Gujarat Technological University

B.Pharm Semester-I

Pharmaceutics I (Unit Operations I)

Theory(3 Hours / Week; 3 Credits)

1. Filtration **8hrs**

Theory and mechanism of filtration process, factors affecting rate of filtration, filter media, filter aids, types of filters, operation of filters, industrial filters-leaf filter, filter press, rotary filter, edge filters, cartridge filters, membrane filters, optimum cleaning cycle in batch filters, etc. Mathematical problems on filtration.

2. Centrifugation: **4hrs**

Principle and theory of centrifugation, industrial centrifuges-perforated basket centrifuge, sedimentation type centrifuge, continuous centrifuges etc. Applications in pharmacy.

3. Evaporation: **8hrs**

Basic concept of phase equilibria, factors affecting evaporation, heat transfer in evaporators, Duhring's Rule and Raoult's law, evaporators- natural circulation forced circulation & film evaporators, single effect and multiple effect evaporators, mathematic problems.

4. Distillation: **8hrs**

Physical concepts, vapour liquid equilibrium relationship, volatility & relative volatility, simple steam and flash distillations, batch and continuous 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.

5 Drying: **9hrs**

Principle, Moisture content, loss on drying, theory & mechanism of drying, drying rate and time calculations, classification of dryers, factors affecting selection of dryers, dryers used in pharmaceutical industries - tray, vacuum, fluidized bed, spray, freeze, tunnel, Microwave, Infra Red(IR), rotary dryers. Mathematical problems on drying.

6 **HVAC(Humidity Ventilation and Air Conditioning):** **8hrs**

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. Basic concepts and types of refrigeration cycles, air conditioning, applications in pharmacy. Design of HVAC systems.

Practical(3 Hours / Week; 3 Credits)

Practicals related to topics in theory should be carried out. Experiments on filtration, factors affecting rate of filtration, demonstration of centrifuge, experiments on evaporation, rectification, determination of HETP, comparison of efficiency of packed and plate columns, steam distillation, experiments to determine EMC of various pharmaceutical raw materials, preparation of drying curves and calculation of rates, demonstration of tray dryer, vacuum dryer, fluid bed dryer, Experiments on determination of humidity and related parameters using DBT/WBT and Dew point methods, demonstration of sling psychrometer, dial type and digital humidity measuring instruments.

Books Recommended

1 Elementary Chemical Engineering - Max S. Peters, Published by McGraw Hill Book Company, New York, 1954

2 Perry's Chemical Engineer's Handbook - Robert H Perry, Green D.W., Maloney J.O.7th Edition, 1998, McGraw – Hill Inc., New York.

3 Tutorial Pharmacy by Cooper & Gunn, ed. S.J.Carter, CBS Publishers & Distributors, Delhi, 6th Edition, 2000.

4. Unit Operations of Chemical Engineering, 5th edition – McCabe, Smith & Harriott, McGraw – Hill Inc., New York.

5 Pharmaceutical Engineering – K.Sambamurthy, 2002 NAI (P) Ltd., Delhi.

6 Pharmaceutics : The Science of Dosage Form Design - M.E. Aulton.

7 The Theory & Practice of Industrial Pharmacy – Lachman L., Lieberman H.A. & Kanjig J.L., 3rd edition, 1990 Varghese Publishing House, Bombay.

8 Alfonso G. Remington: The Science & Practice of Pharmacy. Vol.I & II. Lippincott, Williams & Wilkins Philadelphia.

9 Jani G. K., Pharmaceutics II (Unit Operations), B. S. Shah Prakashan, Ahmedabad.

10 Subramanyam C.V.S., Thimma J, Suresh S.S. et. al., Pharmaceutical Engineering : Principles and Practice, 2002, Vallabh Prakashan, Delhi.

11 Introduction to Chemical Engineering by Walter L. Badger & Julius T. Banchero, Mcgraw Hill International edition, New Delhi, 1955.

12 Filtration in Pharma. Industry by Theodore H. Meltzer, Marcel Dekker Inc., New York, 1987.