Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ETE803	**Microwave Integrated Circuit**	04	--	--	04	--	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
ETE803	**Microwave Integrated Circuit**	20	20	20	80	-	-	-	100

Course pre requisite:

- ETC 403: Wave Theory and Propagation
- ETC 504: RF Modeling and Antennas
- ETC 704: Microwave and Radar Engineering
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Course Objective:

- To understand the integration of microwave devices in the form of IC.
- To understand the basic principles and advanced applications of Microwave Engineering,
- To design different amplifier, oscillator and mixers for various applications.

Course outcome: The students will be able to

- Design and implement the microwave layouts.
- Design and implement the microwave amplifier, oscillator, and mixer circuits.

Module No.		Topics	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**

Recommended Books:

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.

Internal Assessment (IA):
Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:
1. Question paper will comprise of 6 questions, each of 20 marks.
2. Total 4 questions need to be solved.
3. Question No.1 will be compulsory and based on entire syllabus wherein sub questions of 2to 5 marks will be asked.
4. Remaining question will be selected from all the modules.