

**School of Chemistry  
Faculty of Science  
University of the Punjab, Lahore  
Course Outline**



<b>BS Chemistry Semester-VI</b>					
<b>Programme</b>	<b>BS Chemistry</b>	<b>Course Code</b>	<b>Chem-378</b>	<b>Credit Hours</b>	<b>2</b>
<b>Course Title</b>	<b>Protein</b>		<b>Course Type</b>	<b>Major (Elective)</b>	
<b>Course Introduction</b>					
<p>This chapter will give the understanding the concepts related to structure and functions of amino-acids and proteins, and to acquire the knowledge about the different proteins and their function, and the metabolism of essential amino acid and amination along with deamination of amino acids.</p> <p>Amino acids: Structure, Chiral Center, stereoisomerism and optical activity. Classification of amino acids; chemical, nutritional, metabolic and R group. Acid base properties of amino acids. Biological significance of amino acids and peptides. Proteins: Covalent structure, classification, and biological significance of proteins including Primary, Secondary, Tertiary and Quaternary structure of proteins, as Keratins, Collagens and elastin. Conformation, structure and function of Fibrous and globular proteins with special reference to Hemoglobin and Myoglobin. Digestion and Absorption of Proteins. Biosynthesis of essential amino acids and their degradation. Urea Cycle, decarboxylation, transamination and deamination reactions of amino acids and their importance. Synthesis and secretion of creatine and creatinine.</p>					
<b>Learning Outcomes</b>					
<ol style="list-style-type: none"> <li>1. After studying this course, students will be able to understand classification, properties and importance of amino acids.</li> <li>2. Students will also learn Structural classification and biological importance of proteins, dietary proteins and their digestion.</li> <li>3. It will also help to learn general pathways of amino acid metabolism and catabolism</li> </ol>					
<b>Course Content</b>				<b>Assignments/Readings</b>	
<b>Week 1</b>	General lecture about protein			-	
	Amino acids, Structure, Chiral Center, stereoisomerism and optical activity.			Class base learning/test	
<b>Week 2</b>	Classification of amino acids; chemical, nutritional importance, metabolic and R group.			Class base learning/test	
	Acid base properties of amino acids. Biological significance of amino acids and peptides Discuss the previous two-week lectures with students			Class base learning/test	
<b>Week 3</b>	Proteins: Covalent structure and classification of protein			Class base learning/test	
	Biological significance of proteins including Primary, Secondary, Tertiary and Quaternary structure of proteins			Class base learning/test	

<b>Week 4</b>	Structure and Biological significance of Keratins, Collagens and elastin.	Class base learning/test
	Class Discussion	
<b>Week 5</b>	Conformation, structure and function of Fibrous and globular proteins	Class base learning/test
	Details about the structures and biological importance of Hemoglobin and Myoglobin	Class base learning/test
<b>Week 6</b>	Digestion and Absorption of Proteins	Class base learning/test
	Class Discussion	-
<b>Week 7</b>	This lecture divided in to two parts Biosynthesis of essential amino acids and their degradation.	Class base learning/test
	Biosynthesis of essential amino acids and their degradation.	Class base learning/test
<b>Week 8</b>	Class discussion	-
	Quiz (Give marks, if necessary, from assignment)	-
<b>Week 9</b>	Mid Term Exams	-
<b>Week 10</b>	Detail about the Urea Cycle	Class base learning/test
	Decarboxylation	Class base learning/test
<b>Week 11</b>	Class Discussion	
	Lecture divided into two parts transamination and deamination reactions of amino acids and their importance.	Class base learning/test
<b>Week 12</b>	transamination and deamination reactions of amino acids and their importance.	Class base learning/test
	Class Discussion	
<b>Week 13</b>	Discussion on the Assigned topic for assignment	Class base learning/test
	Synthesis and secretion biological importance of creatine	Class base learning/test
<b>Week 14</b>	Synthesis and secretion biological importance and creatinine	Class base learning/test
<b>Week 15</b>	Class discussion	-
	Quiz (Give marks, if necessary, from assignment)	-
<b>Week 16</b>	Submission of assignments. If required then discussion the whole chapter for final term exams preparation	-

### Reading Material

- 1- Lehninger, A. L., Nelson, D. L., & Cox, M. M. (2020). Principles of biochemistry (8th ed.). W. H. Freeman and Company.
- 2- Stryer, L. (2021). Biochemistry (9th ed.). W. H. Freeman and Company.
- 3- Murray, R. K., Bender, D. A., Botham, K. M., Kennelly, P. J., & Rodwell, V. W. (2018). Harper's biochemistry (32nd ed.). McGraw-Hill Education.
- 4- Champ, C., Harvey, R. A., & Ferrie, D. R. (2021). Lippincott's biochemistry (6th ed.). Wolters Kluwer.
- 5- Voet, D. J., Voet, G. J., & Pratt, C. W. (2023). Fundamentals of biochemistry (5th ed.). Wiley.

### Teaching Learning Strategies

- Lecturing using white/black board/Multimedia
- Written Assignments/Quiz/Task/Presentation
- Checking the task

### Assignments: Types and Number with Calendar

Assignment, Quiz, Task, Presentation etc.

### Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

<b>Semester-VI</b>					
<b>Programme</b>	<b>BS Chemistry</b>	<b>Course Code</b>	<b>Chem-379</b>	<b>Credit Hours</b>	<b>1</b>
<b>Course Title</b>	<b>Protein-Lab</b>		<b>Course Type</b>	<b>Major Elective</b>	
<b>Course Introduction</b>					
<p>This protein-lab course will be helpful to understand the practical for the determination of different amino acids and protein from animal and plant sources, and to acquire the knowledge about the use of spectrophotometer and chromatography for the determination of protein and amino acids from samples.</p> <p>Qualitative tests of proteins &amp; amino acids: Biuret Test; Ninhydrin Test; Xanthoproteic Test; Pauly's Test; Hoplein's Test; Ehrich's Test; Sakaguchi Test; Sodium nitroprusside Test; Sullivan Test; sulphate Test Phosphate Test; Aldehyde Test; Extraction of proteins from plant sources and their confirmative tests. Separation and detection of Amino Acids using Paper Chromatography; Determination of total proteins by using different methods by Bradford, lowery and biuret methods. Determination of isoelectric point. Isolation and solubilization of proteins from plant and animal origin.</p>					
<b>Learning Outcomes</b>					
<ol style="list-style-type: none"> <li>1. This study will help students in understanding of practical grounds of different estimation tests of amino acids and proteins.</li> <li>2. Students will also use of chromatography for the separation of amino acids</li> <li>3. Students will be able to learn the use of UV/Visible spectrophotometer for the estimation of protein</li> </ol>					
<b>Course Content</b>				<b>Assignments/Readings</b>	
<b>Week 1</b>	Role of amino-acids and proteins in the life and which kind of test are being in use to determine the amino acids and protein from different sources			Class base learning/test	
<b>Week 2</b>	Qualitative test; Biuret Test; Ninhydrin Test			Class base learning/test	
<b>Week 3</b>	Hoplein's Test, Ehrich's Test			Class base learning/test	
<b>Week 4</b>	Sodium nitroprusside Test, and Sullivan Test Ehrich's Test, and Sakaguchi Test			Class base learning/test	
<b>Week 5</b>	Sulphate Test Phosphate Test and Aldehyde Test			Class base learning/test	
<b>Week 6</b>	Qualitative determination of protein in serum/plants			Class base learning/test	
<b>Week 7</b>	Discussion the practical and if need then repeat the topic			-	
<b>Week 8</b>	Midterm Exams			-	
<b>Week 9</b>	Xanthoproteic Test, and Pauly's Test			Class base learning/test	
<b>Week 10</b>	Extraction of proteins from plant sources and their confirmative tests.			Class base learning/test	
<b>Week 11</b>	Separation and detection of Amino Acids using Paper Chromatography			Class base learning/test	

<b>Week 12</b>	Determination of total proteins by using different methods by Bradford	Class base learning/test
<b>Week 13</b>	Determination of total proteins by using different methods by Lowery	Class base learning/test
<b>Week 14</b>	Isolation and solubilization of proteins from plant and animal origin	Class base learning/test
<b>Week 15</b>	Discussion all practical's if need then repeat	-
<b>Week 16</b>	Final Term	-

### Reading Material

1. Varley, H., Gowenlock, A. H., & Bell, P. G. (2022). *Practical clinical biochemistry* (8th ed.). CBS Publishers & Distributors.
2. Plummer, D. T. (2008). *An introduction to practical biochemistry* (3rd ed.). McGraw-Hill Education.
3. Gowenlock, A. H. (2009). *Varley's practical clinical biochemistry* (6th ed.). Arnold.
4. Williams, B. L., & Wilson, K. (2006). *Principles and techniques of practical biochemistry* (3rd ed.). Cambridge University Press.
5. Online literature as per direction of teacher

### Teaching Learning Strategies

- Lecturing using white/black board/Multimedia
- Written Assignments/Quiz/Task/Presentation
- Discussion about practical
- Checking the results and discussion

### Assignments: Types and Number with Calendar

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