



SYLLABUS

Course Title	PHARMACEUTICAL ENGINEERING III	
Course Code	PH311	
Course Credit	Lecture	: 3
	Practical	: 3
	Tutorial	: 0
	Total	: 6
Course Objectives		
<p>On the completion of the course, students will be able to:</p> <ul style="list-style-type: none"> ▪ Study the principle, theory, mechanism, working and construction of equipments of different unit operations. (Evaporation, distillation, humidification, dehumidification, refrigeration and air conditioning.) ▪ Focus on graphical representation of various equipment for unit operations. ▪ Simplify the pharmaceutical engineering with more practical orientation. 		
Detailed Syllabus		
Sr. No.	Name of Chapter & Details	Hours Allotted
	Section-I	
1	Evaporation: Basic concept of phase equilibria, factors affecting evaporation, theory of	09

	<p>evaporation, heat transfer in evaporators, Boiling point elevation, methods to find out boiling point elevation, Duhring's Rule and Raoult's law, evaporators- natural circulation forced circulation & film evaporators, single effect and multiple effect evaporators, mathematic problems.</p>	
2	<p>Distillation:</p> <p>Physical concepts, vapour liquid equilibrium relationship, Raoult's law, phase diagrams, volatility & relative volatility, simple steam and flash distillations, batch and continuous distillation, extractive distillation, rectification, distillation columns (packed, plate) and their efficiency, McCabe Thiele method for calculation of number of theoretical plates, azeotropic, molecular & steam distillation, mathematical problems.</p>	09
3	<p>Automated Process Control Systems:</p> <p>Temperature, pressure, vacuum, flow level and their measurements, Elements of automatic process control systems.</p>	05
	Section-II	
4	<p>Humidification and dehumidification:</p> <p>Definitions of various terms, wet bulb and adiabatic saturation, temperatures, psychrometric chart and determination of humidity, equipments for humidification and de-humidification operations, applications of humidity control in various pharmaceutical processes.</p>	09
5	<p>Refrigeration and Air conditioning:</p>	04

	Basic concepts and types of refrigeration cycles, air conditioning, applications in pharmacy. Design of HVAC systems.	
6	Extraction: Principle, theory, types of extraction, solvents used for extraction, leaching and extraction equipments, small scale and large scale extraction methods, special extraction techniques, application in pharmaceutical industry.	05
7	Industrial Hazards and Safety Precautions: Mechanical, Chemical, Electrical, Fire and dust hazards. Introduction to waste water treatment in industry.	04

Pharmaceutical Engineering III (Practical)

1. To study effect of temperature on evaporation.
2. To study effect of Surface area on evaporation.
3. To study effect of viscosity on evaporation.
4. To purify the turpentine oil using steam distillation method.
5. To purify the turpentine oil and find out its molecular weight.
6. Calculation of humidity, %RH, Humid heat, Humid Volume by dry bulb and wet bulb temperature.
7. Calculation of humidity parameters by dew point method.
8. Calculation of humidity parameters by mathematical equation. (few parameter will given to calculate other humidity parameters)
9. Demonstration of distillation apparatus.

10. To find out distillation efficiency of given distillation assembly.

11. To find out capacity of distillation assembly.

12. Demonstration of extraction process.

13. To carry out multiple extraction of given drug substance.

14. To find out extraction efficiency process.

15. 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:

- 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.
- Students should be able to know the appropriate instrumental requirement for different types of unit operations used in pharmaceutical industry.

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>

