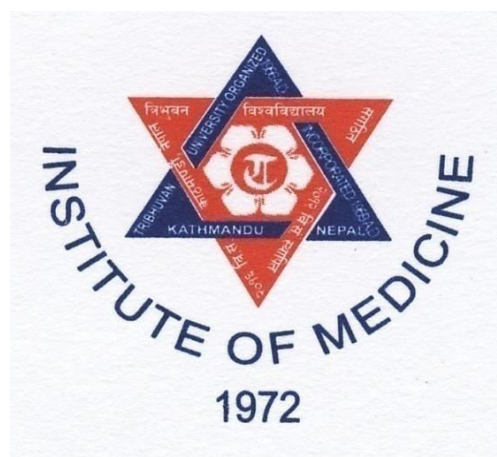


Curriculum
on
Bachelor in Pharmacy
(B. Pharm)



Published by

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INSTITUTE OF MEDICINE

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Maharajgunj, Kathmandu, Nepal

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COURSE OF THIRD YEAR

PHARMACEUTICAL ENGINEERING

Subject: Theory	Year: Third	Code: BP 601 A
Full Marks: 100	Total Teaching hours: 90	Credit hour: 6

Course Description: This course deals with the various unit operations and pharmaceutical designing and operation of various equipments in the pharmaceutical industries.

General objectives: Upon completion of the course of this course, the students will be able to

- a. Describe the engineering aspects of pharmaceutical plants including basic industrial unit operations,
- b. Describe the principles, construction and working of various equipments used in pharmaceutical industries

Specific objectives:

Unit 1: Introduction: [2 Hrs]

After the completion of the course, students will be able to

- a Define pharmaceutical engineering and unit operations;
- b Explain the concept of material and energy balances; describe units and carry out their conversions.

Unit 2: Conveying of Solids: [3Hrs]

- a After the completion of the course, students will be able to
- b Describe belt conveyors, chain conveyors, screw conveyors and pneumatic conveyors.

Unit 3: Size reduction: [5Hrs]

After the completion of the course, students will be able to

- a Define size reduction
- b Discuss objectives of size reduction
- c Discuss mechanisms of size reduction
- d Explain theories and energies of comminution
- e Classify size reduction equipments
- f Discuss principle, construction and working of various size reduction equipments- Rotary cutter mill, Roller mill, Hammer mill, Ball mill, Fluid energy mill and Colloid mill
- g Describe selection of milling equipments.

Unit 4: Size separation: [7Hrs]

After the completion of the course, students will be able to

- a Define size separation
- b Discuss the official standards for powders

- c Discuss sieve analysis
- d List different size separation equipments
- e Explain the principle, construction and working of different equipments of size separation- Shaking screen, Rotex screen, Cyclone separator, Air separator, Bag filter, and Scrubbers
- f Discuss size separation by settling and elutriation method of size separation
- g Discuss selection of size separation equipments

Unit 5: Mixing: [7Hrs]

After the completion of the course, students will be able to

- a Explain fundamentals of mixing
- b Describe mechanisms of solid-solid, liquid- liquid and solid- liquid mixing
- c Discuss degree of mixing and statistical evaluation
- d Discuss factors influencing mixing
- e Explain the principle, construction and working of different types of mixers- Tumblers, Twin shell blender, Double cone blender, Ribbon blender, Sigma blade mixer, Planetary mixer; liquid mixing devices; Silverson mixer emulsifier and Triple roller mill.
- f Discuss selection of mixing equipments equipments

Unit 6: Flow of fluids: [8Hrs]

After the completion of the course, students will be able to

- a Describe the fundamentals of fluids statics and fluid dynamics
- b Discuss nature of fluid flow- Reynolds experiment; Bernoulli's theorem
- c Discuss energy losses during fluid flow
- d Discuss measurement of fluid flow rates
- e Explain principle, construction and working of Orifice meter, Venture meter, Pitot tube and Rotameter; Discuss general principles of transportation of fluids and gases
- f Discuss the different types of valves.

Unit 7: Heat transfer: [8Hrs]

After the completion of the course, students will be able to

- a Define heat transfer and its application
- b Discuss the mechanisms of heat flow
- c Describe Fourier's law
- d Discuss construction and working of heat exchangers and heat interchangers- Tubular heater, Multi pass heater, Liquid to liquid interchanger, and Double pipe heat interchanger
- e Discuss the steam as heating medium.

Unit 8: Crystallization: [4 Hrs]

After the completion of the course, students will be able to

- a Define crystallization
- b Discuss mechanism and theory of crystallization

- c Describe equipments for crystallization- Agitated batch crystallizer, Swenson-Walker crystallizer, Krystal crystallizer and Vacuum crystallizer.
- d Discuss the caking of crystals.

Unit 9: Distillation: [9Hrs]

After the completion of the course, students will be able to

- a Define distillation and its application
- b Discuss theory of distillation- Raoult's law and Dalton's law
- c Describe different distillation methods: Flash distillation, Fractional distillation, Azeotropic & extractive distillation, Steam distillation and Molecular distillation.

Unit 10: Drying: [10 Hrs]

After the completion of the course, students will be able to

- a Explain drying
- b Discuss the application of drying
- c Discuss mechanism and theory of drying
- d Discuss classification of drying equipments
- e Explain principle, construction & working of different dryers: Tray dryer, Drum dryer, Spray dryer, Fluidized bed dryer, Vacuum dryer and Freeze dryer
- f Discuss the factors affecting selection of drying equipments.

Unit 11: Evaporation: [8 Hrs]

After the completion of the course, students will be able to

- a Define evaporation
- b Discuss the applications of evaporation.
- c Discuss the mechanism and theory of evaporation
- d Discuss different factors influencing evaporation
- e Trace general classification of evaporators
- f Explain the principle, construction and working of different evaporators: Horizontal tube evaporator, Vertical tube evaporator, Climbing film evaporator, Falling film evaporator and Multiple effect evaporator.

Unit 12: Filtration and Centrifugation: [9Hrs]

After the completion of the course, students will be able to

- a Define filtration
- b Discuss the applications of filtration
- c Discuss the mechanism and theories of filtration
- d Discuss filter and filter aids
- e Show the classification of filtration equipment
- f Explain the principle, construction & working of industrial filters: Plate and frame filter press, Cartridge filter and Drum filter.
- g Define centrifugation
- h Discuss the process and application of centrifugation
- i Discuss theory of centrifugation

- j Discuss filtration centrifuge.

Unit 13: Humidity, Refrigeration and Air Conditioning: [10 Hrs]

13.1. Humidity

After the completion of the course, students will be able to

- a Describe the general principles, applications and determination of humidity
- b Discuss humidity charts
- c Discuss humidification- applications, mechanisms & approaches
- d Discuss dehumidification- applications, mechanisms & approaches.

13.2. Refrigeration

After the completion of the course, students will be able to

- a Describe general principles; applications; vapor compression and vapor absorption system; theories of refrigeration.

13.3. Air conditioning

After the completion of the course, students will be able to

- a Describe different types of Air Conditioners: Self contained air conditioner, Central air conditioner; HVAC system; and AHU.
- b Describe applications and approaches Air Conditioners
- c Discuss calculation of load of Air-conditioner.

Reference books (Latest Editions)

1. Subrahman C. V, Setty J. T, Suresh S, Devi V. K. Pharmaceutical engineering: principles and practices. Vallabh Prakashan. Hickey A. J. Pharmaceutical process engineering. CRC Press.
2. Sambamurthy K. Pharmaceutical engineering. New Age International.
3. Cullen P. J, Romañach R. J, Abatzoglou N, Rielly C. D. Pharmaceutical blending and mixing. John Wiley & Sons.
4. Hickey A. J. Pharmaceutical process engineering. CRC Press.
5. Ganderton D. Unit Processes in Pharmacy: Pharmaceutical Monographs. Elsevier.
6. Lachman L, Lieberman H. A, Kanig J. L. The theory and practice of industrial pharmacy. Lea & Febiger.