GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3170311
Semester – VII
Subject Name: Biomedical Microsystem

Type of course: Professional Elective course

Prerequisite: Basic physics, Mechanics, Basic principles of different sensors, Basics of material science

Rationale: To impart in students detailed knowledge about Principle and working of micro electro mechanical system (MEMS). To give brief knowledge about Fabrication process of MEMS and applications of Bio-MEMS technology for therapeutic, diagnosis etc.

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	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Introduction to Microelectromechanical (MEMS) Technology:** Evolution of MEMS, Applications of MEMS, Miniaturizations and scaling, Development of MEMS Technology, Comparison of MEMS and Microelectronics,	7
2	**BioMEMS Fabrication Processes and Materials:** Traditional MEMS and Microelectronic materials, Microlithography, Doping, Micromachining: Wet & Dry Etching, Chemical Vapor Deposition, Physical Vapor Deposition, Bulk and Surface Micromachining, LIGA, Wafer Bonding, Chemical Mechanical Polishing, Assembly and Packaging, Conversion factors for Energy and Intensity Units	10
3	**MEMS Sensors and Actuators:** MEMS Actuators, MEMS Sensing, Electron Tunneling, Sensor Noise, MEMS Physical Sensors, Chemical Sensors.	8
4	**MICRO/NANO BIOSENSORS:** Classification of physical sensors, Integrated, Intelligent or Smart sensors, Bio sensing Principles and sensing methods, Biosensors arrays and Implantable devices.	10
5	**Applications of BioMEMS in Biomedical Engineering:** MEMS and neurosurgery, Drug Delivery: Vascular zip codes and Nanoparticle targeting, Quantum Dots for Ultrasensitive, Real-time Biological Imaging and Detection, Diagnostic and Therapeutic Applications of	10

Metal Nano shells			
		Total	**45**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
25%	**30%**	**25%**	**10%**	**10%**	-

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:

1. Biomedical Microsystems by Ellis Meng, Taylor & Francis, 2011
2. Microelectromechanical system design, James j. allen. Taylor & Francis 2nd edition.
3. Senturia, Stephen, D., "Microsystem Design", Kluwer Academic Publishers, 2001
4. Biomedical Nanotechnology. Neelina H Malsch , Taylor & Francis
5. BioMEMS and Biomedical Nanotechnology, volume III Tejal desai, sangetha Bhatia.

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the MEMS Technology and its biomedical application	25%
CO-2	Learn the Fabrication process of Micro electro mechanical systems	25%
CO-3	Learn MEMS Sensors and Actuators, biosensors, smart sensors	20%
CO-4	Understand different challenges to design Biomedical Microsystems	15%
CO-5	Understand the various applications for curing different diseases accurately by using BioMEMS Technology.	15%

w.e.f. AY 2018-19

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List of Experiments:

1. Introduction to MEMS Technology.
2. To study different Fabrication processes of MEMS.
3. To study different MEMS Technologies.
4. To study various types of MEMS Sensors and Actuators.
5. To study various types of Micro/Nano Biosensors.
6. To study the application of Vascular Zip Codes and Nanoparticle Targeting.
7. To study the application of Real-Time Biological Imaging and Detection.
8. To study the application of Diagnostic and Therapeutic Applications of Metal Nano shells.
9. To study the application of Micro devices for Oral Drug Delivery