MICROSYSTEMS – PRINCIPLES, DESIGN AND APPLICATION

MODULE – I (11 hours)

Introduction: MEMS, MEMS Processing, Micromachining, Wafer Bonding, LIGA, MEMS Examples, Scaling Laws

MEMS Materials: MEMS Materials, Silicon, Crystal Defects, Mechanical Properties of Materials, Beams and structures, Piezoelectric Materials, Piezoresistive Materials

MEMS Sensor: Resistive and Capacitive methods, Strain gauges, Piezoresistivity, MEMS Capacitive Sensors, MEMS Position sensor, MEMS Pressure sensor

MODULE – II (11 hours)

MEMS Sensor (Continued): MEMS Accelerometer, MEMS Gyroscope, MEMS Gas Sensors, Cantilever Sensors

MEMS Actuator: Electrostatic MEMS actuators, Comb drives, MEMS RF resonator, Scratch drive, Inchworm motor, Piezoelectric MEMS actuators, Thermal MEMS actuators, Magnetic MEMS actuators

MODULE – III (12 hours)

Optical MEMS: MEMS Infrared sensor, Digital Mirror Displays, Grating Light Valve Displays, Micro-optical elements

Micro-fluidics, Chemical MEMS: Microfluidics – Fluid flow, Electro-osmotic flow, Electrophoresis, Micropumps, Microvalves, Fabrication Process for microfuidic chip, Lab-on-a-Chip, µ-TAS, Inkjet Printer Head

Bio MEMS: DNA Analysis, Micro-array Gene Chip, Micro-surgery, Drug delivery

Text Books:

1. Stephen D. Senturia, *Microsystem Design*, Kluwer Academic/Springer, 2nd edn. (2005), ISBN: 0792372468
2. R.S. Muller and A.P. Pisano, *Micro Actuators*, IEEE Press, 2000.
3. P. Rai-Choudhury, *Recent Advances in MEMS/MOEMS Technologies*, SPIE Press, 2000.
4. S.M. Sze, *Semiconductor Sensors*, Wiley-Interscience Publishers, 1994.
5. T. Fukuda, and W. Menz, (Eds), *Micro Mechanical Systems: Principles and Technology, Handbook of Sensors and Actuators*, Vol. 6, Elsevier, 1998.