

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP/2023)

CLASS: BTECH
BRANCH: MECH/CSE/EEE/IT

SEMESTER : VI
SESSION : SP/2023

SUBJECT: EC361 INTRODUCTION TO MEMS
TIME: 02 Hours

FULL MARKS: 25

INSTRUCTIONS:

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates
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|--------|--|-----|-----|-------------|
| Q.1(a) | Give a brief history of MEMS development. What are the intrinsic characteristics of MEMS? | [2] | CO1 | BL Remember |
| Q.1(b) | Derive the scaling law for static buoyancy force of a solid sphere in a liquid with a density of γ . Assume the sphere is made of a material with a density of γ_s ($\gamma_s < \gamma$). | [3] | CO1 | Create |
| Q.2(a) | What are the different parameters that need to be considered while choosing a MEMS sensor? What are the various noises that can appear in a sensor and what are the origins of these noises? | [2] | CO1 | Understand |
| Q.2(b) | A resistor is made of a suspended, doped polycrystalline silicon beam with the resistance being 5K. Calculate the resistor's Johnson noise when measured in a frequency range of 0 to 100 Hz and 0 to 10 KHz. The temperature of the resistor is 27°C and the bias voltage is 2 V. | [3] | CO1 | Evaluate |
| Q.3(a) | Explain some of the frequently used microfabrication processes. What do you mean by additive and subtractive processes? Give an example of each. | [2] | CO3 | Remember |
| Q.3(b) | What is the difference between diffusion and drift of charge carriers in silicon? State the diffusion equation (Fick's law) explaining the various terms. | [3] | CO3 | Analyse |
| Q.4(a) | Explain the difference between the conductivity of metals and semiconductors. How does the resistivity of resistors and semiconductors behave with temperature? | [2] | CO2 | Understand |
| Q.4(b) | State the expression for the calculation of charge carriers in an intrinsic semiconductor. Explain the various terms involved. | [3] | CO2 | Remember |
| Q.5(a) | Define stress and strain. What are the various factors in MEMS components that can lead to stress and strain? | [2] | CO5 | Understand |
| Q.5(b) | A cylindrical silicon rod is pulled on both ends with a force of 10 mN. The rod is 1 mm long and 100 μm in diameter. Find the stress and strain in the longitudinal direction of the rod. | [3] | CO5 | Analyse |

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