APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
Scheme for Valuation/Answer Key
Scheme of evaluation (marks in brackets) and answers of problems/key
EIGHTH SEMESTER B.TECH DEGREE EXAMINATION, MAY 2019
Course Code: EE404
Course Name: INDUSTRIAL INSTRUMENTATION AND AUTOMATION

Max. Marks: 100   Duration: 3 Hours

PART A
Answer all questions, each carries 5 marks.

Marks

1   The factors that govern the output characteristics of a transducer- 1 mark for each point.   (5)

2   Basic concept and explanation of Nano instrumentation.   (5)

3   Any five important features of instrumentation amplifiers.   (5)

   (Very high input impedance, High CMRR, High and adjustable Voltage gain, high Slew rate, good sensitivity, low output impedance)

4   Advantages of MEMS -2.5 Marks   (5)

   Disadvantages of MEMS - 2.5 Marks

5   The selection criterion for control valves are,   (5)

    1. Noise and vibration
    2. Flow direction
    3. Velocity of fluid
    4. Process temperature
    5. Speed of operation
    6. Leakages
    7. Cost
    8. Life span

   Any five points-1 mark each

6   Definition of an industrial automation system – 2 marks.   (5)

   The different components used in industrial automation systems are

    1. Sensors-
    2. Actuators
    3. Control valves/ Final control element

   1 mark for each components - 3marks

7   PLC   (5)

1. Inputs are sequentially scanned and required outputs are updated
2. Lesser complexity
3. PLCs are rugged
4. Available with I/O modules for diff. voltage levels

PC

1. Can be interrupted using interrupt systems
2. Greater complexity
3. Not rugged in construction
4. Can be interfaced with external equipment

8   Any five key features of DCS – 1 mark each   (5)

1.Better and more consistent control

2.Reduced installation and wiring costs

3.Higher operating efficiency

4.Increased process safety

5.Flexibility

6.Better process management

7.Extendibility

8. Greater centralization of control functions

PART B
Answer any two full questions, each carries 10 marks.

9   a)   Any six factors with brief explanation (1x6 marks)   (6)

(Sensitivity, Operating Range, Accuracy, Cross sensitivity, Errors, Transient and frequency response, Loading effect)

    b)   Diagram showing the time response of second order system with different   (4)
damping ratios – 3 marks

Explanation- 1 mark

10   a)   Diagram – 3 marks   (6)

Working principle and operation of eddy current sensor- 3 marks

     b)   Figure – 2 marks   (4)

Working principle and explanation of a capacitive differential pressure transducer – 2 marks

11   a)   Block diagram representation of a process control system- 3 marks   (5)

Explanation of each blocks -2 marks.

b) Diagram of torque measurement using strain gauge – 2 marks   (5)

Explanation -3marks

PART C
Answer any two full questions, each carries 10 marks.

12 a) Importance of signal conditioning in instrumentation systems- Any five points (1   (5)

mark each)

b) Diagram-2.5 marks   (5)

Explanation for the working principle of phase sensitive detector-2.5 marks

13 a) Diagram of MEMS accelerometer – 2 marks   (5)

Principle of MEMS accelerometer – 3 marks.

b) Any four points to differentiate between bulk and surface micromachining.   (5)

14 a) Derivation of output voltage equation of a logarithmic amplifier- 4 marks   (5)

Explanation – 1 mark.

b) Explanation for the concept of graphical programming in virtual instruments -5   (5)

marks

PART D
Answer any two full questions, each carries 10 marks.

15 a) The role of actuators in automation system: (5)

    1. It converts the form of the variable into the appropriate physical variable, such as torque, heat or flow.

    2. Secondly it amplifies the energy level of the signal manifold to be able to causes changes in the process variables

    - 2.5 marks

Classified in to

    1. Electrical actuators

    2. Hydraulic actuators

    3. Pneumatic actuators

    - 2.5 Marks

b) To convert an open loop system to automates system the following components   (5)

are required

    1. Sensors

    2. Feedback loop

    3. Controller

    4. Actuators

5. Final control element/ valves

   3- Marks

Example with briefing-2 Marks

16 a) PLC ladder diagram to realize two input AND gate – 1.5 marks   (5)

PLC ladder diagram to realize two input OR gate – 1.5 marks

PLC ladder diagram to realize two input XOR gate – 2 marks

   b) The main components of SCADA are   (5)

1. Multiple terminal unit

2. Master station

3. HMI computers

4. Communication infrastructure

17 a) The working of butterfly valves: (5)

Figure with details: 3 Marks

Working   :   2 Marks

   b) Significance of timers and counters in PLC   (5)

1. The complex industrial processes requires timing and counting functions

2. The timers are devices that count increments of time

3. The timer compares its current time with the present time. The output of the timer will be 1 or 0.

4. Counters are used for counting a specified number of contact operations

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