

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019

Course Code: EC465

Course Name: MEMS

Max. Marks: 100

Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks.

Marks

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| 1 | a) | Explain the basic building blocks of MEMS with neat diagrams. | (8) |
| | b) | Explain the principle of operation of thermal sensors and actuators with neat diagrams. | (7) |
| 2 | a) | Derive the equation for pull in voltage. Also explain the advantages and limitations of electrostatic actuation methods. | (8) |
| | b) | Describe the principle of micro-accelerometer with a neat schematic. | (7) |
| 3 | a) | Explain the operating principle of two types of micro motors with suitable schematics | (8) |
| | b) | Determine the moment of inertia for a beam under longitudinal strain and also find the flexural formula | (7) |

PART B

Answer any two full questions, each carries 15 marks.

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|---|----|---|-----|
| 4 | a) | Explain Trimmer force scaling vector. Use scaling laws to estimate the changes in acceleration and time to actuate a MEMS component if its weight is reduced by a factor of 10. | (8) |
| | b) | Explain with figures one method to produce single crystal silicon. Why is silicon used as a substrate material for MEMS. | (7) |
| 5 | a) | With reference to scaling of electrostatic forces explain why electrostatic actuation is preferred over electromagnetic actuation in micro motors. | (8) |
| | b) | Explain the steps involved in photolithography with neat sketches. | (7) |
| 6 | a) | Explain scaling in fluid mechanics .What are the advantages of piezoelectric pumping. | (7) |
| | b) | Discuss different types of polymers used in MEMS. | (8) |

PART C

Answer any two full questions, each carries 20 marks.

- 7 a) Explain surface micro machining process for fabricating a mechanical structure with neat sketches. (10)
- b) State the objectives and explain the general considerations in micro system packaging (10)
- 8 a) Explain LIGA process in detail. (10)
- b) Explain with figures two RF MEMS applications (10)
- 9 a) Explain the three levels of micro system packaging (10)
- b) Explain Anodic bonding and Silicon Fusion Bonding (10)