

# GUJARAT TECHNOLOGICAL UNIVERSITY

## B.PHARM SEMESTER-I

### UNIT OPERATION-I

Subject code: 2210001

*Theory (4 Hours / Week; 4 Credits, 60 Hours)*

Sr. No.	Course Contents	Hours
1.	<b>Size reduction</b> Objectives, importance and theory of size reduction. Factors affecting, energy requirements, mechanisms and methods (dry/wet grinding) of size reductions. Principle, material of construction, applications, advantages and disadvantages of various mills like cutter mill, hammer mill, roller mill, ball mill, fluid energy mill, colloid mill. Study of latest industrial mills used in manufacturing of various dosage forms and their application.	11
2.	<b>Size separation</b> Principles of size separation, screen and its standards as per pharmacopoeia, screening equipments including shaking & vibrating screens, gyratory screens, sedimentation type industrial separators etc. Methods of determining size distribution. Fluid classification methods like sedimentation and elutriation, Principle, material of construction, applications, advantages and disadvantages of cyclone separator, sedimentation tank, etc.	8
3.	<b>Mixing</b> Definition, objectives, mechanism and theory of mixing. Type of mixtures: liquid mixing, powder mixing, semi solids mixing. Principle, material of construction, applications, advantages and disadvantages of shaker mixer, propeller mixer, turbine mixer, paddle mixer, planetary mixer, double cone mixer, V mixer, sigma mixer and colloid mill, ultrasonic mixer, etc.	9
4.	<b>Crystallization</b> Objectives, crystal lattice, types of crystal, crystal form, size and habit, formation of crystals, super saturation theory, factors affecting crystallization process and crystal growth. Study of various types of crystallizers including Swenson walker, tanks, agitated & batch, circulating magma, vacuum and crystal crystallizer etc. Methods for prevention of caking of crystals. Brief study of spherical crystallization process. Numerical problems on crystal yield.	13
5.	<b>Extraction and leaching</b> Principle, theory and types of extraction. Solvents used for extraction, leaching and extraction equipments, small scale and large scale extraction methods, special extraction techniques-supercritical fluid extraction, applications in pharmaceutical industry.	8

6.	<b>Automated process control system</b> Process variables - temperature, pressure, vacuum, flow level and their measurements. Elements of automatic process control systems. Elements of computer aided manufacturing. Introduction to latest process control systems used in pharmaceutical industry.	7
7.	<b>Industrial hazards and safety precautions</b> Industrial hazards: mechanical, chemical, electrical, fire and dust hazards. Measures to prevent and combat the hazards. Accident records. Introduction to waste water system in industry.	4

### UNIT OPERATION-I

**Subject code: 22100P1**

*Practicals (3 hours/week, 4 credits, 45 hours)*

Sr. No.	Course Contents
1	Study of various process parameters during size reduction by various mills.
2	Study of various techniques to determine particle size distribution.
3	Determination of degree of mixing of solid-liquid and solid-solid mixing by different mixing equipments.
4	Study the effect of various factors (rate of cooling, rate of agitation, seeding, solvent, etc.) on crystallization of different salts.
5	Study of liquid-liquid and solid-liquid extraction of various materials by different extraction techniques like maceration, percolation, infusion and decoction.
6	Demonstration of handling hazardous chemicals and safety precautions.

### Books Recommended:

1. Elementary Chemical Engineering - Max S. Peters, Published by McGraw Hill Book Company, New York, 1954
2. Perry's Chemical Engineer's Handbook - Robert H Perry, Green D. W., Maloney J. O. 7th Edition, 1998, McGraw – Hill Inc., New York.
3. Tutorial Pharmacy by Cooper & Gunn, ed. S. J. Carter, CBS Publishers & Distributors, Delhi, 6<sup>th</sup> Edition, 2000.
4. Unit Operations of Chemical Engineering, 5<sup>th</sup> edition - McCabe, Smith & Harriott, McGraw – Hill Inc., New York.
5. Pharmaceuticals: The Science of Dosage Form Design - M. E. Aulton.
6. The Theory & Practice of Industrial Pharmacy – Lachman L., Lieberman H.A. & Kanjig J. L., 3<sup>rd</sup> edition, 1990 Varghese Publishing House, Bombay.
7. Alfonso G. Remington: The Science & Practice of Pharmacy. Vol. I & II. Lippincott, Williams & Wilkins Philadelphia.
8. Online resources can also be accessed.