GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3173908
Semester – VII
Subject Name: MEMS AND BIO MEMS

Type of course: Material Technology

Prerequisite: Synthesis of Nanomaterial, Thin Film Technology

Rationale: Learn about Biological MEMS, Technology Microsystem and materials used in MEMS Technology

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	1	0	4	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs
1	MEMS MICROFABRICATION Historical Development of Microelectronics, Evolution of Microsensors, Evolution of MEMS, Emergence of Micromachines, Modeling - Finite Element Analysis, Fabrication – ALD, Lithography Micromachining, LIGA and Micromolding, Packaging – Challenges, Types, Materials and Processes.	9
2	SCALING OF MEMS Introduction to Scaling Issues, Scaling effects on a cantilever beam, Scaling of electrostatic actuators, Scaling of thermal actuator, Scaling of Thermal Sensors, mechanics and electrostatistics. Influence of scaling on material properties.	9
3	MICROSYSTEMS Microsensors, microaccelerometer, microfluidics, Mechanics for Microsystems design Thermomechanics, fracture mechanics, thin film mechanics. Microfluid mechanics.	8

4	MATERIALS FOR MEMS Materials for mems and pro mems-silicon-metals and polymers-Substrate Materials for MEMSSilicon-quartz-ceramics-Bulk metallic glasses-Sharp Memory alloys, Carbon based MEMS	**8**
5	COMMERCIAL AND TECHNOLOGICAL TRENDS Commercial trends in miniaturization – High density chip analysis-Microaccelerometersmicroresonators-lab-in-chip for DNA and protein analysis – Nano HPLC system-Nano patches	**8**

REFERENCES:

1. Ken Gilleo. MEMS/MOEMS Packaging: Concepts, Designs, Materials and Processes. McGraw-Hill, 2005. 2. Marc Madou, Fundamentals of Microfabrication, CRC Press 1997.
3. MEMS and Microsystems design and manufacture, Tai-Ran Hsu,Tata Mc Graw Hill 2011.
4. Sergey Edward Lyshevski, Nano- and Microelectromechanical Systems, CRC Press 2000.
5. Tai-Ran Hsu, MEMS and Microsystems: Design and Manufacture, McGraw-Hill 2001.
6. Vijay Varadan, Xiaoning Jiang, and Vasundara Varadan, Microstereolithography and other Fabrication Techniques for 3D MEMS, Wiley 2001.

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
35%	**35%**	**35%**			

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Explain aspect associated with MEMS fabrication.	25%
CO-2	Understand scaling of MEMS	25%
CO-3	Understand aspect associated with microsystem and importance of material for MEMS	25%

CO-4	Understand recent trends BioMEMS techniques.	25%