

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 4 – EXAMINATION – SUMMER 2026

Subject Code: BE04005011

Date: 21/05/2026

Subject Name: Mechanical Operation

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.**

- Q.1**
- (a) List out various mechanical operations used in chemical industries with suitable example. **03**
 - (b) Explain ideal screen and actual screen with comparison. **04**
 - (c) Write a short note on ball mill with derivation of critical speed equation. **07**
- Q.2**
- (a) Define: (1) Rittinger's Law (2) Kick's Law (3) Bond's Crushing Law **03**
 - (b) Calculate the sphericity of cylindrical particle of 2 cm diameter and 5 cm height. **04**
 - (c) Explain screen effectiveness and derive its mathematical expression. **07**
- OR
- Q.2**
- (c) Explain differential and cumulative method of particle size analysis. Which analysis is more preferable differential or cumulative? How? **07**
- Q.3**
- (a) Define minimum fluidization velocity and explain its significance. **03**
 - (b) Write merits and demerits of fluidization process. **04**
 - (c) Explain pneumatic conveying system with neat diagram, advantages and disadvantages. **07**
- OR
- Q.3**
- (a) Differentiate clarifier and classifier. **03**
 - (b) What are the important considerations for selection of conveyor? **04**
 - (c) Derive Kozeny–Carman equation for laminar flow through packed bed. **07**
- Q.4**
- (a) What is meant by cake resistance and filter medium resistance? **03**
 - (b) Explain different zones formed during batch sedimentation. **04**
 - (c) A sludge is filtered in a washing plate and frame filter press at a constant pressure of 3 kg/cm^2 . A 15 cm cake is formed in 1 hour with filtrate volume of 6 m^3 at the end of filtration 1.5 m^3 of washing liquor is passed. All other operation takes approximately 10 minutes. Neglect resistance of cloth and flow lines. Determine: (i) The washing time, (ii) Amount of filtrate produced in 24 hours **07**
- OR
- Q.4**
- (a) Explain about Filter aid and Filter Media. **03**
 - (b) Derive mathematical expression for constant rate filtration. **04**
 - (c) Discuss principle, construction and working of basket centrifuge. **07**

- Q.5** (a) What is the Power number? Define its significance. **03**
(b) Explain characteristics, applications and selection criteria of paddles. **04**
(c) Classify impellers used in agitation of liquids and explain each briefly. **07**

OR

- Q.5** (a) Define mixing index and explain its role in determining uniformity of mixture. **03**
(b) Discuss different types of mixers used for solids. **04**
(c) Discuss different techniques used to avoid vortex formation during agitation. **07**
