GANPAT UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

Programme	Bachelor of Technology	Branch/Spec.	Electronics and Communication Engineering
Semester	VII	Version	1.0.0.0
Effective from Academic Year	2026-27	Effective for the Batch admitted in	July 2023
Course Code	2EC71PE09	Course Name	Introduction to MEMS

Teaching Scheme						Examination Scheme (Marks)			
(Per week)	Lecture (DT)		Practical (Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	3	0	1	0	4	Theory	40	60	100
Hours	3	0	2	0	5	Practical	30	20	50

Pre-requisites

Course Outcomes

On successful completion of the course, the students will be able to:

CO1	Explain the fundamentals, classification, and applications of Micro-Electro-Mechanical Systems (MEMS).
CO2	Describe MEMS materials, microfabrication processes, and basic mechanical structures used in MEMS devices.
CO3	Analyze the working principles of common MEMS sensors and actuators used in industrial and consumer applications..
CO4	Identify MEMS-based applications in automotive, biomedical, communication, and consumer electronics domains.

Theory Syllabus

Unit	Content	Hrs.
1	**Introduction to MEMS** Overview of MEMS, evolution of MEMS technology, comparison of MEMS with IC and macro systems, advantages and limitations of MEMS, classification of MEMS devices, MEMS applications in daily life	9
2	**MEMS Materials and Microfabrication** MEMS materials: silicon, polymers, metals, piezoelectric materials, crystal structure of silicon, micromachining concepts, bulk micromachining, surface micromachining, LIGA process (overview), packaging of MEMS devices	9
3	**Mechanical Structures and Transduction Mechanisms** Basic mechanical elements: cantilevers, beams, membranes, diaphragms, springs, basic mechanical parameters (stress, strain, deflection – qualitative), transduction mechanisms: piezo-resistive, capacitive, piezoelectric, thermal and optical transduction (basic concepts)	9
4	**MEMS Sensors** MEMS pressure sensors, accelerometers, gyroscopes, microphones, temperature sensors, gas sensors, working principles, block diagrams, specifications and applications	9
5	**MEMS Actuators and Applications** MEMS actuators: electrostatic, thermal, piezoelectric actuators, RF MEMS (overview), Bio-MEMS (overview), automotive MEMS applications, medical and healthcare MEMS, consumer electronics MEMS, future trends in MEMS technology	9

Practical Content

Practical assignments and tutorials are based on the above syllabus.

Text Books

1	Tai-Ran Hsu, MEMS and Microsystems: Design and Manufacture, McGraw-Hill

Reference Books

1	Stephen D. Senturia, Microsystem Design, Springer

2	Marc Madou, Fundamentals of Microfabrication and Nanotechnology, CRC Press
ICT/MOOCs Reference	
1	NPTEL: Introduction to MEMS – IIT Madras / IIT Kharagpur
2	NPTEL: Microfabrication and MEMS

Mapping of CO with PO and PSO:															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	0	0	0	0	1	1	0	0	3	0	1	0
CO2	2	1	1	0	0	0	0	1	1	0	0	2	0	1	0
CO3	3	3	3	2	2	0	0	1	1	0	0	2	1	1	0
CO4	2	3	2	2	2	0	0	2	2	0	0	2	2	2	0