



# MECHANICAL OPERATIONS

## PROF. SHABINA KHANAM

Department of Chemical Engineering  
IIT Roorkee

**INTENDED AUDIENCE :** Undergraduate students. However, this course will also be helpful for anyone of any professional level, preferably holding a college degree or with substantial industrial experience, working in the production, handling, processing, modification or characterization of particular solids (powders and bulk solids).

**INDUSTRY SUPPORT :** Any chemical industry which deals with particulate matter.

### COURSE OUTLINE :

Around 75% of chemical manufacturing processes involve small solid particles at some point. Proper design and handling of these fine particles often makes the difference between success and failure of the product. Many products such as catalysts, pigments, fertilizers, cements, ceramics and pharmaceuticals are currently manufactured in particulate forms. Mechanical Operations deal with Science and Technology of particulate matter, which is a multidisciplinary field including Materials Science, Environmental, Biomedical, Aerospace, Agricultural, Chemistry, Microbiology and Cell Science, Pharmacy and Medicine. The primary objective of this course is to

- identify the important physical mechanisms occurring in processes involving particles
- discuss unit operation and its role in Chemical industries, characteristics of particulate solids, Principles of size reduction, particle dynamics and separation of particles
- formulate and solve mathematical descriptions of such processes

### ABOUT INSTRUCTOR :

Prof. Shabina Khanam is working as Associate Professor in Chemical Engineering Department of IIT Roorkee. She has completed B.Tech degree from AMU Aligarh, Aligarh in 2000 and M.Tech and Ph.D. degree from IIT Roorkee in 2002 and 2007, respectively. Her major fields of study are Process Integration, Energy Management and Modeling and Simulation. She has almost 9 years of experience in teaching and research. During this period she has supervised 1 Ph.D. and 14 M.Tech theses. At present 6 Ph.D and 3 M.Tech theses are in pipe line. She has published 29 and 24 research papers in different refereed journals and conferences, respectively. She has taught the course Mechanical Operations six times in her 9 years of teaching career.

### COURSE PLAN :

#### Week 1

- Introduction
- Characterization of a single particle
- Characterization of collection of particles

#### Week 2

- Fine grain size distribution
- Effectiveness of screen
- Industrial screening equipment
- Size reduction

#### Week 3

- Laws of comminution
- Examples of laws of comminution
- Size reduction equipment

#### Week 4

- Particle dynamics
- Particle dynamics – Examples
- Classification and Jigging