

ME Mechanical Engineering 1st Year 2nd Semester Examination 2025

Subject: Control of Mechatronic System

Time : Three hours

Full Marks: 100

*Answer any **FOUR** questions.*

1. Compare between the application of supervised and unsupervised learning in the context of maintenance of a machine involving a number of different modules. How could a reward function be formulated for tuning the gains of a PID controller? **18+7**
2. Describe a simple neural network structure along with mentioning some applications of it in different types of machine learning and control. **25**
3. Explain the quick sorting method with the example of a column vector
 $(24 \ 60 \ 15 \ 18 \ 92 \ 80 \ 75)^T$. **20**
How does sorting could help in training a model for constructing missing sensor data? **5**
4. Discuss the MIDA technique for handling sensor data with occasionally missing values. **25**
5. What is fuzzy logic often integrated to machine learning? The Gaussian membership functions of the sum x of the nondimensional error e and its rate de/dt involve three sets, namely 1, 2 and 3, which have membership value of 1.0 respectively at -2.0, 0 and 2.0 and acquire membership value of 0.5 respectively at -3.0, 1.0 and 3.0. For the output variable u , the fuzzy sets are singleton membership value of 1.0 at -2, 0 and 2 for the subsets 1, 2, and 3 respectively. The rule base is: if x is i then u is i for $i=1$ to 3. Determine the output for e and de/dt respectively equal to 0.5 and -1.8. **5+20**
6. Write **short** notes on **5x5**
 - (a) narrow and strong AI
 - (b) logical regression
 - (c) normalizing
 - (d) evaluation metrics for machine learning
 - (e) fuzzification