

Answer All The Following Questions

[100 Marks]

Question (1)

[20 Marks]

- (a) According to power systems control, compare between the various utilized types showing the drawbacks of the traditional types. Give examples for artificial intelligent tools.
- (b) According to artificial neural networks control discuss the following:
- ✓ Construction
 - ✓ Activation functions
 - ✓ Processes inside the neuron
 - ✓ Common utilized types

Question (2)

[20 Marks]

- (a) Give the complete description for the artificial neural networks shown in Figs. (P₂-a) and (P₂-b).

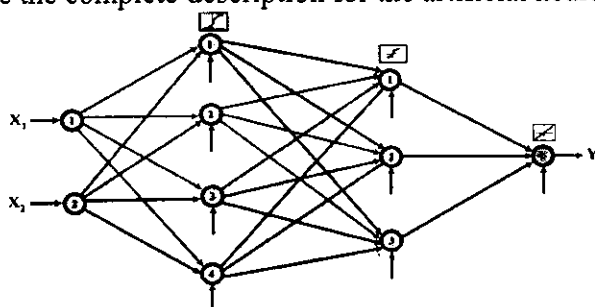


Fig. (P₂-a)

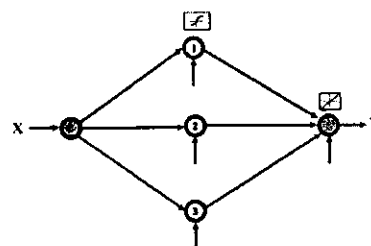


Fig. (P₂-b)

- (b) Write a MATLAB code to design the artificial neural network given in Fig. (P₂-a). Use the Levenberg-Marquardt algorithm to train this neural network.

Question (3)

[30 Marks]

- (a) For a feed-forward artificial neural network, derive the back-propagation algorithm for a neural consists of input layer (one neuron), one hidden layer (two neurons with log-sigmoid activation functions) and one output layer (one neuron with pure-line activation function) respectively.
- (b) For a synchronous generator connected to an infinite bus, equipped with PID controller. The controller output signals corresponding the generated power are listed in the following table:

Generated power	0.65	0.035	0.84	0.93	0.68	0.75	0.74	0.39	0.65	0.17
Control signal	0.72	0.031	0.27	0.04	0.07	0.85	0.69	0.31	0.95	0.04

Design a feed-forward artificial neural network with the construction described in Question 3-a. Use the back-propagation algorithm to calculate the neural network controller parameters to simulate the first datum in the table. Repeat the training process to the iteration where the least square error reaches a value less than 0.005. Set the initial values for all parameters to 0.3 and the learning rate to 0.1.

Question (4)

[30 Marks]

- (a) For fuzzy logic control describe the following:
- ✓ Construction,
 - ✓ Each part function in its construction,
 - ✓ Membership functions,
 - ✓ Fuzzification and defuzzification processes showing their types.
- (b) A fuzzy logic control system with two inputs and one output. Inputs and output are classified using three triangular membership functions. The rule-based system consists of 9 rules. Draw the rules and assign the inputs (0.5, -0.3) and calculate the member functions for each one. Calculate the controller's output corresponding to these inputs values.