

**EC465 203 MEMS****Module 1**

MEMS and Microsystems: Applications – Multidisciplinary nature of MEMS – principles and examples of Micro sensors and micro actuators – micro accelerometer – comb drives - Micro grippers – micro motors, micro valves, micro pumps, Shape Memory Alloys.

Review of Mechanical concepts: Stress, Strain, Modulus of Elasticity, yield strength, ultimate strength – General stress strain relations – compliance matrix. Overview of commonly used mechanical structures in MEMS - Beams, Cantilevers, Plates, Diaphragms – Typical applications

Module 2

Flexural beams: Types of Beams, longitudinal strain under pure bending – Deflection of beams – Spring constant of cantilever – Intrinsic stresses

Actuation and Sensing techniques : Thermal sensors and actuators, Electrostatic sensors and actuators , Piezoelectric sensors and actuators, magnetic actuators.

Module 3

Scaling laws in miniaturization - scaling in geometry, scaling in rigid body dynamics, Trimmer force scaling vector, scaling in electrostatic and electromagnetic forces, scaling in electricity and fluidic dynamics, scaling in heat conducting and heat convection.

Module 4

Materials for MEMS – Silicon – Silicon compounds – Silicon Nitride, Silicon Dioxide, Silicon carbide, Poly Silicon, GaAs ,Silicon Piezo resistors.

Polymers in MEMS – SU-8, PMMA, PDMS, Langmuir – Blodgett Films, Micro System fabrication – Photolithography – Ion implantation- Diffusion – Oxidation – Chemical vapour deposition – Etching.

Module 5.

Overview of Micro manufacturing – Bulk micro manufacturing, Surface micro machining, LIGA process –Microstereo lithography.

Micro system Packaging: general considerations in packaging design – Levels of Micro system packaging.

Module 6

Bonding techniques for MEMS : Surface bonding , Anodic bonding , Silicon - on - Insulator , wire bonding , Sealing – Assembly of micro systems.

Overview of MEMS areas : RF MEMS, BioMEMS, MOEMS, NEMS