

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



Programme	Pharm.D 2nd Semester	Course Code	PHARM-115 (Theory), PHARM-116 (Lab)	Credit Hours	2+1
Course Title	Pharmaceutical Chemistry- IIB (Biochemistry-II)				
Course Introduction					
This course introduces the fundamental concepts of biochemistry with emphasis on clinical and pharmaceutical applications. It covers proteins and amino acids, including their structure, classification, metabolism, and related disorders such as urea cycle and heme abnormalities. The course also explores nucleic acids and their role in modern therapies like gene delivery and diagnostics. Students will study enzymes, their classification, mechanisms, and regulation, along with the role of coenzymes and drug–enzyme interactions. Key signaling molecules such as cAMP and calcium ions are discussed in the context of metabolic regulation. An introduction to clinical biochemistry is included, focusing on the importance of laboratory tests such as uric acid, cholesterol, bilirubin, and creatinine in disease diagnosis. Overall, the course links biochemical principles with real-world medical and pharmaceutical applications.					
Learning Outcomes					
On the completion of the course, the students will be able to: Define and recall proteins, amino acids, enzymes, nucleic acids, and secondary messengers. Recall their classifications, essential amino acids, peptide bonds, and basic lab tests. Describe protein structure, amino acid properties, metabolism, enzyme classes, nucleic acids, and key biochemical tests. Explain enzyme action and regulation, metabolic pathways (urea cycle, heme), and roles of nucleic acids in therapy and diagnostics. Analyze and differentiate types of proteins, amino acids, enzymes, and metabolic disorders. Analyze clinical test variations. Evaluate clinical importance of biomolecules and interpret lab results in disease conditions. Design simple experiments for enzymes and basic diagnostic approaches. Apply biochemical knowledge to drug action, metabolism, and clinical analysis. Demonstrate understanding through problem-solving and interpretation of biochemical and clinical data.					
Course Content (Theory)			Assignments/Readings		
Week 1	Introduction to Proteins and amino acid		Nelson, D. L., & Cox, M. M. (2017). Lehninger principles of biochemistry (7th ed.). W. H. Freeman and Company. Assignment: Define proteins. Classify different types of amino acids.		
	Classification of Proteins and amino acid				
	Physical and chemical properties of Proteins				
	Organizational level of proteins		Nelson, D. L., & Cox, M. M.		

Week 2	Pharmaceutical applications of proteins	(2017). Lehninger principles of biochemistry (7th ed.). W. H. Freeman and Company. Assignment: Write down in detail therapeutic applications of proteins.
	Digestion of proteins	
Week 3	Metabolism of essential amino acids	Akash, M. S. H., & Rehman, K. (2025). Biochemical aspects of metabolic disorders. Elsevier Academic Press. Assignment: Practice metabolic pathways with structures.
	Metabolism of non-essential amino acids	
	Metabolic disorders of biosynthetic pathway	
Week 4	Urea cycle and disorders	Akash, M. S. H., & Rehman, K. (2025). Biochemical aspects of metabolic disorders. Elsevier Academic Press. Assignment: Practice metabolic pathways with structures.
	Heme synthesis	
	Heme degradation and disorders	
Week 5	Introduction to Nucleic acids	Akash, M. S. H., & Rehman, K. (2025). Biochemical aspects of metabolic disorders. Elsevier Academic Press. Assignment: Practice structures of bases.
	Purine bases	
	Pyrimidines bases	
Week 6	Gene therapy	Akash, M. S. H., & Rehman, K. (2025). Biochemical aspects of metabolic disorders. Elsevier Academic Press. Assignment: Make a list of nucleic acids used in gene therapy.
	Use of nucleic acids in gene therapy	
	Drug delivery	
Week 7	Diagnostics	Berg, J. M., & Stryer, L. (2020). Biochemistry (9th ed.). W. H. Freeman and Company Hodges, R. S. (2019). Biochemistry: A short course (3rd ed.). Wiley. Assignment: Enlist vaccines used in Pakistan.
	Introduction to Vaccines	
	Types and medical applications of vaccines	
Week 8	Introduction to targeted therapies	Berg, J. M., & Stryer, L. (2020). Biochemistry (9th ed.). W. H. Freeman and Company Hodges, R. S. (2019). Biochemistry: A short course (3rd ed.). Wiley. Assignment: Compare targeted, antisense therapy and bioanalysis.
	Introduction to antisense therapies	
	Introduction to bioanalysis	
	Introduction to nanotechnology	Berg, J. M., & Stryer, L. (2020).

Week 9	Types of nanotechnological products	Biochemistry (9th ed.). W. H. Freeman and Company Hodges, R. S. (2019). Biochemistry: A short course (3rd ed.). Wiley. Assignment: Enlist nanotechnological products available in market.
	Pharmaceutical applications of nanotechnological products	
Week 10	Introduction to enzymes	Berg, J. M., & Stryer, L. (2020). Biochemistry (9th ed.). W. H. Freeman and Company Hodges, R. S. (2019). Biochemistry: A short course (3rd ed.). Wiley. Assignment: Attempt quiz from the covered lesson
	Classification of enzymes	
	Activation of enzymes	
Week 11	Inhibition of enzymes	Berg, J. M., & Stryer, L. (2020). Biochemistry (9th ed.). W. H. Freeman and Company Hodges, R. S. (2019). Biochemistry: A short course (3rd ed.). Wiley. Assignment: Attempt quiz from the covered lesson
	Specificity of enzymes	
	Allosteric enzymes	Berg, J. M., & Stryer, L. (2020). Biochemistry (9th ed.). W. H. Freeman and Company Hodges, R. S. (2019). Biochemistry: A short course (3rd ed.). Wiley.
		Assignment: Define enzymes and explain concept of activation and inhibition of enzymes.
Week 12	Factors affecting rate of enzyme-catalyzed reaction	Berg, J. M., & Stryer, L. (2020). Biochemistry (9th ed.). W. H. Freeman and Company Hodges, R. S. (2019). Biochemistry: A short course (3rd ed.). Wiley.
	Drug-enzyme interactions	
	Pharmaceutical importance of enzymes	Gout, A. M. (2019). Biochemistry for the pharmaceutical sciences (4th ed.). Wiley. Assignment: Attempt quiz from the reactions covered
	Introduction to Coenzymes	Berg, J. M., & Stryer, L. (2020). Biochemistry (9th ed.). W. H. Freeman and Company
	Coenzymes role in the regulation of metabolic processes.	

Week 13	Secondary Messengers	Hodges, R. S. (2019). Biochemistry: A short course (3rd ed.). Wiley. Assignment: Attempt quiz from the reactions covered
Week 14	Types of Secondary Messengers	Berg, J. M., & Stryer, L. (2020). Biochemistry (9th ed.). W. H. Freeman and Company Hodges, R. S. (2019). Biochemistry: A short course (3rd ed.). Wiley. Assignment: Attempt quiz and prepare a poster on a chart paper.
	Role of cAMP	
	Role of Calcium ions	
Week 15	Role of phosphoinositol	Devlin, T. M. (2016). Textbook of biochemistry with clinical correlations (8th ed.). Wiley-Liss. Assignment: Prepare a poster on normal ranges of uric acid , cholesterol, bilirubin and creatinine
	Introduction to clinical biochemistry	
	Importance of clinical biochemistry	
Week 16	Laboratory tests in diagnosis of diseases including uric acid	
	Laboratory tests in diagnosis of diseases including cholesterol	
	Laboratory tests in diagnosis of diseases including bilirubin and creatinine	
Textbooks and Reading Material		
Main source: Berg, J. M., Tymoczko, J. L., & Gatto, G. J. (2019). Stryer’s biochemistry (8th ed.). W. H. Freeman and Company.		
Other sources: Akash, M. S. H., & Rehman, K. (2025). Biochemical aspects of metabolic disorders. Elsevier Academic Press. 1. Nelson, D. L., & Cox, M. M. (2017). Lehninger principles of biochemistry (7th ed.). W. H. Freeman and Company. 2. Abraham, D. J. (2017). Burger’s medicinal chemistry and drug discovery (8th ed.). Wiley. 3. Devlin, T. M. (2016). Textbook of biochemistry with clinical correlations (8th ed.). Wiley-Liss. 4. Gout, A. M. (2019). Biochemistry for the pharmaceutical sciences (4th ed.). Wiley. 5. Berg, J. M., & Stryer, L. (2020). Biochemistry (9th ed.). W. H. Freeman and Company 6. Hodges, R. S. (2019). Biochemistry: A short course (3rd ed.). Wiley.		

Course content (Practical/lab)				
1. Qualitative analysis of lipids 2. Qualitative analysis of oils 3. Qualitative analysis of Cholesterol 4. Qualitative analysis of Urea 5. Qualitative analysis of Uric acid 6. Qualitative analysis of Bile salts 7. Analysis of milk 8. Quantitative estimation of glucose by Benedicts Method 9. Quantitative estimation of glycine by Sorenson’s Method 10. Quantitative estimation of ascorbic acid by Iodometric Method 11. Quantitative estimation of creatinine by Spectroscopic Method 12. Quantitative estimation of uric acid by Spectroscopic Method 13. Quantitative estimation of cholesterol by Spectroscopic Method				
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