

# CBCS SCHEME



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15EC831

**Eighth Semester B.E. Degree Examination, June/July 2019**

## Micro Electro Mechanical System

Time: 3 hrs.

Max. Marks: 80

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

### Module-1

- 1 a. Explain the difference between MEMS and Microsystems. (08 Marks)
- b. Explain the multidisciplinary nature of Microsystem. (08 Marks)

OR

- 2 a. What are the most obvious distinction between Microelectronics and Microsystems? (08 Marks)
- b. Give at least four distinct advantages of miniaturization of machines and devices. (08 Marks)

### Module-2

- 3 a. What are principal applications of microsensors, actuators and fluidics? (08 Marks)
- b. Describe in detail about Acoustic wave sensors and chemical sensors. (08 Marks)

OR

- 4 a. Explain in detail optical sensors and pressure sensors. (08 Marks)
- b. Describe the four popular actuation techniques for micro devices. Provide atleast major advantages and one disadvantage of each of these techniques. (08 Marks)

### Module-3

- 5 a. Derive a formula for estimating the natural frequency of a micro accelerometer with negligible damping effect. (10 Marks)
- b. Determine the equivalent spring constant  $K$  and the natural frequency  $\omega_n$  of a cantilever beam element in a micro accelerometer in Fig.Q5(b). The beam is made of silicon with a Young's modulus of 190,000 MPa.

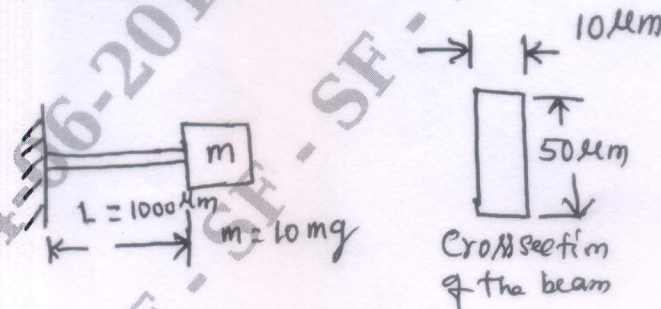


Fig.Q5(b)

(06 Marks)

OR

- 6 a. Describe overview of finite element stress analysis. (10 Marks)
- b. Write short notes on Thin-Film mechanics. (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.





**Module-4**

- 7 a. Explain scaling in electrostatic forces with respect to MEMS. (10 Marks)  
b. Define force scaling vector and obtain the scaling factors:  
i) Acceleration a  
ii) Time t  
iii) Power density  $P/V_0$  (06 Marks)

OR

- 8 a. Obtain the scaling factors in Fluid Mechanics. (10 Marks)  
b. Obtain the scaling factors in:  
i) Scaling of heat flux  
ii) Scaling in thermal conductivity in submicrometer regime (06 Marks)

**Module-5**

- 9 a. What are the limitations of the height of microstructures than can be produced by bulk manufacturing technique? (08 Marks)  
b. Describe the DRIE process. How can DRIE achieve virtually perfect vertical etching? (08 Marks)

OR

- 10 a. List the principle advantages and disadvantages of the LIGA process. (08 Marks)  
b. Why is electroplating necessary in a LIGA process? (08 Marks)

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