

Register No.: Name:

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SIXTH SEMESTER B.TECH DEGREE EXAMINATION (S), AUGUST 2023

ELECTRONICS AND COMMUNICATION ENGINEERING

(2020 SCHEME)

Course Code : 20ECT362

Course Name: Introduction to MEMS

Max. Marks : 100

Duration: 3 Hours

PART A

(Answer all questions. Each question carries 3 marks)

1. Illustrate the functional relationship between the principal components in a microsensor.
2. List out the advantages and disadvantages of using piezo resistors as signal transducer.
3. Determine the moment of inertia for a beam under longitudinal strain.
4. Describe two mechanical structures used in MEMS.
5. Electrostatic actuation is preferred over electromagnetic actuation in micro motors. Justify this statement.
6. State three relevant properties of silicon carbide for use in microsystems.
7. Explain the CVD process with relevant figures.
8. List out the various steps of photolithography process.
9. Give any one application of MOEMS with figures.
10. List out the three levels of micro system packaging.

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Explain the working principle of two types of micro motors with suitable schematics. (9)
b) Explain the operating principle of a commercial product which uses MEMS technology. (5)

OR

12. a) Describe the principle of micro-accelerometer with a neat schematic. (7)
b) Explain the principle of operation of thermal sensors and actuators with neat diagrams. (7)

MODULE II

13. a) Explain the general stress -strain relationship with neat sketches. (7)
b) Derive the expression for longitudinal strain under pure bending in flexural beams. (7)

OR

14. a) Derive an expression for the spring constant of an axially loaded cantilever. (6)
b) Derive the relation between tensile stress and strain in terms of compliance matrix with the help of stress strain diagram. (8)

MODULE III

15. a) Derive equations for acceleration a , time t and power density P/V based on the trimmer force scaling vector? What information does the force scaling vector provide to the MEMS designer? (9)
b) Describe the advantages of polymers in micro systems. Give two examples of polymers (full chemical/commercial names). (5)

OR

16. a) Explain one method to produce single crystal silicon. Why is silicon used as a substrate material for MEMS? (9)
b) Compare the properties of silicon, silicon dioxide and silicon carbide. (5)

MODULE IV

17. a) Explain with block diagram the steps in LIGA process. State two advantages of LIGA process. (8)
b) Explain the ion implantation process with neat diagram. (6)

OR

18. a) With neat sketches, explain the steps in surface micromachining. Describe the various fabrication challenges associated with surface micromachining. (8)
b) Explain the etching process. (6)

MODULE V

19. a) Explain the following bonding techniques with figures (i) Silicon-Insulator (ii) Wire bonding (8)
b) State the challenges involved in designing packages for micro systems. (6)

OR

20. a) Explain the levels of microsystem packaging. (10)
b) Explain anodic bonding with figures. (4)
