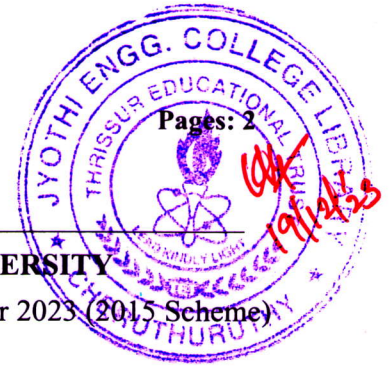


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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S7 (S, FE) / S7 (PT) (S, FE) Examination December 2023 (2015 Scheme)

Course Code: ME407

Course Name: MECHATRONICS

Max. Marks: 100

Duration: 3 Hours

PART A

Answer any three full questions, each carries 10 marks.

Marks

- | | | |
|---|--|-----|
| 1 | a) Explain the principles of thermocouples and thermistors. | (4) |
| | b) Explain any one method of increasing the sensitivity of thermocouples. | (3) |
| | c) Explain the construction and working of RTDs | (3) |
| 2 | a) Differentiate static and dynamic characteristics of a thermocouple. | (6) |
| | b) What are the factors responsible for the response time of a thermocouple | (4) |
| 3 | a) Explain two examples where, single acting and double acting pneumatic cylinders are used for actuation. | (5) |
| | b) Draw the schematic diagram for a double acting pneumatic cylinder with variable cushioning. | (2) |
| | c) Draw a schematic diagram for a hydraulic power pack. | (3) |
| 4 | a) Explain the working of a balanced vane pump with a sketch | (6) |
| | b) Draw the schematics for i) 2/3 way pilot operated valve ii) accumulator | (4) |

PART B

Answer any three full questions, each carries 10 marks.

- | | | |
|---|---|------|
| 5 | a) Explain the fabrication steps of a MEMS pressure sensor with piezo resistive sensing elements | (10) |
| 6 | a) Distinguish CVD from Epitaxy | (4) |
| | b) Explain the working of a transverse comb MEMS accelerometer | (6) |
| 7 | a) Explain the use of aerostatic guideways. | (3) |
| | b) Explain the working of recirculating ball screw and distinguish tensile and compression preloading with sketches | (7) |
| 8 | a) Explain LM guide ways used in CNC machines. | (4) |

- b) Explain Stick-slip phenomenon in guideways and methods to avoid it (4)
- c) What are the coating materials used in friction guideways (2)

PART C

Answer any four full questions, each carries 10 marks.

- 9 a) Explain the working of a hybrid stepper motor. Why teeth are provided on the stator and rotor poles. (6)
- b) Explain the characteristics used to specify a stepper motor (4)
- 10 a) Derive the mathematical expression for temperature variation of an iron box of mass M , heated by an electric coil of power W . The heat loss from the iron box is Q . Assume uniform temperature in the iron box and it has an overall specific heat capacity C_p . (10)
- 11 a) Sketch and explain the schematics of an MPFI engine management system showing the importance of various sensors and actuators (10)
- 12 a) Distinguish between histogram stretching and histogram sliding. (4)
- b) Explain the applications of robotic vision (6)
- 13 a) Explain the working of a CCD camera (6)
- b) Explain segmentation and thresholding as applied to image processing (4)
- 14 a) Design a PLC based pick and place robot, that picks parts from a conveyor and puts in to a bin after checking the size of the part and rejects are put into another bin. (10)
