Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETE803	Microwave Integrated Circuit	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE	ESE			
		10		30	100 (60% Weightage)			

Pre-requisite Course Codes		ETC 403: Wave Theory and Propagation ETC 504: RF Modeling and Antennas ETC 704: Microwave and Radar Engineering
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Design and implement the microwave layouts
	CO2	Design and implement the microwave amplifier, oscillator, and mixer circuits.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Hybrid MICs And Monolithic MICs**			08
	1.1	Definition, characteristics, comparison with conventional circuits, field of application and limitations and criteria for the choice of substrate material in HMICS and MMICS.		
	1.2	Thin film hybrid circuits, thick film hybrid circuits, art work, masking, photolithography, resistor stabilization, sawing, brazing process, wire bonding.		
	1.3	Monolithic MICs: Doping by ion implantation, Ohmic contacts, metal resistive layers, gate metal, dielectric and air-bridge vias, wafer process steps.		
2	**Micro Strip Lines**			08
	2.1	Planar wave guides, non-tem propagation, line impedance definitions, quasi-static approximations, quasi-static line parameters.		
	2.2	Micro strip open circuits and gaps, micro strip corners, step change in width.		
	2.3	Dispersion analysis, micro strip characteristic impedance, symmetric t junction, green's functions, millimeter wave modeling of micro strip lines.		
3	**Coupled Line Propagation**			10
	3.1	Coupled line propagation: wave equations for coupled lines, propagation models, coupled line parameters, coupled line parameter variations with frequency, directional couplings, lange coupler, coupled line pair operated as a four port.		
	3.2	Coplanar wave guides: design considerations and coplanar line circuits.		
4	**Microwave Amplifier Design**			12

	4.1	Introduction, derivation of transducer power gain, stability, power gains, voltage gains, and current gains, single-stage transistor amplifier design.		
	4.2	Power amplifier design: device modeling and characteristics, optimum loading.		
	4.3	Single-stage power amplifier design and multi-stage design.		
	4.4	Power distributed amplifiers. class of operation, power amplifier stability, amplifier linearization methods.		
5	**Microwave Oscillator Design**			08
	5.1	Introduction, compressed smith chart, series of parallel resonance, resonators, two-port oscillator design, negative resistance from transistor model, oscillator q and output power.		
	5.2	Noise in oscillators: linear approach, analytical approach to optimum oscillator design using s parameters, nonlinear active models for oscillators.		
	5.3	Microwave oscillator performance, design of an oscillator using large single y parameters, example for large single design based on bessel functions, design examples for best phase noise and good output power.		
6	**Microwave Mixer Design**			06
	6.1	Introduction, diode mixer theory, single-diode, single-balanced and double-balanced mixers.		
	6.2	FET mixer theory, balanced FET mixers, special mixer circuits, mixer noise.		
			Total	**52**

References:

1. D. H. Schrader, ―*Microstrip Circuit Analysis*‖ , Prentice Hall PTR, New Jersey.
2. D. M. Pozar, ―*Microwave Engineering*‖ , John Wiley & Sons Publication, 2013.
3. K. C. Gupta, R. Garg, and I. J. Bahl, ―*Microstrip Lines and Slot Lines*‖ , Artech House.
4. M. M. Radmanesh, ―*Radio Frequency and Microwave Electronics*‖ , Pearson Education, 2006.
5. D. Vendelin, A. M. Pavio, and U. L. Rohde, ―*Microwave Circuit Design*‖ , John Wiley & Sons Publication.
6. Sweet, ―*MIC and MMIC Amplifier and Oscillator Design*‖ , 1990 Edition, Artech House.