

K. J. Somaiya Institute of Technology, Sion, Mumbai-22  
(Autonomous College Affiliated to University of Mumbai)

Subject Code: EXC701

Subject Name: Microwave Engineering

Date: 25th May 2023

May-June 2022-23				
(B. Tech) Program: Electronics and Telecommunication Engineering				
Examination: LY Semester: VII				
Course Code: EXC701 and Course Name: Microwave Engineering				
Duration: 2.5 Hours			Max. Marks: 60	
Instructions:				
(1). All questions are compulsory.				
(2). Draw neat diagrams wherever applicable.				
(3). Assume suitable data, if necessary.				
Q. No.	Question	Max. Marks	CO	BT level
Q 1	Solve any six questions out of eight:	12		
i)	Discuss the various frequency bands and characteristics of microwaves.	02	CO1	R
ii)	Justify why slow wave structures used in TWT amplifiers? List the name of slow wave structures.	02	CO4	R
iii)	Explain microwave radar system.	02	CO6	R
iv)	Define the dominant mode and degenerative modes of a waveguide?	02	CO2	R
v)	Differentiate between transit time devices and transferred electron devices.	02	CO3	U
vi)	Define VSWR and antenna gain.	02	CO5	U
vii)	Define the terms velocity modulation and current modulation?	02	CO4	R
viii)	Differentiate the rectangular and circular waveguide.	02	CO2	R
Q.2	Solve any four questions out of six.	16		
i)	What is the importance of beam coupling coefficient? Explain the concept of velocity modulation in klystron using apple gate diagram.	04	CO4	R
ii)	Construct a microstrip line on a 0.5 mm alumina substrate ( $\epsilon_r=9.9$ , $\tan\delta=0.001$ ) for a $50 \Omega$ characteristic impedance. Select the length of this line required to produce a phase delay of $270^\circ$ at 10 GHz.	04	CO1	U
iii)	Explain in brief parametric amplifier.	04	CO3	U



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iv)	Justify why Rectangular waveguide does not support TEM propagation?	04	CO2	R
v)	Explain the two antenna method of antenna gain measurement.	04	CO5	R
vi)	Define the followings terms: RADAR range, unambiguous range, pulse repetition frequency (PRF) and pulse repetition time (PRT)?.	04	CO6	U
Q.3	Solve any two questions out of three.	16		
i)	Match a load impedance $Z_L=60-j80 \Omega$ to a 50-ohm transmission line using double stub tuner. The stubs are open circuited and are spaced $\lambda/8$ apart. The match frequency is 2 GHz.	08	CO2	A
ii)	Explain operation of Gunn diode using two valley model and explain different modes of Gunn diode.	08	CO3	A
iii)	Explain the measurement of impedance using microwave bench.	08	CO5	R
Q.4	Solve any two questions out of three.	16		
i)	Derive the wave equation for TM mode of rectangular waveguide.	08	CO2	A
ii)	Explain amplification process in TWT with neat diagram. If TWT operates under the following parameters. Beam voltage= 3 KV Beam Current= 30 Ma $Z_0= 10 \text{ ohm}$ Circuit length= $N=50$ Frequency= 10 GHz Determine: 1. Gain parameter (C) 2. Output Power Gain (Ap) 3. All four propagation constant	08	CO4	R
iii)	List the medical application of Microwaves and explain any one in brief.	08	CO6	R

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