



# SYLLABUS

<b>Course Title</b>	<b>PHARMACEUTICAL ENGINEERING I</b>
<b>Course Code</b>	PH113
<b>Course Credit</b>	Lecture : 3
	Practical : 3
	Tutorial : 0
	Total : 6

## Course Objectives

On the completion of the course, students will be able to:

- Discuss the importance of unit operations in manufacturing; stoichiometry.
- Study the principle, theory, mechanism, working and construction of equipments of different unit operations. (Filtration, centrifugation, drying, heat transfer.)
- Focus on graphical representation of various equipment for unit operations.
- Study the different materials used in the pharmaceutical plant constructions.
- Focus on plant layout and different material handling system.
- Simplify the pharmaceutical engineering with more practical orientation.

## Detailed Syllabus

Sr. No.	Name of Chapter & Details	Hours Allotted
	<b>Section-I</b>	

<p><b>1</b></p>	<p><b>Importance of unit operations in manufacturing; Stoichiometry:</b></p> <p>Unit operation, Unit processes, Unit system, SI unit, CGS unit, material and energy balances, molecular units, mole fraction, tie substance, gas laws, mole volume, primary and secondary quantities, equilibrium state, rate process, steady and unsteady states, dimensionless equations, dimensionless formulae, dimensionless groups, different types of graphic representation, mathematical problems.</p>	<p><b>08</b></p>
<p><b>2</b></p>	<p><b>Heat transfer:</b></p> <p>Modes of heat transfer Conduction- Fourier's law, resistances in series and parallel, use of mean area and mean temperature difference. Convection-Concept of film, overall coefficient, heat transfer by forced convection in laminar and turbulent flow, condensing vapours, evaluation of individual film coefficients. Radiation-Black body, absorptivity &amp; emissivity. Heating of fluids, steam as heating medium, properties and uses of steam, steam traps, study of steam table. Heat exchange equipments-Heat exchangers, condensers, boilers, extended surface scraped and surface equipments etc. applications of heat transfer in industrial processes, Mathematical problems. Pharmaceutical Application of heat transfer.</p>	<p><b>08</b></p>
<p><b>3</b></p>	<p><b>Material handling systems:</b></p> <p>Solids handling- storage, conveyers, vacuum &amp; pneumatic conveying.</p> <p>Liquid handling- storage, pumps,</p> <p>Gases handling - Fans, blowers and compressors.</p> <p>Colour coding of Pipelines, use of forklifts and pallets, Bunkers,</p>	<p><b>07</b></p>

	Conveyers, Air transport., store design in pharmaceutical industries	
	<b>Section-II</b>	
<b>4</b>	<p><b>Filtration:</b></p> <p>Theory and mechanism of filtration, Factors affecting rate of filtration, filter aids, filter media, continuous and batch filters, operation of filters, industrial filters including filter press, rotary filter, edge filter, filter leaf, membrane filter etc, optimum cleaning cycle in batch filters. Mathematical problems. Pharmaceutical Application of filtration.</p>	<b>08</b>
<b>5</b>	<p><b>Centrifugation:</b></p> <p>Principles &amp; Theory of centrifugation, industrial centrifugal filters-perforated basket centrifuge, and centrifugal sedimenters, continuous centrifuges, Application in pharmacy.</p>	<b>04</b>
<b>6</b>	<p><b>Drying:</b></p> <p>Principle, Moisture content, loss on drying, theory &amp; mechanism of drying, drying rate and time calculations, classification of dryers, factors affecting selection of dryers, dryers used in pharmaceutical industries - tray, vacuum, fluidized bed, spray, freeze, tunnel, Microwave, Infra Red(IR), rotary dryers, special drying methods, Mathematical problems on drying. Pharmaceutical Application of dryer.</p>	<b>10</b>
<b>Pharmaceutical Engineering I (Practical)</b>		
1. Evaluation of filter media, determination of rate of filtration, studies of factors affecting filtration, calculation of specific cake resistance and filter medium resistance,.		

2. Demonstration of centrifugation apparatus.
3. Rate of drying and to determine EMC, CMC, and CFMC.
4. Effect of surface area on rate of drying.
5. Overall heat transfer coefficient of the given condenser.
6. Efficiency and capacity of ejector pump.
7. Determine concentration of sodium bicarbonate by material balance.
8. Other practicals covering the syllabus aspects.

#### **Instructional Method and Pedagogy:**

- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
- Surprise tests/Quizzes/Seminar/Tutorials will be conducted.
- The course includes language practices such as Group Discussion, Interviews etc to develop the communication skills of the students.

#### **Students Learning Outcomes:**

- Fast development in the pharmaceutical processing field is possible due to collaborative efforts of pharmaceutical technologies and chemical engineering.
- The basic purpose of studying pharmaceutical engineering is to develop the approach of application of mainly chemical engineering to the field of bulk drug manufacturing and pharmaceutical engineering.
- The subject covers all the important unit operations with specific application to the pharmacy.

- More emphasis has been given on principles, mechanisms and theories of different unit operations. Mathematical treatment is included wherever necessary so as to clarify the concepts.

#### **Text Books:**

1. Elementary Chemical Engineering: Max S. Peters; McGraw Hill, New York.
2. Pharmaceutical Engineering: Dr. G. K. Jani; B.S. Shah prakashan.
3. Tutorial Pharmacy: Cooper & Gunn, ed. S.J.Carter; CBS Publishers, New Delhi.

#### **Reference Books:**

1. The Science & Practice of Pharmacy: A. G. Remington; Lippincott, Philadelphia.
2. Pharmaceutical Engineering Principles and Practice: Subramanyam C.V.S., Thimma J, Suresh S.S.; Vallabh Prakashan, New Delhi.

#### **Additional Resources**

- Soft copies pharmaceutical engineering books are available on <http://www.pharmatext.org>
- Latest information regarding to pharmaceutical engineering are available on <http://www.pharmainfo.net>
- Soft copies of pharmaceutical engineering subjects presentation and material are available on <http://www.authorstream.com>.