1152AU129	MICRO ELECTRO MECHANICAL SYSTEMS	L	T	P	C
		3	0	0	3

1. Preamble

This course explain the MEMS sensors and actuators are used for intelligent embedded systems interacting with automobiles

2. Pre-requisite

NIL

3. Course Outcomes

Upon the successful completion of the course, learners will be able to

CO Nos.	Course Outcomes	Level of learning domain (Based on revised Bloom's)
C01	List the micro fabrication procedures of silicon chips & its mechanical properties	K2
C02	Explain the working of Electrostatic sensors and its applications in real time scenario	K2
C03	Demonstrate the design and fabrication methods of thermal sensors and its applications	K2
C04	Illustrate the fabrication process of Piezo electric sensors and actuators & applications	K2
C05	Explain the magnetic actuators & Micro fluid applications towards medical applications	K2

4. Correlation with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	H	M	L	H							L	L
CO2	H	H	H	M	L	H							M	M
CO3	H	H	H	M	L	H							M	M
CO4	H	H	H	M	L	H							M	M
CO5	H	H	H	M	L	H							M	M

H- Strong; M-Medium; L-Low

5. Course content

UNIT I FOUNDATION IN MICROSYSTEMS **L-9**

Review of Microelectronics Manufacture and Introduction to MEMS - Overview of Micro Systems Technology, Laws of Scaling - The Multi Disciplinary Nature of MEMS - Survey of Materials Central to Micro Engineering - Applications of MEMS in Various Industries

UNIT II MICRO MANUFACTURING TECHNIQUES **L-9**

Photolithography - Film Deposition, Etching Processes - Bulk Micro Machining, Silicon Surface Micro Machining - LIGA Process - Rapid Micro Product Development.

UNIT III MICRO SENSORS **L-9**

Introduction, Micro-Sensor Measurement Principle, Micro-Sensor Fabrication Techniques, Modeling, Micro Pressure Sensors, Micro Accelerometer, Sensors, Micro Thermal Sensors, Micro Floor Sensors, Micro Chemical Sensors, Micro Optical Sensors, Micro Sensor for Humidity and Displacement, Application of Micro Sensors,MEMS Based Gyro

UNIT IV MICRO ACTUATORS **L-9**

Introduction, Classification of Micro Actuators, Electro Static, Optical Micro – Actuators Energy Conversion and Force Generation-Electromagnetic Actuators, Reluctance Motors, Piezoelectric Actuators, Bi-Metal-Actuator Friction and Wear -Transducer Principles

UNIT V INTRODUCTION TO MICRO/NANO FLUIDS **L-9**

Fundamentals of Micro Fluidics- Micro Pump – Introduction – Types - Mechanical Micro Pump Non Mechanical Micro Pumps, Actuating Principles, Design Rules for Micro Pump – Modeling and Simulation, Verification and Testing –Applications.

TOTAL: 45 periods

6. Text Books

1. Chang Liu, "Foundations of MEMS", Pearson International Edition, 2006.
2. Marc Madou , "Fundamentals of microfabrication",CRC Press, 1997.

7. References

1. Richard, W., Heine Carl R. Loper Jr. and Philip, C., Rosenthal, Principles of Metal Casting, McGraw-Hill Book Co., 1980.
2. IS: 1602 – 1960 Code for testing of variable speed internal Combustion engines for Automobile Purposes, 1966.