GUJARAT TECHNOLOGICAL UNIVERSITY

B.E. SEMESTER : VIII

BIOMEDICAL ENGINEERING

Subject Name: **BIOMEDICAL MICROSYSTEMS (BMS)**

Sr. No.	Course Contents	Total Hrs
1.	**Introduction**-Historical Perspective, The Development of MEMS Technology, MEMS: Present and Future, MEMS Challenges.	02
2.	**Fabrication Processes**- Materials, Starting Material — Substrates, Physical Vapor Deposition (PVD), Chemical Vapor Deposition (CVD), Etching Processes, Patterning, Wafer Bonding, Annealing, Chemical Mechanical Polishing (CMP), Material Doping.	06
3.	**MEMS Technologies**-Bulk Micromachining, LIGA, Sacrificial Surface Micromachining, Integration of Electronics and MEMS Technology (IMEMS), Technology Characterization, Alternative MEMS Materials.	06
4.	**Scaling Issues for MEMS**- Scaling of Physical Systems, Computational Issues of Scale, Fabrication Issues of Scale, Material Issues	04
5.	**Design Realization Tools for MEMS**-Design Rules, Standard Components, MEMS Visualization, MEMS Analysis.	04
6.	**Electromechanics**- Structural Mechanics, Damping, Electrical System Dynamics.	04
7.	**MEMS Sensors and Actuators**- MEMS Actuators, MEMS Sensing, Electron Tunneling, Sensor Noise, MEMS Physical Sensors, Chemical Sensors.	06
8.	**MICRO/NANO BIOSENSORS:** Classification of physical sensors, Integrated, Intelligent or Smart sensors, Biosensing Principles and sensing methods, biosensors arrays and implantable devices.	04
9.	**Packaging**- Packaging Process Steps, Postfabrication Processing, Package Selection/Design, Packaging Case Studies	04
10.	**Vascular Zip Codes and Nanoparticle Targeting-**Introduction, In vivo Phage Display in Vascular Analysis, Tissue-Specific Zip Codes in Blood Vessels, Special Features of Vessels in Disease, Delivery of Diagnostic and Therapeutic Agents to Vascular Targets, Homing Peptides for Subcellular Targeting, Nanoparticle Targeting, Future Directions	03
11.	**Engineering Biocompatible Quantum Dots for Ultrasensitive, Real-Time Biological Imaging and Detection-**Introduction, Synthesis and Surface Chemistry, Optical Properties, Applications, Future Work.	04
12.	**Diagnostic and Therapeutic Applications of Metal Nanoshells-**Metal Nanoshells, Biomedical Applications of Gold Nanoshells,	02
13.	**Nanoporous Microsystems for Islet Cell Replacement-**Introduction, Fabrication of Nanoporous Membranes, Biocapsule Assembly and Loading, Biocompatibility of Nanoporous Membranes and Biocapsular Environment, Microfabricated Biocapsule Membrane Diffusion Studies, Matrix Materials Inside the Biocapsule	04
14.	**Microdevices for Oral Drug Delivery-**Introduction, Materials, Microfabrication, Surface Chemistry, Surface Characterization, Miocrodevice Loading and Release Mechanisms	03

The Practical and Term work will be based on the topics covered in the syllabus.

Text Books:

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

Reference:

1. Manz, A., & Becker, H.(Eds.), "Microsystem Technology in Chemistry and Life Sciences", Springer-Verlag, New York, 1999. ISBN: 3-540-65555-7.
2. Bao, M., H., "Micromechanical Transducers: Pressure sensors, accelerometers, and gyroscopes", Elsevier Publications, New York, 2000.
3. Lambrechts, M., "Biosensors: Microelectrochemical Devices", CRC Press, 1992.
4. Buerk, Donald, G., "Biosensors: Theory and Applications", CRC Press, 1995.
5. Madon, Marc, "Fundamentals of Micro fabrication", CRC Press, 1997.
6. Kovacs, Gregory, "Micro machined Transducers Sourcebook", WCB McGraw-Hill, Boston, 1998.
7. Saliterman Steven, S., "Fundamentals of BioMEMS and Medical Microdevices", Wiley Interscience, SPIE Press Monograph Vol. PM153.