

Subject Code: BP203T	Subject Title: Pharmaceutical Engineering (Theory)
Pre-requisite: --	

Course Objective: Upon completion of the course student shall be able to

1. Summarize various unit operations used in pharmaceutical industries with applications.
2. Describe and suggest material handling techniques.
3. Suggest and justify appropriate equipment of the unit operations including their principle, construction, working and specific applications.
4. Describe preventive methods used for environmental pollution and corrosion control in pharmaceutical industries.
5. Draw and comprehend significance of pharmaceutical plant lay out design.

Teaching Scheme (Hours per week)			Evaluation Scheme (Marks)			
Lecture	Tutorial	Credit	Theory			Total
			University Assessment	Continuous Assessment	Internal Assessment	
3	1	4	75	10	15	100

Detailed Syllabus:

Sr. No.	UNIT	Hours	Weightage (%)
1.	<p>Flow of fluids: Types of manometers, Reynolds number and its significance, Bernoulli 's theorem and its applications, Energy losses, Orifice meter, Venturi meter, Pitottube and Roto meter.</p> <p>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.</p> <p>Size Separation: Objectives, applications & mechanism of size separation, official standards of powders, sieves, size separation Principles, construction, working, uses, merits and</p>	10 Hours	22.22%

	demerits of Sieve shaker, cyclone separator, Air separator, Bag filter & elutriation tank.		
2.	<p>Distillation: Basic Principles and methodology of simple distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation</p> <p>Evaporation: Objectives, application, and factors influencing evaporation, differences between evaporation and other heat processes. 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.</p> <p>Heat Transfer : Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers</p>	10 Hours	22.22%
3.	<p>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.</p> <p>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</p>	8 Hours	17.77%
4.	<p>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.</p> <p>Centrifugation: Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and</p>	8 Hours	17.77%

	demerits of Perforated basket centrifuge, non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge		
5.	Materials of pharmaceutical plant construction, Corrosion and its prevention Factors affecting materials selected for pharmaceutical plant construction, Theories of corrosion, types of corrosion and their prevention. Ferrous and nonferrous metals, inorganic and organic nonmetals, basic of material handling systems.	7 Hours	15.55%

Subject Code: BP203P	Subject Title: Pharmaceutical Engineering (Practical)
Pre-requisite: --	

Course Objective: Upon completion of the course student shall be able to

1. Perform the experiments involving unit operations like filtration, distillation, evaporation, drying, mixing, crystallization.
2. Identify the equipment and carry out the experiments related to size reduction and size separation.
3. Describe the basic concepts of heat transfer and HVAC (humidity ventilation and air conditioning).
4. Analyze the problem, communicate suggested solution and interpret the results.

Teaching Scheme (Hours per week)		Evaluation Scheme (Marks)			
Practical	Credit	Theory			Total
		University Assessment	Continuous Assessment	Internal Assessment	
4	2	35	5	10	50

List of Practical:

Sr. No.	Title of the unit
1.	Determination of radiation constant of brass, iron, unpainted and painted glass.
2.	Steam distillation – To calculate the efficiency of steam distillation.
3.	To determine the overall heat transfer coefficient by heat exchanger.
4.	Construction of drying curves (for calcium carbonate and starch).
5.	Determination of moisture content and loss on drying.
6.	Determination of humidity of air – i) From wet and dry bulb temperatures – use of Dew point method.
7.	Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier
8.	Size analysis by sieving – To evaluate size distribution of tablet granulations. – Construction of various size frequency curves including arithmetic and logarithmic probability plots.
9.	Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger ‘s, Bond’s coefficients, power requirement and critical speed of Ball Mill.
10.	Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment.

11.	Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity)
12.	To study the effect of time on the Rate of Crystallization.
13.	To calculate the uniformity Index for given sample by using Double Cone Blender.

Recommended Study Material:

1. Introduction to Chemical Engineering, Walter L Badger & Julius Banchero, Latest edition.
2. Solid phase extraction, Principles, Techniques and Applications, Nigel J.K. Simpson, Latest edition.
3. Unit Operation of Chemical Engineering, McCabe Smith, Latest edition.
4. Pharmaceutical Engineering- Principles and Practices, C.V.S Subrahmanyam et al., Latest edition.
5. Remington, The Science and Practice of Pharmacy, Martin, Latest edition.
6. Theory and Practice of Industrial Pharmacy, Leon Lachmann., Latest edition.
7. Physical pharmaceutics, C.V.S Subrahmanyam et al., Latest edition.
8. Cooper and Gunn's Tutorial pharmacy, S.J. Carter, Latest edition.
9. Practical Manual of Pharmaceutical Engineering, Munira Momin, Tejal Mehta, B. S. Shah Prakashan