



DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE PLAN – PART I			
Name of the programme and specialization	M.Tech. (Communication Systems)		
Course Title	Microwave Circuits		
Course Code	EC605	No. of Credits	3
Course Code of Pre-requisite subject(s)	-		
Session	July 2020	Section (if, applicable)	-
Name of Faculty	Dr.S.Raghavan	Department	ECE
Official Email	raghavan@nitt.edu	Telephone No.	9443130663
Name of Course Coordinator(s) (if, applicable)			
Official E-mail	srk@nitt.edu	Telephone No.	9443494495
Course Type	<input checked="" type="checkbox"/> Core course	<input type="checkbox"/> Elective course	
<b>Syllabus (approved in BoS)</b>			
<p>Introduction and application of microwave circuits - Two-port network characterization. ABCD parameters, Conversion of S matrix in terms of ABCD matrix. Scattering matrix representation of microwave components. Review of Smith chart and its application- Impedance matching using Lumped and Distributed approach.</p> <p>Microwave Passive circuit design: Characteristics, properties, design parameters and applications- Design and realization of MIC Power dividers. 3 dB hybrid design. Directional Coupler design- Hybrid ring design.</p> <p>Microwave filter design- Filter design by insertion loss method –Richards and Kuroda transformation. K inverter, J inverter. Resonator filters. Realization using microstrip lines and strip lines.</p> <p>Microwave amplifier design- Power gain equations -Stability considerations. Maximum gain design, Design for specific gain -Low Noise Amplifier Design. High power design.</p> <p>Microwave oscillator design. One – port and two – port negative resistance oscillators and oscillator design</p>			



**Text Books**

1. Reinhold Ludwig, RF circuit design, 2nd edition, Prentice Hall 2014, ISBN: 978-0131471375
2. David. M. Pozar, Microwave engineering, 4th edition, John Wiley, 2011, ISBN: 978-0470631553.
3. Devendra K. Misra, “Radio-Frequency and microwave communication circuits analysis and design”, 2nd edition, University of Wisconsin-Mulwaukee, A John Wiley & Sons Publication

**Reference Books**

1. B. Bhat, S. K Koul, “Stripline like transmission lines for Microwave Integrated Circuits”, New Age International Pvt. Ltd Publishers, 2007.
2. I.J.Bahl & P.Bhartia, “Microwave Solid state Circuit Design (2/e)”, Wiley, 2003.
3. Matthew M. Radmanesh, Radio Frequency and Microwave Electronics Illustrated, Prentice Hall, 2012
4. S.Y.Liao, “Microwave Circuit Analysis and Amplifier Design”, Prentice-Hall, 1986.
5. G. Mathaei, L young, E.M.T. Jones, “Microwave filters, Impedance-Matching networks and Coupling structures”, Artech House Books.

**COURSE OBJECTIVES**

To make the students familiarize with ABCD parameters, S parameters, Applications of planar transmission lines in the practical microwave circuits, Design and layout of all Microwave Integrated Circuit Design components and then systems.

**MAPPING OF COs with POs**

Course Outcomes	Programme Outcomes (PO) (Enter Numbers only)
1. Understand the basics of Scattering matrix and two port characterization and importance of matching circuits	1, 5
2. Analyze the working principles of couplers, power dividers etc. and their design.	2, 4, 5
3. Design the different types of MIC filters and their implementation.	3, 4
4. Understand the complexities of microwave amplifier design and its stability features.	1, 4, 5
5. Analyze and appreciate the design principles of microwave oscillators.	2, 4, 5

**COURSE PLAN – PART II**

**COURSE OVERVIEW**

A deep understanding of various microwave circuits and the design parameters of those could be obtained. The network parameters of microwave circuits is analysed using the transforms and the complete design of microwave filters is implemented. At last the design and realization of Microwave Integrated Circuit components such as amplifiers and oscillators are studied.

**COURSE TEACHING AND LEARNING ACTIVITIES**

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	Week 1 - 3	A brief introduction about the two port network parameters and application of Microwave circuits. Use of Smith Chart	Online/PPT/ Demo/Tutorial/ Simulation



		(graphical tool) for solving various microwave related problems and its applications will be discussed. Microwave measurements; frequency, wavelength, VSWR. Impedance determination. S parameter measurements. Network analyzer.	
2	Week 4 - 5	Design and realization of MIC components. 3 dB hybrid design. Ratrace Hybrid Ring, Backward wave directional coupler, power divider; realization using microstrip lines and strip lines.	Online/PPT/ Demo/Tutorial/ Simulation
3	Week 6 - 8	MIC filter design with techniques such as Insertion loss method, Richard transformation and Kuroda identity. Low pass to high pass, band pass and band stop transformations. Realization using microstrip lines and strip lines.	Online/PPT/ Demo/Tutorial/ Simulation
4	Week 9 - 10	Amplifier design and stability considerations. Gain and Low Noise Amplifier characteristics. Design of High power amplifier.	
5	Week 11 - 13	Design of Oscillator with various configurations of negative resistance, one port and two port model	Online/PPT/ Demo/Tutorial/ Simulation

**COURSE ASSESSMENT METHODS**

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assessment I	Week 4	60 min	20
2	Assessment II	Week 9	60 min	20
3	Assignment	Submission and Demo before Week 14	-	30
4	Final Assessment	Week 15	120 min	30
CPA	Compensation Assessment	Week 13	60 min	20

**COURSE EXIT SURVEY**



1. The students through class representative may give their feedback at any time which will be duly addressed.
2. Feedback from the students through online class committee meetings (if held)

## **COURSE POLICY**

### **MODE OF CORRESPONDENCE (email/ phone etc)**

1. All the students are advised to attend the online class regularly. All the correspondence (schedule of classes/ schedule of assignment/ course material/ any other information regarding this course) will be intimated during the online session only.

### **COMPENSATION ASSESSMENT POLICY**

1. Attending all the assessments (Assessments 1-4) are MANDATORY for every students.
2. If any student is not able to attend Assessment-1 (1<sup>st</sup> Cycle Test) / Assessment-2 (2<sup>nd</sup> Cycle Test) due to genuine reason and have given prior information about it, then the student is permitted to attend the CPA with 20% weightage of 100 (20 marks) with combined portions of both Assessment I and II.
3. In any case, retest will not be considered as an improvement test.

### **ATTENDANCE POLICY** (A uniform attendance policy as specified below shall be followed)

- At least 75% attendance in each course is mandatory.
- A maximum of 10% shall be allowed under On Duty (OD) category.
- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

### **ACADEMIC DISHONESTY & PLAGIARISM**

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.
- The above policy against academic dishonesty shall be applicable for all the programmes.

### **ADDITIONAL INFORMATION, IF ANY**



Students can approach the course faculty regarding the doubts in the subject during the office hours either in the online class or through E-mail (raghavan@nitt.edu).

**FOR APPROVAL**

Course Faculty \_\_\_\_\_

CC- Chairperson \_\_\_\_\_

HOD \_\_\_\_\_



**Guidelines**

- a) The number of assessments for any theory course shall range from 4 to 6.
- b) Every theory course shall have a final assessment on the entire syllabus with at least 30% weightage.
- c) One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered.
- d) The passing minimum shall be as per the regulations.

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2018	2017	2016	2015	
35% or (Class average/2) whichever is greater.		(Peak/3) or (Class Average/2) whichever is lower		40%

- e) Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.
- f) Absolute grading policy shall be incorporated if the number of students per course is less than 10.
- g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.