SARDAR RAJA COLLEGES

SARDAR RAJA COLLEGE OF ENGINEERING, ALANGULAM

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

MICRO LESSON PLAN

SUBJECT NAME : RF AND MICROWAVE ENGINEERING
SUBJECT CODE : EC2403
YEAR/ SEM : IV / VII
BRANCH : ECE

STAFF NAME: Mrs. S.MUPPUDATHI SUTHA

A.P/ECE

EC2403 RF AND MICROWAVE ENGINEERING

SUBJECT DESCRIPTION AND OBJECTIVES

SUBJECT DESCRIPTION:

Radio frequency (RF) engineering is a subset of electrical engineering that deals with devices that are designed to operate in the Radio Frequency spectrum. These devices operate within the range of about 3 kHz up to 300 GHz.RF engineering is incorporated into almost everything that transmits or receives a radio wave, which includes, but is not limited to, Mobile Phones, Radios, WiFi, and two-way radios.RF engineering is a highly specialized field falling typically in one of two areas; 1) providing or controlling coverage with some kind of antenna/transmission system and 2) generating or receiving signals to or from that transmission system to other communications electronics or controls. To produce quality results, an in-depth knowledge of mathematics, physics, general electronics theory as well as specialized training in areas such as wave propagation, impedance transformations, filters, microstrip circuit board design, etc. may be required. Because of the many ways RF is conducted both through typical conductors as well as through space, an initial design of an RF circuit usually bears very little resemblance to the final optimized physical circuit. Revisions to the design are often required to achieve intended results.

Microwave engineering pertains to the study and design of microwave circuits, components, and systems. Fundamental principles are applied to analysis, design and measurement techniques in this field. The short wavelengths involved distinguish this discipline from Electronic engineering. This is because there are different interactions with circuits, transmissions and propagation characteristics at microwave frequencies.Some theories and devices that pertain to this field are antennas, radar, transmission lines, space based systems (remote sensing), measurements, microwave radiation hazards and safety measures.

OBJECTIVES:

- To study about multi- port RF networks and RF transistor amplifiers
- To study passive microwave components and their S- Parameters.
- To study Microwave semiconductor devices & applications.
- To study Microwave sources and amplifiers.

EC2403 RF AND MICROWAVE ENGINEERING **L T P C**
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UNIT I TWO PORT RF NETWORKS-CIRCUIT REPRESENTATION 9

Low frequency parameters-impedance ,admittance, hybrid and ABCD. High frequency parameters-Formulation of S parameters, properties of S parameters-Reciprocal and lossless networks, transmission matrix, Introduction to component basics, wire, resistor,capacitor and inductor, applications of RF.

UNIT II RF TRANSISTOR AMPLIFIER DESIGN AND MATCHING NETWORKS 9

Amplifier power relation, stability considerations, gain considerations noise figure,impedance matching networks, frequency response, T and Π matching networks, microstripline matching networks

UNIT III MICROWAVE PASSIVE COMPONENTS 9

Microwave frequency range, significance of microwave frequency range - applications of microwaves. Scattering matrix -Concept of N port scattering matrix representation-Properties of S matrix- S matrix formulation of two-port junction. Microwave junctions -Tee junctions –Magic Tee - Rat race - Corners - bends and twists - Directional couplers -two hole directional couplersFerrites - important microwave properties and applications – Termination - Gyrator-IsolatorCirculator - Attenuator - Phase changer – S Matrix formicrowave components – Cylindrical cavity resonators.

UNIT IV MICROWAVE SEMICONDUCTOR DEVICES 9

Microwave semiconductor devices- operation - characteristics and application of BJTsand FETs -Principles of tunnel diodes - Varactor and Step recovery diodes – Transferred Electron Devices -Gunn diode- Avalanche Transit time devices-IMPATT and TRAPATT devices. Parametric devices -Principles of operation - applications of parametric amplifier .Microwave monolithic integrated circuit (MMIC) - Materials and fabrication techniques

UNIT V MICROWAVE TUBES AND MEASUREMENTS 9

Microwave tubes- High frequency limitations - Principle of operation of Multicavity Klystron, Reflex Klystron, Traveling Wave Tube, Magnetron. Microwave measurements: Measurement of power, wavelength, impedance, SWR, attenuation, Q and Phase shift.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Samuel Y Liao, "Microwave Devices & Circuits" , Prentice Hall of India, 2006.
2. Reinhold. Ludwig and Pavel Bretshko 'RF Circuit Design", Pearson Education, Inc., 2006.

REFERENCES:

1. Robert. E.Collin-Foundation of Microwave Engg –Mc Graw Hill.
2. Annapurna Das and Sisir K Das, "Microwave Engineering", Tata Mc Graw Hill Inc., 2004.
3. M.M.Radmanesh , RF & Microwave Electronics Illustrated, Pearson Education, 2007.
4. Robert E.Colin, 2ed "Foundations for Microwave Engineering", McGraw Hill, 2001
5. D.M.Pozar, "Microwave Engineering.", John Wiley & sons, Inc., 2006.

MICRO LESSON PLAN

Week	Hours	LECTURE TOPICS	Book
	UNIT I TWO PORT RF NETWORKS-CIRCUIT REPRESENTATION		
I	1	Low frequency parameters- impedance,admittance,hybrid and ABCD.	R4
	2	High frequency parameters - Formulation of S parameters.	
	3	Properties of S parameters.	
	4	Reciprocal and Lossless networks.	
	5	Transmission matrix	
II	6	Introduction to component basics	
	7	Wire, Resistor	
	8	Capacitor and Inductor.(AV CLASS)	
	9	Applications of RF.(AV CLASS)	
	UNIT II RF TRANSISTOR AMPLIFIER DESIGN AND MATCHING NETWORKS		
III	10	Amplifier power relation (AV CLASS)	T2
	11	Stability considerations	
	12	Gain considerations noise Figure	
	13		
IV	14	impedance matching networks	
	15	Frequency Response	
	16	T and π matching networks	
	17		
	18	Microstripline matching networks	
	UNIT III MICROWAVE PASSIVE COMPONENTS		
V	19	Microwave frequency range	R2,R5,R6
	20	Significance of Microwave frequency range	R2,R5,R6
	21	Applications of microwaves (AV CLASS)	T2
	22	Scattering Matrix	R5
	23	Concept of N port scattering matrix representation	R5

	24	Properties of S matrix	R5
	25	S matrix formulation of two port junction	T1
	26	Microwave junctions- Tee junctions	
	27	Magic Tee, Rat race	
VI	28	Corners, bends and twists	
	29	Directional couplers	
	30	Two hole directional couplers	
	31	Ferrites, important microwave properties and applications (AV CLASS)	R5
	32	Termination ,Gyrator, Isolator, Circulator	T1
	33	Attenuator, Phase changer	R2,R5
	34	S Matrix for microwave components	
	35	Cylindrical cavity resonators.	
	UNIT IV MICROWAVE SEMICONDUCTOR DEVICES		
VII	36	Microwave semiconductor devices- operation - characteristics and application of BJTs and FETs	T1
	37	Principles of tunnel diodes	
	38	Varactor and Step recovery diodes	
	39	Transferred Electron Devices -Gunn diode	
	40	Avalanche Transit time devices- IMPATT and TRAPATT devices. (AV CLASS)	
VIII	41		
	42	Parametric devices -Principles of operation - applications of parametric amplifier	
	43		
	44	Microwave monolithic integrated circuit (MMIC) - Materials and fabrication techniques.	
	45		
	UNIT V MICROWAVE TUBES AND MEASUREMENTS		
IX	46	Microwave tubes- High frequency limitations	T1
	47	Principle of operation of Multicavity Klystron	T1
	48	Reflex Klystron	T1
	49	Traveling Wave Tube, Magnetron.	T1

	50	Microwave measurements: Measurement of power	R2
X	51		
	52	wavelength, impedance, SWR ,Attenuation(AV CLASS)	
	53		
	54	Q and Phase shift.	
	55		

PREPARED BY,

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