

NIRMA UNIVERSITY
School of Technology, Institute of Technology
B.Tech. Electronics & Communication Engineering
Semester - VII
Department Elective IV

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Course Code	2ECDE09
Course Title	MEMS Design

Course Outcomes (COs):

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

1. analyze the concepts of advanced Micro/Nanofabrication technologies.
2. design different techniques and processes for microsensors.
3. identify applications of MEMS in the area of optical communication, RF modulators, switches, devices, and displays.
4. apply techniques of RF MEMS switches in the design of relays, varactors, phase shifter, and antennas.

Syllabus

Teaching hours: 45

UNIT I: Introduction to MEMS

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 **08**

UNIT II: Optical MEMS

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 **08**

UNIT III: RF MEMS

Phase modulators, attenuators, switches, Displays, Scanners, Biosensors, Spectroscopy; Biomedical Imaging, RF MEMS **10**

UNIT IV: RF MEMS Switches

RF MEMS switches and Micro Relays, MEMS varactors and inductors, MEMS phase shifters and filters, micromachined antennas **10**

UNIT V: MEMS Packaging

MEMS Packaging: Packaging design, materials, packaging techniques: Bonding, Sealing, Dicing, Wafer-level packaging, packaging for medical, aerospace, and RF MEMS applications **04**

UNIT VI: RF MEMS Case Studies

Case Study on RF MEMS switches, RF MEMS attenuators, RF MEMS resonators, etc. **05**

Self-Study:

The self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study contents.

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

L = Lecture, T = Tutorial, P = Practical, C = Credit