

INSTITUTE	FACULTY OF PHARMACY
PROGRAM	BACHELOR OF PHARMACY
SEMESTER	2
COURSE TITLE	PHARMACEUTICAL ENGINEERING
COURSE CODE	13PH0203
COURSE CREDITS	6

Objective:

- 1 This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry.

Course Outcomes: After completion of this course, student will be able to:

- 1 To know various unit operations used in Pharmaceutical industries.
- 2 To understand the material handling techniques.
- 3 To perform various processes involved in pharmaceutical manufacturing process.
- 4 To carry out various test to prevent environmental pollution.
- 5 To appreciate and comprehend significance of plant lay out design for optimum use of resources.
- 6 To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries

Pre-requisite of course:To know various unit operations used in Pharmaceutical industries.

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	1	4	75	15	10	35	15

Contents : Unit	Topics	Contact Hours
1	<p>Flow of fluids Flow of fluids: Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturimeter, Pitot tube and Rotometer. Size Reduction: Objectives, Mechanisms & Laws governing size reduction, factors affecting size reduction, principles, construction, working, uses, merits and demerits of Hammer mill, ball mill, fluid energy mill, Edge runner mill & end runner mill. Size Separation: Objectives, applications & mechanism of size separation, official standards of powders, sieves, size separation Principles, construction, working, uses, merits and demerits of Sieve shaker, cyclone separator, Air separator, Bag filter & elutriation tank, Heat Transfer: Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers. Evaporation: Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator & Economy of multiple effect evaporator Distillation: Basic Principles and methodology of simple distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation, Drying: Objectives, applications & mechanism of drying process, measurements & applications of Equilibrium Moisture content, rate of drying curve. principles, construction, working, uses, merits and demerits of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer Mixing: Objectives, applications & factors affecting mixing, Difference between solid and liquid mixing, mechanism of solid mixing, liquids mixing and semisolids mixing. Principles, Construction, Working, uses, Merits and Demerits of Double cone blender, twin shell blender, ribbon blender, Sigma blade mixer, planetary mixers, Propellers, Turbines, Paddles & Silverson Emulsifier, Filtration: Objectives, applications, Theories & Factors influencing filtration, filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters and Seidtz filter Centrifugation: Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge., Materials of pharmaceutical plant construction, Corrosion and its prevention: Factors affecting during materials selected for Pharmaceutical plant construction, Theories of corrosion, types of corrosion and there prevention. Ferrous and nonferrous metals, inorganic and organic non metals, basic of material handling systems.</p>	10

Contents : Unit	Topics	Contact Hours
2	Heat Transfer Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers. Evaporation: Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator & Economy of multiple effect evaporator Distillation: Basic Principles and methodology of simple distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation	10
3	Drying Objectives, applications & mechanism of drying process, measurements & applications of Equilibrium Moisture content, rate of drying curve. principles, construction, working, uses, merits and demerits of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer Mixing: Objectives, applications & factors affecting mixing, Difference between solid and liquid mixing, mechanism of solid mixing, liquids mixing and semisolids mixing. Principles, Construction, Working, uses, Merits and Demerits of Double cone blender, twin shell blender, ribbon 8 blender, Sigma blade mixer, planetary mixers, Propellers, Turbines, Paddles & Silverson Emulsifier	10
4	Filtration Objectives, applications, Theories & Factors influencing filtration, filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters and Seidtz filter Centrifugation: Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge.	8
5	Materials of pharmaceutical plant construction, Corrosion and its prevention Factors affecting during materials selected for Pharmaceutical plant construction, Theories of corrosion, types of corrosion and there prevention. Ferrous and nonferrous metals, inorganic and organic non metals, basic of material handling systems.	7
Total Hours		45

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	Pharmaceutical Engineering Experiment-1, Experiment-2, Experiment-3, Experiment-4, Experiment-5, Experiment-6, Experiment-7, Experiment-8, Experiment-9, Experiment-10, Experiment-11, Experiment-12, Experiment-13	60
2	Pharmaceutical Engineering Tutorial-1, Tutorial-2, Tutorial-3, Tutorial-4, Tutorial-5, Tutorial-6, Tutorial-7, Tutorial-8, Tutorial-9, Tutorial-10, Tutorial-11, Tutorial-12, Tutorial-13, Tutorial-14	15
Total Hours		75

Textbook :

- 1 Pharmaceutical engineering principles and practices, C.V.S Subrahmanyam et al., Vallabh Prakashan, 2019
- 2 Physical Pharmaceutics 1, CVS Subrahmanyam, Vallabh Prakashan, 2015
- 3 Cooper and Gunn's Tutorial pharmacy, S.J. Carter, CBS publishers and distributor, 2017
- 4 Pharmaceutics-I, R. M. Mehta, Vallabh Prakashan, 2019
- 5 Pharmaceutics-I Unit Operation, Dr G K Jani, B. S. Shah Prakashan, 2015

References:

- 1 Introduction to chemical engineering, Introduction to chemical engineering, Walter L Badger & Julius Banchemo, Mc Graw Hill, 1987
- 2 Solid-Phase Extraction Principles, Techniques, and Applications, Solid-Phase Extraction Principles, Techniques, and Applications, Nigel J.K. Simpson, CRC Press, 2000
- 3 Unit Operations of Chemical Engineering, Unit Operations of Chemical Engineering, Warren McCabe and Julian Smith and Peter Harriott, Mc Graw Hill, 2017
- 4 Remington practice of pharmacy, Remington practice of pharmacy, Martin, Lippincott Williams & Wilkins, 2006
- 5 Theory and practice of industrial pharmacy, Theory and practice of industrial pharmacy, and practice of industrial pharmacy Lachmann, CBS Publication, 2020

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
20.00	30.00	25.00	15.00	10.00	0.00

Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and the need of students. The teacher in addition to the conventional teaching method by the blackboard may also use any tools such as demonstration, role play, quiz, brainstorming, MOOCs etc.
- 2 The internal evaluation will be done based on continuous evaluation of students in the laboratory and classroom.
- 3 Students will use supplementary resources such as online videos, NPTEL videos, MOOCs/ e-courses, virtual laboratories.