25SC805 ADVANCED PROTEIN SCIENCE AND TECHNOLOGY IN FOOD SYSTEM

	Hours of Instruction/week—4
Course Code:	**No. of Credits**—4
L-T-P—C3-1-0-4	**Total 60hrs.**

Pre **requisite:** protein chemistry, protein structure, functional properties of protein, protein applications in food industry

CourseObjectives:

To provide students with a comprehensive understanding of protein chemistry in the context of food systems covering structural aspects, physicochemical and functional properties, advanced molecular behavior, and real-world applications, including therisingsignificance of plant-based and alternative protein sources. The course also aimsto develop analytical, technical, and critical thinking skills for addressing current and future challenges in food proteinutilization.

CourseOutcomes:

CO1: Explain the structure, bonding, classification, and biological functions of proteins in food and nutrition.

CO2: Analyze physic chemical and functional properties of proteins in various food systems and their industrial relevance.

CO3: Demonstrate an understanding of protein chemistry at a molecular level, including interactions, enzyme activity, and structural characterization.

CO4: Evaluate real-world applications of food proteins, particularly plant-based innovations, their benefits, limitations, and regulatory issues.

CO5: Analyze and evaluate recent advances and interdisciplinary approaches in protein research and apply emerging technologies.

Skills:

Understand molecular structure, classification, and biochemical functions of proteins in food.

CO-POMappings

	POI	PO2	PO3	PO4	PO5	PO6	PO7	PSOI	PSO2	PSO3	PSO4
CO1	2	2	2	-			I	1	1	1	2
CO2	2	2	2		-		1	1	1	1	2
CO3	2	2	2	-		-	1	1	1	1	2
CO4	2	2	2				1	1	1	1	2
CO5	2	2	2			-	1	1	3	3	3

Syllabus:

UnitI: Introduction to Proteins in Food **12hrs**

Overview of proteins, definition and importance in food and nutrition, chemical composition and peptide bonds,p rotein structure, levels of protein structure: primary, secondary, tertiary, quaternary, types of bonding in protein structures : hydrogen, ionic, disulfide, hydrophobic interactions, classification and functions of proteins, structural, storage, enzymatic, transport, and regulatory proteins, globularvs. Fibrous proteins, role in metabolism, muscle synthesis.

Unit II: Protein Properties in Food Systems **l2hrs**

Protein solubility, water-holding and oil-binding capacities, emulsifying properties, foaming capacity and stability, gelation properties, viscosity and thickening, protein denaturation, protein aggregation, mail lardreaction and glycation, oxidation, fermentation, germination, and cross-linking, protein folding, cold-setvs. heat-induced gels, film and coating formation- edible films, anti microbial and biodegradable packaging.

UnitIII:TechnologyinProtein Chemistry **12hrs**

Protein extraction and isolation technologies, protein purification and concentration, Electrophoresis: SDS-PAGE, Native PAGE, 2D-GE, Mass spectrometry, NMR and X-ray crystallography,aminoacidsandthepeptidebond,proteinfoldinganddenaturation, protein-ligand interactions, membrane proteins and transport, enzymes and enzyme mechanisms, enzyme kinetics and enzyme inhibition, metallo proteins and motor proteins, protein-protein interactions, protein structure analysis, protein quality assessment.

UnitIV:ProteinApplications **l2hrs**

Application of protein in supplements, hospital/nutritional therapy applications, food industry, application in texturized vegetable protein (TVP) and meat analogs, Microencapsulationof proteins and peptides, use of protein-based hydrogels, coatings, and films,protein-based emulsions, plant-based protein meat,plant-based dairy products,plant-based egg simulation products, alternative proteins: Insect proteins, single-cell proteins (algae, fungi, yeast), and lab-grown meat, limitations of plant-based food, regulations and safety concerns.

Unit V: **Emerging Trends in Protein Research** **12hrs**

Proteomics and peptidomics in food science, sustainable sourcing and utilization of proteins, role of proteins in addressing global nutrition challenges, protein fortification strategies in

staple foods, current trends in protein research and innovation, designer and functional proteins: health-promoting peptides, immunomodulatory proteins, Precision nutrition and protein personalization, Al and machine learning in protein prediction and formulation, lntegration of metabolomics and proteomics in diet-health research.

Book References:

1. NakaiS. &ModlerH.W, Proteins in Food Systems, CRC Press, Reprint Edition, 2020,v
2. Kessel,A.,&Ben-Ta1,N.(2018).Introduction to proteins:Structure,function,and motion (2nd ed.). CRC Press.
3. Berg,J.M.,Tymoczko,J.L.,Gatto,G.J.,&Stryer,L.(2019).Biochemistry(9thed.). W.H.Freeman.
4. Hettiarachchy, N. S., Sato, K., Marshall, M. R., &Kannan, A. (Eds.). (2012). Food proteins and peptides: chemistry, functionality, interactions, and commercialization. CRC Press.
5. RickeyY.Yada, Proteins in Food Processing,(2ndEdition),Wood head Publishing, 2017, ISBN: 9780081007213.
6. Fidel Toldrä Advances in Food and Nutrition Research: Proteins in Food Processing and Product Development. AcademicPress, 2021.

EvaluationPattern:

Assessment	Internal	External
Continuons Assessment (CA)	50	
EndSemester		50