MECHANICAL UNIT OPERATIONS

Course Code: 13CH1105

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Course Educational Objectives:

This course introduces the student the following aspects

- Properties, handling and mixing of particulate solids.
- Transportation of solid particulate mass.
- Size reduction equipments and their operation.
- Screening equipments, cake filters centrifugal filters.
- Principles of cake filtration, micro and ultra filtration.
- Gravity settling processes and Centrifugal settling processes.
- Agitation and mixing of liquids.
- Crystallization.

Course Outcomes:

After studying the course the student will have good understanding on

- Properties, mixing and transportation of solids.
- Laws and equipment of size reduction.
- Separation processes like screening, filtration and crystallization.
- Mixing of solids with liquids.

UNIT-I (10 Lectures)

Properties, handling and mixing of particulate solids: Characterization of solid particles, properties of particulate masses, storage of solids, mixing of solids, types of mixers, mixers for cohesive solids, mixers for free-flowing solids.

UNIT-II (14 Lectures)

Size Reduction: Principles of comminution, size reduction equipment—crushers, grinders, ultrafine grinders, cutting machines, equipment operation.

UNIT-III (14 Lectures)

Mechanical Separations: Screening, screening equipment, filtration, cake filters, centrifugal filters, principles of cake filtration, clarifying filters, liquid clarification, gas cleaning, principles of clarification, cross flow filtration, types of membranes, permeate flux for ultra filtration, concentration polarization, partial rejection of solutes, microfiltration, separation based on the motion of particles through fluids, gravity settling processes and centrifugal settling processes.

UNIT-IV (12 Lectures)

Agitation and mixing of liquids: agitation of liquids, circulation velocities, power consumption in agitated vessels, blending and mixing of liquids, suspension of solid particles, dispersion operations.

UNIT-V (10 Lectures)

CRYSTALLIZATION:

crystal geometry, principles of crystallization, equilibria and yields, nucleation, crystal growth, application of principles to design, MSMPR crystallizer, crystallization from melts.

TEXT BOOK:

McCabe W.L., Smith J.C. and Harriott P, "*Unit Operations in Chemical Engineering*", 7th Edition, McGraw Hill, 2005.

REFERENCE:

Alan S. Foust, Leonard A. Wenzel, Curtis W. Clump, Louis Maus, L.Bryce Anderson, "*Principles of Unit Operations*", 2nd Edition, John Wiley & Sons, 2010.