GUJARAT TECHNOLOGICAL UNIVERSITY
BE –SEMESTER 7 (NEW SYLLABUS) EXAMINATION- SUMMER 2018

Subject Code: 2171001   **Date: 28-04-2018**
Subject Name: Microwave Engineering
Time: 02:30 pm to 05:00 pm   **Total Marks: 70**
Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 (a) List out various applications of Microwave and briefly explain any two of them. — 03

(b) Derive and explain the characteristic impedance (Z_0) of transmission line. Also derive the phase velocity from Z_0 for low loss transmission lines. — 04

(c) An open wire transmission line has the following primary constants R=4 Ω/km, L=2.5 mH/km, C=0.009 μF/km, G=0.29 μ mho/km and Frequency of operation is 1 kHz. Determine the following parameters (1) Z_0 (2) α (3) β and (d) Phase Velocity. — 07

Q.2 (a) Mention the equations of cut-off frequency and cut-off wavelength for the rectangular waveguide of the TE_{mn} mode and plot the cross-sectional and longitudinal view of the TE_{10} and TE_{11} mode of the propagation. — 03

(b) What is standing wave? Derive the equation of voltage standing wave ratio (VSWR) in terms of reflection coefficient . — 04

(c) Discuss the reasons due to which the measurement of Z, Y, h and ABCD parameter are difficult at microwave frequencies. Elaborate the S-parameters for the multi-port network along with any two properties. — 07

OR

(c) The S-parameters of a two-port network are given by
$S_{11} = 0.2<0°$, $S_{22} = 0.1<0°$,
$S_{12} = 0.6<90°$, $S_{21} = 0.6<90°$
(1) Prove that the network is reciprocal but not lossless.
(2) Find the return loss at port 1 when port 2 is short-circuited. — 07

Q.3 (a) Define slow wave structure of TWT using any three structures. — 03
(b) Describe structure of microwave corners and twisters with diagrams. — 04
(c) Explain the coupling factor and directivity of the four ports directional coupler. Also derive the S-matrix for completely matched four-port directional coupler. — 07

OR

Q.3 (a) Explain working of tunnel diode when forward bias is applied to it. — 03
(b) Discuss the equations of power gain, noise figure and bandwidth of negative resistance parametric amplifier. — 04

	(c)	Mentioned the symbol and schematic diagram of microwave circulator. Explain the working of the same using geometry containing two magic tee and one phase shifter along with its simplified s-matrix.	07
Q.4	(a)	Describe Hazards of Microwave on Human body.	03
	(b)	State the basic principle of calorimetric method for high power measurement. Explain about static calorimeters and circulating calorimeters methods.	04
	(c)	Elaborate the network analyser and harmonic frequency converter using schematic block diagrams.	07

OR

Q.4	(a)	Define the terms Electromagnetic Interference and Electromagnetic compatibility.	03
	(b)	Draw and explain the schematic diagram and experimental set-up of reflectometer to measure the return loss.	04
	(c)	Explain the material selection and fabrication process of MMIC.	07
Q.5	(a)	Describe the process to measure the noise figure at microwave frequencies.	03
	(b)	Explain constructional difference between coplanar and shielded strip lines.	04
	(c)	Explain about lens antennas used for the microwave applications.	07

OR

Q.5	(a)	Mentioned the basic principal of IMPATT and TRAPATT diodes.	03
	(b)	Briefly explain any two applications of microwaves in medical domain.	04
	(c)	Draw and explain the block diagram of simple RADAR system and differentiate between CW and Pulse RADAR system.	07

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