

Course Code	Course Title	Teaching Load			Marks		Exam (hrs)		Credits
		L	T	P	Int.	Ext.	Int.	Ext.	
BP304T	Pharmaceutical Engineering	3	1	-	25	75	1	3	4

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

**Objectives:** Upon completion of the course, student shall be able:

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
7. Pharmaceutical industries.

#### **Module 01**

**10 Hours**

##### **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 and 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 and end runner mill.

##### **Size Separation**

- Objectives, applications and 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 and elutriation tank.

#### **Module 02**

**10 Hours**

##### **Heat Transfer**

- Objectives, applications and Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection and radiation.
- Heat interchangers and 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 and Economy of multiple effect evaporator.

#### **Distillation**

- Basic Principles and methodology of simple distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation and molecular distillation.

#### **Module 03**

**08 Hours**

##### **Drying**

- Objectives, applications and mechanism of drying process, measurements and 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 and 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, and Paddles and Silverson Emulsifier.

#### **Module 04**

**08 Hours**

##### **Filtration**

- Objectives, applications, Theories and Factors influencing filtration, filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate and frame filter, filter leaf, rotary drum filter, Meta filter and Cartridge filter, membrane filters and Seidtz filter.

##### **Centrifugation**

- Objectives, principle and applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge and super centrifuge.

#### **Module 05**

**07 Hours**

##### **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.

#### **Recommended Books: (Latest Editions)**

1. Introduction to chemical engineering – Walter L Badger and Julius Banchemo.
2. Solid phase extraction, Principles, techniques and applications by Nigel J.K. Simpson.

3. Unit operation of chemical engineering – McCabe Smith.
4. Pharmaceutical engineering principles and practices – C.V.S Subrahmanyam et al.
5. Remington practice of pharmacy- Martin.
6. Theory and practice of industrial pharmacy by Lachmann.
7. Physical pharmaceutics- C.V.S Subrahmanyam et al.
8. Cooper and Gunn's Tutorial pharmacy, S.J. Carter.