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

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Course Code	**6EC173ME22**
Course Title	**MEMS Design**

Course Learning Outcomes (CLOs):

At the end of the course, students will be able to -

1. Comprehend the concepts of advanced Micro/Nano fabrication technologies.
2. Develop the applications of MEMS in area of optical, modulators, switches, and displays.
3. Apply design techniques of RF MEMS switches, relays, varactor, phase shifter, antennas.

Syllabus: **Teaching Hours:45**

UNIT I: Introduction to MEMS **08**

Advanced Micro/Nano Fabrication Technologies: Plasma physics, ICP etch, Deep Si etch, Deep oxide etch, Surface micromachining, Bulk micromachining: multiple wafer stack, SOI, SCREAM, CMOS-MEMS: Thin-film, bulk, DRIE, CMOS-based Sensors and Interface Circuits Design

UNIT II: Electrical, Mechanical and Optical properties of MEMS material **10**

Chemical, Thermal, Inertial, Interface circuit design, Optical MEMS: Fundamentals of light: Propagation, Interference, Doppler Effect, Polarization, Coherence, Micromirrors, Microlens; Microgratings Corner cube reflectors, Optical communications, case study

UNIT III: Applications of MEMS **10**

Phase modulators, attenuators, switches, Displays, Scanners, Biosensors, Spectroscopy

UNIT IV: RF MEMS **13**

RF MEMS switches and Micro Relays, MEMS varactors and inductors, MEMS phase shifters and filters, Micro machined Antenna, case study

UNIT V: MEMS Packaging **04**

Packaging design, materials, Packaging techniques: Bonding, Sealing, Dicing, Wafer-level packaging, Packaging for medical, aerospace and RF MEMS applications

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.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 10 experiments to be incorporated.

Suggested Readings:

1. G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill
2. S. Senturia, Microsystem Design, Kluwer Academic Publishers
3. M. Madou, Fundamentals of Microfabrication, Chemical Rubber Company Press
4. G. Rebeiz, RF MEMS: Theory, Design and Technology, John Wiley & Sons
5. B. Bouma and G. Tearney, Handbook of Optical Coherence Tomography, Marcel Dekker Inc