

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION)**

**CLASS: MTECH  
BRANCH: ET/AMS**

**SEMESTER : I  
SESSION : MO/18**

**SUBJECT: EC606 FUNDAMENTALS OF MEMS**

**TIME: 3 HRS.**

**FULL MARKS: 50**

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
  2. Attempt all questions.
  3. The missing data, if any, may be assumed suitably.
  4. Before attempting the question paper, be sure that you have got the correct question paper.
  5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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- Q.1(a) State the intrinsic characteristics of MEMS. Draw a diagram illustrating the structure and operating principle of an integrated accelerometer. [5]
- Q.1(b) Tabulate brief description of major process categories under microfabrication. [5]
- Q.2(a) Analyse flexural beam bending, starting from types of beams with various boundary conditions, longitudinal strain under pure bending and deflection of beams to find out the spring constant of a fixed-free cantilever beam. [5]
- Q.2(b) Starting from the governing equation of a mass-spring-damper system, find out the response of a MEMS body under sinusoidal input. Comment on damping factor and quality factor. [5]
- Q.3(a) State the fundamentals of thermal transfer along with the governing equation of heat transfer rate for each possible mechanism. Explain the thermal bimorph principle [5]
- Q.3(b) Describe mathematically piezoelectric effect with the help of schematic illustration of piezoelectric crystal in a rectangular system. Illustrate a model of cantilever piezoelectric actuator. [5]
- Q.4(a) Discuss wafer bonding. Compare and contrast various bonding techniques along with respective bonding materials and remarks. [5]
- Q.4(b) Describe each of the options for integrating micromechanical components with integrated circuits with the help of a schematic diagram. Discuss the pros and cons of these options. [5]
- Q.5(a) Review the background and history, device design considerations and detail the successful commercial implementation of a MEMS blood pressure sensor. [5]
- Q.5(b) Review the background and history, device design considerations and detail the successful commercial implementation of a Gyros. [5]

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