SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
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Puttur -517583, Chittoor District, A.P. (India)

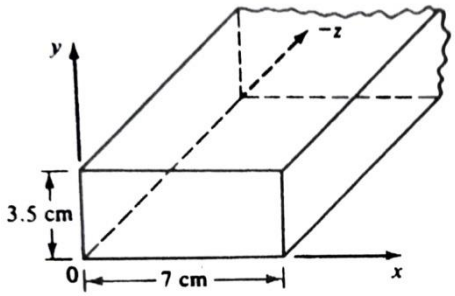
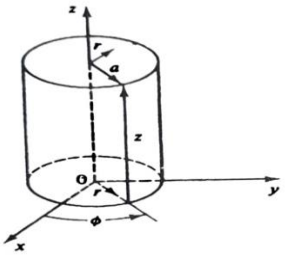
QUESTION BANK (DESCRIPTIVE)

SUBJECT WITH CODE:	MICROWAVE THOERY AND TECHNIQUES (20EC0423)	**COURSE & BRANCH:**	B.TECH-ECE
YEAR & SEM:	III YR & II SEM	**REGULATION:**	R20

UNIT –I
INTRODUCTION OF MICROWAVE

1.	a)	What do you remember about the history in the evolution of Microwaves?	**[L1][CO1]**	**[6M]**
	b)	List out i) Microwave frequency bands based on the IEEE standards. ii) The applications of Microwaves.	**[L1][CO2]**	**[6M]**
2.	a)	Discuss in detail about the concept of mode.	**[L2][CO2]**	**[6M]**
	b)	Describe the concept of dominant mode with suitable examples.	**[L2][CO2]**	**[6M]**
3.	a)	Define the following terms: i) Guide wavelength ii) Phase Velocity iii) Group Velocity.	**[L2][CO1]**	**[6M]**
	b)	The dimensions of a guide are 2.5x1cms.The frequency is 8.6 GHz. Find the cutoff frequencies for TE_{10} and TE_{01} mode.	**[L1][CO5]**	**[6M]**
4.	a)	Compute the expression for phase velocity.	**[L3][CO4]**	**[6M]**
	b)	Describe the concept of dominant mode with suitable examples.	**[L5][CO5]**	**[6M]**
5.	a)	A rectangular waveguide has a=4cms, b=3cms as its sectional dimensions. Predict all the modes which will propagate at 5000MHz.	**[L2][CO1]**	**[6M]**
	b)	Derive the expression for group velocity.	**[L3][CO4]**	**[6M]**
6.	a)	Derive the expression for cut off frequency in a waveguide.	**[L3][CO4]**	**[6M]**
	b)	Express the equation for cut off wave length. Deduce which TE_{mn} mode has the highest cutoff wavelength.	**[L1][CO1]**	**[6M]**
7.	a)	Deduce the relationship between normal wavelength, cut-off wavelength and guided wavelength.	**[L4][CO1]**	**[6M]**
	b)	Define Wave Impedance. Express the equation for wave impedance in TE and TM waves.	**[L2][CO1]**	**[6M]**
8.	a)	Derive the equation for wave impedance in TE mode.	**[L3][CO4]**	**[6M]**
	b)	Derive the equation for wave impedance in TM mode.	**[L3][CO4]**	**[6M]**
9.	a)	List out the features of TEM, TE and TM Modes.	**[L1][CO1]**	**[6M]**
	b)	Discuss Insertion loss that occurs in microwave transmission.	**[L2][CO5]**	**[6M]**
10.	a)	Briefly discuss the losses that occur in a transmission structure in ideal and practical situation.	**[L2][CO5]**	**[6M]**
	b)	Explain about various losses that occur in microwave transmission.	**[L2][CO4]**	**[6M]**

UNIT-II
MICROWAVE PARAMETERS

1.	a)	Explain with neat sketch the working of coaxial line transmission line.	**[L1][CO1]**	**[6M]**
	b)	A coaxial line has the following physical dimensions. Diameter of inner conductor=0.49cm,Inner diameter of outer conductor=1.10cm, Polyethylene dielectric ε_r=2.3. Calculate i) Inductance per unit lengths ii) Capacitance per unit length iii) characteristic impedance iv) the velocity of propagation.	**[L4][CO5]**	**[6M]**
2.	a)	Derive the equation for the propagation of TE waves in rectangular waveguide.	**[L3][CO4]**	**[6M]**
	b)	An air filled rectangular waveguide of inside dimensions operates in the dominant TE_{10} mode as shown in following figure. Compute the cutoff frequency and determine the guided wavelength at f = 3.5 GHz. 	**[L3][CO5]**	**[6M]**
3.	a)	Describe the circular waveguide and the equation of cut off frequency and its dominant mode.	**[L3][CO4]**	**[6M]**
	b)	A TE_{11} Mode is propagating through a circular waveguide. The radius of the guide is 5 cm, and the guide contains an air dielectric. Compute the cutoff frequency. 	**[L3][CO5]**	**[6M]**
4.	a)	Describe the cavity resonator with neat sketch and List it types & applications.	**[L1][CO1]**	**[6M]**
	b)	Derive expression for f_o in rectangular cavity resonator.	**[L3][CO4]**	**[6M]**
5.	a)	Demonstrate the working principle of strip line.	**[L2][CO2]**	**[6M]**
	b)	Explain the working of Microstrip line. Draw its field distribution diagram.	**[L1][CO2]**	**[6M]**
6.	a)	What is Non-TEM line? Express its equation .	**[L1][CO3]**	**[6M]**
	b)	Discuss the Faraday's rotation and Recall the microwave devices which are used f or Faraday rotation.	**[L1][CO4]**	**[6M]**
7.	a)	Discuss about Impedance &Admittance matrix representation of 2 port, N-Port microwave network under analysis of RF and microwave transmission line.	**[L2][CO1]**	**[6M]**
	b)	Derive the S-matrix for series connection of two port network.	**[L3][CO4]**	**[6M]**
8.	a)	Explain the working principle of Gyrator with neat sketch.	**[L2][CO3]**	**[6M]**
	b)	Deduce the S-matrix for Gyrator.	**[L4][CO5]**	**[6M]**
9.	a)	What is isolator? Explain the working principle of Isolator with a neat sketch.	**[L1][CO2]**	**[6M]**
	b)	Deduce the S-matrix for Isolator.	**[L4][CO5]**	**[6M]**
10.	a)	Explain the working principle of Circulator with a neat sketch.	**[L2][CO3]**	**[6M]**
	b)	Deduce the S-matrix for Circulator.	**[L4][CO5]**	**[6M]**

UNIT-III
WAVEGUIDE COMPONENTS AND APPLICATIONS

1.	a)	Interpret the mechanism of coupling in a waveguide.	**[L3][CO1]**	**[6M]**
	b)	Explain the following waveguide components (i) Waveguide posts (ii) Tuning Screws	**[L2][CO2]**	**[6M]**
2.		Describe the following attenuators: i) Resistive Card attenuator ii)Rotary Vane Attenuator	**[L2][CO2]**	**[12M]**
3.	a)	What is the principle of phase shifter? Discuss the working mechanism of rotary vane phase shifter with neat sketch.	**[L1][CO3]**	**[6M]**
	b)	Explain the significance and formulation of S-matrix in detail.	**[L2][CO1]**	**[6M]**
4.	a)	List out the properties of S-matrix.	**[L1][CO3]**	**[6M]**
	b)	Derive S-matrix calculation for two port network.	**[L2][CO4]**	**[6M]**
5.	a)	Construct the microwave tee, whose rectangular slot is cut along the broader dimension, Describe in detail.	**[L3][CO5]**	**[6M]**
	b)	Derive the S-matrix for E-Plane Tee.	**[L2][CO4]**	**[6M]**
6.	a)	Construct the microwave tee, whose rectangular slot is cut along the wider dimension, Describe in detail.	**[L3][CO5]**	**[6M]**
	b)	Derive the S-matrix for H-Plane Tee.	**[L1][CO4]**	**[6M]**
7.	a)	Construct the microwave tee, whose rectangular slot is cut both along the width and breadth of long waveguide dimension, Describe in detail.	**[L3][CO2]**	**[6M]**
	b)	Discuss about the applications of the magic Tee.	**[L2][CO3]**	**[6M]**
8.	a)	List and explain the applications of magic Tee.	**[L2][CO2]**	**[6M]**
	b)	Demonstrate the working of Directional Coupler with suitable diagram & express its Coupling factor and directivity.	**[L2][CO1]**	**[6M]**
9.	a)	A directional coupler has the scattering matrix given below. Evaluate its directivity, coupling, and isolation. $[S]=\begin{bmatrix} 0.05\angle 30 & 0.96\angle 0 & 0.1\angle 90 & 0.05\angle 90 \\ 0.96\angle 0 & 0.05\angle 30 & 0.05\angle 90 & 0.1\angle 90 \\ 0.1\angle 90 & 0.05\angle 90 & 0.04\angle 30 & 0.96\angle 0 \\ 0.05\angle 90 & 0.1\angle 90 & 0.96\angle 0 & 0.05\angle 30 \end{bmatrix}$	**[L4][CO1]**	**[6M]**
	b)	Derive S-matrix for Directional Coupler.	**[L2][CO4]**	**[6M]**
10.	a)	In a phase shift measurement setup, without the waveguide component the guide wavelengths measured 7.2cm and the reference null was at 10.5cm. With the component the reference null got shifted to 9.3cm.Inspect the phase shift of the component.	**[L4][CO4]**	**[6M]**
	b)	What are the types of directional coupler? Explain in detail.	**[L1][CO1]**	**[6M]**

UNIT-IV
MICROWAVE TUBES

1.	a)	Discuss the classifications of microwave tubes	**[L2][CO3]**	**[6M]**
	b)	Distinguish between O type Microwave tubes and M type Microwave tubes.	**[L4][CO3]**	**[6M]**
2.	a)	Explain the constructional details and principle of operation of two cavity klystron with the neat sketch.	**[L2][CO6]**	**[6M]**
	b)	Illustrate the phenomenon of bunching with the help of Applegate diagram of two cavity Klystron tube	**[L3][CO5]**	**[6M]**
3.	a)	What are the Re-entrant Cavities? Why these are different from Resonant cavities? Explain.	**[L1][CO4]**	**[6M]**
	b)	Explain the velocity modulation process in two cavity Klystron tube.	**[L2][CO4]**	**[6M]**
4.	a)	What is meant by bunching process and transit time?	**[L1][CO5]**	**[6M]**
	b)	A two cavity klystron amplifier has the following characteristics: Voltage gain = 15 dB, Input Power = 5 mW, R_{sh} of input cavity = 30 k ohm, R_{sh} of output cavity =40 k ohm, load impedance = 40 k ohm. Find input rms voltage and the output rms voltage.	**[L3][CO6]**	**[6M]**
5.	a)	Discuss in detail about the working of Reflex Klystron and modes of oscillation with neat applegate Diagram.	**[L2][CO4]**	**[6M]**
	b)	Explain the process of velocity modulation of a Reflex Klystron.	**[L2][CO4]**	**[6M]**
6.	a)	Derive the expression of output power for Reflex Klystron.	**[L3][CO6]**	**[6M]**
	b)	Derive the expression of condition for maximum efficiency for Reflex Klystron.	**[L3][CO6]**	**[6M]**
7.	a)	Discuss about magnetron and its various modes.	**[L2][CO4]**	**[6M]**
	b)	A normal circular magnetron has the following parameters inner Radius Ra=0.15 m, Outer Radius R0=0.45 m, Magnetic flux density β0 = 1.2 m Wb/m2. Determine the Hull cut-off Voltage and the cyclotron frequency in GHz.	**[L5][CO4]**	**[6M]**
8.	Explain in detail about 8- Cavity magnetron with suitable diagram.		**[L2][CO6]**	**[6M]**
		Explain in detail about working principle of 8- Cavity magnetron.	**[L2][CO6]**	**[6M]**
9.	a)	Derive the expression for Hull-Cutoff Voltage and Hartree Conditions.	**[L3][CO6]**	**[6M]**
	b)	A reflex klystron operates at the peak mode of n = 2 with V0 = 280 V, I0 = 22 mA and signal voltage V1 = 30 V. Determine input & output power and efficiency.	**[L3][CO6]**	**[6M]**
10.	a)	Explain the constructional structure of travelling wave tube	**[L2][CO6]**	**[6M]**
	b)	List the applications of travelling wave tube	**[L1][CO1]**	**[6M]**

UNIT-V
MICROWAVE MEASUREMENTS

1.	a)	With the help of a neat sketch, briefly explain the functions of different blocks of a microwave bench.	**[L2][CO4]**	**[6M]**
	b)	What are the precautions to be taken while setting up microwave bench for measurement of various parameters? Explain.	**[L1][CO5]**	**[6M]**
2.	a)	Discuss in detail about the microwave power measurement using Bolometric technique.	**[L2][CO4]**	**[6M]**
	b)	Explain about measurement of attenuation using a power ratio method.	**[L2][CO4]**	**[6M]**
3.	a)	Explain about measurement of attenuation using RF substitution method.	**[L2][CO4]**	**[6M]**
	b)	Explain briefly Slotted line method of microwave frequency measurement.	**[L2][CO4]**	**[6M]**
4	a)	Explain briefly Down conversion method of microwave frequency measurement .	**[L2][CO4]**	**[6M]**
	b)	What is VSWR? How to calculate reflection coefficient from VSWR measurements.	**[L1][CO5]**	**[6M]**
5	a)	Explain how Low values of VSWR(S<10) can be measured directly from the VSWR meter using the experimental set-up.	**[L1][CO4]**	**[6M]**
	b)	List the possible errors in VSWR measurement.	**[L1][CO5]**	**[6M]**
6	a)	Explain how high values of VSWR(S>10) can be measured directly from the VSWR meter using the experimental set-up.	**[L2][CO4]**	**[6M]**
	b)	Two identical directional couplers are used in a waveguide to sample the incident and reflected powers. The output of the two couplers is found to be 2.5mw and 0.15mW. Determine the value of VSWR in the waveguide.	**[L5][CO6]**	**[6M]**
7	a)	With the help of wave meter method explain the microwave frequency measurement.	**[L1][CO5]**	**[6M]**
	b)	Assume you have two directional couplers (20 dB) in a guide to sample the incident and reflected powers. The outputs of the two couplers are 3mw and 0.1mw respectively. What is the value of VSWR in the main waveguide? What is the value of reflected power?	**[L3][CO4]**	**[6M]**
8	a)	Explain the measurement of Quality factor (Q) using Reflectometer method.	**[L2][CO6]**	**[6M]**
	b)	Sketch the experimental setup necessary for the measurement of impedance using slotted line. Explain it in detail.	**[L1][CO6]**	**[6M]**
9	a)	Estimate the SWR of a transmission system operating at 10GHz. Assume TE_{10} wave transmission inside a waveguide of dimensions a=4cm, b=2.5cm. The distance measured between twice minimum power points = 1 mm on a slotted line.	**[L4][CO4]**	**[6M]**
	b)	Using the Reflectometer method, explain how to measure the impedance with the help a block diagram.	**[L2][CO4]**	**[6M]**
10	a)	In a setup for measuring impedance of a reflectometer, what is the reflection coefficient when the outputs of two couplers are 2mw and 0.5mw respectively?	**[L3][CO4]**	**[8M]**
	b)	What are the methods used to overcome losses in impedance matching?	**[L1][CO4]**	**[4M]**

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