

KL University
Department of Electronics & Computer Engineering
M.Tech (wcsn) 2015-2017

Course Code : 15-EM5213
Course Title : Micro Electro Mechanical systems (MEMS)
Course Structure : 3-2-0
Credits : 4

SYLLABUS:

Unit-1

Overview of MEMS and Micro Systems: Introduction, miniaturization, Reliability, Advantages of MEMS, working principles of chemical sensors, optical, pressure and thermal sensors, micro actuation: actuation using thermal forces, actuation using piezo electric crystals, actuation using electrostatic forces; micro accelerometers, micro fluidics, MEMS switches, phase shifters, varactors, tunable oscillators

Unit-2

Basics of MEMS technology: Molecular theory of matter and intermolecular forces, doping of semi conductors, the diffusion process, scaling laws in miniaturization, Engineering mechanics: static bending of thin plates, mechanical vibrations, thermo mechanics, fluid flow in nano scale.

Unit-3

Micro system Design: Introduction, design considerations, process design, mechanical design, micro system packaging, essential packaging technologies, 3D packaging, assembly, selection of materials, Finite Element Analysis (FEA).

Unit-4

Fabrication methods: Lithography: Introduction, wafers, masks, spinning resist and soft baking, exposure and post exposure treatment, resolution, mathematical expression of resist profiles, image reversal, interface effects, radiation and resist profiles, ion implantation, diffusion, oxidation, RIE, Chemical Vapour Deposition (CVD), Physical Vapour Deposition (PVD), deposition by epitaxy, comparison of bulk and surface micromachining, comparison of wet and dry etching, LIGA process. System level packaging, single and multichip packaging.

Unit-5

Case Study: MEMS capacitive switch, MEMS capacitive accelerometer, MEMS pressure sensor, quartz rate gyroscope, cantilever based micro cantilevers for mass measurement.

Text Books:

1. Microsystem Design by *Stephen D.Senturia*, Springer International Edition, 2010
2. RF MEMS Theory, Design and Technology by *Gabriel M.Rebeiz*, Wiley India Pvt Ltd.
3. MEMS and Microsystems: Design and Manufacture by *Tai-Ran Hsu*, Tata McGraw Hill, 2002
4. The MEMS Handbook, *Mohamed Gad-el-Hak*, CRC Press, 2002.
5. Foundations of MEMS by *Chang Liu*, Second Edition, Pearson Publication