SWARNANDHRA COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

Narsapur, West Godavari District, A.P. 534280

DEPARTMENT OF MECHANICAL ENGINEERING

LESSON PLAN

Course Code	Course Title	Semester	Branches	Contact Periods /Week	Academic Year	Date of commencement of Semester
23RB6E02	Micro Electro Mechanical Systems	VI	Mechanical Engineering	5	2025-26	10-12-2025

COURSE OUTCOMES

1	Describe basics of Micro Electromechanical Systems (MEMS), mechanical sensors and actuators. [K2]
2	Illustrate thermal sensors and actuators used in MEMS. [K3]
3	Describe the principle of magnetic sensors and actuators. [K2]
4	Apply the principle and various devices of Micro-Opto-Electro Mechanical Systems. [K2]
5	Analyze applications and considerations on micro fluidic systems. [K2]
6	Illustrate the principles of chemical and biomedical micro systems. [K3]

UNIT	Outcomes / Bloom's Level	Topics No.	Topics/Activity	Text Book / Reference	Contact Hour	Delivery Method
			INTRODUCTION			
I	Describe basics of Micro Electromechanical Systems (MEMS), mechanical sensors and actuators. [K2]	1.1	Introduction about Micro Electromechanical Systems	T1, T2	1	Chalk & Talk, PPT & Think share Pair
		1.2	MEMS history and development	T1, T2	1	
		1.3	Lithography Principles & Methods	T1, T2	1	
		1.4	Structural and Sacrificial Materials	T1, T2	1	
		1.5	Thin Film Deposition	T1, T2	1	
		1.6	Impurity Doping	T1, T2	1	
		1.7	Surface Micro machining	T1, T2	1	
		1.8	Wafer Bonding	T1, T2	1	
		1.9	LIGA method	T1, T2	1	

		MECHANICAL SENSORS AND ACTUATORS				
		1.10	Principles of sensing and actuation	T1, T2	1	
		1.11	Beam and cantilever actuator	T1, T2	1	
		1.12	Shear mode piezo actuator	T1, T2	1	
		1.13	Flow Sensor actuator	T1, T2	1	
		1.14	Gripping piezo actuator	T1, T2	1	
Total					**14**	
THERMAL SENSORS AND ACTUATORS						
II	Illustrate thermal sensors and actuators used in MEMS. [K3]	2.1	Heat transfer processes	T1, T3	1	Chalk & Talk, & Video
		2.2	Thermos devices	T1, T3	1	
		2.3	Thermocouple	T1, T3	1	
		2.4	Peltier effect heat pumps	T1, T3	1	
		2.5	Thermal flow sensors	T1, T3	1	
		2.6	Shape memory alloys	T1, T3	1	
		2.7	Micro spring thermal actuator	T1, T3	1	
		2.8	Data storage cantilever	T1, T3	1	
Total					**08**	
MAGNETIC SENSORS AND ACTUATORS						
III	Describe the principle of magnetic sensors and actuators [K2]	3.1	Magnetic materials for MEMS and properties	T1, R1	1	Chalk & Talk, & Quiz
		3.2	Magnetic sensing and detection	T1, R1	1	
		3.3	Magneto resistive sensor	T1, R1	1	
		3.4	MEMS magnetic sensor	T1, R1	1	
		3.5	Feedback circuit integrated magnetic sensor	T1, R1	1	
		3.6	Magnetic probe-based storage device.	T1, R1	1	
		MICRO-OPTO-ELECTROMECHANICALSYSTEMS				
		3.7	Principle of MOEMS technology	T1, R1	1	
		3.8	Properties of light & modulators	T1, R1	1	
		3.9	Beam splitter and microlens	T1, R1	1	

	Apply the principle and various devices of Micro-Opto-Electro Mechanical Systems. [K3]	3.10	Micromirrors and digital micromirror device	T1, R1	1	
		3.11	light detectors, Grating Light Valve	T1, R1	1	
		3.12	Optical Switch, Waveguide	T1, R1	1	
Total					**12**	
MICRO FLUIDIC SYSTEMS						
IV	Discuss the applications of micro fluidic systems. [K2]	5.1	Applications of micro fluidic systems	T1, T2	1	Chalk & Talk, & Video
		5.2	Fluid actuation methods	T1, T2	1	
		5.3	Dielectrophoresis	T1, T2	1	
		5.4	Electro Wetting	T1, T2	1	
		5.5	Electro thermal flow	T1, T2	1	
		5.6	Electro Thermal Flow	T1, T2	1	
		5.7	Electro Osmosis Flow	T1, T2	1	
		5.8	Opto electro wetting	T1, T2	1	
		5.9	Micro fluidic channel	T1, T2	1	
		5.10	Micro fluid dispenser, microneedle	T1, T2	1	
		5.11	Molecular gate, micro pumps.	T1, T2	1	
Total					**11**	
CHEMICAL AND BIOMEDICAL MICRO SYSTEMS						
V	Illustrate the principles of chemical and biomedical micro systems. [K3]	5.1	Sensing mechanism & principle	T1, T2	1	Chalk & Talk, & Video
		5.2	Membrane-transducer materials	T1, T2	1	
		5.3	Chem.-Lab-On-a-Chip	T1, T2	1	
		5.4	Chemo-resistors	T1, T2	1	
		5.5	Chemo-capacitors	T1, T2	1	
		5.6	Chemo-transistors	T1, T2	1	
		5.7	Electronic Nose (E-Nose)	T1, T2	1	
		5.8	Mass sensitive chemo-sensors	T1, T2	1	
		5.9	Fluorescence detection	T1, T2	1	
		5.10	Calorimetric spectroscopy	T1, T2	1	
Course Beyond Syllabus			MEMS for space Application	web	1	
Total					**11**	
CUMULATIVE PROPOSED PERIODS					**56**	

Textbooks:	
S.No.	AUTHORS, BOOK TITLE, EDITION, PUBLISHER, YEAR OF PUBLICATION
T1	Mahalik N P, MEMS, Tata McGraw-Hill Education (India) Pvt Limited, 2013.
T2	Rai - Choudhury P, MEMS and MOEMS Technology and Applications, PHI Learning Private Limited, 2009.
T3	Nadim Maluf, An Introduction to Micro Electro Mechanical System Design,2nd Edition, Artech House, 2004.

Reference Books:	
S.No.	AUTHORS, BOOK TITLE, EDITION, PUBLISHER, YEAR OF PUBLICATION
R1	Tai-Ran Hsu, MEMS and Micro Systems: Design and Manufacture,1st Edition, McGraw Hill Education, 2017
R2	Chang Liu, Foundation of MEMS, 2nd Edition, Pearson Education, 2011
R3	Gerald Urban, Bio-MEMS (Micro systems), Springer.2006
R4	Mohamed Gad-el-Hak, MEMS Handbook, CRC Press, 2002.

Web Details	
	https://nptel.ac.in/courses/117105082
	https://lecturenotes.in/subject/134/micro-electro-mechanical-systems

		Name	Signature with Date
i.	Faculty	Dr. R Sanjeev Kumar	
ii.	Course Coordinator	Dr. R Sanjeev Kumar	
iii.	Module Coordinator	Dr. D Bhanu Prakash	
iv.	Programme Coordinator	Dr. M Francis Luther King	

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Principal