

Introduction to Physical Pharmaceutics (Theory)

**A Course Book for B. Pharm Semester II
(BP206T)**

*As per the new Pharmacy Council of India Syllabus
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Preface

This book presents the theory of Physical Pharmaceutics prescribed for the second semester of the Bachelor of Pharmacy programme under the Pharmacy Council of India, in course BP206T. It is written to serve the student who must both understand the subject and pass the university examination. Every topic in the prescribed syllabus is covered, in the order of the five units, and each is treated to the depth the examination demands and no further, so that the book remains concise without leaving any required topic untaught.

The book is built on a single idea: that each physicochemical property of a drug or a dosage form can be defined, can be measured, and has a consequence for the way a formulation behaves. Solubility, the partition coefficient, surface activity, particle size, and flow are not abstractions but measurable quantities, each tied to a specific behaviour of a real product. The text moves through each property in this way, from its definition, through its measurement, to its use in formulation, drawing the connections between the units so that the subject reads as one continuous account rather than a series of separate topics.

The standard pharmaceutical compendium for an Indian book is the Indian Pharmacopoeia, which is cited as the governing authority for compendial values, with the United States and British Pharmacopoeias mentioned only as labelled comparisons. Worked examples are given for every calculation, with each step shown and the units carried through, and the chapter-end self-assessment follows the pattern of the university question paper, with short-answer, long-answer, and multiple-choice questions and numerical problems, each with a model answer.

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How to use this book

The book is arranged in seven chapters across the five units of the syllabus. Each chapter opens with a short list of learning outcomes, which state what the reader should be able to do after studying the chapter and which are traceable to the official Course Outcomes of the course. The body of the chapter develops the topic with definitions, classifications, mechanisms, figures, and worked examples. Key terms are set in bold where they are first defined, and quick-recall boxes summarise the points most often tested.

Three kinds of reader are served by the same pages. The first-time learner should read the chapter in order, working through each worked example. The reviser should read the chapter summary and the quick-recall boxes, then test understanding against the self-assessment. The student preparing the night before the examination should concentrate on the topics tagged “High-yield” in the self-assessment, on the figures, and on the consolidated formula sheet at the end of the book. Cross-references to other chapters are given so that a concept taught once can be revisited where it is used again.

COURSE OBJECTIVES

The objectives of this course are to:

1. Provide a comprehensive understanding of the theory and principles of pharmaceutical processes and unit operations involved in drug manufacturing.
2. Impart knowledge of physicochemical phenomena such as solubility, dissolution, interfacial phenomena, rheology, and micromeritics relevant to dosage form design.
3. Develop understanding of colloidal and coarse dispersions, including suspensions and emulsions, and their pharmaceutical applications.
4. Familiarize students with rheological and micromeritic properties of powders and dispersions and their role in formulation development and evaluation.
5. Build a strong foundation for formulation development, process optimization, and quality control of pharmaceutical dosage forms.

COURSE OUTCOMES (CO)

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

1. Explain and interpret the fundamental principles governing pharmaceutical manufacturing processes and unit operations.
2. Analyze physicochemical properties of drugs and excipients and correlate them with formulation stability, quality, and performance.
3. Apply concepts of interfacial phenomena, colloids, and dispersions in the design and evaluation of pharmaceutical dosage forms.
4. Evaluate and optimize pharmaceutical processes by controlling variables related to rheology, micromeritics, and dispersion systems.
5. Demonstrate foundational competency required for advanced studies in formulation development, industrial pharmacy, and pharmaceutical research.

SYLLABUS

Unit no.	Topics	No. of lectures required
I	Solubility distribution phenomenon & buffers Solubility expression, Solute solvent interactions, Solubility of liquid and liquids, Solubility of solids and liquids, Solubility of Gas in Liquids, Raoult's Law. Factors affecting solubility, Measurement of saturation Solubility, Effect of pH on solubility, Partition Coefficient – Measurement and significance, Critical Solution Temperature and Applications. Introduction to buffers, Buffers in pharmaceutical and biological system, pH determination methods (Electrometry and colorimetry). Buffer equation / Factor influencing the pH of buffer solutions, Factor influencing Buffer capacity, General procedure for preparing buffers, Indicators.	9 hours
II	Interfacial phenomenon Liquid interface: Surface and interfacial tension, surface free energy, Measurement of surface and interfacial tension, Spreading coefficient, surface active agent, HLB, detergency, types of monolayers at liquid surface. Adsorption at solid interface, Liquid Interface (contact angle, activated charcoal and Wetting). Adsorption of surface-active agents. Electric properties of interface / Electric double layer, Nernst and zeta potential effect of electrolytes	8 hours
III	Colloidal and Coarse Dispersion Colloidal dispersions: Types of colloidal dispersions (Lyophobic, Lyophilic, Association colloids), Optical properties of colloids, Kinetic properties of colloids, Electrical properties of colloids, Size and shape of colloidal systems, Stability of colloidal system (peptization and protective action), Application of Colloidal System. Coarse Dispersions: Suspensions, stokes law (Theory of	12 hours

	sedimentation), Effect of Brownian movement / Sedimentation of flocculated particles, sedimentation parameters. Flocculation and controlled structure flocculation. Theories of emulsification and stabilization (DLVO Theory, Monomolecular adsorption, Multimolecular adsorption, Film formation, Solid particle adsorption). Physical instabilities of emulsions (creaming, coalescence and breaking, and phase inversion).	
IV	Rheological studies Newtonian systems and non-Newtonian systems. Thixotropy – measurement / Bulges and spurs. Negative thixotropy, Determination of rheological properties (Viscometers / single and multi-point). Viscoelasticity, psycho-rheology. Applications of rheology in pharm	8 hours
V	Micromeritics Particle size and size distribution, Particle Shape and Surface area: Methods for determination and significance. Flow properties of powders: determination, significance and methods of enhancement. Advanced flow properties of powers (Powder flow tester).	8 hours

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