KATHMANDU UNIVERSITY
End Semester Examination
January/February 2024

Level : B.E.
Year : III
Time : 2 hrs. 30 mins.

08 FEB 2024

Course : EPEG 317
Semester : I
F.M. : 40

SECTION "B"
[5 Q × 8 = 40 marks]

Attempt *ANY FIVE* questions. Symbols have their usual meanings. Urgent appropriate assumptions are permissible.

1. Design a fuzzy logic controller for a self-driving vehicle shown in Figure 1. It is desired that the motor speed of the vehicle increase when it approaches a steep road as well as when the total weight of people in the car is high.
Consider that the steep plane varies from 0 to 70 degrees, total weight of the car varies from 1000 to 2000 kg, and the motor speed varies from 0 to 100 rpm. Also, calculate the crisp output for motor speed for a particular weight and inclination angle [8]

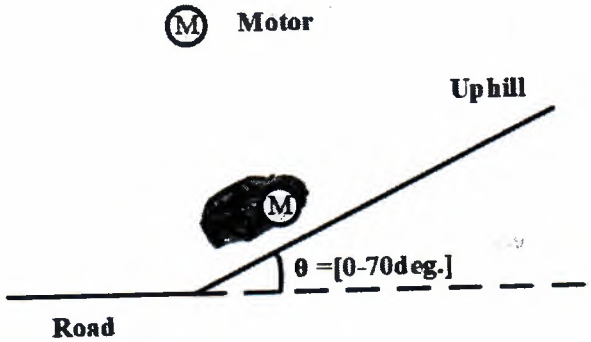

Figure 1. A self-driving vehicle traveling uphill

2. a. Develop a 5-bit Binary Weighted Digital to Analog converter and explain its advantages and disadvantages. [4]

   b. Explain the errors in measurement system and need for calibration. [4]

3. a. Explain the working principles of an ammeter and voltmeter based on Permanent magnet moving coil. [5]

   b. Explain the operation of instrument transformers. [3]

4. a. Develop a Data acquisition system (DAS) to measure the temperature of a certain equipment. Specify the type of sensor, ADC and other necessary components that you will use to build it along with their functions. [6]

   b. Show how can we practically develop the DAS in real-world. [2]

5. a. Derive the relationship for output for voltage to current converter used in instrumentation. [5]

   b. Explain the process of occurrence of inductive and capacitive interference in electronic circuits. [3]

6. a. A TV company requires to rotate (change the position) of their disc antenna according to some reference setting for a proper operation. Develop a closed loop control system for it and also explain the function of each component that will be used for its implementation. [6]

b. Explain the working and application of a thermocouple. [2]

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Marks Scored:

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Exam Roll No. :
Time: 30 mins.
F. M. : 10

Registration No.:
Date : 08 FEB 2024

SECTION "A"
[20Q. × 0.5 = 10 marks]

Choose and encircle the most appropriate option from each set of choices.

1. Which of the following component is a plant in control system?
   a. Pneumatic amplifier
   b. Hydraulic amplifier
   c. Motor
   d. Difference amplifier

2. Calibration is important to:
   a. Measure the accuracy of equipment
   b. Find the sensitivity of equipment
   c. Weight of equipment
   d. Velocity of equipment

3. Electrical transducer performs transformation of
   a. Electrical quantity to physical quantity
   b. Physical quantity to electrical quantity
   c. Physical quantity to other physical stages
   d. Electrical quantity to other electrical stages

4. LVDT is a/an
   a. Active transducer
   b. Passive transducer
   c. Thermal sensor
   d. Infra-red sensor

5. Which signal conditioning circuit provides a non-linear output?
   a. Voltage divider
   b. Op-amp based
   c. High frequency amplifier
   d. Filter circuit

6. Circuit B is connected to Circuit A which results in the drop in voltage of circuit A (Loading effect). Which component can be used to reduce this loading effect?
   a. Unity- Gain Buffer
   b. Power Amplifier
   c. Filter circuit
   d. Microcontroller

7. The minimum input voltage a 12-bit Arduino of 5V reference can detect is
   a. 1.22mV b. 3.88mV c. 4.88 mV d. 10μV

8. Flash ADC has
   a. Fastest conversion time
   b. High resolution
   c. (a) and (b)
   d. Good accuracy

9. A 3-bit R-2R DAC (S_1, S_2, S_3) have a state of (1,1,0) respectively. The reference voltage to DAC is 5V and the value of all the resistors are 1kΩ. What is the expected analog voltage from the DAC?
   a. 4.5V b. 1.25V c. 2.75V d. 3.75V

10. The major advantage of a R-2R DAC is
    a. High resistance values
    b. Small resistance values
    c. Slowest conversion time
    d. None

11. Synchronous transmission is _____ than asynchronous serial data transmission
    a. Faster
    b. Slower
    c. Same
    d. None

12. A strain gauge has a gauge factor of 2. Its length is changed by 2m, the corresponding change in its resistance will be _____
    a. 1.33Ω
    b. 3Ω
    c. 0.75Ω
    d. 4Ω

13. An Arduino of 10-bit resolution and 5V reference displays 1000 digital value. The analog equivalent of it is _____
    a. 3.56V
    b. 4.00V
    c. 4.88V
    d. 2.35V

14. A basic D'alvanometer with a full-scale deflection of 50μA and internal resistance of 500Ω is used as a voltmeter. The value of the multiplier resistance needed to measure a voltage of 0-5V range is _____
    a. 145.5kΩ
    b. 99.5kΩ
    c. 199.5kΩ
    d. 100kΩ

15. A Permanent moving coil based ammeter can be converted to a voltmeter by
    a. Changing number of wire turns
    b. Inserting a series resistor
    c. Inserting a parallel resistor
    d. Increasing magnetic flux density of permanent magnet

16. The common rating of secondary of a current transformer is _____
    a. 10A/100A
    b. 1A/5A
    c. 50A
    d. 3A

17. Interference due to capacitive interference can be reduced by using _____
    a. Copper cables
    b. Industrial cables
    c. Twisted cables
    d. Shielded cables

18. The major advantage of a Programmable logic controller is _____
    a. Highly accurate
    b. Precise control
    c. Large number of interfaces
    d. Suitable for most environmental and industrial conditions

19. The process of converting fuzzy rules to value that can be used by the controller is called
    a. Deffuzification
    b. Fuzzification
    c. Rules
    d. All of these

20. The programming of a PLC is based on _____
    a. C
    b. Python
    c. Matlab
    d. Ladder logic