B.E. Electronics & Telecommunication / Communication Engineering / Electronics Engineering
Eighth Semester

EC / EN8052 - Elective-II : Micro Electro Mechanical Systems

P. Pages : 2 **GUG/W/18/2033**

Time : Three Hours * 1 5 5 1 * Max. Marks : 80

Notes : 1. All questions carry marks as indicated.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) Explain the various sensor characteristics that has to be considered while developing a sensor. **8**

b) Compare the various actuation methods used for MEMS devices and also give the general criteria when considering actuators designs and selection. **8**

OR

2. a) Discuss about the frequently used microfabrication processes. **8**

b) A cylindrical silicon rod is pulled on both ends with a force of 10 mN. The rod is 1mm long and 100 - μm in diameter. Find the stress and strain in the longitudinal direction of the rod. **2**

c) Give the methods for analyzing the deflection of beams under simple loading conditions. **6**

3. a) Explain pull in effect of parallel plate actuators. **8**

b) Discuss the procedures for calculating the equilibrium displacement under static (DC) and quasistatic (low frequency) bias conditions of electrostatic actuator under bias. **8**

OR

4. a) Why must thermal couples involve two different materials ? Explain. **8**

b) Write a short note on thermal resistors. **8**

5. a) A fixed-free cantilever is made of single crystal silicon. The longitudinal axis of the cantilever points in the [100] crystal orientation. The resistor is made of by diffusion doping, with a longitudinal gauge factor of 50. The length (ℓ), width (w), and thickness (t) of the cantilever are 200 μm, 20 μm and 5 μm, respectively. If a force F = 100 μN is applied at the end of the cantilever in the longitudinal direction, what would be the percentage change of resistance. **8**

b) Explain the method to analyze the stress and strain distribution in a mechanical element under a given applied force. **8**

OR

6.	a)	Give the mathematical description of Piegoelectric effect.	**8**
	b)	Explain a compact model for calculating the curvature of bending in a cantilever piezoelectric actuator.	**8**
7.	a)	Explain the process of low-pressure chemical vapour deposition with diagrams.	**8**
	b)	Give the material selection criteria for two layer process.	**8**

OR

8.	a)	Give the practical factors affecting the yield of MEMS.	**8**
	b)	Write a short note on stiction and anti stiction methods. Suggest ways to reduce stiction.	**8**
9.	a)	Explain the role of SU-8 polymer for MEMS applications.	**8**
	b)	Write a short note on Parylene as a polymer for MEMS devices.	**8**

OR

10.	a)	Explain the working of multimodal polymer based tactile sensor.	**8**
	b)	Draw the schematic diagram of a LCP polymer flow sensor and explain the working.	**8**

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