Q. Code:922499

Reg. No. | | | | | | | | | | | | | |

B.E / B.TECH. DEGREE EXAMINATION, MAY 2023

Seventh Semester

EC18701 – RF AND MICROWAVE ENGINEERING

(Electronics and Communication Engineering)

(Regulation 2018)

TIME: 3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Explain the active and passive components at microwave frequencies.	**2**
CO 2	Analyze the multi-port networks and transistor amplifiers at RF frequencies.	**4**
CO 3	Analyze microwave devices for various applications.	**4**
CO 4	Evaluate the microwave sources and their applications.	**3**
CO 5	Measure and analyze the microwave signal parameters.	**3**

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Define S-parameter for a two port network.	**1**	**2**
2.	Mention any four differences between low frequency circuits and high frequency microwave circuits.	**1**	**2**
3.	Draw the block diagram of generic amplifier system.	**2**	**2**
4.	Calculate the VSWR of an amplifier, if the amplifier has reflection coefficient 0.275.	**2**	**3**
5.	Write down the S-matrix of the E-plane Tee.	**3**	**2**
6.	Compare IMPATT diode and Gunn diode.	**3**	**2**
7.	Interpret the High frequency effects in vacuum tubes.	**4**	**2**
8.	Explain frequency pulling and frequency pushing in magnetrons.	**4**	**3**
9.	Describe the scales in VSWR meter.	**5**	**2**
10.	Interpret the methods used for low, medium and high power measurement.	**5**	**3**

PART- B (5 x 14 = 70 Marks)

			Marks	CO	RBT LEVEL
11. (a)	**(i)**	Prove that the S-Matrix for a reciprocal network is symmetric.	**(7)**	**1**	**3**
	(ii)	The S-parameters of a two-port network are given $S_{11} = 0.2 \angle 90^\circ$, $S_{22} = 0.2 \angle 90^\circ$, $S_{12} = 0.5 \angle 90^\circ$, $S_{21} = 0.5 \angle 0^\circ$, (i) Determine whether the network is lossy or not. (ii) Determine whether the network is reciprocal. Find the insertion loss of network.	**(7)**	**1**	**3**

(OR)

(b)	Derive Z and Y matrix for the multi-port network. Formulate the scattering matrix for n-port microwave network.	**(14)**	**1**	**3**
12. (a)	A microwave amplifier is characterized by its S-parameters. Derive the equations for power gain, available power gain and transducer power gain for a transistor amplifier.	**(14)**	**2**	**3**
	(OR)			
(b)	Evaluate the stability considerations for RF amplifier design with various stabilization methods.	**(14)**	**2**	**3**
13. (a)	Derive the scattering matrix for the Hybrid Tee using 'S' parameter theory.	**(14)**	**3**	**3**
	(OR)			
(b)	With the help of two valley model, explain how negative resistance can be achieved in Gunn diode. Mention its applications.	**(14)**	**3**	**3**
14. (a)	A two cavity Klystron has the following parameters. V_0 = 1000 V, R_0= 40 kΩ, I_0 = 25 mA, f = 3 GHz, Gap spacing in either cavity (d) = 1 mm, Spacing between two cavities L=4 cm, Effective shunt impedance R_{th} = 30 KΩ. Calculate the input gap voltage, voltage gain and efficiency.	**(14)**	**4**	**3**
	(OR)			
(b)	Illustrate with interaction region diagram the mechanism of operation of TWT amplifier, its applications and the expression for the gain of a TWT.	**(14)**	**4**	**3**
15. (a)	**(i)** Consider a Spectrum analyser used to display frequency components from 0-3 GHz selecting suitable frequency of local oscillator, demonstrate superheterodyne principle used in spectrum analyser to display these frequency components.	**(7)**	**5**	**2**
	(ii) Demonstrate the slotted line method of low and high VSWR measurement.	**(7)**	**5**	**2**
	(OR)			
(b)	Elaborate impedance and dielectric constant measurement using necessary block diagrams.	**(14)**	**5**	**2**

PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

		Marks	CO	RBT LEVEL
16.	A microwave transistor has the following S parameters at 10 GHz, with 50Ω reference impedance. S_{11} =0.45 ∟150˚, S_{22} = 0.40∟-150˚, S_{12} = 0.01∟0˚, S_{21} = 2.05∟10˚. The source impedance is Z_S = 20 Ω and load impedance is Z_L = 30 Ω, compute the power gain, available gain and the transducer power gain.	**(10)**	4	5