Marks Scored:

KATHMANDU UNIVERSITY
End Semester Examination [C]
April, 2022

Level : B.E.
Year : III
Course : EPEG 317
Semester : I

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

Registration No.:
Date :

SECTION "A"
[20Q × 0.5 = 10 marks]

Encircle the most appropriate option.

1. The control system used in industry to control industrial process is termed as:
   a. Computer control
   b. Process control
   c. Human control
   d. None of the above

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. Static error refers to the
   a. Sum between the measured and true value of the quantity
   b. Difference between the measured and true value of the quantity
   c. Multiplication between the measured and true value of the quantity
   d. Smallest value that the equipment can detect

4. A digital voltmeter displays 10.2V. Its resolution is
   a. 0.1V
   b. 0.01V
   c. 0.001V
   d. 0.0001V

5. 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

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

7. Which is the best industrial amplifier?
   a. Summing amplifier
   b. Inverting amplifier
   c. Logarithmic amplifier
   d. Instrumentation amplifier

8. The sampling frequency should be
   a. Equal to the signal frequency
   b. Less than the signal frequency
   c. At-least twice the signal frequency
   d. All of the above

9. The advantage of flash ADC is
   a. Highest accuracy
   b. Fastest conversion time
   c. Slowest conversion time
   d. High resolution

10. Successive ADC has
    a. Fastest conversion time
    b. High resolution
    c. Both a and b
    d. Good accuracy

11. The major disadvantage of a binary weighted DAC is need for
    a. High resistance values
    b. Small resistance values
    c. Slowest conversion time
    d. None of the above

12. The major advantage of a R-2R DAC is
    a. High accuracy
    b. High resistance values
    c. Small resistance values
    d. All of the above

13. Parallel transmission is _____ than serial data transmission
    a. Faster b. Slower c. Same d. None of the above

14. The components of a data acquisition system are
    a. Sensors
    b. Signal conditioning circuit
    c. Sample and hold circuit
    d. All of the above

15. The analog ammeter consists of
    a. AC supply
    b. DC battery
    c. Permanent magnet and a fixed coil
    d. Permanent magnet and a moving coil

16. Energy meter measures the amount of _____ consumed by the load
    a. Active power b. Reactive power c. Energy d. Frequency

17. Programmable logic controllers (PLC) are widely used in
    a. Homes b. Industries c. Universities d. Robotics

18. Fuzzy logic control is based on
    a. Degree of uncertainty
    b. Precise control
    c. Low power control
    d. All of the above

19. The different stages in fuzzy logic control are
    a. Fuzzification, and Defuzzification
    b. Fuzzification, Rule making and Defuzzification
    c. Fuzzification and Decision making
    d. Fuzzification, Rule making, Decision making, and Defuzzification

20. The gain of inverting amplifier is:
    a. R_f / R_1 b. $R_f + R_1$ c. $R_f - R_1$ d. $-R_f / R_1$

    Where R_f: Feedback resistor, R_1: Input resistor

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

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

SECTION "B"
[5Q × 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 2000 to 3000 kg, and the motor speed varies from 0 to 200 rpm. Also, calculate the crisp output for motor speed for a particular weight and inclination angle.

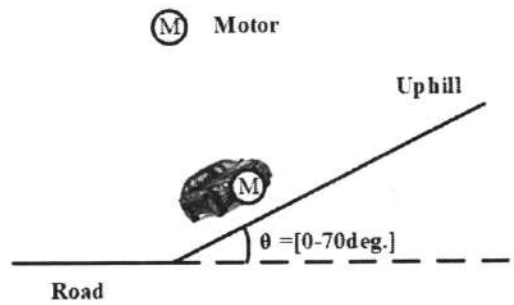

Figure 1. A self-driving vehicle traveling uphill

2. Show how a Successive Analog to Digital Converter can be used to convert an input voltage of 11 volts to a 6 bit digital value. Take the ADC reference voltage as 14 volts. Also list the advantages and disadvantages of this converter.

3.
   a. Explain the working principle of Ammeter based on Permanent magnet moving coil. [4]
   b. It is desired to measure the voltage across 50 kΩ resistor in the circuit of Figure 2. Two voltmeters are available for this measurement: voltmeter 1 with a sensitivity of 1000Ω/V and voltmeter with a sensitivity of 40,00Ω/V. Both meters are used in their 50V range. Calculate [4]
      i. the reading of each meter
      ii. the error in each reading expressed as a percentage of the true value.

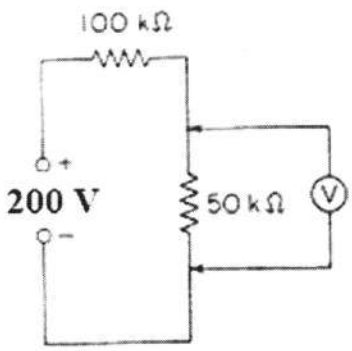

Figure 2. Voltmeter connected across load

4. An electric substation requires continuous monitoring of its transformer temperature. Develop a Data acquisition system (DAS) for it. Specify the type of sensor, ADC and other necessary components that you will use to build it along with their functions. Also, briefly explain how the data from DAS can be displayed on a Personal computer (PC). [6+2]

5.

a. Define signal conditioning and explain its types. [4]
b. A sensor outputs a voltage ranging from -3V to -1V. Design a signal conditioning circuit to interface it with a microcontroller of 0-5V. [4]

6.

a. Explain the working principle of a linear variable differential transformer and also mention its advantages and disadvantages. [4]
b. Explain the working principle of thermal sensors: Resistance temperature detector, Thermocouple and Thermistor. [4]