Sub Code: BECT 701 **ROLL NO……..……..**

ODD SEMESTER EXAMINATION, 2024 – 25

IV Year (VII Sem) B.Tech.: Electronics & Communication Engineering

MICROWAVE ENGINEERING

Duration: 3:00 hrs **Max Marks: 100**

Note: - Attempt all questions. All Questions carry equal marks. In case of any ambiguity or missing data, the same may be assumed and state the assumption made in the answer.

Q 1.	Answer any two parts of the following. [Unit-1]	(10x2= 20)
	a) (i) Explain the construction and working principles of quasi-planar transmission line?	(5 marks)
	(ii) What are the key considerations in designing transitions between planar and non-planar transmission lines?	(5 marks)
	b) What are transverse transmission techniques, and how are they applied to multi-dielectric planar structures? Explain the significance of these techniques in analyzing field propagation and ensuring proper impedance matching.	(10 marks)
	c) Describe the common types of discontinuities, and their impact on signal integrity and circuit performance.	(10 marks)
Q 2.	Answer any two parts of the following. [Unit-2]	(10x2= 20)
	a) (i) Show that the TM_{01} and TM_{10} modes do not exists in Rectangular Waveguides.	(5 marks)
	(ii) Write a short note on Microstrip line	(5 marks)
	b) A rectangular waveguide is filled by dielectric material of $\varepsilon_r = 9$ and has inside dimensions of 7 cm x 3.5 cm. It operates in the dominant TE_{10} mode. Then determine: i. Cutoff frequency ii. Phase velocity in the guide at frequency of 2 GHz iii. Guide wavelength at same frequency.	(10 marks)
	c) Derive the expressions for the field components inside a rectangular waveguide for the propagation of the TE and TM modes.	(10 marks)
Q 3.	Answer any two parts of the following. [Unit-3]	(10x2= 20)
	a) (i) Explain Microwave Circulators and Isolators.	(5 marks)
	(ii) What are bends, corners, and twists?	(5 marks)
	b) What do you understand by Waveguide Tee's? Explain H-Plane Tee with the help of S-Matrix.	(10 marks)
	c) A directional Coupler has a coupling factor of 10 dB, an input signal of 5mW is applied. Determine the directivity o directional Coupler. If the power measured at the isolated port is 10mW.	(10 marks)
Q 4.	Answer any two parts of the following. [Unit-4]	(10x2= 20)
	a) (i) How are radiation patterns for microwave antennas measured?	(5 marks)
	(ii) What are the primary limitations of conventional active devices at microwave frequencies?	(5 marks)
	b) What is VSWR, and why is it an important parameter in microwave measurements? Describe the procedure for measuring VSWR in a microwave transmission line and discuss the implications of high VSWR on system performance.	(10 marks)

	c) Describe the methods used to measure the impedance of a microwave system or component. How is attenuation measured at microwave frequencies, and what tools or setups are typically used for this purpose? Discuss the challenges associated with these measurements. (10 marks)
Q 5.	Answer any two parts of the following. [Unit-5] (10x2= 20) a) (i) Describe the construction and operation of a cylindrical magnetron in the pi-mode. (5 marks) (ii) Describe the high frequency limitations of conventional vacuum tubes. (5 marks) b) A reflex klystron operated at 9 GHz with a DC beam voltage of 600 V for $1\frac{3}{4}$ mode, repeller space length of 1 mm and DC beam current of 10 mA. The beam coupling coefficient is assumed to be 1. Calculate (i) Repeller Voltage (ii) Electronic Efficiency (iii) Output Power. (10 marks) c) A travelling wave tube operates under the following parameters: Beam Voltage: $V_0 = 3$ kV Beam Current: $I_0 = 30$ mA Characteristic impedance of helix: $Z_0 = 10\Omega$ Circuit Length $N = 50$ Frequency: $f = 10$ GHz Determine: (a) The gain parameter C, (b) The output power gain A_p in decibels, and (c) All four propagation constants. (10 marks)

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