

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 7 – EXAMINATION – SUMMER 2026

Subject Code: 3172611

Date: 03/06/2026

Subject Name: Rubber Product and Process Computer Aided Design

Time: 02:30 PM TO 05:00 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.**

- Q.1**
- (a)** Define Computer-Aided Design (CAD) and state its core relevance to rubber product manufacturing. **03**
 - (b)** Discuss how Simulation helps in minimizing material waste and defects during the rubber molding process. **04**
 - (c)** Elaborate on the roles and interdependencies of Design, Optimization, and Simulation in creating an efficient rubber product. Show how they form an integrated system. **07**
- Q.2**
- (a)** State the primary objectives of using optimization techniques in rubber process engineering. **03**
 - (b)** Explain the step-by-step procedure of the Graphical Method used in optimization. **04**
 - (c)** Derive the mathematical formulation for the Least Square Method (Linear Regression) and demonstrate with a hypothetical example how to fit a straight line to a set of polymer property data. **07**
- OR
- Q.2**
- (c)** Discuss the role of mathematical modeling in rubber design. **07**
- Q.3**
- (a)** Explain the fundamental concept of curve fitting of polynomials. **03**
 - (b)** Explain the Least Square Method for fitting a straight line ($y = mx + c$) to a given set of experimental rubber testing data. **04**
 - (c)** Differentiate between Interpolation and Extrapolation using appropriate algorithms. **07**
- OR
- Q.3**
- (a)** What is the Secant method? Write down its iterative formula. **03**
 - (b)** Explain the algorithm of Newton's method with the help of a flow chart or step-by-step procedure. **04**
 - (c)** Explain the significance of Numerical Differentiation and Integration algorithms in computer-aided design. **07**
- Q.4**
- (a)** Define Genetic Algorithm (GA) and state its core concept. **03**
 - (b)** Differentiate between the 'Crossover' and 'Mutation' operators in GA with a neat sketch. **04**
 - (c)** Discuss in detail how Genetic Algorithms are applied to Rubber Extruder Design. What are the typical objective functions and variables involved? **07**
- OR
- Q.4**
- (a)** Explain the term "Fitness Function" in the context of GA. **03**

- (b)** Discuss the role of representation (encoding) schemes in Genetic Algorithms. **04**
- (c)** Explain the step-by-step methodology of implementing a Genetic Algorithm to solve optimization problems. **07**

- Q.5**
- (a)** Mention any three distinct advantages of using FEA in engineering design. **03**
 - (b)** Give a general description of the steps involved in solving a problem using FEA. **04**
 - (c)** Explain the working mechanism and training methods of an Artificial Neural Network. **07**

OR

- Q.5**
- (a)** What are the limitations or disadvantages of Finite Element Analysis? **03**
 - (b)** Explain the difference between pre-processing, processing, and post-processing phases in FEA. **04**
 - (c)** Describe the complete architecture of a Data Acquisition & Analysis system suitable for a rubber manufacturing plant. **07**
