

Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NECD540	RF and Microwave MEMS	3	0	0	3

Course Objective

This course is designed to familiarize the students to Formulate fabrication steps for passive and active MEMS devices, model MEMS filters and Phase shifters, analyze reliability issues in MEMS structures.

Learning Outcomes

Classify several RF for MEMS devices, their parameters and packaging standards, Model MEMS filters and Phase shifters for specific RF applications, Design micro machined passive components such as Inductors, Capacitors, Switches, Transmission lines and Antennas.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Maxwell's Equation, Boundary conditions, Power & Energy and Time harmonic electromagnetic fields, Classification of EM Problems and Some Important Theorem, etc. Wave equation and solution, analytical solution, Solution of inhomogeneous vector potential wave equations.	10	Basic idea of electromagnetics and some useful theorem for basic understanding of the MEMS.
2	Review of fundamentals of microwave transmission lines and circuits; Conventional design of microwave components and subsystems. Micro machined passive elements; Micro machined inductors: Effect of inductor layout, reduction of stray capacitance of planar inductors, folded inductors, variable inductors and polymer-based inductors; MEMS Capacitors: Gap-tuning and area-tuning capacitors, dielectric tunable capacitors.	10	Understanding of basics of RF/Microwave Engineering, transmission line, key parameters familiarization of Smith chart, and MEMS inductor and capacitors.
3	Introduction to RF MEMS technologies: Need for RF MEMS components in communications, space and defense applications, Materials and fabrication technologies, Actuation methods in MEMS, Special considerations in RF MEMS design. micro machined filters for millimeter wave frequencies; Various types of MEMS phase shifters; Ferroelectric phase shifters, MEMS Switches.	12	Student will familiarize the basics RF MEMS and design components of the same.
4	Examples of RF MEMS components and case studies: Micro-switches, Planar, on-chip components, Transmission lines and other components, Micro-machined antennas, Micro-machined phase shifters. Role of MEMS packages, types of MEMS packages, module packaging, packaging materials and reliability issues.	10	Students will able to understand different RF MEMS and its applications in different domains.
Total		42	

Text Book:

1. Rebeiz G M, "MEMS: Theory Design and Technology", John Wiley & Sons, 1999

Reference Books:

1. De Los Santos H J, "RF MEMS Circuit Design for Wireless Communications", Artech House, 1999
2. Trimmer W, "Micromechanics & MEMS", IEEE Press, 1965
3. Madou M, "Fundamentals of Microfabrication", CRC Press, 1997