

Pharmaceutical Engineering

10B11PY511

Core Course

Credits: 4

L 3 T 1 P 0

Pre-requisites: Pharmaceutical Biotechnology

Course Objectives:

The objective of the course is to develop an understanding of basic principles and concepts of engineering in pharmaceutical processes.

Course Assessment:

Mid Term Test	30
End Term Test	45
Teacher Assessment (Based on Assignments, quizzes etc.)	25
Total	100

Course Outcomes:

CO I: Able to apply engineering principles to address issues in various pharmaceutical processes

CO II: Able to understand the principles and methodology of various processes involved in a pharmaceutical industry

Topics covered:

Unit operations and basic principles: Introduction to thermodynamics and its laws , Laws of mass and energy balances- Molal units, Dalton's law, equilibrium relationships and steady state.

Fluid Flow: Types of flow, Reynolds number, Bernoulli's theorem, Energy losses, basic equation of fluid flow, measurement of flow, mixing. **Size reduction:** Hammer mill, fluid energy mill and disintegrator. **Size separation:** Sieving, sedimentation and centrifugation. **Filtration-**

Filter aids, filter leaf, filter press, rotary filter and edge filter. **Heat transfer:** Conduction, convection and radiation. Heat exchangers. **Evaporation:** Evaporating stills and pans, Heat and vapor transferring evaporators. **Distillation:** Vapor liquid equilibrium, azeotropic and zeotropic mixtures, steam and fractional distillation. **Crystallization and Drying:** Theory of

crystallization, characteristics of crystals, study of various types of crystallizers – agitated batch crystallizer, Swenson walker crystallizer, krystal crystallizer, vacuum crystallizer, caking of crystals and its prevention. **Drying:** Theory, equipments: Tray dryer, drum dryer, spray dryer, freeze dryer.

Text books

1. Paulines DM, “*Bioprocess Engineering Principles*”, 8th ed., Academic press, New York, 2003.
2. Subrahmanyam CVS, Setty JT, Suresh S, Devi VK, “*Pharmaceutical engineering: Principles and practices*”, 1st ed. Reprint, Vallabh Prakashan, Delhi, 2002.
3. Gavhane KA, “*Unit Operations-I*”, 18th ed., Nirali Prakashan, Pune, 2010.
4. Lal B, Subramanyam N, Hemne PS, “*Heat Thermodynamics and statistical Physics*” 1st ed. S. Chand & Company, New Delhi, 2007.