

(EC538) MICRO ELECTRO MECHANICAL SYSTEMS
(ELECTIVE - II)

Objective of the Course : This course is designed to equip students with fundamental understanding of the basic multi - physics that govern the behaviour of most classes of MEMs.

UNIT - I

Introduction, Basic Structures of MEM Devices – (Canti Levers, Fixed Beams diaphragms). Broad Response of Micro Electromechanical Systems (MEMs) to Mechanical (force, pressure etc.) Thermal, Electrical, Optical and Magnetic stimuli, Compatibility of MEMS from the point of Power Dissipation, Leakage etc.

UNIT - II

Review of Mechanical Concepts like Stress, Strain, Bending Moment, Deflection Curve. Differential equations describing the Deflection under Concentrated Force, Distributed Force, Deflection Curves for Canti Levers – Fixed beam. Electrostatic Excitation – Columbic Force between the Fixed and Moving Electrodes. Deflection with voltage in C.L, Deflection Vs Voltage Curve, Critical Fringe Fields – Field Calculations using Laplace Equation. Discussion on the Approximate Solutions – Transient Response of the MEMS.

UNIT - III

Two Terminal MEMS – capacitance Vs Voltage Curve – Variable Capacitor. Applications of Variable Capacitors. Two Terminal MEM Structures. Three Terminal MEM structures – Controlled Variable Capacitors – MEM as a Switch and Possible Applications.

UNIT - IV

MEM Circuits & Structures for Simple GATES – AND, OR, NAND, NOR, Exclusive OR, simple MEM Configurations for Flip-Flops Triggering, Applications to Counters, Converters. Applications for Analog Circuits like Frequency Converters, Wave Shaping. RF Switches for Modulation. MEM Transducers for Pressure, Force Temperature. Optical MEMS.

UNIT - V

MEM Technologies: Silicon Based MEMS – Process Flow – Brief Account of Various Processes and Layers like Fixed Layer, Moving Layers, Spacers Etc., Etching Technologies.

Metal Based MEMS: Thin and Thick Film Technologies for MEMS. PROCESS flow and Description of the Processes. Status of MEMS in the Current Electronics scenario.

REFERENCE BOOKS:

1. Gabriel.M.Review, R.F. "MEMS Theory, Design and Technology", John Wiley & Sons, 2003.
2. Thimo Shenko, "Strength of Materials", CBS Publishers & Distributors., 2000.
3. Ristic L. (Ed.), "Sensor Technology and Devices", Artech House, London 1994.
4. Servey E.Lyshevski, "MEMS and NEMS, Systems Devices; and Structures", CRC Press, 2002.