

**Punjab University College of  
Pharmacy Faculty of Pharmacy  
University of the Punjab, Lahore  
Course Outline**



| Programme                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Pharm.D 1st Semester                                                                                                                                                              | Course Code | PHARM-101(Theory),<br>PHARM-102 (Lab)                                                        | Credit Hours | 3+1 |
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| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | PHYSICAL PHARMACY -1                                                                                                                                                              |             |                                                                                              |              |     |
| Course Introduction                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                   |             |                                                                                              |              |     |
| <p>Physical pharmacy is a foundational pharmaceutical science that applies physical and chemical principles to the development, evaluation, and stability of drug dosage forms. It bridges chemistry, physics, and pharmacy to understand how drug molecules behave, ensuring effective, stable, and bioavailable medication delivery systems. It acts as a bridge between basic sciences and practical pharmacy, focusing on Preformulation, stability, and drug delivery systems to ensure therapeutic effectiveness. Key areas include solubility, rheology, micromeritics, and kinetics.</p> <p>Key Aspects of Physical Pharmacy:</p> <ul style="list-style-type: none"><li>• <b>Preformulation Studies:</b> Evaluates the physical and chemical properties of a drug substance (e.g., solubility, particle size, polymorphism) before formulating it into a stable dosage form.</li><li>• <b>Dosage Form Design:</b> Utilizes principles like surface tension and interfacial phenomena to create stable suspensions, emulsions, and tablets.</li><li>• <b>Stability and Kinetics:</b> Predicts the shelf-life of products by understanding drug degradation rates (hydrolysis, oxidation).</li><li>• <b>Drug Delivery:</b> Enhances the delivery of drugs to target sites within the body by managing physicochemical characteristics.</li></ul> |                                                                                                                                                                                   |             |                                                                                              |              |     |
| Learning Outcomes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                   |             |                                                                                              |              |     |
| <p>On the completion of the course, the students will be able to:</p> <ul style="list-style-type: none"><li>• Describe the historical evolution of pharmacy through ancient Greek, Arab, and Muslim contributions and the significance of official compendia and texts.</li><li>• Explain basic physicochemical principles relevant to drug delivery systems and formulations.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                   |             |                                                                                              |              |     |
| Course Content (Theory)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                   |             | Assignments/Readings                                                                         |              |     |
| Week 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Introduction to Pharmacy and History:</b><br>i. Introduction and orientation to the Pharmacy Profession with the current scope and latest applications.                        |             | Adejare, A. (2020). Remington: The Science and Practice of Pharmacy: Academic Press.         |              |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ii. A survey of the history of pharmacy through ancient, Greek, and Arab periods with special reference to the contribution of Muslim scientists to pharmacy and allied sciences. |             |                                                                                              |              |     |
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| <b>Week 2</b> | <b>Introduction to Pharmaceutical Literature:</b> Introduction to the scientific literature, literature types in pharmacy, official texts and compendia, and their significance.      | <i>Preformulation, Product Design, and Regulatory Science</i> : Wiley. 3. Allen, L. V. (2021). <i>Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems</i> : Wolters Kluwer Health.                                                                                                                                                 |
| <b>Week 3</b> | <b>Introductory concepts in Physical Pharmacy</b><br>i. Fundamentals and overview of the concepts of physicochemical properties and their application in product development.         | Anderson, S. (2005). <i>Making Medicines: A Brief History of Pharmacy and Pharmaceuticals</i> : Pharmaceutical Press.                                                                                                                                                                                                                        |
| <b>Week 4</b> | Basic concepts of physical pharmacy in dosage forms science and its various applications.                                                                                             | British Pharmacopeia Commission (2024). <i>British Pharmacopeia 2025</i> . Medicines and Healthcare Products Regulatory Agency.                                                                                                                                                                                                              |
| <b>Week 5</b> | <b>Physicochemical Principles:</b><br>i. <b>Solutions:</b> Types, concentration expressions, ideal and real solutions, colligative properties, and applications in pharmacy.          | Brun, P. L., Crauste-Manciet, S., Krämer, I., Smith, J., & Woerdenbag, H. (2023). <i>Practical Pharmaceutics: An International Guideline for the Preparation, Care and Use of Medicinal Products</i> : Springer International Publishing.<br><b>Assignment:</b> Make a flow chart of all the physicochemical principles in physical pharmacy |
| <b>Week 6</b> | <b>Solubility and Solubilization:</b> Definition and concepts of solubility and Solubilization, mechanism, factors affecting solubility and solubilization.                           | <b>Assignment:</b> Enlist the basic definitions of physicochemical procedures and give one example each                                                                                                                                                                                                                                      |
| <b>Week 7</b> | <b>Dissolution and Permeation:</b> Definition and concepts, types, Factors affecting dissolution and permeation, Noyes-Whitney equation                                               | Denton, P., & Rostron, C. (2013). <i>Pharmaceutics: The Science of Medicine Design</i> : OUP Oxford. 8. <i>European Pharmacopeia (11th edition)</i> . European Directorate for the Quality of Medicines & Healthcare.<br><b>Assignment:</b> Modeling Dissolution and Permeation of BCS Class II Drugs                                        |
| <b>Week 8</b> | <b>Polymorphism:</b> Basic concept, lattice structure, and significance in pharmaceuticals. Amorphous and crystalline solids and their effect on thermodynamics. Role in dissolution. | <b>Assignment:</b> Polymorphism impact on Drug Formulation and Performance.                                                                                                                                                                                                                                                                  |
| <b>Week 9</b> | <b>Ionization and Buffers:</b> i. Strong vs. Weak Electrolytes, pH, pKa, and buffer systems and capacity.                                                                             | Fahr, A., & Scherphof, G. L. (2018). <i>Voigt's Pharmaceutical Technology</i> : Wiley. 10. Lovett, A. W. (2014). <i>Introduction to the Pharmacy Profession</i> : Jones & Bartlett Learning.<br><b>Assignment:</b> Make a chart showing acidic and basic buffers list.                                                                       |

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| Week 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Henderson Hasselbalch Equation and application in drug formulation.                                                                  | Ma, J. K. H., & Hadzija, B. (2013). Basic Physical Pharmacy: Jones & Bartlett Learning                                                                                                                                                                                                                                              |
| Week 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Hypo, hyper, and Isotonic solutions and pharmaceutical applications.                                                                 | Sinko, P. J. (2023a). <i>Martin's Physical Pharmacy and Pharmaceutical Sciences</i> : Wolters Kluwer Health. 13. Swarbrick, J. (2013). <i>Encyclopedia of Pharmaceutical Science and Technology, Fourth Edition, Six Volume Set (Print)</i> : Taylor & Francis.<br><b>Assignment:</b> Brief note on types of solutions in pharmacy. |
| Week 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Micromeritics:</b><br>i. Particle size and its distribution, Texture and morphological characteristics of pharmaceutical powders. | Taylor, K., & Aulton, M. E. (2021). <i>Aulton's Pharmaceutics: The Design and Manufacture of Medicines</i> : Elsevier. 15. <i>United States Pharmacopeia-National Formulary (USP-NF 2024)</i> . United States Pharmacopeial Convention                                                                                              |
| Week 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Role and importance of micromeritics in pharmacy and medicines.                                                                      |                                                                                                                                                                                                                                                                                                                                     |
| Week 14                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Methods of particle size analysis, distribution, and morphological determination (sieving, microscopy etc.).                         |                                                                                                                                                                                                                                                                                                                                     |
| Week 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Flow properties: Carr’s Index, Hausner’s ratio                                                                                       |                                                                                                                                                                                                                                                                                                                                     |
| Week 16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Flow properties: angle of repose.                                                                                                    | Zebroski, B. (2015). <i>A Brief History of Pharmacy: Humanity's Search for Wellness</i> : Taylor & Francis.                                                                                                                                                                                                                         |
| Textbooks and Reading Material                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                     |
| <b>Main source:</b> Adejare, A. (2020). Remington, Al-Achi, A., Gupta, M. R., & Stagner, W. C. (2022). <i>Integrated Pharmaceutics: Applied Preformulation, Product Design, and Regulatory Science</i> : Wiley.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                     |
| <ul style="list-style-type: none"><li>• <b>Other sources:</b> Allen, L. V. (2021). <i>Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems</i>: Wolters Kluwer Health.</li><li>• Anderson, S. (2005). <i>Making Medicines: A Brief History of Pharmacy and Pharmaceuticals</i>: Pharmaceutical Press.</li><li>• British Pharmacopeia Commission (2024). <i>British Pharmacopeia 2025</i>. Medicines and Healthcare Products Regulatory Agency.</li><li>• Brun, P. L., Crauste-Manciet, S., Krämer, I., Smith, J., &amp; Woerdenbag, H. (2023). <i>Practical Pharmaceutics: An International Guideline for the Preparation, Care and Use of Medicinal Products</i>: Springer International Publishing.</li><li>• Denton, P., &amp; Rostron, C. (2013). <i>Pharmaceutics: The Science of Medicine Design</i>: OUP Oxford.</li><li>• <i>European Pharmacopeia (11th edition)</i>. European Directorate for the Quality of Medicines &amp; Healthcare.</li><li>• Fahr, A., &amp; Scherphof, G. L. (2018). <i>Voigt's Pharmaceutical Technology</i>: Wiley.</li><li>• Lovett, A. W. (2014). <i>Introduction to the Pharmacy Profession</i>: Jones &amp; Bartlett Learning.</li></ul> |                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                     |

| Course Content (Practical/lab)                                                                                                                     |         |                                             |                       |         |
|----------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------------------------------------------|-----------------------|---------|
| 1.Introduction to laboratory safety and various apparatus used in laboratory                                                                       |         |                                             |                       |         |
| 2.Basic calculation in pharmaceutical analysis                                                                                                     |         |                                             |                       |         |
| 3.Preparation of molar and normal solutions.                                                                                                       |         |                                             |                       |         |
| 4.Determination of specific gravity and density of various solvents by pycnometer.                                                                 |         |                                             |                       |         |
| 5.Determination of solubility of KCl at room temperature.                                                                                          |         |                                             |                       |         |
| 6.preparation of buffer solutions.                                                                                                                 |         |                                             |                       |         |
| 7.preparation of isotonic solution by different methods.                                                                                           |         |                                             |                       |         |
| <ul style="list-style-type: none"><li>• NaCl equivalent method</li><li>• Freezing point depression method</li><li>• White Vincent method</li></ul> |         |                                             |                       |         |
| 8.Standardization of NaOH solution using titration                                                                                                 |         |                                             |                       |         |
| 9.Determination of angle of repose                                                                                                                 |         |                                             |                       |         |
| 10.Determination of LBD, TBD, Carr’s index and hausner’s ratio of given powder samples.                                                            |         |                                             |                       |         |
| 11.Purification of benzoic acid by crystallization.                                                                                                |         |                                             |                       |         |
| 12.Purification of camphor sample by sublimation                                                                                                   |         |                                             |                       |         |
| Assignments: Types and Number with Calendar                                                                                                        |         |                                             |                       |         |
| Assignment/presentation (20 marks)                                                                                                                 |         |                                             | Class quiz (30 marks) |         |
| No.                                                                                                                                                | Week    | Deadline for submission                     | No.                   | Week    |
| Assignment 1 (Pre-mid)                                                                                                                             | Week 3  | Within the timeline assigned by the teacher | Quiz 1 (pre-mid)      | Week 4  |
|                                                                                                                                                    |         |                                             | Quiz 2 (pre-mid)      | Week 7  |
| Assignment 2 (Post-mid)                                                                                                                            | Week 11 |                                             | Quiz 3 (post-mid)     | Week 10 |
|                                                                                                                                                    |         |                                             | Quiz 4 (post-mid)     | Week 14 |