



BRAINWARE UNIVERSITY

Term End Examination 2023

Programme – M.Tech.-RA-2022

Course Name – Mechatronics System Design

Course Code - OEC-MIRA201A

(Semester II)

Full Marks : 60

Time : 2:30 Hours

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question)

1 x 15=15

1. Choose the correct alternative from the following :

(i) Identify, in the generation of element geometries, for what value of j_e , the element geometries lie within the limits of acceptable distortion?

- | | |
|--------------|----------------------------|
| a) $j_e > 0$ | b) $j_e < 0$ |
| c) $j_e = 0$ | d) Any real value of j_e |

(ii) Recall: a pneumatic symbol is

- | | |
|--|--|
| a) Different from a hydraulic symbol used for the same function | b) The same as a hydraulic symbol used for the same function |
| c) Not to be compared to a hydraulic symbol used for the same function | d) None of the mentioned |

(iii) Define, which of the following is correct for tactile sensors.

- | | |
|----------------------------|-----------------------|
| a) Touch sensitive | b) Pressure sensitive |
| c) Input voltage sensitive | d) Humidity sensitive |

(iv) Explain, what is the algebraic sum of the reference input and feedback.

- | | |
|----------------------|----------------------|
| a) Error Signal | b) Error Detector |
| c) Controlled system | d) Controlled output |

(v) State the principle does the linear system follow.

- | | |
|-------------------------------------|-----------------------------------|
| a) Principle of energy conservation | b) Principle of mass conservation |
| c) Principle of electromagnetism | d) Principle of superposition |

(vi) Choose the correct answer: Transient response analysis is done for _____ systems.

- | | |
|-------------------------|----------------------|
| a) Unstable | b) Stable |
| c) Conditionally stable | d) Marginally stable |

(vii) Indicate, which sensor should be used for calculating distance.

- a) DHT11
c) HC-SR04
- b) LM335Z/NOPB
d) MPX10DP
- (viii) Indicate, prototyping involves ____
- a) conceptual design
c) database for maintaining project information
- b) replacing non-computer systems with actual hardware
d) sub models for eventual reuse
- (ix) Choose the correct answer: A semiconductor can act as _____
- a) Insulator
c) Pure conductor
- b) Semi conductor
d) All of the mentioned
- (x) Write from the option: Speed and Position in CNC can be controlled using ____
- a) slide table and spindle
c) feedback system
- b) machine code unit
d) graphic user interface
- (xi) Illustrate the full form of "PUMA" in context to robotics.
- a) Programmable used machine to assemble
c) Programmable universal machine for assembly
- b) Programmed utility machine for assembly
d) Programmed utility machine to assemble
- (xii) Indicate, which among the following is a false statement regarding "Mechatronic system".
- a) Its initial cost of setup is high
c) More output in less time
- b) Does not require highly skilled labours for operating it
d) It provides flexibility in production
- (xiii) Write, how many principle axes do a Cartesian robot has.
- a) 2
c) 4
- b) 3
d) 5
- (xiv) Illustrate whether a thermocouple is a transducer.
- a) Thermocouple is a transducer
c) undefined
- b) Thermocouple is a transducer
d) None of the mentioned
- (xv) Illustrate whether accuracy is the difference between a true value and the measured value.
- a) The statement is correct
c) undefined
- b) The statement is incorrect
d) None of the mentioned

Group-B

(Short Answer Type Questions)

3 x 5=15

2. compare the characteristics of proportional controller and proportional plus integral controller. (3)
3. Name few materials used in binding of strain gauge. Recall the types of bimetallic sensors. (3)
4. Illustrate the purpose of using potentiometer in displacement sensor. (3)
5. Describe: Marginally stable invariant system mean. Illustrate the function of decoder. (3)
6. Write the difference between traditional design approach and Mechatronics approach (3)

OR

Write, how a traditional design of temperature control of domestic central heating system is improved by mechatronic design. (3)

Group-C

(Long Answer Type Questions)

5 x 6=30

7. Illustrate about criteria should be considered when selecting a transducer for a mechatronic system, such as accuracy, sensitivity, and resolution, and how can these be optimized for (5)

different applications?

8. Illustrate, how has the integration of Mechatronics technology impacted the manufacturing industry in terms of efficiency and productivity. (5)
9. Explain some of the key challenges associated with modeling hydraulic systems, and how can these challenges be addressed in the design process? (5)
10. Write, how can we use system identification to optimize the performance of control systems and other engineering applications? (5)
11. Choose, what are some common challenges in system identification, and how can they be overcome? (5)
12. Decide, how do sensors and actuators differ in terms of their function and application, and what are some common examples of each? (5)

OR

Decide, how can different types of sensors be used to measure various physical quantities, such as temperature, pressure, and position, and what are some factors to consider when selecting the appropriate sensor for a given application? (5)
