B.TECH. (SEM VI) THEORY EXAMINATION 2022-23

Time: 3 Hours

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt all questions in brief.

Qno.

Question

- What are the different types of MEMS fabrication? a.
- Which What is piezoresistive sensor? b.
- What is Hooke's law and modulus of elasticity? c.
- d. How do you calculate strain from bending stress?
- e. How much weight can a cantilever take?
- f. What is the effect of damping in structural dynamics?
- Differentiate between Couette flow and Poiseuille flow? g.
- Define electrostatic force with example. h.
- i. Write the principle of operation and types of MEMS resonator.
- į. What is thermocouple and its function?

SECTION B

2. Attempt any *three* of the following:

- Describe methods a. the three principal signal transduction for micropressuresensors. Provide atleast one major advantage and one disadvantage of each of these methods.
- Explain operating principle of pressure sensor. Describe the representation b. process flow for fabricating pressure sensors.
- Explain in brief the technique of PVD for MEMS device Fabrication. Also c. define step coverage and shadowing.
- d. Design a pressure sensor with a memsmicro sensors suitable for anengineering application
- Estimate the ratio of airflow in the section of small tube 10µmin diameter and e. 1cm in length. Assume that a pressuredifference of 5 Pa is maintained between the inlet and outletof the tube section. The airflow takes places at roomtemperature.

SECTION C

3. Attempt any one part of the following:

- With neat sketch describe the working principal of any twotype of microa. actuation techniques.
- Write briefly about all the Substrate materials available in the market. List their b. applications individually.

10x3=30

242.32

INTRODUCTION TO MEMS

Roll No.

Total Marks: 100

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Sub Code:KOE063

10x1 = 10

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4. Attempt any one part of the following:

- Explain the concept of incompressible fluid flow inmicro conduit. a.
- Differentiate between bulk and surface micro machining. Explain the role of b. sacrificial layer in fabrication of MEMS devices.

5. Attempt any *one* part of the following: 10x1 = 10

- a. Draw and explain working principle of cantilever. Show basic quantitative behavior of cantilever. Also discuss process steps for fabrication of cantilever.
- Design a micro actuator with a mems micro accelerometer suitablefor an b. engineering application.

6. Attempt any *one* part of the following:

- Calculate the electrostatic forces on the plate electrodes with an appliedDC a. voltage at 70V. The geometry and dimensions of the plate electrodeare shown in figure. The plate are initially misaligned by 20 percent inboth length and width directions. Pyrex is used as the dielectricmaterial, so there is no gap change with the applied voltage.
- Why are electrostatic forces used to run micro motors rather thanconventional b. A2.32 electromagnetic forces? Explain why this actuationtechnique is not used in macrodevices and machines.

7. Attempt any *one* part of the following:

- Discuss the functioning of micro pressure sensors with differentmeans of signal a. transduction with their relative merits .
- Estimate the flow rate of a nitrogen gas in a section of minutetube 30 nm in b. diameter x 50 nm long. A pressure difference of 0.5 Pa is applied to drive the 7.06.202308:52:19 flow. The flow is conducted atroom temperature, 20°C.

10x1 = 10

10x1 = 10