



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	Cont act Hour	Delivery Method
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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	



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MECHANICAL SENSORS AND ACTUATORS				
1.10 1.11 1.12 1.13 1.14	Principles of sensing and actuation	T1, T2	1	
	Beam and cantilever actuator	T1, T2	1	
	Shear mode piezo actuator	T1, T2	1	
	Flow Sensor actuator	T1, T2	1	
	Gripping piezo actuator	T1, T2	1	

Total **14**

THERMAL SENSORS AND ACTUATORS

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

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-ELECTROMECHANICAL SYSTEMS					
	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		

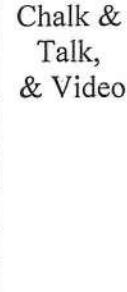
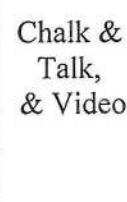


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Apply the principle and various devices of Micro-Opto-Electro Mechanical Systems. [K3]	3.10 Micromirrors and digital micromirror device	T1, R1	1	
	3.11 light detectors, Grating Light Valve	T1, R1	1	
	3.12 Optical Switch, Waveguide	T1, R1	1	
Total				12
MICRO FLUIDIC SYSTEMS				
5.1 Applications of micro fluidic systems	T1, T2	1		
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				
Illustrate the principles of chemical and biomedical micro systems. [K3]	5.1 Sensing mechanism & principle	T1, T2	1	
	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



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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, 2 nd 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, 1 st Edition, McGraw Hill Education, 2017
R2	Chang Liu, Foundation of MEMS, 2 nd 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	



Principal