Subject Code: KOE063

PAPER ID-410156

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM VI) THEORY EXAMINATION 2023-24
INTRODUCTION TO MEMS

TIME: 3 HRS **M.MARKS: 100**

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

SECTION A

1. Attempt *all* questions in brief.

a.	Name some materials commonly used in MEMS fabrication.	02
b.	How are sensors and transducers important in MEMS devices?	02
c.	Describe the displacement of beam structures under load.	02
d.	How does viscosity affect air damping?	02
e.	How does air damping affect MEMS dynamics?	02
f.	What are some thermal effects in MEMS?	02
g.	Explain step voltage driving in electrostatic actuation.	02
h.	What are fringe effects in electrostatic actuation?	02
i.	What is capacitive sensing in MEMS?	02
j.	What are some applications of MEMS in RF?	02

SECTION B

2. Attempt any *three* of the following:

a.	Explain the importance of materials and substrates selection in MEMS fabrication.	10
b.	Discuss Hooke's Law and its application to the analysis of beam structures in MEMS. How does Hooke's Law relate stress to strain in these structures?	10
c.	Explain the drag effect of a fluid and its relevance to MEMS devices.	10
d.	Discuss the fringe effects in electrostatic actuation. How do these effects impact the performance and reliability of MEMS devices?	10
e.	Describe the limitations of micromechanical resonators in RF applications.	10

SECTION C

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

a.	Discuss the characteristics of MEMS devices that make them suitable for various sensing and actuation applications.	10
b.	Describe the principles of piezoelectricity and its significance in MEMS.	10

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

a.	Explain the concept of the moment of inertia in beam structures. How is the moment of inertia calculated, and what is its significance in beam analysis?	10
b.	Explain the concepts of stress and strain in the context of beam and diaphragm structures.	10

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

a.	Explain the drag effect of a fluid and its relevance to MEMS devices. How does the viscosity of a fluid affect the drag force on a moving object?	10
b.	Explain Reynolds' equations for squeeze-film air damping. How are these equations used to calculate the damping effect in MEMS devices?	10

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

a.	Discuss the principles of electrostatic forces and their application in MEMS devices.	10
b.	Explain the negative spring effect in electrostatic actuation. How does this effect impact the vibration frequency and stability of MEMS devices?	10

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

a.	Explain the principles of thermocouples and their application in MEMS devices.	10
b.	Discuss the modeling of one-port and two-port micromechanical resonators in MEMS.	10