NIRMA UNIVERSITY
SCHOOL OF TECHNOLOGY, INSTITUTE OF TECHNOLOGY
M.Tech. in Electronics & Communication Engineering (VLSI Design)
M.Tech. Semester - II
<u>Department Elective I</u>

L	T	Practical component				C
		LPW	PW	W	S	
3	-	-	-	-	-	3

Course Code	6EC164ME22
Course Title	CMOS RF Circuit Design

Course Learning Outcomes (CLOs):

At the end of the course, students will be able to -
1. Evaluate receiver architectures based on the RF performance parameters.
2. Analyse high frequency MOS based circuits working under Linear or Saturation Region.
3. Design and implement RF integrated circuits using active and passive components for given specifications.

Syllabus: **Teaching Hours:45**

UNIT I: Introduction and Transmission Media   **04**
Introduction and applications of RF systems. RF systems – Basic architectures, Transmission media and reflections, Maximum power transfer.

UNIT II: RF Concepts   **05**
Smith Charts, Two Port networks, Noise, Non-linearity, Sensitivity and Dynamic Range.

UNIT III: RLC Circuits using MOS   **04**
Matching networks basics, Pi network, T network, RL, RC and RLC matching circuits, Fabrication of passive Devices using MOS.

UNIT VI: Noise   **04**
Types of noises, Noise in MOSFETs, Noise modelling for CMOS, Intrinsic MOS noise parameters, Noise figure.

UNIT V: LNA and Mixer   **09**
Power match versus noise match, Large signal performance, Mixer basics, single balanced mixers, double balanced mixers.

UNIT VI: RF Power Amplifiers   **06**
Class A, AB, B, C amplifiers, Class D, E, F amplifiers.

UNIT VII: Phase Lock Loops, Oscillators and Frequency Synthesizers   **13**
Linearized PLL models, Phase detectors, charge pumps, Loop filters, Resonators, Negative resistance, Oscillators, Frequency division, Integer-N synthesis, Fractional frequency synthesis, NCO and DDS

Self-Study:
The self-study contents will be declared at the commencement of Semester. Around 10% of the questions will be asked from self-study contents.

Suggested Readings:
1. Thomas H. Lee, The Design of CMOS Radio-Frequency Integrated Circuits, Cambridge University Press
2. Behzad Razavi, RF Microelectronics, Prentice Hall of India
3. Bosco Lenug , VLSI for Wireless Communication, Prentice Hall of India
4. Robert Caverly, CMOS RF IC Design Principles, Artech House.
5. M. Jamal Deen, Tor A. Fjeldly, CMOS RF Modelling characterization and application, World Scientific Publication