

The objectives of the subject are:

1. To impart adequate knowledge and scientific information regarding basic principles of Pharmaceutical Engineering to develop , manufacture of products, processes and components in pharmaceutical industry
2. To enhance the understanding on design, build and maintenance of devices ,systems, materials and processes
3. To impart adequate knowledge of practical aspects of application of various equipments of pharmaceutical industry
4. To impart adequate practical knowledge to deliver quality products as per the industrial and Pharmacopoeial standards

Why this Course ???? (contd..)

5. To provide adequate knowledge of practical aspects of inducing requisite features into the value added products and marketing of engineering technology
6. To enable the student to maintain a high standard of ethics and conduct in professional career
7. To facilitate the student to develop an attitude to seek lifelong learning to update the knowledge and professional skills
8. To enable the student to cope in various situations, irrespective of the different cultures or constraints involved and develop leadership and entrepreneurial skills

The Course is being delivered to meet the highlighted objective of the course to meet the course aim.

Subject Aim and Summary

This course is designed to impart a fundamental knowledge on the art and science of unit operations used in pharmaceutical industry. The course is designed to prepare students for better understanding of engineering aspects of pharmaceutical equipments and for further study in the course discipline

Subject Intended Learning Outcomes (ILO)

After studying this subject, a student will be able to:

1. Explain the basic laws involved in stoichiometry
2. Describe the basic concepts involved in pharmaceutical operations
3. Discuss the working principles, advantages, disadvantages and applications of various unit-operations
4. Analyze the efficiency of equipment for important operations such as filtration, drying and evaporation
5. Explain the significance of construction materials in the designing and operation of Equipments
6. Recommend the coordinated functioning of several unit operations for completion of any unit process

Subject Content

- **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.

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- **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.

Subject Content Contd...

☛ **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.

Method of Assessment

Total Marks : 100

There are two components for assessment in this subject:

Total Mark : 100

Component 1(IA): 25 Marks

1A: Attendance: 4 Marks

1B: Assignment and interaction with student: 6 Marks

1C: Sessional Exam: 15 Marks

Component 2 (SEE):

Semester End Examination: 75 Marks

Method of Assessment Contd..

Component - 2 : 75 % weight

A 3 hour duration semester end examination will be conducted for maximum marks of 100 and will be reduced to 75 % weight.

The assessment questions are set to test the learning outcomes. In each component certain learning outcomes are assessed. The following table illustrates the focus of learning outcome in each component assessed:

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Intended learning outcome		1	2	3	4	5	6
Component 1	A	X	X	X	X	X	X
	B						X
Component 2		X	X	X	X	X	X

Both the components will be moderated by a second examiner.

References



Subject Resources

- Class Notes

a. Essential Reading

1. Walter L. Badger, Julius T Banchero. (1955) *Introduction to Chemical Engineering*. 1st Edition. New York: McGraw Hill Company.
2. Nigel JK Simpson. (2000) *Solid phase extraction, Principles, techniques and applications*. Marcel Dekkar Inc, New York.
3. McCabe Smith. (2005) *Unit Operations of Chemical Engineering*. 7th Edition. McGraw Hill Inc. New York .
4. Subramanyam CVS et al., (2016) *Pharmaceutical Engineering – Principles and Practices*. Vallabh Prakashan, New Delhi.
5. Subrahmanyam CVS. (2015) *Physical pharmaceuticals*. Vallabh Prakashan, New Delhi.6. Carter SJ. (2005) *Cooper and Gunn's Tutorial pharmacy*. CBS publishers and Distributors, New Delhi.

References contd..

Recommended Reading

1. Don W Green, James O Maloney, Robert H Perry. (2003) *Perry's Chemical Engineer's Handbook*. 6th Edition. New York: McGraw Hill Book Company.
2. Peters Max. (1984) *Elementary Chemical Engineering*. 2nd Edition. New York: McGraw Hill Book Company, New York.
3. Sambamurthy K. (2012) *Pharmaceutical Engineering*. 1st Edition. New Age International, New Delhi.

d. Magazines and Journals

1. International Journal of Pharmaceutical engineering and drug design. IGI Global, Germany.
2. Pharmaceutical engineering. ISPE, USA.

d. Websites

1. www.ispe.org/pharmaceutical-engineering-magazine
2. www.pharmaceuticalengineering.org

Thanks

LastBenchPharmacist.blogspot.com