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

III B. Tech II Semester Regular/Supplementary Examinations, May/June -2024
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
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UNIT-I

1. a) Discuss different losses associated with microstriplines. [7M]
   b) Obtain the TE mode field equations for a rectangular wave guide. [7M]

(OR)

2. a) Draw the field patterns for dominant mode of propagation for TE mode in rectangular wave guide and explain. [7M]
   b) Inside a waveguide for a particular mode, the phase velocity is three times the group velocity at 6 GHz. Find the cut off frequency and guide wavelength**.** [7M]

UNIT-II

3. a) Explain the operation of a two cavity klystron amplifier with the help of a schematic diagram and apple gate diagram. [7M]
   b) Discuss different operating modes and output characteristics of a reflex klystron oscillator. [7M]

(OR)

4. a) A reflex klystron operates at the peak mode of n =2 with beam voltage 300V, beam current of 20mA, signal voltage of 40V. Determine input power, output power, and efficiency. [7M]
   b) Discuss the gain bandwidth limitation and lead inductance effect in conventional tubes at high frequencies. [7M]

UNIT-III

5. a) Draw the diagram of a helical TWT and explain how amplification is achieved using a TWT. [9M]
   b) A travelling wave tube has the following characteristics beam voltage = 2kV, beam current = 4 mA, f = 8 GHz, circuit length = 50, Z_o= 20 Ω. Determine the gain parameter and power gain. [5M]

(OR)

6. a) Discuss the construction and working of a cylindrical magnetron. [10M]
   b) Derive equation of hull cut off condition in a magnetron?. [4M]

UNIT-IV

7. a) Explain the principle of operation of bethe hole directional coupler using relevant diagram. [7M]
   b) Write the significance of use of s-parameters at microwave frequencies and also write the properties of s-matrix. [7M]

(OR)

8. a) Explain the construction and working of a hybrid ring. [7M]
   b) Write notes on tuning screws and posts. [7M]

UNIT-V

9. a) Discuss different modes of operation of GUNN diode. [7M]
   b) Explain bolometric method of power measurement. [7M]

(OR)

10. a) Draw the block diagram of a typical microwave bench setup and explain the function of each block. [7M]
    b) Explain a method to measure high VSWR. [7M]

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

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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) Write notes on characteristic impedance of a microstrip line. [7M]
   Also find the characteristic impedance of a microstrip line with the following parameters.
   $\epsilon_r = 5.21$, h =7 mils, t = 2.8 mils, w = 10 mils.(1mil = 0.0254mm)
   b) Obtain the TM mode field equations for a rectangular wave guide. [7M]

(OR)

2. a) Draw the field patterns for TM_{11} mode in rectangular wave guide and explain. [7M]
   b) Explain the terms dominant mode and degenerate mode in rectangular wave guide with examples. [7M]

UNIT-II

3. a) Draw the schematic diagram of a reflex klystron and explain the principle of operation using apple gate diagram. [10]
   b) Present the classification of microwave tubes. [4M]

(OR)

4. a) A two cavity klystron amplifier has the following characteristics [7M]
   Voltage gain = 14dB, input power = 5mW, R_{sh} of input cavity =30kΩ, R_{sh} of output cavity = 40kΩ, Load impedance = 40Ω.
   Determine the input rms voltage, output rms voltage and the power delivered to the load.
   b) List the performance characteristics and applications of a reflex klystron. [7M]

UNIT-III

5. a) Discuss the nature of four propagation constants in a TWT. [7M]
   b) What are cross field devices? How does a magnetron sustain oscillations using the cross field? Assume π mode foe explaining the same. [7M]

(OR)

6. a) Derive the expression for the cut-off magnetic flux density with reference to a cylindrical cavity magnetron. [10M]
   b) Explain the terms frequency pushing and frequency pulling with reference to a magnetron. [4M]

UNIT-IV

7. a) Explain the principle of operation of 2 hole directional coupler using relevant diagram. [7M]
   b) Draw the geometry and explain the principle of operation of H-plane Tee. [7M]

(OR)

8. a) What is Faraday rotation? Also explain the construction and working of rotary vane type attenuator. [7M]
   b) Obtain s-matrix for H-plane Tee. [7M]

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UNIT-V

9.	a)	Explain a method to measure low VSWR.	[7M]
	b)	Explain a method to measure phase shift.	[7M]
		(OR)	
10.	a)	Explain power ratio method to measure attenuation.	[7M]
	b)	Classify TEDs and explain Gunn effect.	[7M]

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

III B. Tech II Semester Regular/Supplementary Examinations, May/June -2024
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
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UNIT-I

1. a) Discuss Quality factor Q of microstrip lines. Also determine surface resistivity and Qc for the microstrip line made of a copper conductor 0.254mm wide on a G-10 fiberglass-epoxy board 0.20mm in height. The relative dielectric constant of the board material is 4.8 measured at 25GHz. The microstrip line 0.035mm thick is to be used for 10 GHz. [7M]
   b) Discuss different applications of microwaves. [7M]

(OR)

2. a) Obtain the expression for characteristic wave impedance in a rectangular wave guide for TE_{mn} mode. [7M]
   b) Obtain the expression for group velocity in a rectangular wave guide. Also explain the term guide wavelength. [7M]

UNIT-II

3. a) Discuss skin effect losses, dielectric losses and radiation losses in conventional tubes at high frequencies. [7M]
   b) Discuss the concept of electronic admittance in reflex klystron. [7M]

(OR)

4. a) A two-cavity klystron operates at 6GHz with a dc beam voltage of 12kV and a 2mm cavity gap. For a given input RF voltage, the magnitude of the gap voltage is 100V. Calculate the transit time at the cavity gap, the transit angle and the velocity of the electrons leaving the gap. [7M]
   b) What is velocity modulation? Explain how velocity modulation is used in klystron amplifiers. [7M]

UNIT-III

5. a) Discuss the geometry of a helical slow wave structure and its use in a TWT. [8M]
   b) How is bunching achieved in a cavity magnetron? Explain phase focusing effect. [6M]

(OR)

6. a) Draw the structure of 8- cavity magnetron and explain bunching process? [7M]
   b) Compare the performance characteristics of magnetron and TWT amplifier. [7M]

UNIT-IV

7. a) Explain the construction and working of dielectric phase shifter. [7M]
   b) Draw the geometry and explain the principle of operation of magic Tee. [7M]

(OR)

8. a) Discuss coupling mechanism using probes and loops. [7M]
   b) Explain the construction and working of an ferrite isolator. [7M]

UNIT-V

9. a) Explain measurement of impedance using slotted line. [7M]
   b) Explain measurement of attenuation using RF substitution method. [7M]

(OR)

10. a) Explain a method to measure Q of a cavity. [7M]
    b) Explain a method to measure frequency. [7M]

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

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Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**
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UNIT-I

1.	a)	Does a rectangular wave guide support TEM mode of propagation? Justify.	[5M]
	b)	A copper rectangular wave guide is filled with air has dimensions 10 cm x 6 cm and 25 cm length is operated at 9 GHz with dominant mode as mode of propagation. Find i) Phase velocity ii)Group Velocity & iii) Characteristic impedance.	[9M]

(OR)

2.	a)	Derive the field expression for TE&TM modes in rectangular waveguide.	[7M]
	b)	Obtain the expression for phase velocity in a rectangular wave guide. Also obtain the relationship between phase and group velocities.	[7M]

UNIT-II

3.	a)	Discuss inter electrode capacitance effect and transit effect limitations of conventional tubes at high frequencies.	[8M]
	b)	Explain the terms electronic and mechanical tuning with reference to reflex klystron.	[6M]

(OR)

4.	a)	Derive the expression for efficiency of reflex klystron oscillator.	[7M]
	b)	A reflex klystron is operated at 9 GHz with a dc beam voltage of 550V for 1 ¾ mode, repeller space length of 0.1 cm and dc beam current of 11 mA. Assuming the beam coupling coefficient to be 1 calculate the repeller voltage, electronic efficiency and output power.	[7M]

UNIT-III

5.	a)	TWT operates under the following conditions beam voltage = 3kV, beam current = 30mA, N = 50, Z_o of helix = 10 Ω, f = 8GHz determine the gain parameter, output power gain and propagation constants.	[7M]
	b)	An X-band pulsed cylindrical magnetron has the following operating parameters: anode voltage = 26kV, beam current = 27A, magnetic flux density = 0.336 Wb/m^2, radius of cathode cylinder = 5cm, radius of vane edge to center = 10cm. Compute the cyclotron angular frequency, cut-off voltage for a fixed magnetic flux density and cutoff magnetic flux density for a fixed anode voltage.	[7M]

(OR)

6.	a)	Draw the structure of TWT and explain its amplification process .	[7M]
	b)	Discuss modes of resonance of a magnetron and explain Π mode of operation.	[7M]

UNIT-IV

7.	a)	Draw the geometry and explain the principle of operation of E-plane Tee.	[7M]
	b)	Obtain the s-matrix of a three port circulator.	[7M]

(OR)

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

8. a) Obtain s-matrix for magic plane Tee. [7M]

   b) Write notes on different wave guide irises. [7M]

UNIT-V

9. a) Discuss RWH theory. [7M]

   b) Explain measurement of impedance using reflectometer. [7M]

(OR)

10. a) Explain a method to measure phase shift. [7M]

    b) Calculate the VSWR of a transmission system operating at 10 GHz. Assume TE_{10} mode with a=4 cm and b = 2.5cm. The distance between the measured power points is 1mm on a slotted line. [7M]