Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NECD539	Radio Frequency Integrated Circuits	3	0	0	3

Course Objective
The objective of the course is to present an introduction to Radio Frequency Integrated Circuits, with an emphasis on how to design - efficiently, and effectively – a RFIC.
Learning Outcomes
Upon successful completion of this course, students will: • have a broad understanding of design and challenges of architecture of RF transceiver. • have a high-level understanding of design of LNA. • have a high-level understanding of design of RF Power Amplifier. • have a high-level understanding of design of RF Mixer. • have a high-level understanding of design of RF Oscillator.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Fundamentals of RF circuits and systems: Duplexing, FDMA, dB, dBm, Voltage gain, Channel, ACR, AACR, Noise factor, NF of a cascaded system, Sensitivity, HD, Gain compression, P1dB, Cross modulation, Inter modulation, IM3, IIP3, SFDR, Transmit mask.	7	This unit will help students to get information about different parameters of RF circuits.
2	Transmitter and Receiver architectures: Review of modulation schemes, Receiver architectures, Transmitter architectures Passive and active components for CMOS RFIC: Review of MOSFET, RF transistor layout, CMOS process, Capacitors, Varactors, Resistors, Inductors, Transformers, Transmission lines Resonance, Matching, S-parameters, etc. Noise in electrical circuits and NF calculations, Two port noise theory.	7	This unit will help students in understanding the steps to design RF Transceivers.
3	Low Noise Amplifiers: Resistive terminated CS and CG LNA, Inductive degenerated LNA, Shunt feedback LNA, Noise canceling LNAs, Linearity improvement techniques.	7	This will help in designing LNAs.
4	Power Amplifiers: Basics and Class A, B, C, D, E, F and other configurations, Power combining, Linearity improvement techniques.	7	This will help in designing RF Power Amplifiers.
5	Mixers: Specifications, NL system as a mixer, Active mixers, Passive mixers.	6	This will help in designing RF Mixers.
6	Oscillators: Introduction, LC Oscillators, Phase noise, Introduction to PLLs; Type-I PLLs, Charge pump PLLs: Mathematical model, Design issues and Phase noise, Frequency synthesizers: Integer N synthesizers, Dividers.	8	This will help in designing RF Oscillators.
	Total	**42**	

Text Book:

1. RF Microelectronics by BehzadRazavi, Pearson, Second Edition.

Reference Book:

1. Microwave Transistor Amplifier, Analysis and Design by Gullermo Gonzalez, Prentica Hall, Second Edition.