

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

Nov – Dec 2024-25

B. Tech. Program: **Electronics and Telecommunication Engg. Scheme: II :**
Regular Examination: LY Semester VII

Course Code: **EXC701** and Course Name: **Microwave Engineering**

Date of Exam: **26/11/24**

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 two questions out of three: (05 marks each)	10		
a)	Discuss different characteristics of microwaves.		1	2
b)	State various modes of Gunn diode and explain any one of them		3	2
c)	What is meant by RADAR range?		6	2
Q 2	Solve any two questions out of three: (05 marks each)	10		
a)	Write a short note on rectangular waveguide. Teflon ($\epsilon_r = 2.1$) filled rectangular waveguide has following parameters $a=3$ cm, $b=1.5$ cm. Calculate cut-off frequency for dominant mode.		2	3
b)	Draw and explain the functional diagram of magnetron oscillator.		4	2
c)	Summarize the double minimum method of VSWR measurement using microwave bench.		5	2
Q.3	Solve any two questions out of three. (10 marks each)	20		
a)	Match a load impedance of $Z_L = 60 - j80 \Omega$ to a 50Ω line using a double stub tuner. The stubs are open circuited and are spaced $\lambda/8$ apart. The match frequency is 2 GHz. (use smith chart)		2	3
b)	i. What are bulk properties of a GUNN diode that give rise to negative resistance like characteristics? (3 M) ii. Draw the structure of BARITT diode and explain its working. (3 M) iii. Derive the S-matrix of four port microwave circulator. (4 M)		3	3
c)	List the measuring instruments to measure microwave frequency. Explain the method of microwave frequency using direct and indirect methods.		5	2
Q.4	Solve any two questions out of three. (10 marks each)	20		

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a)	i. Explain the working principal of two cavity Klystron as amplifier using neat labelled diagram. (5 M)	4	3
	ii. A two cavity klystron amplifier has the following parameters: (5 M) $V_0 = 1200$ V, $R_0 = 30$ K Ω , $I_0 = 25$ mA and $f = 10$ GHz. Gap spacing in either cavity: $d = 1$ mm. Spacing between two cavities $L = 4$ cm. Effective shunt impedance, excluding beam loading: $R_{sh} = 30$ K Ω . a) Solve for an input gap voltage to give maximum voltage. b) Solve for the voltage gain neglecting the beam loading in the output cavity. c) Solve for the efficiency of the amplifier neglecting the beam loading. Note: For maximum V_2 , $J_1(X) = 0.582$ at $X_1 = 1.841$.		
b)	Construct the wave equation for a TM wave and obtain all field components in a rectangular waveguide.	3	3
c)	i. Explain MTI radar. (3 M)	5	2
	ii. Define: Pulse repetition frequency (PRF), Pulse repetition Time (PRT) and Maximum unambiguous range. (3 M)		
	iii. List the medical application of Microwaves. Explain microwave hyperthermia and diathermy. (4 M)		
