

2.1 PHYSICAL PHARMACEUTICS (THEORY)

50 hours ; 2 hours/week

- 1. Distribution law:** Explanation, limitations and applications. **4 hours; 6-8 marks**
- 2. Kinetics & drug stability:** Rates and molecularity of a reaction, determination of order, factors influencing rate of reactions, stabilization of drugs, applications of chemical kinetics to the stability testing of pharmaceuticals. Simple numerical problems. Stabilization of medicinal agents against common reactions like hydrolysis and oxidation. Accelerated stability testing in dating of pharmaceutical dosage forms by ICH guidelines. **8 hours; 13-15 marks**
- 3. Interfacial phenomenon:** Liquid interfaces, adsorption at liquid/solid interfaces, adsorption isotherms, concept of contact angle, hydrophile lipophile balance, spreading coefficient, Gibb's adsorption equation and electrical properties of interfaces. **6 hours; 10-12 marks**
- 4. Diffusion and dissolution:** Steady state diffusion, types of diffusion, diffusion equation, diffusion cells, dissolution of tablets and capsules, Hixon-Crowell cube root law, dissolution apparatus; factors affecting dissolution. **5 hours; 8-10 marks**
- 5. Rheology:** Newtonian and Non-Newtonian systems, thixotropy, determinations of rheological properties (single and multipoint instruments). Applications to pharmacy. Rheological consideration, preparation, physical stability and evaluation of suspensions. Rheology of emulsions, micro-emulsions, multiple emulsions. **9 hours; 13-15 marks**
- 6. Micrometrics:** Particle size distribution, methods for determining particle size, shape and surface area. Derived properties of powders. Simple numerical problems. **5 hours; 8-10 marks**
- 7. Colloids:** Definition, types, preparation, purification, stabilization of colloids, properties, optical properties, kinetic properties, electrical properties, Donnan membrane phenomenon. **5 hours; 8-10 marks**
- 8. Complexation:** Types of complexes, metal complexes, organic molecular complexes, inclusion compounds, methods of analysis of complex. **5 hours; 8-10 marks**
- 9. Analytical techniques :** Brief introduction and applications of newer analytical techniques – DSC, X-Ray Diffraction, X-Ray Crystallography, SEM, TEM. **3 hours; 5-7 marks**

PHYSICAL PHARMACEUTICS (PRACTICALS)
75 hours ; 3 hours/week

1. Determination of viscosity of liquids using Ostwald's viscometer.*
2. Determination surface tension of liquid by drop weight method.*
3. Study of flow properties of granules viz., rate of flow, angle of repose, bulk density.*
4. Preparation, stabilization and evaluation of hydrophobic colloids.**
5. Determination of partition coefficient of benzoic acid between benzene and water.**
6. Determination of HLB number of surfactants by Griffins method.**
7. Determination of shelf life using accelerated stability studies.**
8. Determination of rate constant for first order reactions.**
9. Determination of rate constant for second order reactions.**
10. Study of particle size distribution by optical microscopy.*
11. Determination of required HLB number for the oil phase to be presented as an emulsion. Formulation and evaluation of emulsion.**
12. Determination of constants of Freundlich and Langmuir adsorption for adsorptions of acetic acid on activated charcoal.**
13. Determination of stability constant of glycine-copper complex by pH titration method.**
14. Construction of rheograms and study of rheological behaviour of biphasic systems employing multipoint viscometers. (For demonstration)

Note: ** Denotes major experiments * Denotes minor experiments

SCHEME OF EXAMINATION

1. Synopsis	-10 Marks
2. Major experiment (indicated by **)	-30 Marks
3. Minor experiment (indicated by *)	-20 Marks
4. Viva voce	-10 Marks
Total	<hr/> = 70 Marks <hr/>

PHYSICAL PHARMACEUTICS REFERENCE BOOKS

1. Carter SJ. Cooper and Gunn's Tutorial pharmacy. 6th ed. New Delhi: CBS Publishers; 2000.
2. Gennaro AL. Remington: The science and practice of pharmacy Vol I and II. 20th ed. Philadelphia: Lippincott Williams and Wilkins; 2000.
3. Martin A, Bustamante P, Chun AHC. Physical pharmacy. 4th ed. New Delhi: BI Waverly Pvt Ltd; 1995.
4. Rawlins EA. Bentley's textbook of pharmaceuticals. 8th ed. New Delhi: Reed Elsevier India Pvt Ltd; 2010.
5. Subrahmanyam CVS. Essentials of physical pharmacy. Delhi: Vallabh Prakashan; 2003.
6. Subrahmanyam CVS. Textbook of physical pharmaceuticals. 2nd ed. Delhi: Vallabh Prakashan; 2003.
7. Willard HH, Meritt LL, Dean JA, Settle FA. Instrumental methods of analysis. 7th ed. New Delhi: CBS Publishers & Distributors; 1986.

LIST OF MINIMUM EQUIPMENTS REQUIRED

1. Brookfield's viscometer	01 no.
2. Digital electronic balances	03 nos.
3. Digital pH meters	01 no.
4. Microscopes	05 nos.
5. Ostwald's Viscometers	15 nos.
6. Stage and eye piece micro meters	05 nos.
7. Stalagmometers	15 nos.