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**PRESIDENCY UNIVERSITY  
BENGALURU**

**SCHOOL OF ENGINEERING  
MID TERM EXAMINATION - OCT 2023**

**Semester :** Semester VII - 2020

**Course Code :** ECE3042

**Course Name :** Sem VII - ECE3042 - Mems and Nanotechnology

**Program :** B. TECH

**Date :** 31-OCT-2023

**Time :** 2:00PM - 3:30PM

**Max Marks :** 60

**Weightage :** 30%

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**Instructions:**

- (i) Read all questions carefully and answer accordingly.
  - (ii) Question paper consists of 3 parts.
  - (iii) Scientific and non-programmable calculator are permitted.
  - (iv) Do not write any information on the question paper other than Roll Number.
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**PART A**

**ANSWER ALL THE QUESTIONS**

**(5 X 2 = 10M)**

1. Microfabrication, also known as MEMS fabrication, refers to a group of methods that can alter a substrate material either additively or subtractively to create complex structures made of various materials by interacting tiny features. The principal microfabrication process used in bulk manufacturing is  
(CO1) [Knowledge]
2. A cantilever is a rigid body that extends horizontally over open space but is only anchored or supported at one end. Cantilever beam is formed by which micromachining technique?  
(CO1) [Knowledge]
3. Smart materials are materials that are manipulated to respond in a controllable and reversible way, modifying some of their properties as a result of external stimuli such as certain mechanical stress or a certain temperature, among others. Possible smart materials range from but are not limited to piezoelectrics, magnetcs, photonics, triboelectrics, stimuli-responsive polymers, composites, hybrids, flexible/stretchable, photomechanical, and shape memory materials. So explain piezoelectricity, with examples.  
(CO1) [Knowledge]
4. Give the acronym of MEMS?  
(CO2) [Knowledge]
5. What is the purpose of sacrificial layer in micro-machining techniques.  
(CO2) [Knowledge]

## PART B

ANSWER ALL THE QUESTIONS

(3 X 10 = 30M)

6. An actuator is designed to deliver a desired motion when it is driven by a power source.  
(a) Explain the process of actuation using thermal forces.  
(b) Explain the working of the capacitive actuation.  
(CO1) [Comprehension]
7. **Micromachining is a techniques of fabricating the structure in micro-scale. Explain with neat sketches, various process steps in surface micromachining process to fabricate for the cantilever structure.**  
(CO1) [Comprehension]
8. Silicon, Metals, Ploymers and Ceramics are the different materials used in the manufacturing of MEMS devices. Mention the basic techniques behind MEMS fabrication. Give the detail difference evaporation and sputtering with neat diagram.  
(CO2) [Comprehension]

## PART C

ANSWER THE FOLLOWING QUESTION

(1 X 20 = 20M)

9. **Piezoresistive, piezoelectric and capacitive sensing all uses the vibration as the driving mechanism for their sensing principle. Explain how these sensing mechanism works with neat and clean diagram.**  
(CO1,CO2) [Application]