Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. Sem. – IInd - Examination – June/July- 2011

Subject code: 1720311

Subject Name: Microelectromechanical Systems

Date:01/07/2011 **Time: 10:30 am – 01:00 pm**

Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Give key definition: (i)Proof Mass (ii) Capacitance (iii) Piezoresistivity (iv) Magnetomotive force (v) Combustion (vi) Elelctrostatics (vii) Folded-beam suspension	**07**
	(b)	i) Give classification of three major groups of Integrated Microsystems.	**03**
		ii) Discuss micro and smart system in detail	**04**
Q.2	**(a)**	i) Draw a sketch and explain Piezoresistive Pressure Sensor	**05**
		ii) Define offset voltage and nonlinearity of a pressure sensor.	**02**
	(b)	Draw a sketch and explain Silicon Capacitive Accelerometer.	**07**
		OR	
	(b)	A research lab tried to make a 314 μm long cantilever beam with diamond-like-carbon (DLC) thin-film technology. The beam had rectangular cross-section with 15 μm in-plane width and 5 μm out-of-plane thickness. In its released condition, it was noticed that it had curled into a semicircular form. DLC's Young's modulus and Poisson ratio were measured to be 100 GPa and 0.3, respectively.	**07**
Q.3	**(a)**	Explain lift-off techniques for patterning thin films and compare the sequence of process steps with lithography.	**07**
	(b)	Explain dry and wet chemical etching techniques.	**07**
		OR	
Q.3	**(a)**	What are wafer bonding techniques?	**07**
	(b)	Give comment on the choice between positive and negative photoresistive materials in lithography.	**07**
Q.4	**(a)**	Write a note on Modeling of Coupled Electromechanical Systems.	**07**
	(b)	Discuss Finite Element model for structures with piezoelectric sensors and actuators.	**07**
		OR	
Q.4	**(a)**	Suggest methods to avoid stiction caused by electrostatic actuation of RF-MEMS switches.	**07**

	(b)	With the help of diagram explain the different process steps involved in the surface micro machining technology for realizing a polysilicon cantilever beam.	**07**
Q.5	**(a)**	Discuss the importance of packaging in Microsystems. Compare and contrast these with the general requirements for general integrated circuits.	**07**
	(b)	Explain with an example how wafer- level packaging is done for Microsystems.	**07**

OR

Q.5	**(a)**	Discuss Applications of Smart materials and Microsystems in detail.	**07**
	(b)	Discuss different types of Microsystems packages.	**07**

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