

## 18BB1156

### M. Tech. EXAMINATION, 2020

(Second Semester)

(C Scheme) (Main & Re-appear)

(ECE)

MTEC526C

MEMS AND IC INTEGRATION

*Time : 3 Hours]*

*[Maximum Marks : 75*

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Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

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**Note :** Attempt *Five* questions in all. Q. No. **9** is compulsory. Select *one* question from each Unit. All questions carry equal marks.

#### Unit I

1. Explain the following : **15**
  - (a) CMOS process in IC fabrication
  - (b) Microsystem applications in telecommunications.
2. (a) Describe various signal transduction methods for micro-pressure sensors. Provide major advantages and disadvantages of each method. **10**
  - (b) Discuss major components of microfluidic system. **5**

#### Unit II

3. (a) Discuss design consideration of Microsystems. **7**

- (b) Determine the minimum thickness of the circular diaphragm of a micro-pressure sensor made of Silicon with conditions : **8**  
 Diameter  $d = 600 \mu\text{m}$ ; Applied pressure  $p = 20 \text{ MPa}$ ; Yield strength of silicon,  $\sigma_y = 7000 \text{ MPa}$ ;  $E = 1,90,000 \text{ MPa}$  and  $\nu = 0.25$ .
4. (a) Using suitable example, determine how to assess the flow-induced force in a micro valve. **8**  
 (b) How fluid flow can be modeled in nano scale designs. **7**

### Unit III

5. (a) Discuss scaling of electrostatic forces applicable to design of microsystems. **7**  
 (b) Discuss the scaling laws for heat transfer. Estimate the variation of heat flow and time required to transmit heat in a solid with a reduction in size by a factor of 10. **8**
6. (a) What is the working principle of CVD ? Show all the chemical reactions in depositing Silicon Nitride thin film over silicon. **10**  
 (b) Compare dry etching and wet etching. **5**

### Unit IV

7. (a) Discuss material selection criteria for surface micromachining. **7**  
 (b) Draw and explain major steps in LIGA process. **8**
8. Write short notes on the following : **15**  
 (a) Micro-system packaging and interfaces  
 (b) Essential components of a Microassembly work cell.

### Compulsory Question

9. Explain the following : **15**  
 (a) Microelectronics and Microsystems  
 (b) Working principle of tactile sensors

- (c) Need of acoustic sensors
- (d) Equivalent circuit representation of MEMS
- (e) Sputtering process
- (f) Need for miniaturization of machines and devices.