



BRAINWARE UNIVERSITY

Term End Examination 2023-2024

Programme – M.Tech.-RA-2023

Course Name – Advanced Control System in Robotics

Course Code - PCC-MIRA102

(Semester I)

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Brainware University
398, Ramkrishnapur Road, Barasat
Kolkata, West Bengal-700125

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) Select what type of information is required as input for a state observer to estimate the state of a system.
- a) Input and output signals of the system b) Only the output signals of the system
c) Only the input signals of the system d) A mathematical model of the system
- (ii) Select which mathematical technique is often used to design state observers for linear time invariant systems.
- a) Fourier analysis b) Laplace transform
c) Kalman filtering d) Newton's method
- (iii) Select what does LQR stand for in the context of control system design.
- a) Linear Quadratic Regulation b) Long-Range Quotient Regression
c) Low-Quality Resonance d) Linear Quality Reaction
- (iv) Predict which control system parameter is typically designed to be robust against variations in system parameters.
- a) Set point b) Controller gain
c) Time constant d) Integral time
- (v) In Adaptive Pole Placement, select which parameter(s) are adjusted to achieve desired pole locations.
- a) Only proportional gain b) Only integral gain
c) Both proportional and integral gains d) Derivative gain
- (vi) Choose what is the function of fuzzy logic in intelligent control systems.
- a) To represent precise values b) To handle uncertainty and imprecision
c) To replace traditional control systems d) To improve computational speed
- (vii) A fuzzy set is explained by its:
- a) Membership function b) Fuzzy logic operator
c) Fuzzification level d) Crisp set value
- (viii) Predict the process of converting crisp inputs into fuzzy sets is known as:

- a) Inference
b) Defuzzification
c) Fuzzification
d) Aggregation
- (ix) Select a hybrid system that combines genetic algorithms and neural networks can be useful in:
a) Image recognition tasks.
b) Sentiment analysis of text data.
c) Solving complex optimization problems.
d) Playing traditional board games.
- (x) What does time domain analysis in control systems primarily discuss on?
a) Frequency response
b) Time response
c) Transfer function
d) Root locus
- (xi) Select the primary function of a control system in robotics.
a) Provide power to the robot
b) Control and coordinate the robot's movements
c) Provide wireless communication
d) Enhance the robot's aesthetics
- (xii) In time domain analysis, select what is the system's output when the input is a unit impulse function.
a) Step response
b) Ramp response
c) Impulse response
d) Frequency response
- (xiii) Show what is the rise time of a control system response.
a) The time it takes to reach a steady-state value
b) The time it takes to reach 10% of the final value
c) The time it takes to reach 90% of the final value
d) The time it takes to reach the maximum overshoot
- (xiv) In time domain analysis, choose what is the characteristic equation of a linear time-invariant system.
a) Transfer function
b) Laplace transform
c) Differential equation
d) Root locus
- (xv) Name which type of control system is commonly used in robotics for precise positioning and movement.
a) Open-loop control
b) Closed-loop control
c) Feed-forward control
d) On-off control

Group-B

(Short Answer Type Questions)

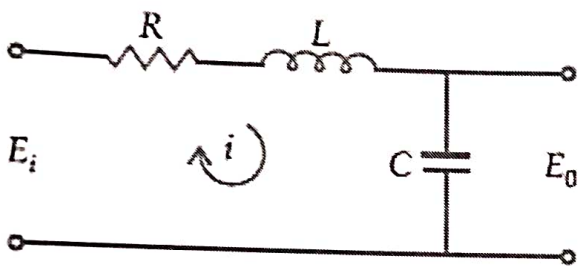
3 x 5=15

2. Write the advantages of Routh- Hurwitz Criterion. (3)
3. Write the advantages of using a Kalman filter as a state observer. (3)
4. Show the time response of a Second Order System. (3)
5. List the disadvantages of Fuzzy Logic Control. (3)
6. What are the basic steps to design a Fuzzy Logic Controller? (3)

OR

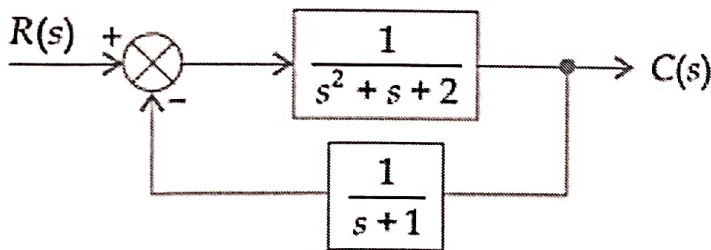
Express the key features of reinforcement learning. (3)

7. Write some common applications of basic adaptive control in engineering and automation. (5)
8. Compare between Open Loop and Closed Loop Control System. (5)
9. Write a short note on Neuro-Fuzzy Controller. (5)
10. Write the name of different learning laws in neural networks. (5)
11. Determine the transfer function of the electrical network shown in Fig: (5)



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12. For the system shown in Figure. Calculate K_p and e_{ss} for unit step input. (5)



OR

- For the given signal flow graph evaluate the ratio C/R . (5)

