Pharm. Engineering-I
(Unit Operations – I)

THEORY 3 hours/ week

UNIT -I

1. **Heat Transfer:** Heat transfer, overall heat transfer coefficient, sources of heat, steam and electricity as heating media, determination of requirement of amount of steam/ electrical energy, steam pressure, heat exchangers and **heat interchangers, Radiation, black body, Grey body, Stefan Boltzmann equation, Kirchoff's law, application of Fourier's law, Forced and natural circulation and their application**. A few numerical problems may be solved.

2. **Drying:** Moisture content and mechanism of drying, rate of drying and time of drying calculations. Classification and types of dryers, dryers used in pharmaceutical industries with special reference to Fluidised bed dryer, spray dryer, freeze dryer, vacuum dryer, tray dyer etc. A few numerical problems may be solved.

UNIT -II

3. **Size Reduction and Size Separation:** Definition, objectives of size reduction and size separation, factors affecting size reduction, laws governing energy and power requirements of mills including ball mill, hammer mill, fluid energy mill, sieve analysis, standards of sieves, size separation equipment shaking and vibrating screens, gyratory screens, cyclone separator, air separator, bag filters, cottrell precipitator, scrubbers, size separators basing on sedimentation theory. A few numerical problems may be solved.

UNIT -III

4. **Mixing and Homogenization:** Theory of mixing, mixing efficiency,Factors influencing mixing, solid-solid, solid-liquid and liquid-liquid mixing equipments, homogenizers such as **Sigma blade mixer, Planetary mixer, Airjet mixer, jet mixer, Silverson mixer-emulsifier and triple roller mixer.** A few numerical problems may be solved.

UNIT -IV

5. **Distillation:** Raoult's law, phase diagrams, volatility, simple, steam and flash distillations, principles of rectification, Mc cabe Thiel method for calculation of number of theoretical plates, Azeotropic and extractive distillation. A few numerical problems may be solved.

UNIT-V

6. **Evaporation:** Basic concept of phase equilibria, factors affecting evaporation, evaporators, film evaporator, single effect and multiple effect evaporator, **Mathematical problems on evaporation.**

7. **Filtration:** Theory of filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter. Factors affecting filtration, optimum cleaning cycle on batch filters. A few numerical problems may be solved.