25SC805 ADVANCED PROTEIN SCIENCE AND TECHNOLOGY IN FOOD SYSTEM

	HoursofInstruction/week—4
CourseCode:	**No.ofCredits**—4
L-T-P—C3-1-0-4	**Total60hrs.**

Pre**requisite:**proteinchemistry,proteinstructure,functionalpropertiesofprotein,protein applications in foodindustry

CourseObjectives:

Toprovidestudentswithacomprehensive understanding ofprotein chemistry inthecontext 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:Explainthe structure,bonding,classification,andbiologicalfunctions ofproteins in food and nutrition.

CO2:Analyzephysicochemicalandfunctionalpropertiesofproteinsinvariousfood systems and their industrialrelevance.

CO3:Demonstrate anunderstandingofproteinchemistryatamolecularlevel,including interactions, enzyme activity, and structural characterization.

CO4:Evaluatereal-world applicationsoffoodproteins, particularlyplant-based innovations, their benefits, limitations, and regulatory issues.

CO5:Analyzeand evaluaterecentadvancesandinterdisciplinaryapproachesinprotein research and apply emerging technologies.

Skills:

Understandmolecularstructure,classification,andbiochemicalfunctionsofproteinsin food.

CO-POMappings

	POI	PO2	PO3	PO4	PO5	PO6	PO7	PSOI	PSO2	PSO3	PSO4
CO1	2	2	2	-			1	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:IntroductiontoProteinsinFood 12hrs

Overviewof proteins, definition and importancein food andnutrition, chemical composition andpeptidebonds,protein structure,levels of proteinstructure:primary,secondary,tertiary, quaternary,typesofbondinginproteinstructures:hydrogen,ionic,disulfide,hydrophobic interactions,classificationand functions ofproteins, structural, storage, enzymatic,transport, andregulatoryproteins,globularvs.Fibrousproteins,rolein metabolism,musclesynthesis. **Unit II: Protein Properties in Food Systems l2hrs**

Proteinsolubility,water-holdingandoil-bindingcapacities,emulsifyingproperties,foaming capacity and stability, gelation properties, viscosity and thickening, protein denaturation, protein aggregation, maillardreaction and glycation, oxidation, fermentation, germination, andcross-linking,proteinfolding,cold-setvs.heat-inducedgels,filmandcoatingformation-edible films,antimicrobial 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, enzymekineticsandenzyme inhibition,metalloproteinsand motor proteins, protein-protein interactions,proteinstructureanalysis, protein qualityassessment.

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.

UnitV:**EmergingTrendsinProteinResearch 12hrs**

Proteomicsandpeptidomicsinfoodscience,sustainablesourcingandutilizationofproteins, roleofproteinsinaddressingglobalnutritionchallenges,proteinfortificationstrategiesin

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, lntegrationofmetabolomicsand proteomics indiet-healthresearch.

BookReferences:

1. NakaiS. &ModlerH.W ,ProteinsinFoodSystems,CRCPress,ReprintEdition, 2020,v
2. Kessel,A.,&Ben-Ta1,N.(2018).Introductiontoproteins: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,ProteinsinFoodProcessing,(2ndEdition),WoodheadPublishing, 2017, ISBN: 9780081007213.
6. FidelToldräAdvancesinFoodandNutritionResearch:ProteinsinFoodProcessing andProduct Development. AcademicPress, 2021.

EvaluationPattern:

Assessment	Internal	External
ContinuonsAssessment(CA)	50	
EndSemester		50