

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
B.Tech Degree S7 (R,S) Examination November 2025 (2019 Scheme).

Course Code: ECT415

Course Name: MECHATRONICS

Max. Marks: 100**Duration: 3 Hours**

PART A

Answer all questions, each carries 3 marks.

Marks

- | | | |
|----|---|-----|
| 1 | Describe the components and working of a mechatronic system using a block diagram. | (3) |
| 2 | Explain any one sensing technique for flow with the help of a diagram. | (3) |
| 3 | With neat sketches, explain any two standard symbols used in hydraulic and pneumatic circuit diagrams. | (3) |
| 4 | Explain the operation of a Direction Control Valve with a clear and well-labelled schematic diagram. | (3) |
| 5 | Distinguish between timers and counters in programmable logic control with the help of its timing diagrams. | (3) |
| 6 | Illustrate and describe the components of a control system with the help of a block diagram. | (3) |
| 7 | Explain the working principle of differential pressure sensors. | (3) |
| 8 | Explain the principle and operation of a MEMS-based accelerometer. | (3) |
| 9 | Illustrate the histogram processing technique for enhancing the image contrast. | (3) |
| 10 | Distinguish between histogram stretching and sliding operations in image processing. | (3) |

PART B

Answer any one full question from each module, each carry 14 marks.

Module I

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| 11 | a) Explain the working principle of Ultra sound and light-based range finders with the help of diagrams and equations. | (10) |
| | b) Draw and explain the working of Piezoelectric sensors | (4) |

OR

- 12 a) Describe the working principle of a tactile sensor with a neat schematic diagram. (8)
Explain how strain gauges are utilized for measuring force and torque, and include suitable diagrams
- b) Some temperature-controlled switches are operated by bimetallic strips. Describe (6)
how they work.

Module II

- 13 a) Compare and contrast the operations of a Process Control Valve and Pressure (7)
Control Valve with the help of its sketches.
- b) Design a hydraulic circuit to operate a winch fitted with a hydraulic motor. The (7)
motor should be run clockwise, counter clockwise and stopped. Use a manually
operated valve.

OR

- 14 a) Provide a detailed analysis of the working and operation of a servo motor, (10)
explaining its functional components and control mechanism with the help of a
well-labelled schematic diagram.
- b) Draw and write the functions of any two standard flow control valve symbols. (4)

Module III

- 15 a) Develop a PLC ladder program for the following sequence: Start a motor with (10)
push switch, and then after a delay of 90s, start a pump. When the motor switched
off, the pump will get switched off after a delay of 5s. Mention the logic used for
each rung in the program to substantiate your answer.
- b) Explain programmed adaptive control with a block diagram. (4)

OR

- 16 a) Devise a circuit that can be used to start a motor and after a delay of 100s start a (10)
pump. When the motor is switched off there should be a delay of 10s before the
pump is switched off.
- b) Explain the model of an electrical system with basic building blocks, clearly (4)
mention all assumptions.

Module IV

- 17 a) Provide a detailed explanation of the various types of etching techniques employed in the fabrication of Micro-Electro-Mechanical Systems (MEMS), highlighting their principles, methodologies, and applications in the manufacturing process (8)
- b) Discuss in detail the factors and criteria that influence the selection of surface micromachining versus bulk micromachining techniques in the design and fabrication of microsystems. (6)

OR

- 18 a) Describe the processes of sputtering and Plasma Enhanced Chemical Vapor Deposition (PECVD) and their applications in MEMS fabrication. (7)
- b) Explain wet etching and dry etching and explain how etching process is controlled? (7)

Module V

- 19 a) Illustrate and analyze, with the aid of a clear diagram, the different mechatronics modules utilized in an automatic car park barrier system, explaining the role and interaction of each module (14)

OR

- 20 a) Draw and explain the implementation of an automotive engine management system with the help of a schematic diagram. (7)
- b) Present a comprehensive and detailed explanation of the mechatronic system underlying a weighing machine, describing the interaction of its mechanical, electronic, and control components, along with the working principle, and support your explanation with well-labelled and relevant diagrams. (7)
