

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

~~Feb~~ ~~March~~ 2024

(B. Tech) Program: Electronics and Telecommunication Engineering Scheme: IIB

Examination: LY Semester: VII

Course Code: EXC701 and Course Name: Microwave Engineering

Date of Exam: 01/03/2024

Duration: 2.5 Hours

Max. Marks: 60

Supplementary Examination

Instructions:

- (1) All questions are compulsory.
- (2) Draw neat diagrams wherever applicable.
- (3) Assume suitable data, if necessary.

		Max. Marks	CO	BT level
Q 1	Solve any six questions out of eight:	12		
i)	Compare the stripline, microstrip line and coplanar lines?	02	1	U
ii)	Summarize the difference between transit time devices and transferred electron devices.	02	3	U
iii)	Define: VSWR, Return loss, Antenna gain and Friss transmission	02	5	U
iv)	Compare TWT amplifier and klystron amplifier.	02	4	U
v)	Explain parametric amplifier.	02	3	R
vi)	Explain microwave radar system.	02	6	U
vii)	Illustrate why Rectangular waveguide does not support TEM propagation?	02	2	U
viii)	Explain the 3 port circulator as an isolator.	02	2	U
Q.2	Solve any four questions out of six.	16		
i)	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)	04	4	Ap
ii)	Construct a microstrip line on a 0.6 mm FR4 substrate ($\epsilon_r = 4.4$, $\tan\delta = 0.02$) for a 50Ω characteristic impedance. Select the length of this line required to produce a phase delay of 270° at 10 GHz.	04	1	Ap
iii)	List the industrial application of Microwaves and explain any one in brief.	04	6	U
iv)	Explain operation of Gunn diode using two valley model.	04	3	U

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v)	Explain the measurement of impedance using microwave bench set up.	04	5	U
vi)	Construct the S-matrix of Directional couplers.	04	2	Ap
Q.3	Solve any two questions out of three.	16		
i)	Solve a matching network using the terminating impedance $Z_L = 60 - j80 \Omega$, design two single stub (short circuited) tuning network to match this load to a 50Ω line. (Use smith chart)	08	1	Ap
ii)	Explain the working principle of IMPATT diode, and derive the power output and efficiency?	08	3	Ap
iii)	Explain the measurement of dielectric constant of solid using microwave bench setup.	08	5	U
Q.4	Solve any two questions out of three.	16		
i)	Derive equation for phase velocity, cut-off frequency, cut-off wavelength and field equations for rectangular waveguide. Rectangular waveguide has following characteristics $b = 1.5 \text{ cm}$, $a = 3 \text{ cm}$, $\mu_r = 1$, $\epsilon_r = 25$. Solve: 1. Cut off frequency for TE_{10} and TM_{11} and show the dominant mode.	08	2	Ap
ii)	Construct the equation of velocity modulation in klystron. A two Cavity Klystron amplifier has the following parameters. <ul style="list-style-type: none"> • Beam voltage= 1 KV • Beam Current= 25 mA • $R_o = 40 \text{ Kohm}$ • $F = 3 \text{ GHz}$ • $d = 1 \text{ mm}$ • $L = 4 \text{ mm}$ 	08	4	Ap
iii)	Derive the RADAR range equation. Also, compare the different radars.	08	6	U
