GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering
Level: UG
Branch: Food Engineering & Technology
Subject Code: BE03051021
Subject Name: Food Chemistry

WEF Academic Year :	2024-25
Semester :	3
Category of the Course :	PCC

Prerequisite :	**Nil**
Rationale :	Food chemistry is a fundamental component of food technology, providing essential knowledge about the properties of water, carbohydrates, fats, proteins, and food additives, along with their roles in food systems. This field explores the chemical changes that occur in foods during handling, processing, and storage. Additionally, it encompasses the study and development of food products, as well as quality evaluation. Through this course, students gain a comprehensive understanding of the chemical composition of food and its functional significance in maintaining quality, safety, and nutritional value.

Course Outcome :

After Completion of the Course, Student will able to :

No.	Course Outcomes
01	Knowledge about the moisture and water activity and understand the basic concept of shelf life of foods.
02	Study of carbohydrates to understand the properties and role of carbohydrates in foods.
03	Knowledge of structure of fatty acids, their physical and chemical properties.
04	Study of properties of food protein, structure and understand the functional role of protein in foods.
05	Knowledge of food additives and understand their role in food processing.

Teaching and Examination Scheme:

Teaching - Learning Scheme (in Hours per Semester)					Total Credits = TH/30	Assessment Pattern and Marks					Total Marks
						Theory		Tutorial / Practical			
L	T	P	PBL*	TH		ESE (E)	PA (M)	PA/ (I)	PBL (I)	ESE (V)	
45	0	30	45	120	04	70	30	20	30	50	200

Where L = Lecture, T= Tutorial, P= Practical, TW/SL = Term-Work / Self-Learning, TH = Total Hours, ESE = End-Semester Examination, PA = Progressive Assessment

*** Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.**

Course Content :

Sr. No.	Course Content	No. of Hours	
1	**Introduction to Food Chemistry & Water in Food Systems** • Definition, scope, and importance of food chemistry in food technology • Chemical composition of food and its significance • Water: Structure, properties, and functions in food • Water activity and its role in food stability • Sorption isotherms and moisture determination	**7**	**15**
2	**Carbohydrates and Their Functional Roles** • Classification and structure of carbohydrates (monosaccharides, disaccharides, polysaccharides) • Functional properties of carbohydrates in food (sweetness, gelatinization, caramelization) • Dietary fiber and its significance in human health • Chemical reactions of carbohydrates (Maillard reaction, caramelization)	**10**	**20**
3	**Proteins, Enzymes, and Their Role in Food Systems** • Structure and classification of proteins • Functional properties of proteins (gelation, emulsification, foaming) • Protein denaturation and its impact on food texture • Enzymes in food processing (browning, fermentation, tenderization) • Protein interactions in food systems	**9**	**20**
4	**Lipids, Food Additives, and Chemical Changes in Food** • Classification and structure of lipids • Physical and chemical properties of fats and oils (oxidation, rancidity, melting point) • Role of lipids in food (texture, flavor, nutrition) • Food additives: Types, functions, and safety concerns • Chemical reactions affecting food quality (lipid oxidation, protein denaturation)	**9**	**25**
5	**Food Quality, Safety, and Analytical Techniques** • Food contaminants and adulteration • Chemical changes during food processing (fermentation, drying, freezing, irradiation) • Nutritional labeling and regulatory standards • Analytical techniques in food chemistry (chromatography, spectrometry, proximate analysis) • Functional foods and nutraceuticals: Bioactive compounds and their health benefits	**10**	**20**

Reference Book :

1. Food chemistry Author: L.H.Meyer (CBS Publisher, Delhi)
2. Foods : Facts and Principle Author: N.Shakuntala Manay and M. Sadaksharaswamy (New Age International Publisher)
3. Food chemistry Author: O.R. Fennema (Marcel Dekkar Inc.)
4. Food chemistry Author: H.D. Belitz and W. Groech (Springer Publication)
5. Food preservation and processing Author: M. Kalia and S. Sood (Kalyani Publisher)

Suggested Course Practical List :

1. Preparation of standard solutions
2. Determination of moisture content of different food samples by air oven method
3. Determination of moisture content by infra red moisture balance
4. Determination of protein content in food samples by micro kjeldahl apparatus
5. Determination of crude fat content in different oilseeds by soxhlet apparatus
6. Determination of ash content of food sample
7. Determination of acid value of oil
8. Determination of iodine value of a given oil
9. Determination of peroxide value of a given oil sample
10. Determination of acidity and pH of fruit juice

List of Laboratory/Learning Resources Required :

Equipment :

1. Electronic balance
2. Hot air oven
3. Infrared moisture meter
4. Micro Kjeldhal unit
5. Soxhlet apparatus and heater
6. Muffle furnace
7. Water bath
8. Glass wares, plastic wares and metal wares

List of Open Source Software/learning website :

www.ift.org
www.rsc.org
www.fao.org
NPTEL

*** List of suggested activities for Problem Based Learning:**

Sr. No.	Activity Name	Suggested Topics/Focus Area	Hours	Evaluation Criteria
1	Industry/Research Laboratory Visit	Visit to food processing unit, R&D center, food testing lab (e.g., dairy, bakery, oil mill, FSSAI lab)	10 h (Visit + Report)	Report with observations, flow diagram, critical control points
2	Technical Video-Based Learning	Unit operations (drying, milling), food safety (HACCP, ISO 22000), thermal processing	10 h	Report/Presentation based on learning outcomes
3	Assignment Writing (Numericals)	Mass/energy balance, drying rate, thermal conductivity, food refrigeration load	10 h	Based on assignment depth and accuracy
4	Problem Solving / Coding	Shelf life prediction models, food drying simulation (using Python/Excel), curve fitting for kinetics	10 h	Based on correctness and code output
5	Online Course (MOOCs)	NPTEL/SWAYAM course on Food Processing, Food Microbiology, Packaging Technology	10 h	Based on completion certificate and assessment
6	Complex Problem Solving	Case: Spoilage in packaged milk; identify root cause and solution	10 h	Based on root cause analysis and justification
7	Industrial Safety Videos	Food plant safety, hygiene and sanitation, machinery safety	10 h	Based on quiz or summary report
8	Discussion on Research Papers	Food fortification, novel food packaging, extrusion, nanotechnology in food	20 h (5 papers × 4 h)	Evaluation of scientific depth, summary of findings
9	Poster/Chart/Power Point Presentation	Food adulteration detection, cold chain, pasteurization process, millet-based products	6 h	Presentation clarity and content relevance
10	Model Development (Working/Non-working)	Mini spray dryer, solar dryer, shell & tube heat exchanger, agitator mixer	8–12 h	Internal/external demonstration and explanation
11	Industrial Exposure (2–3 Days)	Observe processes in dairy/fruit processing/bakery/oil refinery, identify inefficiencies	20 h	Critical evaluation report with suggested solutions

12	Group Discussion (Technical Trends)	Food sustainability, functional foods, AI in food industry, alternative proteins	1 h per GD	Technical input and communication skill
13	Case Study-Based Learning	Real case: Maggi ban (regulatory aspect), Patanjali contamination issue, FSSAI recall cases	10 h	Report with fact analysis and regulatory links
14	Application / Software Development	Nutrition calculator app, food label generator, moisture loss calculator	10 h	Based on functionality and usability

- All records pertaining to the evaluation and assessment of self-learning activities must be properly maintained and preserved at the institute level. These records should be made available to the university upon request.
- Institutes are encouraged to utilize digital platforms, such as Microsoft Teams, for effective record-keeping and to ensure transparency in the evaluation and assessment of self-learning activities.

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