

GANPAT UNIVERSITY

B. Tech. Semester: VIII Mechatronics Engineering

CBCS Regular Examination Apr-June 2017

2MC801 Computational Intelligence Techniques

Time: 3 Hours

Total Marks: 70

- Instruction:**
- 1 Start a new question from new page.
 - 2 Draw the figure with right indication.
 - 3 Answer to the two sections must be written in separate answer sheet.
 - 4 Assume necessary data and mention your assumption.

Section - I

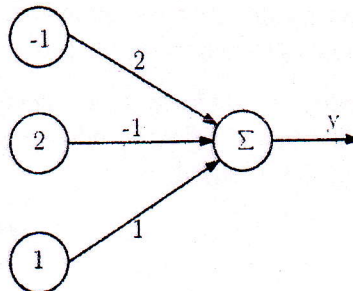
Que. 1

- (a) What is Hebbian learning? Explain mathematical model of Hebbian modification and covariance hypothesis. (06)
- (b) First discuss any three activation function with mathematical equation. Then explain the concept of tunability for activation function. (06)

OR

Que. 1

- (a) Discuss 3D error plotting concept for ANN and 'Gradient Descent Algorithm'. (06)
- (b) Write all equations for 'error correction learning'. Use the same to update the weights for given ANN for single iteration. Consider network is pure linear. Targeted output for network is 1 and learning rate $\eta = 0.3$. Take bias value $b = 0$. (06)



Que. 2

- (a) Give only definition of following terms (06)
 1. Crisp relationship
 2. Fuzzy relation
 3. Max-min composition operation
- (b) 'IF x is R THEN y is S ' where $R = \begin{bmatrix} 0.2 & 0.3 & 0.6 \\ 1 & 2 & 3 \end{bmatrix}$ and $S = \begin{bmatrix} 0.4 & 0.6 & 0.8 \\ 5 & 7 & 9 \end{bmatrix}$ infer S' (05)
for the following rule 'IF x is R' THEN y is S' ', where $R' = \begin{bmatrix} 0.7 & 0.8 & 0.4 \\ 1 & 2 & 3 \end{bmatrix}$, use Mamdani Implication using following compositions
 1. Max-min composition
 2. Max-product composition
 3. Min-max composition
 4. Max-max composition

OR

Que. 2

- (a) What is projection of fuzzy relations and cylindrical extension? Take suitable example of relation to explain X & Y projections and cylindrical extension. (06)
- (b) Give block diagram of Mamdani Model, then explain concept of 'fuzzifier' and 'Rule base'. (05)

Que. 3

- (a) Give comparison of human brain to artificial neural network. (04)
- (b) Discuss linguistic modifiers for fuzzy logic. (04)
- (c) Explain (04)
1. Dienes-Rescher implication
 2. Zadeh implication

Section – II

Que. 4

- (a) A dc generator developing open-circuit voltage V volts has an internal resistance of R ohms. Determine the value of the load resistance x for which power delivered by generator will be minimum. Also determine load resistance of the generator that can deliver maximum power at open circuit voltage 240 V with internal resistance 10 Ω. Find maximum power delivered. (04)
- (b) The profit per acre of farm is given by (04)
- $$f(x_1, x_2) = 26x_1 + 20x_2 + 4x_1x_2 - 3x_1^2 - 4x_2^2$$
- Where x_1 and x_2 denote, the labor cost and fertilizer cost respectively, find the values of x_1 and x_2 to maximize the profit.
- (c) Design a window in a shape of a rectangle surmounted by a semicircle with the perimeter of 20 meter so as to allow maximum airflow when it is opened. Use Lagrange multiplier method. (04)

OR

Que. 4

- (a) Show that a ball can travel maximum distance when thrown at an angle of 45° from horizontal for a given velocity. Use the necessary and sufficient conditions of one dimensional optimization. (04)
- (b) Examine the points at extreme values of the function (04)
- $$f(x_1, x_2) = x_1^3 + 3x_1x_2^2 - 15x_1^2 - 15x_2^2 + 72$$
- (c) A beam of uniform rectangular cross-section is to be cut from a log having circular cross section of radius r. The beam is to be used as a cantilever of fixed length to carry a concentrated load at its free end. Determine the dimensions of the beam that correspond to maximum tensile stress capacity. Use Lagrange multiplier method. (04)

Que. 5

- (a) Use constrained variation to maximize the volume of a box made up of thin sheet metal whose surface area is 24 cm² (05)
- (b) Give that petrol burnt per hour in a motor bike varies as the cube of its velocity. Obtain the most economical speed (v) to go against air which flows at x km/hr. Use direct substitution method. (06)

OR

Que. 5

- (a) A rectangular steel tank open at the top is to have volume 32 cubic meters. Find the dimensions of the box requiring least material for its construction using constrained variation method. (06)
- (b) A page has maximum area 24 cm^2 , find out its maximum print area when 2 cm and 3 cm margins are left from each side while printing using direct substitution method. (05)

Que. 6 Do as directed

- (a) Using Kuhn-Tucker condition find the values of β for which $x_1^* = 1, x_2^* = 2$ will be optimal to the problem. (04)

$$\begin{aligned} \text{Maximize } f(x_1, x_2) &= 2x_1 + \beta x_2 \\ \text{Subjected to } g_1 &= x_1^2 + x_2^2 - 5 \leq 0 \\ g_2 &= x_1 - x_2 - 2 \leq 0 \end{aligned}$$

- (b) The horse power generated by pelton wheel is proportional to $u(v-u)$, where u is the velocity of the wheel, which is variable and v is the velocity of the jet, which is fixed. Show efficiency of pelton wheel will be maximum when $u = v/2$. (04)
- (c) Using genetic algorithm find out maximum value of $x^3 - x^2$ into interval $[0, 31]$ (04)

END OF PAPER