



Department of Electronics and Communication Engineering
National Institute of Technology, Tiruchirappali-620 015

COURSE PLAN

M.Tech. (communication Systems)

EC 605

MICROWAVE CIRCUITS

COURSE OUTLINE

Course code and name:

EC 605 Microwave Circuits

Course type and Semester Offered

Core course & Postgraduate I-Semester

Number of credits - (L–T–P) C : (3–0–0) 3

Pre-requisites

EC204 Transmission Lines and Wave guides

UG-IV Semester

Department offering the course- ECE

Faculty handling the course

Dr.S.Raghavan B.E., M.Sc.(Engg), Ph.D., Professor, ECE

E-mail of the faculty – raghavan@nitt.edu

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COURSE OVERVIEW

- **The course deals with the following**
- **Microwave Circuit Theory**
 - **The Essentials of Planar Transmission lines and the Design Factors**
 - **Design and layout of all types of M.I.C.Filters.**
 - **The methodology of M.I.C.components design and Layout drawing**
 - **Design Of MIC Amplifiers and Oscillators and to draw the Layout.**

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COURSE OBJECTIVES

- **After the successful completion of the course, the student will be confident to be industrial perfect in the complete design and Layout aspects of Planar Transmission lines, M.I.C.Components, Filters, Amplifiers and Oscillators.**

COURSE OUTCOMES (CO)

CO1: understand the basics of Scattering matrix and two port characterization.

CO2: analyze the design principles of passive microwave components such as couplers and power dividers.

CO3: distinguish between the different types of MIC filters and their implementation.

CO4: understand the complexities of microwave amplifier design and its stability features.

CO5: identify the suitable microwave power sources of given specification for the selected application.

CO6: appreciate the design principles of microwave oscillators

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COURSE CONTENT

TWO-PORT NETWORK CHARACTERIZATION.

Scattering matrix representation of microwave components.

PLANAR TRANSMISSION LINES: Characteristics, properties, design parameters and applications.

DESIGN AND REALIZATION OF MIC COMPONENTS. 3 dB hybrid design. Backward Directional Coupler, Hybrid ring and Power dividers.

MIC FILTERS. Kuroda transformation. K inverter, J inverter. Resonator filters. Realization using microstrip lines and strip lines.

MICROWAVE AMPLIFIER DESIGN. Power gain equations. Maximum gain design. Low noise Design. High power design. Stability considerations.

MICROWAVE OSCILLATOR DESIGN. One – port and two – port negative resistance oscillators. Oscillator design using large – signal measurements.

REFERENCE BOOKS

- **David M.Pozar, Microwave Engineering. John Wiley & Sons, Inc,2013**
- **I.J. Bhal & P. Bhartia, Microwave Solid state Circuit Design, Wiley, 2003.**
- **S.Y. Liao, Microwave Amplifier and Oscillator Design, Pearson Education, 2003.**
- **G. Gonzalez, Microwave Transistors and Amplifiers, Prentice-Hall, Englewoo Cliffs, 1984.**
- **Annapoorna Das, Microwave Engineering, Tata McGraw Hill, 2010.**
- **Application Notes AN 154-Agilent**

COURSE ASSESSMENT

➤ **Internal assessment-50 %**

Assignment -1 (Based on 3 Units) – 05 %

Cycle test -1(first and second unit) – 20 %

Assignment -2 (Based on 2 units) – 05 %

Cycle test -2(third and fourth unit) – 20 %

➤ **End Semester exam-50 %**

(All five units with 10% credence for each unit)

COURSE SLOTS

DEPARTMENT OF **ELECTRONICS AND COMMUNICATION** ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI-620 015

TIME TABLE FOR ACADEMIC YEAR 2016-2017-ODD SEMESTER

DEGREE: M.Tech. Communication System BATCH & SEMESTER: (AY 2016-18) I

Class Committee Chairperson: Dr.E.S. Gopi

Venue: LH-113

Time/ Day	8.30- 9.20	9.20-10.10	10.10- 10.30	10.30-11.20	11.20-12.10	12.10 -1.30	1.30-2.20	2.20-3.10	3.10-4.00	4.00 - 4.30 8	
	1	2		3	4		5	6	7		
Monday		B	I N T E R V A L	C	D	L U N C H	E				
Tuesday		C		D	A		F	←-----Q ₁ -----→			
Wednesday		A		E	B		D				
Thursday	A	E		C				F			
Friday		C					C				

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COURSE TEACHING AND LEARNING ACTIVITIES

Hour	Topic	Mode of delivery
1	INTRODUCTION to the Subject	PPT, Chalk & Talk
2	Input Impedance of a Transmission line	Chalk & Talk
3	Short Circuit , Open Circuit Impedances	Chalk & Talk
4	ABCD Parameters of Z, Y, Transformer and Transmission line	Chalk & Talk
5	Scattering Parameters and Properties	Chalk & Talk
6	ABCD parameters and S parameters Inter relationship	Chalk & Talk
7	Numerical Problems	Chalk & Talk

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Hour	Topic	Mode of delivery
8	Signal Flow Graph-Significance	Chalk & Talk
9	Planar Transmission lines Introduction	PPT,CAD,Chalk & Talk
10	Microstrip Lines Design Essentials	PPT,Chalk & Talk
11	Strip line _Design Essentials	PPT,Chalk & Talk
12	Slot Line, CPW and FIN Line	PPT,Chalk & Talk
13	Nomograms for parameter computations	Chalk & Talk
14	Comparison of variants of Planar Transmission lines,	Chalk & Talk

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Hour	Topic	Mode of delivery
15	3 dB Hybrid Design_ Equations Derivation	Chalk & Talk
16	3 dB Hybrid Design _layout	Chalk & Talk
17	Backward Directional Coupler design Parameters and Layout	Chalk & Talk
18	Hybrid Ring Design Parameters	Chalk & Talk
19	Hybrid Ring Layout	Chalk & Talk
20	Power Dividers Equal and Unequal	Chalk & Talk
21	S Matrix description of the Components	Chalk & Talk

Hour	Topic	Mode of delivery
22	MIC Filters Introduction	Chalk & Talk
23	Filter fundamentals (Image parameters)	Chalk & Talk
24	Butterworth polynomials and Chebyshev polynomials	Chalk & Talk
25	Computations of 'g' values	PPT,CAD,Chalk & Talk
26	K inverter, J Inverter ABCD MATRIX	PPT,Chalk & Talk
27	Kuroda identities	Chalk & Talk
28	Filters-Frequency and Impedance scaling	PPT,Chalk & Talk

Hour	Topic	Mode of delivery
29	Stepped Impedance Method Of Realization of L and C (T- π representation of a Transmission Line)	Chalk & Talk
30	Stub Method of Realization of L and C (Open circuit and Short circuit Impedance Of Transmission Line)	Chalk & Talk
31	Realization and Layout of Microstrip LPF Stepped Impedance Method	Chalk & Talk
32	Realization and Layout of Microstrip LPF Stub Method	Chalk & Talk
33	Coupled Theory and representation of Coupled lines interms of EVEN and ODD mode Impedance	Chalk & Talk
34	Design and Layout of Microstrip BAND PASS Filter	PPT,Chalk & Talk
35	Resonator filters-filter transformations	PPT,Chalk & Talk

Hour	Topic	Mode of delivery
36	Microwave Amplifiers_Introduction	PPT,CAD,Chalk & Talk
37	b ₂ /b _s derivation-Signal Flow graph and Conventional Method	Chalk & Talk
38	Various Power Gains-Derivations	PPT,CAD,Chalk & Talk
39	Computations of Various Power Gains	PPT,CAD,Chalk & Talk
40	Stability factor and Delta Factor	PPT,CAD,Chalk & Talk
41	Smith Chart Solution_ Constant Gain Circles	PPT,CAD,Chalk & Talk
42	Smith Chart Solution_Stability circles	PPT,CAD,Chalk & Talk

Hour	Topic	Mode of delivery
43	Smith Chart Solution_Noise Figure circles	Chalk & Talk
44.	Microwave Oscillator Design_Introduction	Chalk & Talk
45	One Port Oscillator	Chalk & Talk
46	Two Port Oscillator conditions	Chalk & Talk
47	Smith Chart method of Oscillator Design	Chalk & Talk
48	Oscillator Design and Layout	Chalk & Talk
49	Numerical Problems	Chalk and talk

Hour	Topic	Mode of delivery
50	Software Demo	CAD
51	Software Demo	CAD

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Assignments

Assignment-I

Assignment-II: Based on all the units CAD related assignment topics are given.

Tutorials

Numerical problems on the all the topics are given and computations are carried out.

IEEE Papers –First papers by the Introducing Authors_Discussion