Time: 3 Hours **Max. Marks: 80**

Note :

- **Question No.1 is compulsory.**
- Solve **ANY THREE** questions from the **remaining** five questions.
- The figure to the right indicates full marks.
- Draw a **neat and clean figure** to support your answers
- Assume suitable data wherever required, but justify the same.

Q. 1		Solve **ANY FOUR** questions from the following.	
	a)	List the unique characteristics of MEMS. Briefly explain it.	**5**
	b)	Explain the significance of the silicon in MEMS.	**5**
	c)	Describe the LTCC process with a neat figure.	**5**
	d)	Explain a basic principle of the micro-sensors with a neat sketch.	**5**
	e)	Illustrate the working of comb drive with neat sketch	**5**
	f)	What are the applications of SMA in MEMS devices?	**5**
Q. 2	**a)**	Explain the Scaling laws of miniaturization in MEMS	**10**
	b)	Explain the LIGA process (with a neat figure) in detail from the initial stage to the final product.	**10**
Q. 3	**a)**	Explain the operating principle of thermal micro sensor with figures. State any two applications of it.	**10**
	b)	Determine the electrostatic force (for 100 V) exerted on the plates (in the direction of length, width, and normal) separated by a distance of 3 microns and having a length and width of 2000 microns. The plates are separated by static air (relative permittivity equal to 1) as dielectric material and $\varepsilon_0 = 8.85 \times 10^{-12}$ $C^2/N\text{-}m^2$.	**10**
Q. 4	**a)**	Explain the application of MEMS in automobiles and medical fields using any case study (with neat sketches)	**10**
	b)	Explain the wet and dry etching process with a neat figure.	**5**
	c)	Illustrate micro Pressure sensors with a neat sketch	**5**
Q. 5	**a)**	Explain lithography using a suitable diagram.	**10**
	b)	Explain the working principle of acceleration micro sensors with neat sketch.	**10**
Q. 6	**a)**	Explain the concept of Electrostatic force with a figure and explain its any one application in a microactuator with a neat sketch.	**10**
	b)	Illustrate soft lithography process with neat sketch	**5**
	c)	Explain Surface micro machining with neat sketch.	**5**

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