U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

February / March 2023 Semester End Main Examinations

Programme: B.E. **Semester: VII**
Branch: ES – Cluster Elective **Duration: 3 hrs.**
Course Code: 19EI7CE2ME **Max Marks: 100**
Course: MEMs **Date: 28.02.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

UNIT - I

1	a)	What is miniaturization in microsystems? Mention its benefits.	**07**
	b)	Bring out the comparison between Microelectronics and Microsystems.	**07**
	c)	Discuss the applications of Microsystems in healthcare and Aerospace industry	**06**

UNIT - II

2	a)	What are the different means of actuation in microdevices? With diagrams discuss actuation using SMAs and using piezoelectric crystals.	**12**
	b)	Discuss the principal of operation used in thermal and microthermopile sensor with necessary diagrams.	**08**

UNIT - III

3	a)	Discuss scaling in rigid-body dynamics and derive necessary equations.	**12**
	b)	Explain scaling in electricity and also indicate a significant disadvantage of scaling down power supply systems.	**08**

OR

4	a)	What are substrates and wafers? Mention the common substrate materials used in MEMS and mention the reason for using these substrate materials in both microelectronics and microsystems.	**04**
	b)	Discuss the Czochralski (CZ) method to produce single-crystal silicon and wafers.	**07**
	c)	Briefly outline the principles of Miller indices, indicating the distribution of silicon atom in various planes and arrangement of flats in wafers with suitable diagrams.	**09**

UNIT - IV

5	a)	What is Lithography? With neat sketch discuss the different steps in photolithography.	**10**
	b)	It is required to provide a thin film of silicon dioxide on a silicon substrate using carrier gas. Suggest an appropriate method (CVD) with diagram to implement the same.	**10**

OR

6	a)	Discuss the surface micromachining process to realize a cantilever structure.	**07**
	b)	What is Etch stop? How is it achieved? Bring out the different aspects of Etch stop techniques.	**07**
	c)	Explain the major fabrication steps involved in LIGA process.	**06**

UNIT - V

7	a)	Summarize the common failure mechanisms of Microsystems packaging.	**10**
	b)	List the different types of microsystems packaging technologies and discuss the flip-chip assembly in detail with advantages.	**10**

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