

# CBCS SCHEME

USN 

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17ME745

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022

## Smart Materials and MEMS

Time: 3 hrs.

Max. Marks: 100

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

### Module-1

- 1 a. Explain applications of Smart Structures and differentiate between open loop and closed loop Smart Structures. (10 Marks)  
b. Explain with a neat sketch, working of Inchworm linear motor. (10 Marks)

OR

- 2 a. Discuss vibration control through shape memory alloy with suspended mass attached at free end of beam. (10 Marks)  
b. Explain Piezoelectric effect and properties of piezoelectric materials. (10 Marks)

### Module-2

- 3 a. Discuss Bingham Plastic model and pre-yield response of MR fluids. (10 Marks)  
b. Explain with neat sketches any two applications of ER and MR fluids. (10 Marks)

OR

- 4 a. Explain total internal reflection in optical fiber and discuss fiber optic strain sensor. (10 Marks)  
b. Explain with a neat sketch, principle of operation of Fabry-Perot sensor. (10 Marks)

### Module-3

- 5 a. Derive governing equation of motion and condition for amplitude of main mass to be independent of damping ratio for parallel damped vibration absorber. (14 Marks)  
b. Discuss gyroscopic vibration absorber and mention its applications. (06 Marks)

OR

- 6 a. Explain the characteristics of natural structures. (10 Marks)  
b. Discuss biomimetic sensing with any two examples from Natural System. (10 Marks)

### Module-4

- 7 a. Explain Intrinsic Characteristics of MEMS. (10 Marks)  
b. Explain with a neat sketch photolithography and Thin-Film deposition process. (10 Marks)

OR

- 8 a. Discuss the properties of any two piezoelectric materials. (10 Marks)  
b. Compare major sensing and actuation methods. (10 Marks)

### Module-5

- 9 a. Explain with sketch working of acceleration sensor. (10 Marks)  
b. Discuss design and fabrication of channels and valves. (10 Marks)

OR

- 10 a. Discuss design considerations in BP sensors. (10 Marks)  
b. Explain any four concern related to MEMS product development. (10 Marks)

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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.