



Gyanmanjari
Innovative University

Course Syllabus
Gyanmanjari Institute of Technology
Semester- 5 (B.Tech.)

Subject: Mechanical Unit Operations- BETCH15311

Type of course: Professional Core

Prerequisite: Understanding of Basic Physics and Chemical Operations

Rationale: Studying mechanical unit operations, a core area of chemical engineering, is to understand and apply the principles and equipment involved in physical processes like crushing, grinding, screening, and filtration, which are crucial for preparing materials and separating products in various industries.

Teaching and Examination Scheme:

| Teaching Scheme | | | Credits | Examination Marks | | | | | Total Marks |
|-----------------|---|---|---------|-------------------|-----|-----------------|----|-----|-------------|
| CI | T | P | C | Theory Marks | | Practical Marks | | CA | |
| | | | | ESE | MSE | V | P | ALA | |
| 3 | 0 | 2 | 4 | 60 | 30 | 10 | 20 | 30 | 150 |

Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

| Sr. No. | Course content | Hrs. | Weightage |
|---------|--|------|-----------|
| 1 | Properties and handling of Particulate solids Characterization of solid particles, Classification of solid materials, Screen analysis, Specific surface mixture, Standard screen series, Properties of particulate masses, Storage of solids | 10 | 20% |
| 2 | Size Reduction Principle of Comminution, Energy and power requirement, Laws of size reduction, size reduction equipment's and its operations, principle of size enlargement Screening; Mechanical Separation, Screening (Sieving), type of screening equipment, ideal and actual screens and its effectiveness. | 10 | 30% |



| | | | |
|----|---|----|-----|
| | | | |
| 3 | Separation Based on Motion of Particulate through the Fluids; Gravity settling process, sedimentation, cyclone separators Fluidization Principle of fluidization, flow through packed bed, pressure drop in packed bed, pressure drop flow diagrams Type of Fluidization Particulate fluidization, aggregative fluidization, determination of minimum fluidizing velocity, application, advantages, disadvantages and use of fluidization techniques | 15 | 30% |
| 4. | Beneficiation process; Filters, Bag Filters, Fibrous or deep bed filters, Magnetic separation, Electrostatic separation, gravity concentrator, froth floatation, Flocculation | 10 | 20% |

Continuous Assessment:

| Sr. No | Active Learning Activities | Marks |
|--------------|---|-------|
| 1. | Poster on size reducing instrument: Make Poster on any 2 instruments used in mechanical operations and Upload posters on GMIU Web portal. | 10 |
| 2. | Fluidization: Subject faculty will provide name of industry and student has to prepare a flow chart of that industry which includes fluidization unit and explain the complete process of that industry. Upload on GMIU Web portal. | 10 |
| 3. | Beneficiation: Explain the beneficiation process used in the power sectors and how it is benefiting in process and helping to tackle the pollution, Upload a report on GMIU Web portal. | 10 |
| Total | | 30 |

Suggested Specification table with Marks (Theory): 60

| Distribution of Theory Marks (Revised Bloom's Taxonomy) | | | | | | |
|--|-----------------|-------------------|-----------------|-------------|--------------|------------|
| Level | Remembrance (R) | Understanding (U) | Application (A) | Analyze (N) | Evaluate (E) | Create (C) |
| Weightage | 30% | 30% | 25% | 15% | 00 | 00 |



Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from the above table.

Course Outcome:

| After learning the course, the students should be able to: | |
|--|--|
| CO1 | Understand the basics of solid particles and its handling in the industries. |
| CO2 | Knowledge of screening and size reduction process and related machines in chemical and other industries. |
| CO3 | Understanding of fluidization process and packed bed columns used in industries |
| CO4 | Exploration of beneficiation process in chemical engineering applications |

List of Practicals:

| Sr. No. | Description | Unit | Hours |
|--------------|---|------|-----------|
| 1 | Determination of average particle size of a mixture of particles by sieve analysis. | 1 | 4 |
| 2 | Study and operation of Jaw crusher and thereby verification of Rittinger's constant. | 1 | 4 |
| 3 | Determination of reduction ratio, maximum feed size and theoretical capacity of crushing rolls. | 2 | 4 |
| 4 | Study of Ball mill and comparison of its critical speed with the operating speed. | 2 | 2 |
| 5 | Study and operation of a cyclone separator and thereby finding its efficiency of separation | 3 | 4 |
| 6 | Study and operation of a Magnetic separator and thereby finding its efficiency of separation. | 4 | 4 |
| 7 | To find the filter medium resistance of a Vacuum Leaf Filter | 4 | 4 |
| 8 | Study of Froth Floatation Cell | 4 | 4 |
| Total | | | 30 |

Instructional Method:

The course delivery method will depend upon the requirement of content and needs of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done based on Active Learning Assignment



Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Reference Books:

- [1] MECHANICAL OPERATIONS Fundamental Principles and Applications by Patil
- [2] Unit Operations of Chemical Engineering by McCabe & Smith

