V

9. a) Explain Bolometer method for power measurement using microwave bench. [7M]
   b) What are the different precautions have to be made while measuring parameters at Microwave range? [7M]

(OR)

10. a) Explain the method of measurement of low and high VSWR with neat diagrams. [7M]
    b) Explain how Gunn diode is used as an oscillator with the help of circuit diagram. [7M]

|''|'||||''|''|||'|

Code No: R203204A **R20** SET -3

III B. Tech II Semester Regular Examinations, July -2023
MICROWAVE ENGINEERING
(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
*****

UNIT-I

1. a) Derive the equation for the solution to the Helmholtz equation in rectangular coordinates. [7M]
   b) Discuss about the impossibility of TEM mode in Waveguides. [7M]

(OR)

2. a) Derive the field equations of rectangular waveguide in TE mode, starting from Maxwell's equations. [7M]
   b) Prove that the cutoff frequency is same for both TE and TM modes. [7M]

UNIT-II

3. a) Explain the classification of microwave tubes. [7M]
   b) Reflex klystron is operating at 100 GHz. If the mode operating in the tube corresponds to n=4, determine the transit time of the electron in the repeller space. [7M]

(OR)

4. a) Derive expression for output power in a Two-cavity klystron. [7M]
   b) Derive the expression for bunching process, output power and efficiency of reflex klystron. [7M]

UNIT-III

5. a) Draw different slow wave structures and explain why slow wave structures are used in travelling wave tubes. [7M]
   b) Draw cavity magnetron and explain its working for π-mode. [7M]

(OR)

6. a) Discuss the performance of magnetrons and list the important applications. [7M]
   b) What are the different propagation constants of TWT? How to calculate them? [7M]

UNIT-IV

7. a) Explain the operation of magic tee with neat diagram and derive its S- matrix. [7M]
   b) Explain in detail about waveguide irises, tuning screws and posts, waveguide attenuators with neat diagram. [7M]

(OR)

8. a) Explain different types of directional couplers with neat sketches and derive the S- matrix for directional coupler. [7M]
   b) Explain the operation of Four-port circulator with suitable diagrams. [7M]

UNIT-V

9. a) Calculate the SWR of a transmission system operating at 8GHz. The distance between two minimum power points is 0.9mm on a slotted line whose velocity factor is unity. [7M]
   b) Explain the method of measurement of impedance at microwave frequencies with suitable block diagram. [7M]

(OR)

10. a) What is bolometer? How it is used for microwave measurements? [7M]
    b) Draw the characteristics of Gunn diode and explain how negative region is obtained in it. [7M]

Code No: R203204A **R20** SET -4

III B. Tech II Semester Regular Examinations, July -2023
MICROWAVE ENGINEERING
(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
*****

UNIT-I

1.	a)	Sketch circular and rectangular waveguides and give the comparison.	[7M]
	b)	Explain the impossibility of TEM wave propagating through the waveguide.	[7M]
		(OR)	
2.	a)	Explain TE, TM and TEM modes in a waveguide. What is meant by the dominant mode in a rectangular waveguide? Explain.	[7M]
	b)	Explain the mathematical analysis of rectangular waveguide.	[7M]

UNIT-II

3.	a)	Derive the equation of optimum output power of two cavity Klystron amplifier.	[7M]
	b)	Draw and explain the mode characteristics of Reflex Klystron.	[7M]
		(OR)	
4.	a)	Give the difference between two cavity klystron and reflex klystron. Also draw the schematic of reflex klystron and explain its working.	[7M]
	b)	Differentiate between klystron and travelling wave tubes.	[7M]

UNIT-III

5.	a)	Explain about crossed field device and also describe why strapping is needed.	[7M]
	b)	Explain the mechanism of oscillations of Magnetron oscillator with the aid of suitable diagram and discuss its performance characteristics.	[7M]
		(OR)	
6.	a)	Explain the amplification process for a helix type travelling wave tube. List its applications.	[7M]
	b)	Draw different slow wave structures and explain why slow wave structures are used in travelling wave tubes.	[7M]

UNIT-IV

7.	a)	Derive the S-Matrix for 3-port isolator and explain the operation of isolator.	[7M]
	b)	In an H-plane Tee junction, 20mW power is applied to port 3 that is perfectly matched to the junction. Calculate the power delivered to the load 60Ω and 75Ω connected to ports 1 and 2.	[7M]
		(OR)	
8.	a)	What are the different types of attenuators? Explain them with neat diagrams.	[7M]
	b)	What are the properties of S-matrix? Derive the S-matrix of Circulator.	[7M]

UNIT-V

9.	a)	Explain RWH- theory in Gunn diode and draw its characteristics.	[7M]
	b)	Explain different methods of measuring VSWR and explain any one method with neat diagrams.	[7M]
		(OR)	
10.	a)	Explain different methods of measurement of impedance using microwave bench.	[7M]
	b)	Write short notes on Bolometer Method in detail.	[7M]

|''|'||||''|''|||'|