



M.E DEGREE EXAMINATIONS: JUNE 2018

(Regulation 2015)

Second Semester

CAD / CAM

P15CCTE25 : Micro Electro Mechanical Systems Design

COURSE OUTCOMES

- CO1: CO 1: Explain the working of micro systems.
CO2: Classify the materials based on its application.
CO3: Discuss about micromechanics.
CO4: Understand and explain micro system manufacturing.
CO5: Explain micro system design.

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

- 1 Sequence the microsystem design process in order CO5 [K₂]
1.packaging 2.signal mapping 3.selection of materials and manufacturing 4.design analysis
a) 2-3-4-1 b) 3-2-1-4
c) 3-4-2-1 d) 4-1-3-2
- 2 Mathematical models derived from these physical laws are valid for MEMS components CO2 [K₁]
a) > 1 μm b) < 1 μm
c) = 1 μm d) ≠ 1 μm
- 3 The silicon diaphragm is the basic structure used in _____ CO1 [K₁]
a) Pressure sensor b) Voltage sensor
c) Actuators d) Relays
- 4 Assertion (A): A sensing or actuating element and a signal transduction unit CO1 [K₁]
Reason (R): MEMS as a micro sensor
a) Both A and R are Individually true and R is the correct explanation of A b) Both A and R are Individually true but R is not the correct explanation of A
c) A is true but R is false d) A is false but R is true
- 5 Techniques used in MEMS fabrication include all but which of the following? CO3 [K₁]
a) Wet etching b) Dry etching
c) Photolithography d) Electro discharge machining

- 6 --- type of photo resist is used in LIGA process CO4 [K₁]
 a) Sensitive to X-ray radiation b) Good thermal stability at 140°C
 c) Un exposed part must be soluble d) Should have porosity
- 7 Assertion (A): Mechanical vibration principle is used in the design of CO3 [K₂]
 microaccelerometer, which is a common MEMS device for measuring forces induced by moving devices
 Reason (R): Microaccelerometers are used as the sensors in automobile air bag deployment systems
 a) Both A and R are Individually true and R is the correct explanation of A b) Both A and R are Individually true but R is not the correct explanation of A
 c) A is true but R is false d) A is false but R is true
- 8 Bio Sensor uses CO5 [K₂]
 a) Photo resist entities b) Biological substances
 c) Diagnostic equipments d) FDA approval for sales.
- 9 The main purpose of microsystem packaging is CO4 [K₁]
 a) Thermal and mechanical impact b) Compact Design
 c) Size of the component d) Assembly
10. Match list I with list II according to concepts related to industrial design and select the correct answer using the codes given CO2 [K₁]

List I	List II
A. physical	1. polysilicon, silicon dioxide, silicon nitride, metals, polymers
B. chemical	2. material placed onto substrate, techniques include sputtering and evaporation
C. substrates	3. stream of source gas reacts on substrate to grow product, techniques include chemical vapor deposition and atomic layer deposition
D. thin films	4. silicon, glass, quartz

	A	B	C	D
a)	4	2	3	1
b)	2	3	4	1
c)	1	4	2	3
d)	3	2	1	4

PART B (10 x 2 = 20 Marks)

11. Explain MEMS as Microactuators. CO1 [K₁]
12. Write the expression for scaling in geometry. CO1 [K₂]
13. Define substrates and wafers. CO2 [K₂]
14. Name the types of thin films used in microelectronics. CO2 [K₂]
15. Draw the three modes of fracture. CO3 [K₂]

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| 16. Draw the schematic configuration of accelerometers. | CO3 | [K ₂] |
| 17. What are the major reliability issues involved in microsystem packaging? | CO4 | [K ₂] |
| 18. Discuss the clean room technology. | CO4 | [K ₂] |
| 19. Write down the major tasks involved in microsystem design. | CO5 | [K ₂] |
| 20. Give some application of MEMS in bio-medical field. | CO5 | [K ₂] |

PART C (6 x 5 = 30 Marks)

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| 21. Explain Deposition by epitaxy | CO1 | [K ₂] |
| 22. With an example explain Scaling in Geometry | CO1 | [K ₂] |
| 23. Discuss the silicon compounds used in MEMS. | CO2 | [K ₁] |
| 24. Write short notes on fracture mechanics and stress intensity factor. | CO3 | [K ₂] |
| 25. Explain Bulk Micro manufacturing. | CO4 | [K ₂] |
| 26. Give the various applications of micro system. | CO5 | [K ₂] |

Answer any FOUR Questions

PART D (4 x 10 = 40 Marks)

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| 27. Explain the working principles of Micro actuators. | CO1 | [K ₂] |
| 28. Explain the Photolithography process in mems system | CO2 | [K ₂] |
| 29. Describe the design theory of micro accelerometers with neat sketch. | CO3 | [K ₂] |
| 30. Discuss in detail about the microsystem packaging techniques and types. | CO4 | [K ₂] |
| 31. In detail explain the design considerations of microsystems. | CO5 | [K ₂] |
