

**M.Tech Odd Semester (CBCS) Exam.,
December—2016**

AGRICULTURAL ENGINEERING

(1st Semester)

Course No. : MAEEL-08

(Computer Graphics and Simulation)

Full Marks : 50

Pass Marks : 15

Time : 2 hours

- Note :*
1. Attempt **any five** questions.
 2. Begin each answer in a new page.
 3. Answer parts of a question at a place.
 4. Assume reasonable data wherever required.
 5. The figures in the margin indicate full marks for the questions.
1. Explain the following with engineering examples : 2×5=10
 - (a) Simulation
 - (b) Modeling
 - (c) Optimization
 - (d) Pattern recognition
 - (e) Classification

2. Derive the expression for the path traced by the end effector of a mechanical robot made using a 4-bar mechanism. Explain the criterion for the complete rotation of the smallest link of the mechanical robot. 5+5=10
3. Explain swarm intelligence. Find the position of the swarm with 5 random particles after 2 iterations that work to identify the optimum solution to the function $x^2 - 2x - 3 = 0$ such that $x \in [-4, 4]$. 3+7=10

4. Consider a function

$$f(x_1, x_2) = (x_1^2 - x_2 - 1)^2 + (x_1 - x_2^2 - 7)^2$$

Find the position of the swarm with 5 random particles after 2 iterations that work to identify the optimum solution to this function in the space $x_i \in [0, 10]$ for all $i = 1, 2$. 10

5. Consider maximization of the objective function $f(x) = x^2$ for $x \in [0, 31]$. Use population size of 4 chromosomes.

- (a) Form the initial population.
- (b) Show next generation using (i) stochastic remainder sampling without replacement and (ii) stochastic sampling with replacement. 10

(3)

6. Distinguish between fuzzy set and crisp set with examples. Explain various fuzzy membership functions. 5+5=10

7. Consider a Mamdani fuzzy model for inferencing with the following rules (universe for X is $[-10, 10]$ an universe for Y is $[0, 10]$) :

If x is small, then y is low

If x is medium, then y is moderate

If x is large, then y is high

The antecedent fuzzy set memberships are defined as

Small X = trapezoid (x ; 10, 10, 6, 2),

Medium X = trapezoid (x ; 6, 2, 2, 6),

Large X = trapezoid (x ; 2, 6, 10, 10).

The consequent fuzzy sets are defined as

Low Y = trapezoid (y ; 0, 0, 2, 4),

Moderate Y = trapezoid (y ; 2, 4, 6, 8),

High Y = trapezoid (y ; 6, 8, 10, 10).

What would be the Mamdani model output for (a) crisp input $x = 0$ using centroid defuzzification and (b) crisp input $x = 4$ using mean of maximum defuzzification? 10

(4)

8. Explain the working of artificial neural network for regression modelling/ pattern recognition from the following : 10

| Random numbers | | | | | | | | | |
|----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0.8 | 0.2 | 0.4 | 0.1 | 0.9 | 0.4 | 0.8 | 0.0 | 0.3 | 0.2 |
| 0.4 | 0.8 | 0.1 | 0.1 | 0.8 | 0.9 | 0.1 | 0.3 | 0.3 | 0.5 |
| 0.4 | 0.5 | 0.2 | 0.9 | 0.8 | 0.5 | 0.4 | 0.9 | 0.8 | 0.5 |
| 0.3 | 0.4 | 0.6 | 0.2 | 0.8 | 0.0 | 0.7 | 0.7 | 0.8 | 0.1 |
| 0.8 | 0.6 | 0.4 | 0.8 | 0.2 | 0.4 | 0.0 | 0.0 | 0.1 | 0.5 |
| 0.5 | 0.5 | 0.9 | 0.8 | 0.5 | 0.5 | 0.3 | 0.0 | 0.8 | 0.3 |
| 0.5 | 0.5 | 0.0 | 0.1 | 0.4 | 0.8 | 0.7 | 0.3 | 0.0 | 0.1 |
| 0.8 | 0.4 | 0.9 | 0.4 | 0.5 | 0.5 | 0.5 | 0.7 | 0.2 | 0.1 |
| 0.5 | 0.9 | 0.6 | 0.8 | 0.9 | 0.0 | 0.7 | 0.9 | 0.9 | 0.1 |
| 0.0 | 0.0 | 0.6 | 0.2 | 0.9 | 0.6 | 0.5 | 0.5 | 0.5 | 0.5 |
