

A textbook of Physical Pharmaceutics (Theory)

BP206T

A Textbook for B. Pharm Semester II

As per the new Pharmacy Council of India (PCI) Syllabus 2026 (NEP 2020)

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Preface

This book presents the physical chemistry that underlies pharmaceutical formulation, written to the Pharmacy Council of India syllabus for the second-semester B.Pharm subject Physical Pharmaceutics (course code BP206T). Its purpose is narrow and deliberate: to teach, to the depth the university examination demands, the physicochemical principles that govern how drugs dissolve, how interfaces behave, how dispersions are stabilised, how materials flow, and how powders are characterised, and to show at every step why these principles matter at the formulation bench and on the manufacturing floor.

The subject sits early in the pharmacy curriculum, yet it carries ideas that recur throughout the degree and throughout professional practice. Solubility and dissolution decide whether a drug can be absorbed; interfacial phenomena decide whether an emulsion or a suspension will hold together; rheology decides whether a product can be poured, spread, or injected; and micromeritics decides whether a powder will flow into a die and deliver a uniform dose. The chapters are arranged to build these ideas in a dependable order, each resting on the ones before it, so that a concept introduced once is used confidently thereafter.

The treatment is formal and exam-aligned. Every chapter opens with a precise definition, lays out the relevant classification, derives the governing relationships rather than merely asserting them, works numerical examples in full with units carried throughout, and closes with a graded self-assessment in the pattern of the university question paper. The Indian Pharmacopoeia is taken as the primary compendium, with other pharmacopoeias cited only as labelled comparison. Quantitative values that depend on a specific pharmacopoeial edition or a particular reference are marked for the reader to confirm against the current source, in keeping with the discipline that a textbook should teach the principle reliably and flag the figure that may change.

The book is offered to first-year students as a single, self-contained source for the subject, and to teachers as a faithful map of the syllabus.

Corrections and suggestions from teachers and students are welcome, and will improve the next edition.

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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

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	Topics	No. of lectures
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.	09 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.	08 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 sedimentation), Effect of Brownian movement / Sedimentation of flocculated particles, sedimentation parameters. Flocculation and controlled 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).	12 Hours
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, psychorheology. Applications of rheology in pharmacy.	08 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 powders (Powder flow tester).	08 Hours

How to use this book

The book serves three readers from the same pages.

The first-time learner should read a chapter straight through, in order, working each boxed Example before reading its answer. The chapters are dependency ordered, so nothing in a later chapter assumes anything that an earlier one has not established.

The reviser should read the chapter summary first, then the quick-recall box, and return to the body only for the sections the summary shows to be unfamiliar. The comparison tables are written to be reproduced under examination conditions and are the most efficient revision material in the book.

The examinee should work the self-assessment section. The short-answer questions carry model answers written to the two- to five-mark band; the long-answer questions carry structured plans that state where the marks lie, including which diagrams must be drawn; the numerical problems carry complete solutions with the arithmetic shown; and the multiple-choice questions test the definitions and values most often examined.

A note on units. SI units lead throughout. Where a CGS unit is still the working unit in pharmacy, as poise is for viscosity and dyne per centimetre for surface tension, it is given alongside in parentheses, because question papers continue to use it.

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