

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA
School of Electronics and Communication Engineering
B. Tech. (ECE) Major Examination (Odd) 2018-19

Entry No:
 Date:

Total Number of Pages: [02]
 Total Number of Questions: [07]

Course Title: Microwave Engineering
 Course Code: ECL 3050

Time Allowed: 3.0 Hours

Instructions / NOTE

Max Marks: [50]

- Attempt All Questions.
- Support your answer with neat freehand sketches/diagrams, wherever appropriate.
- Assume an appropriate data / information, wherever necessary / missing.

(13) 26
 13 8
 34
 36+

Section - A			
Q1.	(a) A two port network is lossless when $\underline{Z}_{11} + \underline{Z}_{22} = 1$. (b) The input impedance of an open-circuited $\lambda/2$ transmission line is _____. (c) Bolometer is used to measure _____ at microwave frequency. (d) Double minima method is used to measure _____. (e) The depletion layer width in Tunnel diode is on the order of _____. (f) In a microwave oven _____ is used as a source.	[01] [01] [01] [01] [01] [01]	CO1 CO5 CO5 CO5 CO4 CO1
Q2.	(a) What are the limitations of the conventional tubes? Explain. (b) Write a short note on Faraday Rotation in the anisotropic medium.	[04] [04]	CO1 CO2
Section - B			
Q3.	(a) Calculate the operating frequency of a Silicon based IMPATT diode with drift length of $2\mu\text{m}$ and drift velocity of 10^7 cm/s . (b) A TRAPATT diode has $N_A = 2 \times 10^{15} \text{ cm}^{-3}$, $J = 30 \text{ kA/cm}^2$, Calculate the avalanche zone drift velocity.	[03] [03]	CO4 CO4
Q4.	(a) How the bunching processes takes place in a Klystron? Explain. (b) Find the expression for the optimum distance L between Buncher and Catcher cavity at which maximum fundamental component of current occurs in the two cavity Klystron tube.	[04] [04]	CO4 CO3
Q5.	(a) A cubical resonator made of copper is to be designed at 10 GHz. Find the dimensions of the cavity. (b) An air-filled circular waveguide having an inner radius of 1 cm is excited in dominant mode at 10 GHz. Find (a) cut-off frequency (b) guided wavelength (c) wave impedance and (d) Bandwidth. It is given that $X_{11}' = 1.841$, $X_{11} = 3.832$, $X_{01} = 2.405$	[04] [08]	CO3 CO2

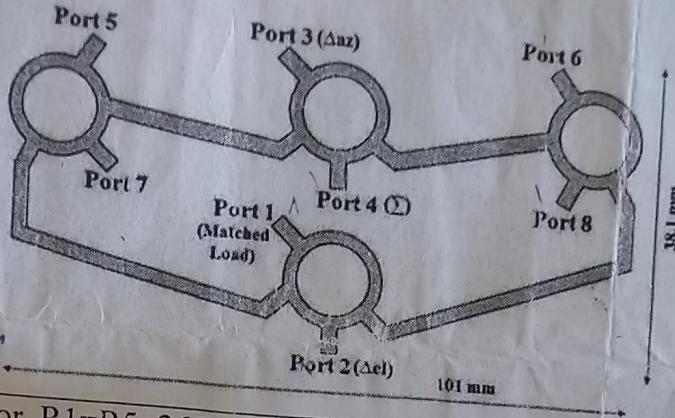
TE₁₁
 TM₀₁
 TG₁₀
 TM₁₁

Q6.

For the Monopulse comparator shown below, write the S-matrix if ports are perfectly matched.

[04]

CO3

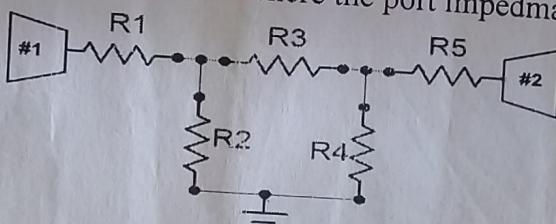


Q7.

For $R_1=R_5=26\Omega$, $R_2=R_4=35\Omega$ and $R_3=70\Omega$ in the following network find the S-matrix where the port impedance is 50Ω .

[06]

CO3



Course Outcomes:

CO1: To learn the basic concepts of Microwave Engineering and its applications

CO2: To gain knowledge about the wave propagation through the guided media

CO3: To apply the basic analysis techniques to the microwave devices

CO4: To gain the working knowledge of different types of sources at microwave frequency

CO5: To learn the measurement techniques at microwave frequency

CO	Questions Mapping	Total Marks	Total Number of Students (to be appeared in Exam)
CO1	1(a), 1(f), 2(a)	06	70
CO2	2(b), 5(b)	12	70
CO3	4(b), 5(a), 6,7	18	70
CO4	1(e), 3(a), 3(b), 4(a)	11	70
CO5	1(b), 1(c), 1(d)	03	70

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA
School of Electronics and Communication Engineering
B. Tech. (ECE) Minor Examination (ODD) 2019-20

Entry No: **17BEC033**
Date:

Total Number of Pages: [01]

Total Number of Questions: [01]

Course Title: **MICROWAVE ENGINEERING**

Course Code: **ECL 3050**

Time Allowed: 1.5 Hours

Max Marks: [30]

Instructions / NOTE

- Attempt All Questions.
- Support your answer with neat freehand sketches/diagrams, wherever appropriate.
- Assume an appropriate data / information, wherever necessary / missing.

Section - A			
Q1.	(a) $[S] = \{[Z] - [U]\} + \dots$ (b) Diagonal elements of S-Matrix is zero when	[01] [01]	CO5 CO5
Q2.	With the help of neat diagram, explain the working of Rat Race Coupler. Write its S-Matrix and explain its two applications.	[06]	CO1
Section - B			
Q3.	A rectangular waveguide with dimensions $a=5\text{cm}$, $b=2.5\text{ cm}$ is to operate below 7 GHz. The guide is filled with a medium characterized by $\sigma=0$, $\epsilon_r=4$, $\mu_r=1$. (a)How many TE and TM modes can propagate through it? (b) Calculate the cutoff frequency of each mode?	[02]+ [03]	CO2
Q4.	An air filled rectangular waveguide of dimension $a=4\text{ cm}$, $b=2\text{ cm}$ transports energy in the dominant mode at a rate of 2mW. If the operating frequency is 10 GHz, determine the peak value of the electric field components in the guide. Also find the maximum voltage across the narrow wall.	[05]	CO2
Q5.	An air filled circular resonance cavity with radius $a=4\text{ cm}$, and length $d=10\text{cm}$ is made of copper ($\sigma_c=5.8\times 10^7\text{ S/m}$). Find the dominant mode resonance frequency. Now, if the length is reduced to 6cm, what will be the resonance frequency for the dominant mode? (Given $X'_{11}=1.841$, $X_{11}=3.832$).	[04]	CO2
Q6.	With the neat diagram, explain the phase shifting property of the Scattering parameters.	[04]	CO3
Q7.	Find the S parameters of the following two port circuit. The port impedances are 50Ω .All impedances in the figure are in Ohm.	[04]	CO7

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CO	Questions Mapping	Total Marks	Total Number of Students (to be appeared in Exam)
CO1	2	96	62
CO2	3,4,5	14	62
CO3	6,7	08	62
CO4	0	02	62
CO5	1		

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Entry No:

17BEC033

Date:

Total Number of Pages: [02]

Total Number of Questions: [10]

Course Title: MICROWAVE ENGINEERING

Course Code: ECL 3050

Time Allowed: 3.0 HoursInstructions / NOTE

Max Marks: [50]

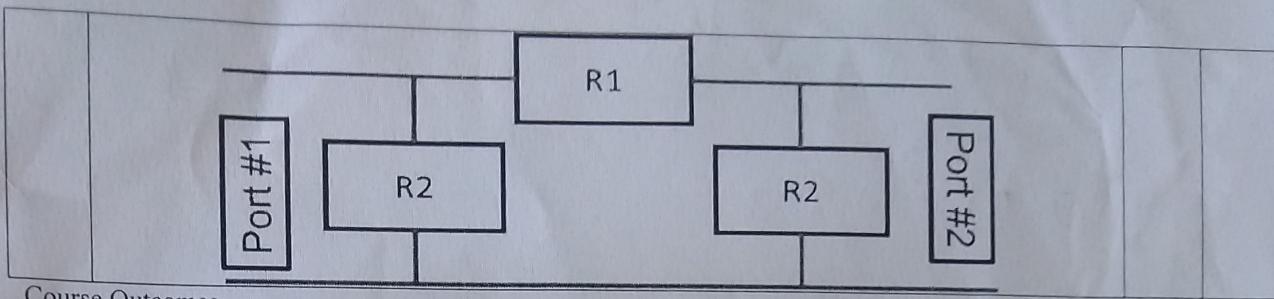
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Section - A

Q1.	(a) _____ and _____ are the example of O-type and M-Type Tubes, respectively.	[01]	CO4
	(b) In the practical applications, the VSWR on the line should be _____ than _____.	[01]	CO5
	(c) In TE and TM modes in the rectangular waveguide, _____ and _____ component of the electromagnetic wave are zero.	[01]	CO1
	(d) The frequency range of S and X bands is _____ and _____ GHz, respectively.	[01]	CO1
(e) In a standard rectangular waveguide, the ratio of width to the height is _____.			[01] CO2
Q2.	In a standard rectangular waveguide, the dominant mode cut off frequency is 10 GHz. Find the cut-off frequency of TE ₂₀ and TM ₃₁ Modes. Also find the characteristic impedance all these three modes at 60 GHz if the waveguide is filled with the air.	[03]	CO3

Section - B

Q3.	With the neat diagram, explain the working of a Reflex Klystron. Also draw the mode curves and explain its importance.	[05]	CO4
		[05]	CO4
Q4.	What is the two valley model theory in the Gunn Diode? Explain with the neat diagram. What are the three criteria to be satisfied by the band structure of the semiconductor to exhibit the negative resistance?	[05]	CO4
Q5.	Design an Isolator using the Ferrite material and explain its working principles.	[03]	CO4
Q6.	(a) The input power in a two-hole directional coupler is 1mW. The coupler has a coupling coefficient of 15 dB and directivity of 50 dB. Calculate power at all other ports. (b) When do we use double minima method in VSWR measurement? With the neat diagram, explain the measurement steps.	[03]	CO2
		[03]	CO5
Q7.	A two cavity Klystron has the following parameters. $V_o=2000V$, $R_o=30k\Omega$, $I_o=20mA$, $f=4GHz$, Gap spacing in either cavity (d)=2mm, Spacing between cavities (L)=4cm, Effective shunt impedance (R_{sh})= $30k\Omega$, $J_1(X)=0.582$, $X=1.841$, Electron charge = $1.602 \times 10^{-19} C$, Electron mass = $9.109 \times 10^{-31} Kg$. (a) Find the Bencher cavity gap voltage (V_1) to give maximum output V_2 . (b) Find the voltage gain, neglecting the beam loading in the input cavity. (c) Find the efficiency of the Amplifier neglecting beam loading.	[06]	CO3
Q8.	The S-parameters of a two-port network are given by $S_{11} = 0.2 \angle 90^\circ$, $S_{22} = 0.2 \angle 90^\circ$, $S_{12} = 0.5 \angle 90^\circ$, $S_{21} = 0.5 \angle 0^\circ$ (a) Determine whether the network is lossy or not. (b) Is the network symmetrical and reciprocal (c) Find the insertion loss of network (d) Find the return loss at port 1 when port 2 is short circuited.	[01] [01] [02] [02]	CO1
Q9.	What is the Faraday rotation in the Anisotropic media? Find the expression of the phase constants when a +z-directed electromagnetic wave passes through a long ferrite rode which is magnetically biased in the direction of the propagation of the wave.	[02+ 04]	CO2
Q10.	In the following circuit, R1, R2, and port impedances are 37.75Ω , 150.45Ω and 50Ω , respectively. Find the Return loss and attenuation.	[05]	CO5



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CO1	1(c),1(d),8	08	65
CO2	1(e),6(a),9	10	65
CO3	2,7	09	65
CO4	1(a),3,4,5	14	65
CO5	1(b),6(b),10	09	65