BRAINWARE UNIVERSITY

Term End Examination 2024-2025
Programme – M.Tech.(RA)-2024
Course Name – Advanced Control System in Robotics
Course Code - MEC10102
(Semester I)

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) In a control system the output of the controller is given to
   a) Amplifier b) Sensor
   c) Final control element d) Comparator

(ii) Identify the following that are not characteristics of the closed loop systems
   a) It does not have the ability to control the system transient response b) It does not involve I/O measurements
   c) It reduces the sensitivity of plant-parameter variations d) It does not compensate for disturbance

(iii) Select a feature that is not considered as good control system
   a) Slow response b) Sufficient power handling capacity
   c) Good stability d) Good accuracy

(iv) Identify the type 2 system has at the origin.
   a) no net pole b) simple pole
   c) net pole d) two poles

(v) Choose the following element that is not used in an automatic control system
   a) Final control element b) Sensor
   c) Oscillator d) Error detector

(vi) Transfer function of the system is defined as the ratio of Laplace output to Laplace input considering initial conditions_____
   a) 1 b) 2
   c) 0 d) infinite

(vii) select, how does increasing the integral gain (Ki) affect the PID controller?
   a) It reduces steady-state error but can cause increased overshoot and oscillations b) It improves the system's response time
   c) It decreases the rate of error change d) It eliminates the need for proportional gain

(viii) Fuzzy logic is usually represented as _____

a) IF-THEN-ELSE rules
b) IF-THEN rules
c) Both IF-THEN-ELSE rules & IF-THEN rules
d) None of the mentioned

(ix) Matrix Q is :

a) Positive semi definite symmetric matrix
b) Positive definite non-symmetric matrix
c) Negative definite symmetric matrix
d) Negative definite non-symmetric matrix

(x) choose which of the following is not the feature of a modern control system.

a) Correct power level
b) No oscillation
c) Quick response
d) Accuracy

(xi) Benefits of feedback:

a) Performance of system is greater.
b) Need for system much larger path gain and system instability.
c) Controlled variable accurately follows the desired value
d) Affected by parameter variations

(xii) Bounded input and Bounded output stability notion concerns with :

a) A system under influence of input
b) A system not under influence of input
c) A system under influence of output
d) A system not under influence of output

(xiii) Linear mathematical model applies to :

a) Linear systems
b) Stable systems
c) Unstable systems
d) All of the mentioned

(xiv) The difference between the set points and the measured signal is known as

a) Error
b) Bias
c) Both a and b
d) None of the above

(xv) The transfer function of a linear time-invariant system is

a) A function that relates the input to the output
b) A function that describes the system's internal state
c) A function that depends on time and varies with system parameters
d) A constant value

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Define controlled variable, manipulated variable and load variable in process control. (3)

3. Write Ziegler Nichols tuning formulae. (3)

4. Explain saturation in nonlinear control system. (3)

5. Illustrate artificial neural network (ANN) in the context of control systems. (3)

6. Write the difference between Continuous Time Signal and Discrete Time Signal. (3)

OR

Write the Advantages and Disadvantages of Closed Loop Control System. (3)

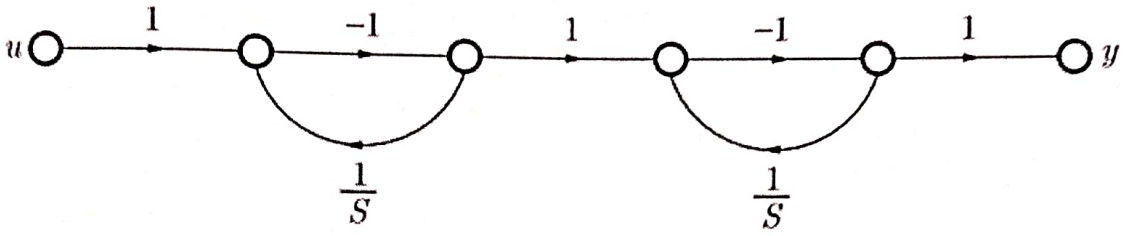
Group-C

(Long Answer Type Questions) 5 x 6=30

7. Explain the steps of manual tuning of PID controller. (5)

8. The state variable equations and the state diagram of a system are shown below. Evaluate the state-variable equations and the state transition matrix of the system. (5)

$$\dot{X} = AX + Bu;\ y = CX + Du$$



9. Differentiate between Fuzzification and Defuzzification. (5)

10. Define degenerative and regenerative feedback control systems. (5)

11. Write the name of different learning laws in neural networks. (5)

12. Discuss how the stability is affected for integral and derivative control. (5)

OR

Explain Indirect Adaptive Control. (5)

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