SIDDARTHA INSTITUTE OF SCIENCE AND TECHNOLOGY: PUTTUR
(AUTONOMOUS)
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QUESTION BANK (DESCRIPTIVE)

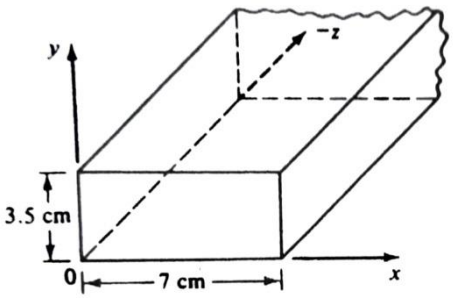
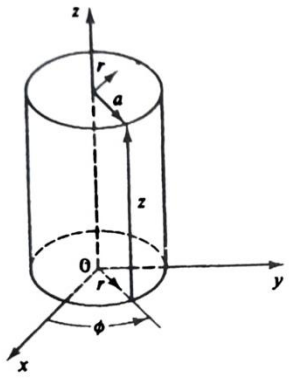
Subject with Code: MTT (19EC0422) **Course & Branch**: B.Tech - ECE

Year & Sem: III & II **Regulation:** R19

UNIT –I
INTRODUCTION OF MICROWAVE

1.	a)	What do you remember about the history in theevolution of Microwaves?	**[L1][CO1]**	**[4 M]**
	b)	List out i) The applications of Microwaves. ii) Microwave frequency bands based on the IEEE standards.	**[L1][CO2]**	**[6 M]**
2.	a)	Discuss in detail about the concept of mode	**[L2][CO2]**	**[5 M]**
	b)	Describe the concept of dominant mode and degenerate mode with suitable examples.	**[L2][CO2]**	**[5 M]**
3.	a)	Define the following terms i) Guide wavelength ii) Cut off frequency iii) Cut off wavelength.	**[L2][CO1]**	**[6 M]**
	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]**	**[4 M]**
4.	a)	Compute the expression for phase velocity.	**[L3][CO4]**	**[5 M]**
	b)	A rectangular waveguide has a=4cms, b=3cms as its sectional dimensions. Predict all the modes which will propagate at 5000MHz.	**[L5][CO5]**	**[5 M]**
5.	a)	Express the equation for wave impedance in TE and TM waves.	**[L1][CO1]**	**[6 M]**
	b)	Derive the expression for group velocity.	**[L2][CO1]**	**[4 M]**
6.	a)	Identify the method to estimate the power transmission for TE_{mn} and TM_{mn} modes.	**[L2][CO3]**	**[5 M]**
	b)	Derive the expression for cut off frequency in a waveguide.	**[L3][CO4]**	**[5 M]**
7.	a)	How to estimate the Power Losses in Rectangular Guide?	**[L2][CO4]**	**[7 M]**
	b)	Interpret power handling capability of Rectangular waveguide.	**[L3][CO2]**	**[3 M]**
8.	a)	List out the features of TEM, TE and TM Modes.	**[L2][CO1]**	**[5 M]**
	b)	Explain the attenuation due to metal conductivity &dielectric loss tangent in losses associated with microwave transmission.	**[L1][CO2]**	**[5 M]**
9.	a)	Explain about various losses that occur in microwave transmission.	**[L2][CO4]**	**[6 M]**
	b)	A circular waveguide operating in the dominant mode at a frequency of 9GHz with maximum field strength of 300V/cm. The internal diameter is 5cm. Calculate the maximum power transfer.	**[L4][CO5]**	**[4 M]**
10.	a)	Summarize the Concept of impedance in microwave transmission.	**[L2][CO1]**	**[5 M]**
	b)	What are the methods used to overcome losses in impedance matching?	**[L1][CO4]**	**[5 M]**

UNIT-II
MICROWAVE PARAMETERS

1.	a)	Discuss about Impedance &Admittance matrix representation of 2 port, N-Port microwave network under analysis of RF and microwave transmission line.	**[L2][CO1]**	**[6 M]**
	b)	Derive the S-matrix for series connection of two port network.	**[L3][CO4]**	**[4 M]**
2.	a)	Explain with neat sketch the working of coaxial line transmission line.	**[L1][CO1]**	**[5 M]**
	b)	A coaxial line has the following physical dimensions. Diameter of inner conductor=0.49cm,Inner diameter of outer conductor=1.10cm,Polyethylene dielectric €r=2.3.Calculate i) Inductance per unit lengths ii) Capacitance per unit length iii) characteristic impedance iv) the velocity of propagation	**[L4][CO5]**	**[5 M]**
3.	a)	Derive the equation for the propagation of TE waves in rectangular waveguide.	**[L3][CO4]**	**[5 M]**
	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]**	**[5 M]**
4.	a)	Derive the equation for the propagation of TM waves in circular waveguide.	**[L3][CO4]**	**[5 M]**
	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]**	**[5 M]**
5	a)	Describe the cavity resonator with neat sketch and List it types & applications.	**[L1][CO1]**	**[5 M]**
	b)	Derive expression for f_o in rectangular cavity resonator.	**[L3][CO4]**	**[5 M]**
6	a)	Demonstrate the working principle of strip line.	**[L2][CO2]**	**[5 M]**
	b)	Explain the working of Micro strip line. Draw its field distribution diagram.	**[L1][CO2]**	**[5 M]**
7	a)	What is Non-TEM line? Express its equation for V-I.	**[L1][CO3]**	**[5 M]**
	b)	Discover the Faraday's rotation and Recall the microwave devices which are used for Faraday rotation.	**[L2[CO4]**	**[5 M]**
8	a)	Explain the working principle of Gyrator with neat sketch.	**[L2][CO3]**	**[5 M]**
	b)	Deduce the S-matrix for Gyrator.	**[L4][CO5]**	**[5 M]**

9	a)	Explain the working of principle Circulator with a neat sketch.	**[L2][CO3]**	**[5 M]**
	b)	Deduce the S-matrix for Circulator.	**[L4][CO5]**	**[5 M]**
10.	a)	What is Isolator? Derive its S-matrix.	**[L1][CO2]**	**[6 M]**
	b)	List the applications of Circulator.	**[L1][CO1]**	**[4 M]**

UNIT-III
WAVEGUIDE COMPONENTS AND APPLICATIONS

1.	a)	Interpret the mechanism of coupling in a waveguide.	**[L3][CO1]**	**[5 M]**
	b)	Extend the following waveguide components (i) Waveguide posts (ii) Tuning Screws	**[L2][CO2]**	**[5 M]**
2.		Describe the following attenuators a) Resistive Card attenuator b)Rotary Vane Attenuator	**[L2][CO2]**	**[10 M]**
3.	a)	What is the principle of phase shifter? Discuss the working mechanism of rotary vane phase shifter with neat sketch.	**[L1][CO3]**	**[5 M]**
	b)	List out the properties of S-matrix.	**[L1][CO3]**	**[5 M]**
4.	a)	Explain the significance and formulation of S-matrix in detail.	**[L2][CO1]**	**[4 M]**
	b)	Derive S-matrix calculation for two port network.	**[L2][CO4]**	**[6 M]**
5	a)	Identify the microwave tee, whose rectangular slot is cut along the broader dimension, Describe in detail.	**[L3][CO6]**	**[5 M]**
	b)	Derive the S-matrix for E-Plane Tee	**[L2][CO4]**	**[5 M]**
6	a)	Identify the microwave tee, whose rectangular slot is cut along the wider dimension, Describe in detail	**[L3][CO5]**	**[5 M]**
	b)	Derive the S-matrix for H-Plane Tee	**[L1][CO4]**	**[5 M]**
7	a)	Identify the microwave tee, whose rectangular slot is cut both along the width and breadth of long waveguide dimension, Describe in detail	**[L3][CO1]**	**[5 M]**
	b)	Discuss about the applications of the magic Tee.	**[L2][CO3]**	**[5 M]**
8	a)	Demonstrate the working of Directional Coupler with suitable diagram & Express its Coupling factor and directivity.	**[L2][CO1]**	**[5 M]**
	b)	A directional coupler has the scattering matrix given below. Evaluate the directivity, coupling, 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]**	**[5 M]**
9	a)	Derive S-matrix for Directional Coupler.	**[L2][CO4]**	**[5 M]**
	b)	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]**	**[5 M]**
10.	a)	What are the types of directional coupler? Explain in detail.	**[L1][CO1]**	**[5 M]**
	b)	Derive the S-matrix for Hybrid ring.	**[L2][CO4]**	**[5 M]**

UNIT-IV
MICROWAVE TUBES

1.	a)	Mention the limitations of conventional tubes usage at Microwave frequencies. Explain inter-electrode capacitance and lead inductance effect.	**[L2][CO3]**	**[6 M]**
	b)	Distinguish between O type Microwave tubes and M type Microwave tubes.	**[L4][CO3]**	**[4 M]**
2.	a)	Explain the constructional details and principle of operation of two cavity klystron with the neat sketch.	**[L2][CO6]**	**[7 M]**
	b)	Illustrate the phenomenon of bunching with the help of Applegate diagram of two cavity Klystron tube	**[L3][CO5]**	**[3 M]**
3.	a)	Explain the velocity modulation process in two cavity Klystron tube and derive the equation for velocity modulation.	**[L2][CO4]**	**[5 M]**
4.	a)	What is meant by bunching process and transit time?	**[L1][CO5]**	**[4 M]**
	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.	**[L2][CO6]**	**[6 M]**
5	Discuss in detail about the working of Reflex Klystron with mechanism and modes of oscillation.		**[L2][CO4]**	**[10 M]**
6	a)	Derive the expression for output power for Reflex Klystron	**[L3][CO6]**	**[5 M]**
	b)	Derive the expression of condition for maximum efficiency for Reflex Klystron	**[L3][CO6]**	**[5 M]**
7	a)	Discuss about magnetron and its types	**[L2][CO4]**	**[4 M]**
	b)	A normal circular magnetron has the following parameters inner Radius Ra=0.15 m, Outer Radius R0=0.45 m, Magnetic flux density $\beta 0$ = 1.2 m Wb/m2. Determine the Hull cut-off Voltage and the cyclotron frequency in GHz.	**[L5][CO4]**	**[6 M]**
8	Explain in detail about 8- Cavity magnetron with suitable diagram.		**[L2][CO6]**	**[10 M]**
9	Derive the mathematical analysis of cylindrical magnetron with necessity diagrams.		**[L3][CO6]**	**[10 M]**
10.	a)	Derive the expression for Hull-Cutoff Voltage and Hartree Conditions.	**[L3][CO6]**	**[6 M]**
	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.	**[L5][CO6]**	**[4 M]**

UNIT-V
MICROWAVE MEASUREMENTS

1.	a)	Distinguish between low frequency measurements and microwave measurements.	**[L4][CO4]**	**[4 M]**
	b)	List the possible errors in VSWR measurement.	**[L1][CO5]**	**[6 M]**
2.	a)	Discuss in detail about the microwave power measurement using Bolometric technique.	**[L2][CO4]**	**[5 M]**
	b)	Discuss calorimeter technique, explain in detail about the microwave power measurement.	**[L2][CO6]**	**[5 M]**
3.	a)	With the help of a neat sketch, briefly explain the functions of different blocks of a microwave bench.	**[L2][CO4]**	**[5 M]**
	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]**	**[5 M]**
4.	Explain about measurement of attenuation using a microwave bench setup**.**		**[L2][CO4]**	**[10 M]**
5.	Explain briefly on the following microwave frequency measurement methods: (i) Slotted line method. (ii) Down conversion method.		**[L2][CO4]**	**[5 M]**
6.	a)	What is VSWR? Explain how Low values of VSWR(S<20) can be measured directly from the VSWR meter using the experimental set-up.	**[L1][CO4]**	**[5 M]**
	b)	Explain how high values of VSWR(S>20) can be measured directly from the VSWR meter using the experimental set-up.	**[L2][CO4]**	**[5 M]**
7.	a)	With the help of wave meter method explain the microwave frequency measurement	**[L1][CO5]**	**[5 M]**
	b)	What are the precautions to be taken while setting up microwave bench for measurement of various parameters? Explain	**[L6][CO5]**	**[5 M]**
8.	a)	Describe the measurement of impedance using slotted line and Smith chart	**[L4][CO4]**	**[5 M]**
	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]**	**[5 M]**
9.	a)	Sketch the experimental setup necessary for the measurement of impedance using slotted line. Explain it in detail.	**[L3][CO4]**	**[5 M]**
	b)	Using the reflectometer method, explain how to measure the impedance with the help a block diagram.	**[L2][CO4]**	**[5 M]**
10.	a)	Explain the measurement of Quality factor (Q) using Reflectometer method.	**[L2][CO4]**	**[5 M]**
	b)	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.	**[L6][CO4]**	**[5 M]**

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