

Enrollment No./Seat No.:

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering - SEMESTER - VII EXAMINATION - WINTER 2025

Subject Code: 3172611

Date: 26-11-2025

Subject Name: Rubber Product and Process Computer Aided Design

Time: 10:30 AM TO 01:00 PM

Total Marks: 70

Instructions

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

	Marks
Q.1 (a) What is the relation between simulation and optimization?	03
(b) Explain the graphical method of solving two-variable optimization problems with linear objective function and constraints.	04
(c) Using Newton's method, find the point of minimum for the unconstrained function $f(x) = x^4 - 2x^2 + 5$. Show the steps for the first two iterations starting from $x_0 = 1$.	07
Q.2 (a) Write any three essential features of optimization problems.	03
(b) Define the term: Simulation. How does Simulation differ from Design?	04
(c) Describe the least square method with an example.	07

OR

- (c) To Schedule the production in two plants, A&B each of which can manufacture two products. no1 & no2. How should scheduling take place to maximise profits while meeting the market requirements based on the following data

Plant	Material Processed kg/day		Profit kg/day	
	1	2	1	2
A	MA_1	MA_2	SA_1	SA_2
B	MB_1	MB_2	SB_1	SB_2

How many days per year (365) should each plant operate processing each kind of material? Formulate the problem and discuss any one method to solve the problem.

- Q.3 (a) Write any three basic components of a Simple Genetic Algorithm (SGA). 03
- (b) Discuss the effect of Rank selection in Genetic Algorithm (GA) on its performance during the optimization process. 04
- (c) Explain the concept, theory, and history of Genetic Algorithm and specifically outline its application in Rubber Extruder Design. 07

OR

- (a) Write the first three algorithm steps for a simple Genetic Algorithm (GA) for optimization. 03
 - (b) Discuss the effect of mutation probability on the performance of GA. 04
 - (c) Describe the complete procedure for solving optimization problems using a Simple Genetic Algorithm (SGA), including the initial population, evaluation, and selection steps. 07
- Q.4**
- (a) Write any three basic components of Finite Element Analysis (FEA). 03
 - (b) List any four advantages of the Finite Element Method (FEM). 04
 - (c) Explain the step-by-step procedure of Finite Element Analysis (FEA) and outline its application in rubber process design. 07

OR

- (a) Define the following terms in the context of FEA: (1) Element, (2) Node, and (3) Mesh. 03
 - (b) Explain the general description of the Finite Element Method (FEM). 04
 - (c) Justify the use of FEA as a superior tool for predicting the fatigue life of rubber components (like engine mounts) over empirical testing methods. 07
- Q.5**
- (a) Write any three Disadvantages of the Artificial Neural Network (ANN) method. 03
 - (b) Schematically represents the structure of a simple Artificial Neural Network. 04
 - (c) Apply the Secant Method to find the root of the equation $x^2 - 4x - 10 = 0$ in the interval [4, 6] for the first two iterations. 07

OR

- (a) List and briefly describe the three common uses of algorithms in rubber product and process design. 03
- (b) Differentiate between manual design and CAD-based design. 04
- (c) Find a root of an equation $f(x) = x^3 - x - 1$ using secant method. 07
