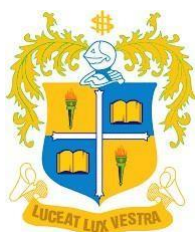


LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF) FOR POSTGRADUATE PROGRAMMES

(With effect from 2022-23)

PG FOOD CHEMISTRY AND FOOD PROCESSING
Department of Chemistry



LOYOLA COLLEGE (AUTONOMOUS)
CHENNAI - 600034

PREFACE

The curriculum of postgraduate Food Chemistry and Food Processing has been designed to explain the concepts in branches of Chemistry, Biochemistry, Food Microbiology, Food Biotechnology, Food Safety, Various processing operations of Meat, Sea foods, Livestock and Dairy. The course will aid the students apply the acquired skills required in the invention process, formulation and development of new food products. The subject elective papers offered in the course enables the students to apply the principles of costing, pricing and distribution systems in sustainable food manufacturing process, thereby empowering them to become a successful entrepreneur by understanding the potential needs of the market.

The purpose of the outcome-based education is meant to provide an exposure to the fundamental aspects in different branches of food chemistry and its applications, keeping in mind the growing needs for higher education, employability, entrepreneurship and social responsibility. The periodical restructuring of the syllabi is carried out to fulfill the requirements of graduate attributes, qualification descriptors, programme learning outcomes and course-level learning outcomes. The outcome-based education enriches the curriculum to deliver the basic principles, synthetic strategies, mechanisms and application-oriented learning for the benefit of students. It also includes self-learning module, minor projects and industrial internship to enable students to get equipped for higher studies and employment.

The programme also includes training to students for seminar presentation, preparation of internship reports, hands-on training in lab courses, skills to handle instruments, developing leadership qualities, organization and participation in the interdepartmental and intercollegiate academic competitions. The outcome-based curriculum is intended to enrich the learning pedagogy to global standards. ICT enabled teaching-learning platforms are provided to students along with the interaction of international scientists. The seminars periodically delivered by industrialists, subject experts and former professors would certainly help the students to update with latest technology/trends in different fields of food chemistry and food processing.

The exposure to the industrial internship and MoUs with industries can open an avenue for a start-up and its progress would be followed regularly. The OBE based evaluation methods will reflect the true cognitive levels of the students as the curriculum is designed with course outcomes and cognitive level correlations as per BLOOM's Taxonomy.

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VISION AND MISSION OF LOYOLA COLLEGE

VISION

Towards holistic formation of youth, grounded in excellence, through accompaniment to serve the humanity.

MISSION

- To provide inclusive education through an integral and holistic formative pedagogy.
- To promote skills that prepare them for the future.
- To kindle in young minds the spirit of social and environmental justice with a blend of academic excellence and empathy.
- To stimulate critical and conscientious scholarship leading to meaningful and innovative human capital.

CORE VALUES

- *Cura Personalis*
- Pursuit of Excellence
- Moral Rectitude
- Social Equity
- Fostering solidarity
- Global Vision
- Spiritual Quotient

VISION AND MISSION OF THE DEPARTMENT

VISION

To strive with excellence in teaching and research in Chemistry to empower students with values for the society.

MISSION

To render competent and empathetic educational service to meet global standards in academia/industry through commitment, dedication and continuous learning.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) (School of Physical Sciences)

PEO 1	Professional Skill Development To provide professional training and skill development to students in physical sciences, related disciplines and nurture them to become responsible persons in the society.
PEO 2	Core Competency Development To augment their core-competencies and knowledge levels in science, humanities and inter-disciplinary areas by imparting education of high standards and advanced technological tools with specialized research orientation.
PEO 3	Innovative Curriculum of Global Relevance To upgrade the curriculum periodically based on scientific advancements, innovations and societal relevance, so as to cater to the shifting global demands as cited by University Grants Commission, CSIR, etc.
PEO 4	Environmental Sensitivity and Sustainability To infuse environmental sensitivity in students through academic activities and hence equip them with technical skills and scientific knowledge required to protect and safeguard the environment for a sustainable future by respecting ecological balance of the globe.
PEO 5	Ethical Principles and Holistic Development To promote ethical values and special focus on the holistic development of students to become proficient, skilled, competent and socially responsible people.
PEO 6	Accessibility and Academic Excellence To provide an accessible learning environment of excellence and equal opportunity to students, enabling them to develop their creativity, critical thinking, leadership, employability skills and making them competent for job market.

PROGRAMME OUTCOMES (POs)
(School of Physical Sciences)

PO 1	<p>Disciplinary and Inter- disciplinary Knowledge for Capacity Building</p> <p>Students will acquire required knowledge of the laws governing nature through classroom teaching and experimenting in the laboratories. They will develop a sense of interdisciplinary approach to identify and resolve issues through project, seminars, field work, internships and industrial visits related to their curriculum.</p>
PO 2	<p>Skills for Effective and Efficient Communication</p> <p>Students will be able to improve and enhance their communication skills such as reading, writing, listening and speaking. This will help them to express their ideas clearly and effectively and subsequently empower them to become agents of social change and hence pave the way for betterment of the society at large.</p>
PO 3	<p>Sense of Inquiry and Problem-solving Skills</p> <p>Students will demonstrate the core competencies of their discipline through analytical reasoning, problem solving and research related skills, cooperation, team work, scientific reasoning and thinking that would make them emerge as entrepreneurs or administrative personnel.</p>
PO 4	<p>Skills to Impact Society</p> <p>Students will develop leadership, team spirit and other psychomotor skills which will help them to identify, approach and analyze the existing societal problems with an eye to look beyond gender, age, caste, creed or nationality and work for the emancipation and empowerment of humanity.</p>
PO 5	<p>Energy, Ethics and Environment</p> <p>They will be able to involve themselves in framing policies of social relevance and develop scientific temper to harness energy and work on alternate resources scientifically. They will be aware of the environmental issues and imbibe the spirit of ethical values in establishing a self-sustained environment for a healthy society.</p>
PO 6	<p>Self-directed and Lifelong Learning</p> <p>Through digital literacy, students will engage in self-paced and curious learning with necessary knowledge acquisition and hence develop motivation for a sustained lifelong learning capability. Students will accumulate knowledge by continuous activity centered learning and leverage the past knowledge to solve the problems in the future.</p>
PO 7	<p>National and International-priorities Preferences and Perspectives</p> <p>Students will be able to prioritize national and global issues with an aim to build a nation and an integrated world through contributions that imbibe the spirit of multicultural competency, creative thinking, critical analysis, political awareness and the much-needed awareness on international policies.</p>

PROGRAMME SPECIFIC OUTCOMES (PSOs)
PG Food Chemistry & Food Processing

PSO 1	To understand and recall the basic concepts in all the related areas of Food Chemistry and Food Processing and correlate to the food industry, public health and safety.
PSO 2	To acquire the theoretical knowledge and practical skills to meet the specific needs and challenges of the food industry, consumers, environment and society.
PSO 3	To transform the acquired knowledge to evaluate the food components/quality using laboratory skills and instrumentation techniques.
PSO 4	To integrate and apply the different principles of Food Chemistry and Food Processing and its related sciences in sustainable food production and manufacturing practices..
PSO 5	To develop the required competency in all the areas of Food Chemistry and Food Processing for higher studies/ research/administration and entrepreneurship.
PSO 6	To evaluate and utilize the chemical and biological concepts/processing techniques/regulations/food laws in the several domains of the food business operations.
PSO 7	To critically examine and formulate research concepts catering the societal applications associated with Food Chemistry and Food Processing

Correlation Rubrics

High	Moderate	Low	No Correlation
3	2	1	0

Mapping of PEOs with Vision and Mission

	PEO1	PEO2	PEO3	PEO4	PEO5	PEO6
Vision	3	3	3	3	3	3
Mission	3	3	3	3	3	3

Mapping of POs with PEOs

	PEO1	PEO2	PEO3	PEO4	PEO5	PEO6
PO1	3	3	3	3	3	3
PO2	3	3	3	2	3	3
PO3	3	3	3	3	3	3
PO4	3	3	3	3	3	3
PO5	3	3	3	3	2	3
PO6	3	2	3	3	3	3
PO7	3	3	3	3	3	2

Mapping of PSOs with PEOs

	PEO1	PEO2	PEO3	PEO4	PEO5	PEO6
PSO1	3	3	3	3	3	2
PSO2	3	3	3	3	3	3
PSO3	3	3	3	3	3	3
PSO4	3	3	3	3	3	3
PSO5	3	3	3	3	3	3
PSO6	3	3	3	3	3	3
PSO7	3	3	3	3	3	3

Mapping of PSOs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
PSO1	3	2	3	3	3	3	3
PSO2	3	3	3	3	3	3	3
PSO3	3	3	3	3	3	3	3
PSO4	3	3	3	3	3	3	3
PSO5	3	3	3	3	3	3	3
PSO6	3	3	3	3	3	3	3
PSO7	3	3	3	3	3	3	3

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI
DEPARTMENT OF CHEMISTRY
(2021 - Restructured Curriculum)

OVERALL COURSE STRUCTURE (MSc Food Chemistry and Food Processing)

Sem	Sub. Code	Course Title	T/ L	Category	Cr	Hrs
I	PFP1MC01	Chemistry of Macro and Micronutrients	T	MC	6	5
I	PFP1MC02	Unit Operations and Food Packaging	T	MC	6	6
I	PFP1MC03	Human Nutrition and Biochemistry	T	MC	6	6
I	PFP1MC04	Food Microbiology, Hygiene and Sanitation	T	MC	6	5
I	PFP1MC05	Analysis of Macronutrients and Enzyme catalysis	L	MC	2	4
I	PFP1MC06	Food Microbiology Lab	L	MC	2	4
II	PFP2MC01	Techniques in Food analysis	T	MC	4	5
II	PFP2MC02	Scientific Research Methodology	T	MC	3	3
II	PFP2MC03	Plant Product Processing	T	MC	5	5
II	PFP2MC04	Analysis of Micronutrients and Bioactive components	L	MC	2	4
II	PFP2MC05	Baking and Confectionery Lab	L	MC	2	3
II	PFP2MC06	Fruit and Vegetable Processing Lab	L	MC	2	3
II	PFP2LS01	Life Skills [#]	T	LS	1	2 [#]
II	PFP2SI01	Summer Internship (3 to 4 Weeks) [#]	-	SI	1	-
II	PFP2MO01	Additional Credits (MOOCs) ^{##}	-	MO	2	2 ^{##}
III	PFP3MC01	Meat, Poultry and Seafood Processing	T	MC	6	6
III	PFP3MC02	Dairy and Beverage Processing	T	MC	6	5
III	PFP3MC03	Dairy and Meat Processing Lab	L	MC	2	3
III	PFP3MC04	Analysis of Food Additives and Toxins	L	MC	2	3
III	PFP3ID01	Food Biotechnology	T	ID	3	6
III	PFP3MC05	New Product Development Lab	L	MC	2	3
IV	PFP4MC01	Food Quality, Safety and Food Laws	T	MC	6	5
IV	PFP4MC02	Food Additives and Food Toxicology	T	MC	7	6
IV	PFP4MC03	Food Safety Lab	L	MC	2	4
IV	PFP4PJ01	Project	P	PJ	5	15

Major Elective

Sem	Sub. Code	Course Title	T/L	Category	Cr	Hrs
II	PFP2ME01	Functional Foods and Nutraceuticals	T	ME	2	4
II	PFP2ME02	Management of Lifestyle Diseases	T			
III	PFP3ME01	Sustainable Food Management	T	ME	2	4
III	PFP3ME02	Entrepreneurs for Food Industries	T			

Courses offered to other Departments

Sem	Sub. Code	Course Title	T/L	Category	Cr	Hrs
II	PFP2CD01	Dynamics of Food and Health	T	CD	1	3
III	PFP3VA01	Value – Added Courses (from other institutions) #	T	VA	1	2 [#]

MC – Major Core; **ME**-Major Elective; **ID**-Inter-Disciplinary; **MO**-MOOC; **LS**-Life Skills; **SK**-Soft Skills;

CD-Cross Disciplinary; **VA**- Value Added; **SI**-Summer Internship; **SL**-Service Learning; **PJ**-Project

M.Sc. Food chemistry and Food Processing Restructured LOCF Curriculum (effective from June, 2022)

PART	SEMESTER I	SEMESTER II	SEMESTER III	SEMESTER IV
MAJOR CORE (MC)	Chemistry of Macro and Micronutrients (5h/6c)	Techniques in Food analysis (5h/4c)	Meat, Poultry and Seafood Processing (6h/6c)	Food Quality, Safety and Food Laws (5h/6c)
	Unit Operations and Food Packaging (6h/6c)	Scientific Research Methodology (3h/3c)	Dairy and Beverage Processing (5h/6c)	Food Additives and Food Toxicology (6h/7c)
	Human Nutrition and Biochemistry (6h/6c]	Plant Product Processing (5h/5c)	Dairy and Meat Processing Lab (3h/2c)	Food Safety Lab (4h/2c)
	Food Microbiology, Hygiene and Sanitation (5h/6c)	Analysis of Micronutrients and Bioactive components (4h/2c)	Analysis of Food Additives and Toxins (3h/2c)	-
	Analysis of Macronutrients and Enzyme catalysis (4h/2c)	Baking and Confectionery Lab (3h/2c)	New Product Development Lab (3h/2c)	-
	Food Microbiology Lab (4h/2c)	Fruit and Vegetable Processing Lab (3h/2c)	-	-
MAJOR ELECTIVE (ME)	-	Functional Foods and Nutraceuticals (4h/2c)	Sustainable Food Management (4h/2c)	-
	-	Management of Lifestyle Diseases (4h/2c)	Entrepreneurs for Food Industries (4h/2c)	
INTER-DISCIPLINARY (ID)	-	-	Food Biotechnology (6h/3c)	-
ADDITIONAL CREDIT (MOOCs) (MO)	-	(2h#/2c##) (outside class hours)	-	-
LIFE SKILLS (LS)	-	(2h/1c) (outside class hours)	-	-

SOFT SKILLS (SK)	-	-	(2h/1c) (outside class hours)	-
CROSS-DISCIPLINARY (CD)	-	Dynamics of Food and Health (3h/1c)		-
VALUE - ADDED COURSES (VA)	-		(2h/1c) (outside class hours)	-
SUMMER INTERNSHIP (SI)	-	(3 to 4 Weeks/1c)		-
SERVICE LEARNING (SL)	-	-	(2h/1c) (outside class hours)	-
PROJECT (PJ)	-	-	-	Project (15h/5c)
Total	30h/28c	32h/23c (2h#/2c## Additional)	36h/26c	30h/20c

Note: A Theory paper shall have 3 to 6 contact hours and a practical session shall have 2 to 4 contact h

COURSE DESCRIPTOR

Course Code	PFP1MC01
Course Title	CHEMISTRY OF MACRO AND MICRO NUTRIENTS
Credits	6
Hours/Week	5
Category	Major Core (MC) – Theory
Semester	I
Regulation	2022
Course Overview	
<ol style="list-style-type: none"> 1. The aim of the course underlines the chemical concepts of macro and micro food components present in the food materials. 2. The content of the course gives knowledge on the organic molecules present in the food. 3. The course elaborates the basic functions of food constituents with a chemistry perspective. 4. This course focusses on the structures, classification and functions of carbohydrates, proteins, lipids, vitamins, minerals and enzymes. 5. It also explores the various factors that affect the chemical changes of food components during processing and storage conditions. 	
Course Objectives	
<ol style="list-style-type: none"> 1. To understand the structure and phase diagram of water, concept of water activity and the various interactions of water and ice in food. 2. To analyse the structure, properties and applications of carbohydrates in food industry. 3. To articulate the functions of amino acids and proteins in food processing industries. 4. To identify the chemical reactions involved in macro and micro food components. 5. To discuss the various types of vitamins and the role of enzymes in food modification. 	
Prerequisites	Basic knowledge of chemistry & life sciences.

SYLLABUS

UNIT	CONTENT	HOURS	Cos	COGNITIVE LEVEL
I	Water Physical and Chemical properties of water, free, bound and entrapped water, Intermolecular hydrogen bonding - structure of ice and water-association of water molecules, Interaction of water with hydrophobic and hydrophilic substances-	13	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6

	<p>Phase transition diagram of water.</p> <p>Water activity (aw): Principles and measurements - relationship to relative vapour pressure (RVP): Moisture sorption isotherm and relation of water activity with food stability.</p> <p>Solute effects on water: glass transitions and molecular mobility in foods, Kinetic Principles: Key concepts underlying molecular mobility in food.</p> <p>Ice in presence of solutes, Solute-solvent – ion-dipole, dipole-dipole and induced dipole interactions.</p>			
II	<p>Carbohydrates</p> <p>Monosaccharides: Chirality, isomerisation, Oxidation and reduction reactions, Maillard Browning and related reactions – Generation of heterocyclic compounds in foods.</p> <p>Oligosaccharides: Hydrolytic reactions and their applications in the food industry.</p> <p>Polysaccharides: Solubility-Properties of gums and hydrocolloids: Viscosity and stability, Indigestible polysaccharides: Food gels - xanthan gums, carageenan, alginates, pectin, gum arabic and their food applications, Digestible polysaccharides- Starch, amylase and amylopectin, Gelatinisation and retrogradation, Uses of modified and unmodified starch, Cellulose-CMC and MCC; its applications in food industry.</p>	13	<p>CO1</p> <p>CO2</p> <p>CO3</p> <p>CO4</p> <p>CO5</p>	<p>K1, K2, K3,</p> <p>K4, K5, K6</p>
III	<p>Chemistry of Lipids and Oil</p> <p>Introduction to lipids: IUPAC Nomenclature- Lipid's classifications- Physical properties- melting, softening, smoke, flash and fire, turbidity points, specific gravity and refractive index. Lipids extraction from food samples- sample preparation, pretreatments, solvent extraction. Methods of determination – Density and Dielectric measurements: Analysis of lipids- degree of unsaturation, Free Fatty Acid (FFA), oxidative stability and oxidation products.</p>	13	<p>CO1</p> <p>CO2</p> <p>CO3</p> <p>CO4</p> <p>CO5</p>	<p>K1, K2, K3,</p> <p>K4, K5, K6</p>

	Chemistry of lipids in food materials: Physical and chemical changes of lipids -hydrolysis-oxidation-polymerization reactions; factors affecting oil decomposition- volatile and non-volatile decomposition products. Measurement of decomposition products: significance, advantages, limitations. Process of frying- effect of frying on fats, changes in fats and oil rancidity, lipolysis, flavor reversion, auto-oxidation and its prevention: Antioxidants: types, action, reactions and quenching mechanism (chemistry of singlet and triplet oxygen) of lipids.			
IV	<p>Proteins</p> <p>Amino acids: Physiochemical properties of amino acids. Peptides – geometry of peptide linkage and synthesis of peptide bonds using glycine, alanine, lysine, cysteine, glutamic acid and arginine amino acids. Isoelectric point.</p> <p>Proteins: Structure of proteins- primary, secondary, tertiary and quaternary structures. Factors affecting the stability of protein structure – steric strain, hydrogen bond, electrostatic and hydrophobic interactions, disulphide bonds, van der waals interactions, conformational stability and adoptability of proteins. Protein denaturation - thermodynamics of denaturation. Denaturation of proteins - physical and chemical agents- effect of pH, organic solvents/solutes interactions.</p> <p>Reactions of proteins in food: Reactions with lipids, sulphites, chemical and enzymatic modifications of proteins- alkylation, acylation, phosphorylation, sulphitolysis, enzymatic hydrolysis, plastein reactions.</p>	13	<p>CO1</p> <p>CO2</p> <p>CO3</p> <p>CO4</p> <p>CO5</p>	<p>K1, K2, K3,</p> <p>K4, K5, K6</p>
V	<p>Enzymes and Vitamins</p> <p>Enzymes: Nomenclature, classification, and factors influencing the enzyme activity – temperature, pH and specificity, chemical nature of enzymes, Catalysis - enzyme kinetics; Lock and key model,</p>	13	<p>CO1</p> <p>CO2</p> <p>CO3</p> <p>CO4</p> <p>CO5</p>	<p>K1, K2, K3,</p> <p>K4, K5, K6</p>

	<p>Enzyme inactivation and control, reversible inhibitors, competitive and uncompetitive inhibition, Irreversible inhibitors.</p> <p>Food modification: Role of endogenous enzymes in food quality, color, lipoxygenase, chlorophyllase, texture- pectic enzymes; flavor and aroma changes, nutritional quality in food.</p> <p>Enzymes as processing aids: production of sweeteners, in modifying lipids, in milk and dairy products, Latest trends in enzymes and food management.</p> <p>Vitamins: Introduction and Classification- Fat soluble vitamins: Vitamin- A and provitamin- A, vitamin D and E- stability and mechanism of degradation, Water soluble vitamins: Vitamins B and C – stability and degradation mechanism. Major and Minor mineral constituents in food – Essential metals as nutrients, solubility of minerals. Acid- base theory; Lowry- Bronsted and Lewis theory; Chelate effect. Chemical and functional properties of minerals in food calcium, phosphate, iron, nickel and copper.</p>			
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Textbooks

1. Owen R Fennema's (2008) Food Chemistry 4th Edition, CRC Press Publishers.
2. B.Srilakshmi. 2018, Food Science, 7th multi-color edition, New age international publishers.
3. Vaclavik, V. A. and Christian E. W. (2003). "Essentials of Food Science". 2nd Edition, Kluwer Academic, Springer
4. Belitz.H.D,Grosch .W and Schieberle.P (2009) Food Chemistry 4th Edition, Spinger.
5. P.K.Bhattacharya ,2005,Biochemistry, Narosa Publishing House.

Suggested Readings

1. James K Edward, (Eds.) (2011),Water quality and treatment, Handbook on drinking water, Sixth edition. Mc graw Hill Publishers.
2. De Man, John M. "Principles of Food Chemistry". 3rd Edition, Springer, 1999.
3. Cheung.C.K .Peter and M.M.Bhavbhuti (Eds) (2015) " Handbook of Food chemistry" Springer-Verlag Berlin Heidelberg Publisher.
4. Hui.Y.H. (Ed) (2006) "Handbook of Food Science, Technology and Engineering" CRC Press
5. S.J.Lippard, 1998, Bioinorganic chemistry, Viva books (P) Ltd.

Web resources

1. <https://www.basu.org.in/wp-content/uploads/2020/04/Structure-of-Water.pdf>
2. <http://ecoursesonline.iasri.res.in/mod/page/view.php?id=90216>
3. http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/food_technology/food_chemistry/02.water_in_food_systems/et/10_et_m2.pdf

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Level
CO 1	Understand and recall the basic concepts of food chemistry.	K1, K2
CO 2	Determine and interpret the types of micro and macro food components involved in food processing.	K3
CO 3	Analyse and distinguish the various physical and chemical properties of the food materials.	K4
CO 4	Evaluate and ensure the quality and stability of food materials.	K5
CO 5	Summarize the effect of various chemical constituents in food and consumer products.	K6

COURSE DESCRIPTOR

Course Code	PFP1MC02
Course Title	UNIT OPERATION AND FOOD PACKAGING
Credits	6
Hours/Week	6
Category	Major Core (MC) – Theory
Semester I	I
Regulation	2022
Course Overview <ol style="list-style-type: none">1. The course aims to provide the basic thermodynamic concepts involved in different food systems and an in-depth understanding of the various unit operations in food industries.2. This paper explains the application of the various food processing and preservation techniques in the food manufacturing sector.3. The course illustrates novel technological aspects adopted in food preservation, processing and food packaging industries.4. The contents of the course gives knowledge on the area of food packaging technology and apply scientific principles in creating innovative packaging materials and techniques for foods.5. This course is a blend of creativity, research and testing in food preservation and processing.	
Course Objectives <ol style="list-style-type: none">1. To understand the various thermodynamic aspects involved in food processing operations.2. To apply the principles of preservation in various food processing systems.3. To analyse and compare the usefulness of emerging technologies with the existing preservation methods.4. To perceive the applications of different processing and packaging techniques in food industry.5. To select appropriate quality testing methodologies and develop innovations in food processing and packaging.	
Prerequisites: Basic Knowledge in Life Science and Chemistry.	

SYLLABUS

UNIT	CONTENT	HOURS	Cos	COGNITIVE LEVEL
I	<p>Unit Operations & Thermodynamics in food</p> <p>Unit operations in food processing: Heat transfer, fluid flow, mass transfer, mixing, size adjustment, fluid-solid separation, filtration, membrane separation, drying and crystallization</p> <p>Thermodynamics of evaporation: phase change graph, boiling point elevation, Duhring plot-Plank's equation for freezing time (No derivation): Assumptions and limitations, freezing point curve of water- Crystallization: Mechanism and kinetic equation for rate of nucleation.</p> <p>Significance of $\Delta G, \Delta H, \Delta S$ & $E^\circ(\text{SRP})$-Surface phenomenon: Interfacial tension and adsorption-Types of dispersion and consequences of dispersed system-Colloidal dispersion: Electric double layer and DLVO theory- Liquid dispersions: sedimentary aggregation kinetics</p> <p>Kinetics to shelf life: Chemical changes during processing and storage. Food quality function: Order of reaction, Shelf life:Temperature effects – Arrhenius shelf-life plot approach</p>	15	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6
II	<p>Food Preservation Techniques</p> <p>Thermal processing: blanching, pasteurisation, sterilisation, UHT processing, aseptic processing, canning and retorting, cooking of foods.</p> <p>Low temperature processing: refrigeration, chilling and freezing methods, physical, chemical and microbial changes in food during freezing.</p> <p>Separation and concentration technology: membrane separations: principle, methods and applications in solid and liquid foods.</p> <p>Dehydration: drying methods; changes in food during drying and dehydration; drying equipment.</p> <p>Overview of preservation using traditional methods- microbes, natural and artificial preservatives.</p>	18	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6

III	<p>Alternative Food Processing Technologies</p> <p>Thermal Technologies: Microwave, Radiofrequency, Infrared Heating, Pressure-Assisted Thermal Sterilization, Ohmic Heating, Dielectric Heating and Minimal processing with Sous-Vide.</p> <p>Non-Thermal Technologies: High Hydrostatic Pressure Processing, Irradiation, UV, Cold Plasma, Ultrasound, Pulsed Electric Field, MRI and Pulsed Light Technologies.</p> <p>Hurdle Technology: potential hurdles, principles of combined preservation methods and applications.</p>	15	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6
IV	<p>Food Packaging Technology</p> <p>Packaging Materials Used for Food – Definition, functions, significance, classification and types - polymers, metals, glass, paper and indigenous materials.</p> <p>Edible packaging materials: Functions and types- polysaccharide, protein and lipid based edible coatings, flavor encapsulation, Food applications of edible films and coatings.</p> <p>Lamination, need of lamination, types, properties, advantages & disadvantages of each type.</p> <p>Packaging as a Preservation Technique: Concepts, types, sources and mechanism of action of MAP, Active and Bioactive Packaging. Intelligent packaging – Principles, Types – films, bar codes, labels,; Indicators, Radio-Frequency Identification (RFID), TTI, smart packaging and IoT Applications</p>	15	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6
V	<p>Food packaging: Machinery, Testing & Quality Assurance</p> <p>Packaging Machinery: cartoning, filling of solids and liquids, form-fill-seal, heat sealing, vacuum packaging. Printing on packages, Bar coding and food labelling.</p> <p>Packaging of Processed foods: Properties and applications for bakery products, frozen foods, carbonated, non-carbonated and alcoholic beverages, oils, powders and snack foods.</p>	15	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6

Testing of Packaging materials: Physical, optical, electrical, thermal, mechanical and rheological properties of packaging materials. Food and packaging interaction, Hazard assessment and Testing of migration of package components. Waste management and recycling in Food Packaging Industry.			
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Text Books

1. Cheng, H., Xu, H., Julian McClements, D., Chen, L., Jiao, A., Tian, Y., Miao, M., & Jin, Z. (2022). Recent advances in intelligent food packaging materials: Principles, preparation and applications. In Food Chemistry (Vol. 375, p. 131738). Elsevier BV. <https://doi.org/10.1016/j.foodchem.2021.131738>.
2. Clark, S., Jung, S., & Lamsal, B. (Eds.). (2014). Food Processing. John Wiley & Sons, Ltd. <https://doi.org/10.1002/9781118846315>
3. Rahman, M.S. (2020). Handbook of Food Preservation (3rd ed.). CRC Press. <https://doi.org/10.1201/9780429091483>
4. Sharma, H., & Panesar, P. (Eds.). (2018). Technologies in Food Processing (1st ed.). Apple Academic Press. <https://doi.org/10.1201/b22422>
5. Singh, P., Wani, A.A., & Langowski, H.-C. (Eds.). (2016). Food Packaging Materials: Testing & Quality Assurance (1st ed.). CRC Press. <https://doi.org/10.4324/9781315374390>

Suggested Reading

1. Alexandru Mihai Grumezescu, Alina Maria Holban (2018) Handbook of Food Bioengineering, Volume XX: Biopolymers for food design, 1st Edition, ISBN: 9780128114490, Elsevier (Academic Press), Cambridge, USA.
2. Birwal, P., Goyal, M.R., & Sharma, M. (Eds.). (2021). Handbook of Research on Food Processing and Preservation Technologies: Nonthermal Food Preservation and Novel Processing Strategies (1st ed.). Apple Academic Press. <https://doi.org/10.1201/9781003161295>
3. Goyal, M.R., Sharma, M., & Birwal, P. (Eds.). (2021). Handbook of Research on Food Processing and Preservation Technologies: Design and Development of Specific Foods, Packaging Systems, and Food Safety (1st ed.). Apple Academic Press. <https://doi.org/10.1201/9781003184645>
4. Robertson, G.L. (Ed.). (2009). Food Packaging and Shelf Life: A Practical Guide (1st ed.). CRC Press. <https://doi.org/10.1201/9781420078459>
5. Sun, D.W. (Ed.). (2016). Handbook of Frozen Food Processing and Packaging. CRC Press. <https://doi.org/10.1201/b11204>

Web Resources

<https://nptel.ac.in/courses/126/105/126105015/>

<https://www.openlearning.com/courses/introduction-to-food-packaging>

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Level
CO 1	To understand the basic concepts of thermodynamics and unit operations in food processing, preservation and packaging.	K1, K2
CO 2	To apply and examine the principles of processing in various food formulations, food systems and packaging techniques.	K3
CO 3	To illustrate the applications of traditional and novel processing, packaging techniques in extending the shelf life of food products.	K4
CO 4	To evaluate the methods of processing, preservation and packaging operations in food.	K5
CO 5	To integrate and summarize the role of processing and packaging technologies in ensuring sustainable food quality and safety.	K6

COURSE DESCRIPTOR	
Course Code	PFP1MC03
Course Title	HUMAN NUTRITION & BIOCHEMISTRY
Credits	6
Hours/week	6
Category	Major Core Paper (Theory)
Semester	I
Regulation	2022
Course Overview:	
<p>1. This course outlines the basic understanding of how to optimize our diet for a sound physical, mental and social well-being and provides an in-depth knowledge on the role of food and nutrients in our human system.</p> <p>2. This paper encompasses the significance of nutrition as a vital component of our daily living that supports growth, development and ageing while maintaining a healthy body weight, and reducing the risk of non-communicable diseases.</p> <p>3. The units in the course focus on the importance of macro- and micronutrients for our health and acquiring the skills to plan one's own diet by making optimal nutritional choices.</p> <p>4. This course is structured to explain the concepts of biochemistry and its relationship to human nutrition.</p> <p>5. The course has been specifically planned to provide an overview on the quantitative understanding of the interactions of biological molecules from structural, thermodynamic and molecular levels.</p>	
Course Objectives:	
<p>1. To introduce the students to the basic concepts of Biochemistry ,Nutrition, Food and Health.</p> <p>2. To enable the students to understand the role of nutrients in health and well-being.</p> <p>3. To sensitize the students to the understanding of the physiological and metabolic functions of nutrients.</p> <p>4. To understand the bioenergetics and metabolic processes involved in energy production and utilization.</p> <p>5. To provide a comprehensive background in molecular biology and understand the mechanism of DNA replication, transcription and translation in prokaryotes.</p>	
Prerequisites:	Basic knowledge in life science and an aptitude to explore the areas of nutrition and biochemical science.

SYLLABUS		HOURS	COs	Cognitive levels
UNIT	CONTENTS			
I	<p>Nutrition – An Introduction:</p> <p>Food as a source of nutrients, classification of nutrients, concept of food groups, food guide pyramids, principles of balanced diet, dietary recommendations.</p> <p>Dietary sources, digestion, utilization, recommended intake, deficiency of Macro and Micronutrients in brief</p> <p>Macronutrients: Carbohydrates, Lipids, Proteins</p> <p>Micronutrients: Fat soluble Vitamins – Vitamin A, D, E and K; Water Soluble Vitamins – Thiamin, Riboflavin, Niacin, Ascorbic acid, Pyridoxine, Folate; Minerals – Calcium, Iron, Iodine, Fluorine, Zinc.</p>	15	<p>CO1</p> <p>CO2</p> <p>CO3</p> <p>CO4</p> <p>CO5</p>	<p>K1, K2, K3</p> <p>K4, K5, K6</p>
II	<p>Significance of nutrients in our system:</p> <p>Evaluation of dietary protein quality and their significance</p> <p>Energy measurements, Energy balance and factors influencing energy requirements;</p> <p>Determination of energy value of food: direct and indirect calorimetry; Assessment of Nutritional status</p> <p>Nutritional requirements through normal life cycle – An overview of different stages of lifecycle and the nutritional demands at every stage.</p>	15	<p>CO1</p> <p>CO2</p> <p>CO3</p> <p>CO4</p> <p>CO5</p>	<p>K1, K2, K3</p> <p>K4, K5, K6</p>

III	Biological oxidation and structure of membranes: General concept of oxidation and reduction, electron transport chain, oxidative phosphorylation, uncouplers and inhibitors of electron transport chain and oxidative phosphorylation. Supramolecular architecture of membranes, its structure and functions, transport through biological cell membrane.	15	C01 C02 C03 C04 C05	K1, K2, K3 K4, K5, K6
IV	Carbohydrates, Proteins and Fats metabolism: Metabolism of carbohydrates: Glycolysis, TCA Cycle, Glycogenesis, Glycogenolysis, HMP shunt, Gluconeogenesis. Metabolism of fats: fatty acid biosynthesis and oxidation, cholesterol biosynthesis, lipoprotein functions. Metabolism of proteins: amino acids oxidation-transamination, deamination, decarboxylation – urea cycle.	15	C01 C02 C03 C04 C05	K1, K2, K3 K4, K5, K6
V	Introduction to Molecular Biology: Nucleic acids: Genetic code, nucleic acids, and structure of DNA and RNA. An overview of prokaryotic DNA replication, transcription, and translation.	18	C01 C02 C03 C04 C05	K1, K2, K3 K4, K5, K6

Textbooks for reference:

1. Mahan L K and Escott Stump S (2013). Krause's Food & Nutrition Therapy, 13th ed. Saunders-Elsevier.
2. Stacy Nix (2009). William's Basic Nutrition and Diet Therapy, 13th Edition. Elsevier Mosby.
3. Cox, M.M. and Nelson, David L. Lehninger (2021), "Principles of Biochemistry". 8th Edition, W.H. Freeman.

4. Lubert Stryer et al, (2019) Biochemistry,9th Edition.

Suggestive Readings:

1. Wardlaw, Smith. Contemporary Nutrition: A Functional Approach. 2012.
2. Williams Melvin. Nutrition for health, fitness and sports. Mc Graw Hill 2004
3. Joshi AS. Nutrition and Dietetics Tata Mc Graw Hill. 2nd edition, 2010
4. ICMR. Nutrient Requirements and Recommended Dietary Allowances for Indian, 2010
5. Martin Eastwood. Principles of Human Nutrition, II Edition, Blackwell Publishing Company,2003
6. Life, chemistry and molecular biology”, W. Pickering, C. Smith and E.J. Wood, pub. Portland Press.
7. “Biochemistry” D. Voet and J.G. Voet, pub. Wiley, 2011

Web resources:

1. <https://www.frontiersin.org/journals/nutrition>
2. <https://www.journalofexerciseandnutrition.com>
3. <https://www.foodandnutritionjournal.org>
4. <https://pubchemdocs.ncbi.nlm.nih.gov/about>
5. <https://libguides.bodleian.ox.ac.uk>.

Cos	CO description	Cognitive Level
CO1	To understand and recall the role of nutrients and their biochemical concepts for a healthy well-being.	K1.K2
CO2	To develop an understanding of the different digestive and metabolic pathways of macro nutrients in energy production.	K3
CO3	To analyse the basic dietary principles and calculate the bioenergetics for maintaining homeostasis in the human system.	K4
CO4	To select the appropriate food pattern, physical activity levels and evaluate the mechanism of gene action for optimal health and well-being.	K5
CO5	To combine the principles of nutrition and biochemistry to understand the functioning of the human system.	K6

COURSE DESCRIPTOR

Course Code	PFP1MC04
Course Title	FOOD MICROBIOLOGY, FOOD HYGIENE AND SANITATION
Credits	6
Hours/week	05
Category	Major Core (MC) – Theory
Semester	I
Regulation	2022
<p>Course overview</p> <p>1. An important discipline of food processing, this course outlines the interaction between microorganism and food, the role of food hygiene and sanitation for facilitating safe food production.</p> <p>2. The content enables to learn and understand the microflora of food, the desirable and undesirable aspects of microorganisms in the food industry, microorganisms in relation to food hygiene and sanitation.</p> <p>3. The knowledge on the concepts of microbial growth, intrinsic and extrinsic factors affecting microbial growth in foods, food spoilage, food borne illnesses and advanced techniques to understand the microbial assessment of food and the processing environment will be acquired through this course.</p> <p>4. It helps to understand food safety hazards, principles and guidelines of sanitation procedures required in food establishments.</p> <p>5. In this course, the standards and guidelines with regard to microbiological quality, food hygiene and sanitation will be discussed.</p>	
<p>Course Objectives</p> <p>1. To develop an understanding on the role of food microbiology, food hygiene and sanitation in the food industry.</p> <p>2. To outline the significant microorganisms that inhabit, contaminate or create food and explore food handling techniques for food safety practices.</p> <p>3. To know the advanced techniques and assess the microbial quality of food, implement preventive measures to minimize food safety hazards and risks.</p> <p>4. To acquire knowledge on microbial activity in food, food safety hazards, the principles and procedures of food sanitation practices.</p> <p>5. To familiarize with current developments and challenges in the field of food microbiology, hygiene and sanitation requirements in the food industry.</p>	

Prerequisite:	Knowledge on Basic Microbiology.
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UNIT	CONTENT	HOURS	COs	COGNITIVE LEVELS
I	<p>Introduction to Food Microbiology, Microbial food fermentations:</p> <p>Importance and significance of microbiology in Food Microbes of importance in food.</p> <p>Microbial growth curve-Intrinsic and Extrinsic factors in foods that influence microbial growth. Interactions between food and bacteria. Indicator organisms.</p> <p>Beneficial microorganisms -Classification of food fermentations, Starter Culture, Role of microorganisms in production of fermented foods, microbial metabolites of importance in the food industry, Safety of fermented foods.</p> <p>Probiotics, prebiotics and synbiotics.</p> <p>Mushroom cultivation and Single cell protein.</p> <p>Improvement of industrially important microorganisms.</p>	15	CO1, CO2, CO3, CO4, CO5	KI, K2, K3, K4, K5, K6
II	<p>Effect of microorganisms on food degradation, spoilage and food borne illness:</p> <p>Biochemical changes caused by microbial spoilage and types of food spoilage reactions in various foods. Significance of psychrophilic organisms, specific spoilage organisms and control of spoilage of foods.</p> <p>Classification and characteristics of food borne diseases, etiological agents, routes of transmission and investigation. Bacteria, Yeast and mold, Virus and parasites -Emerging pathogens.</p>	15	CO1, CO2, CO3, CO4, CO5	KI, K2, K3, K4, K5, K6

III	<p>Advanced methods of microbial examination of foods and shelf-life prediction</p> <p>Sampling and preparation of microbiological analysis, uncertainty in microbiological testing, Microbiological standards, reference criterion of foods.</p> <p>Conventional vs rapid methods of analysis. Advanced, rapid and automated microbial methods, Use of rapid kits.</p> <p>Shelf-life prediction and modeling.</p>	10	CO1, CO2, CO3, CO4, CO5	KI, K2, K3, K4, K5, K6
IV	<p>Food hygiene</p> <p>Food contamination sources and its entry into the food chain protection against contamination, Food related hazards.</p> <p>Microorganisms in water, Chlorination, UV radiation, Standards for potable water.</p> <p>Microbial risk assessment.</p> <p>Future challenges in control of microbes in the food chain.</p>	10	CO1, CO2, CO3, CO4, CO5	KI, K2, K3, K4, K5, K6
V	<p>Sanitation and Food industry</p> <p>Sanitation guidelines-Definition and regulation of food sanitation.</p> <p>Cleaning and sanitation of food establishment, equipment, cleaning compounds and sanitizers, safety limits of sanitizers. Food Filtration, Chlorination, Ozonation, Disinfection, CIP and COP.</p> <p>Importance of personal hygiene of food handlers.</p> <p>Planning and implementation of Training programme.</p> <p>Relationship of microorganisms to sanitation</p> <p>Sewage and waste product handling and treatment.</p> <p>Control of infestation, Integrated Pest management</p> <p>Food sanitation control and inspection.</p>	15	CO1, CO2, CO3, CO4, CO5	KI, K2, K3, K4, K5, K6

Text Books:

1. Bibek Ray and Arun Bhunia, (2018). Fundamentals of Food Microbiology, 5 th Edition, CRC press.
2. James M. Jay, Martin J.Loessner and David A Golden, (2005).Modern Food Microbiology, 7 th Edition, Springer Science Media Inc.
3. Frazier W.C. and West off D.C, (2008). Food Microbiology, 4 th Edition, Tata McGraw-Hill Publishing Co, New Delhi.
- 4.Hayes P.R and S.J. Forsythe (2010) Food Hygiene, Microbiology and HACCP, 3rd edition, Springer Science.
- 5.Lawley, R., Curtis L. and Davis, J. (2004) The Food Safety Hazard Guidebook, RSC publishing.

Suggested readings:

1. Adams, M.R and M.O. Moss (2008). Food Microbiology, 3 d edition New Age International Pvt Ltd Publishers.
2. Dubey RC and Maheshwari DK (2014). A text book of Microbiology, Revised edition, Chand Publishers, New Delhi.
- 3.Vijaya Ramesh (2007). Food Microbiology, 2 nd edition, MJP Publishers.
- 4.Wilson.L. Charles (2008) Microbial Food Contamination, 2 nd edition, CRC Press.
- 5.Mortimore S. and Wallace C (2013). HACCP, A practical approach, 3rd Edition, Chapman and Hill, London.

Web Resources:

<https://www.fsis.usda.gov/policy/advisory-committees/national-advisory-committee-microbiological-criteria-foods-nacmcf>
https://fssai.gov.in/upload/uploadfiles/files/Nutraceuticals_Regulations.pdf
https://www.youtube.com/watch?v=OA_vKCyuoDA
https://fssai.gov.in/upload/uploadfiles/files/Guidance_Note_FSMP_28_08_2020.pdf
<https://www.fao.org/fao-who-codexalimentarius/codex-texts/codes-of-practice/en/>
<https://hygienefoodsafety.org/>
https://www.fssai.gov.in/upload/uploadfiles/files/Compendium_Nutra_29_09_2021.pdf

Course outcomes (CO) and Cognitive level mapping

Cos	CO Description	Cognitive levels
CO1	Recall the terms and definitions related to microbes and food, hygiene and sanitation in the food industry.	K1, K2
CO2	Explain the microorganisms that inhabit, create and contaminate food, advanced microbial assessment techniques, safe food handling procedures.	K3
CO3	Apply this knowledge to eliminate food contamination and provide quality materials and processes through assessment.	K4
CO4	Evaluate the importance of food microbiology, hygiene and sanitation protocols to eliminate food contamination and promote food fermentation.	K5
CO5	Create and produce safe food with the knowledge gained in the areas of food microbiology, hygiene and sanitation.	K6

COURSE DESCRIPTOR

Course Code	PF1MC05
Course Title	ANALYSIS OF MACRO NUTRIENTS AND ENZYME CATALYSIS
Credits	2
Hours/Week	4
Category	Major Core (MC) - Lab
Semester	I
Regulation	2022
Course Overview:	
<ol style="list-style-type: none"> 1. This course explores the knowledge on various quantitative techniques for the macro nutrient analysis of foods. 2. It aims at understanding the optimum catalytic activity of enzymes for its application in food industries. 3. The units in the course explores the mechanism of enzymatic activity in food samples in a laboratory set up. 4. The course encompasses the usage of computational aids, software available to detect the binding efficacy of macro molecules in food and analyse its biological applications. 5. This course also explores the knowledge of macronutrients contents in food and its significance in maintaining the healthier life style. 	
Course Objectives:	
<ol style="list-style-type: none"> 1. To qualitatively identify and evaluate the macronutrient components of food. 2. To perform and interpret the quantitative estimation of macronutrients using semi-automated instruments. 3. To compare and examine the catalytic activity of enzymes on the stability of food. 4. To develop analytical skills and interpret the results related to the enzyme activities in food. 5. To understand the bioinformatic tools available to study the structure of macronutrient. 	
Prerequisites	Knowledge on basic chemistry and life science skills.

SYLLABUS				
Unit	Content	Hours	COs	Cognitive level
I	<p>QUANTITATIVE ANALYSIS:</p> <p>1. Estimation of sugars (reducing and non-reducing) in fruit juices.</p> <p>2. Estimation of hardness of water / chlorine - total, temporary and permanent by EDTA method.</p> <p>3. Estimation of Peroxide Value and Anisidine value in Fats and Oils.</p> <p>4. Estimation of Glycine.</p> <p>5. Estimation of Iodine number, Saponification value, RM number and free fatty acids in fats and oils.</p> <p>6. Estimation of total carbohydrates by Anthrone method.</p>	15	<p>CO 1</p> <p>CO 2</p> <p>CO 3</p> <p>CO 4</p> <p>CO 5</p>	<p>K1, K2,</p> <p>K3, K4,</p> <p>K5, K6</p>
II	<p>BASICS IN BIO-INFORMATICS:</p> <p>5. Computational techniques for macronutrients - software for the analysis of data.</p> <p>6. A practical guide to large scale docking, Genome databases at NCBI,EBI,TIGR,SANGER</p>	10	<p>CO 1</p> <p>CO 2</p> <p>CO 3</p> <p>CO 4</p> <p>CO 5</p>	<p>K1, K2,</p> <p>K3, K4,</p> <p>K5, K6</p>
III	<p>ENZYME KINETICS:</p> <p>1.Determination of Catalase activity from food source (chow chow)</p> <p style="padding-left: 40px;">i) Effect of optimum pH</p> <p style="padding-left: 40px;">ii) Effect of optimum temperature</p> <p style="padding-left: 40px;">iii) Substrate concentration</p> <p style="padding-left: 40px;">iv) Enzyme concentration</p> <p>2.Determination of Amylase activity from food source (malted barley)</p> <p style="padding-left: 40px;">i)Effect of optimum pH</p> <p style="padding-left: 40px;">ii)Effect of optimum temperature</p> <p style="padding-left: 40px;">iii)Substrate concentration</p> <p style="padding-left: 40px;">iv)Enzyme concentration</p> <p>3. Determination of total amylase activity from sweet potatoes by DNSA method.</p> <p>4.Determination of diastatic activity of honey</p>	15	<p>CO 1</p> <p>CO 2</p> <p>CO 3</p> <p>CO 4</p> <p>CO 5</p>	<p>K1, K2,</p> <p>K3, K4,</p> <p>K5, K6</p>

IV	DEMONSTRATIVE EXPERIMENTS: 13. Estimation of fat using Soxhlet apparatus. 14. Analysis of protein using Kjeldhal apparatus. 15. Determination of soluble and insoluble fibre using fibra plus apparatus.	12	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6
Text Books for references: 1.Choudhuri.S, 2014. Bioinformatics for Beginners: Genes, Genomes, Molecular Evolution, Databases and Analytical Tools. 2.FSSAI lab manual 8, 2012. Methods for analysis of foods.3.Mark Brandt(2002),Laboratory manual in Biochemistry,third edition, 4. Bruce R.D’ Arcy Geoff Hawel (2003) Chemical food analysis- a practical manual, a university of queensland publication. 5.Baxevanis A. D., Ouellette B. F. F., 2005. Bioinformatics - A Practical Guide to the Analysis of Genes and Proteins, 3rd edition, Wiley’s Publications.				
Suggested Readings: 1. J.Jayaraman,Laboratory manual in Biochemistry (2011)New Age International publishers. 2. N S Punekar, Enzyme kinetics, catalysis and mechanisms(2018) ISBN 978-981-13-0784-3, Springer edition. 3. Venkatarajan S.M., Pandjassarame K. 2009. Bioinformatics: A Concept-Based Introduction, Springer publications.				
Web Resources: https://fssai.gov.in/cms/manuals-of-methods-of-analysis-for-various-food-products.php https://link.springer.com/book/10.1007/978-981-13-0785-0 https://doi.org/10.1007/978-981-13-0785-0				

Course Outcomes (COs) and Cognitive Level Mapping

Cos	CO Description	Cognitive Level
CO 1	To recognize and quantify the macronutrient and enzyme activity associating to the required optimum conditions in food.	K1, K2
CO 2	To perform qualitative and quantitative analysis of macronutrients and enzymes in food.	K3
CO 3	To detect and compare the macronutrient and enzyme levels in food using laboratory skills and semi-automated instruments.	K4
CO 4	To interpret and predict the macronutrient and enzyme components in raw and processed food.	K5
CO 5	To propose and summarize the macronutrient and enzyme analysis in food and report their applications in the food manufacturing sector.	K6

COURSE DESCRIPTOR

Course Code	PFP1MC06
Course Title	FOOD MICROBIOLOGY LAB
Credits	2
Hours/week	4
Category	Major Core (MC) – Lab
Semester	I
Regulation	2022
<p>Course overview</p> <ol style="list-style-type: none"> 1.The course is designed to understand the principles and theories of microbial analysis related to the food sector. 2.The content aims to explore the various tools, equipment and techniques required in a microbiology lab. 3. The course will develop the practical skills in the field of microbiology to perform the various techniques used in microbial analysis of food, water and food processing environment. 4. The details of the paper focusses on sampling, enumerating, culturing, isolating and staining microbes of importance in the food sector. 5. The paper imparts knowledge on how to accept or reject foods based on microbial analysis using approved and relevant microbial standards. 	
<p>Course Objectives</p> <ol style="list-style-type: none"> 1.To understand the relationship between theory and practical work in the field of food microbiology. 2.To acquire the skills necessary for operating the tools and equipment in the microbiology lab. 3.To use the principle of aseptic techniques, sampling and sample preparation for microbial examination. 4.To perform all the tests for analysing the microbiological quality of different food products, water and the environment. 5.To be equipped to analyse samples for microbial acceptability in food sector. 	
Prerequisite:	Knowledge on Basic Microbiology.

SYLLABUS

S.No.	Experiments	Hours	COs	Cognitive levels
1.	A. Introduction to basic microbiology tools, equipment and microbiol analysis techniques. B. Methods of sterilization.	52	CO1, CO2, CO3, CO4, CO5.	K1, K2, K3, K4, K5, K6.
2.	Preparation of different types of culture media (complex, differential and selective).			
3.	Microscopy and Staining Techniques- Preparation of smears, simple staining.			
4.	Enumeration of microorganism- Sampling and serial dilution - Total count, Yeast and mold count in food products (Pour plate method), Detection of E. coli, Salmonella, and Staphylococcus in food samples.			
5.	Isolation, purification and preservation of microorganisms Streak plate method, slants and stabs.			
6.	Gram's staining.			
7.	Fungal examination –Lactophenol cotton blue staining.			
8.	Bacteriological Analysis of Water – Detection of pathogenic and Indicator organisms by Most probable number (MPN) method.			
9	Microbiological examination of milk- Dye reduction test.			
10.	Antimicrobial sensitivity test for establishing sensitivity to preservatives, antibiotics, sanitizers, disinfectants, detergents and minimal inhibitory concentrations.			
11.	Environmental hygiene - Assessment of surface sanitation by swab/rinse method, equipment swabs, Assessment of personal			

	hygiene, sampling of air microflora for airborne microorganisms.			
12.	Demonstration of Rapid and automated microbial method. Visit to a lab.			

Text Books

1. Harrigan, W.F. (2011). Laboratory Methods in Food Microbiology, 3rd Edition, Academic Press.
2. FSSAI manual of methods for analysis of foods-Microbiological testing (2017.)
3. Rajan. S and Selvi Christy (2015). Essentials of Microbiology, Anjanaa Book House Publishers, Chennai
4. Rajan and Selvi Christy (2004) Experimental procedures in Life Sciences – Ajantha book house, Chennai.
5. IS 10500: (2018) – Drinking water specifications.

Suggested Readings

1. Cuppuccino and N. Sherman 1996 Microbiology - A Laboratory manual Benjamin Cummins, New York
2. IS 1622: (1981) – Method of sampling and microbiological examination of water.
3. IS 5404 (1984), Reaffirmed 2005. Methods for Drawing and Handling of Food samples for. *microbiological analysis*.
4. Kannan.M. 1996, Laboratory Manual in General Microbiology.

Web Resources

- <https://law.resource.org/pub/in/bis/S06/is.5404.1984.pdf>
- <https://ajph.aphapublications.org/doi/book/10.2105/MBEF.0222>
- <https://www.fda.gov/food/laboratory-methods-food/bacteriological-analytical-manual-bam>

Course outcomes (CO) and Cognitive level mapping

Cos	CO Description	Cognitive levels
CO1	Define the aim of the experiment, identify the requirements for the lab session and explain the procedures required to perform the microbial examination in the food related business.	K1, K2
CO2	Apply the knowledge gained and perform experiments in food microbiology.	K3
CO3	Analyse the observations to estimate the microbiological quality of the sample based on relevant standards.	K4
CO4	Interpret and report the result to classify the samples based on its microbiological quality.	K5
CO5	Summarize the results of the microbial assessment and propose its acceptability / unacceptability for further processing.	K6

COURSE DESCRIPTOR

Course Code	PFP2MC01
Course Title	TECHNIQUES IN FOOD ANALYSIS
Credits	4
Hours/Week	5
Category	Major Core (MC) – Theory
Semester	II
Regulation	2022
COURSE OVERVIEW <ol style="list-style-type: none">1. This course focusses on the study of analytical techniques for characterizing the structure and properties of food constituents.2. It provides in depth information on sample preparation, error analysis and calculations in relation to food analysis.3. The course explains the impact of various factors on the physical and chemical changes of food.4. The contents in the course elaborates the principle and application of separation techniques used to identify the food constituents.5. This course explores the techniques used to qualitatively and quantitatively evaluate the constituents present in food.	
COURSE OBJECTIVES <ol style="list-style-type: none">1. To acquire knowledge about the structure and environment of molecules present in food materials.2. To identify suitable sampling methods and analytical techniques for food quality analysis.3. To select appropriate instrumental techniques for the analysis of various food components.4. To obtain knowledge on the qualitative and quantitative estimation of different food materials.5. To gain theoretical insights to perform analysis and compile data related to evaluation of food samples.	
PREREQUISITES	Basics of Chemistry and Life Science.

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	<p>Introduction to chemical analysis: Reason for analyzing the food constituents; properties to be analyzed; important criteria for selecting appropriate technique; sample selection and sampling plans; preparation of laboratory samples; Data analysis- Accuracy, Precision, Absolute and relative errors; methods of minimizing errors; Normal error curve and its importance; Methods of expressing concentration of solution; Preparation of standard solutions, primary standards; General principles and applications of titrimetric, gravimetric and colorimetric methods employed 13in food analysis.</p>	13	CO 1, CO 2, CO 3, CO4, CO 5	K1, K2, K3, K4, K5, K6
II	<p>Spectroscopy: Principle, elementary idea and applications of the following spectroscopic techniques in food analysis: UV-Visible, IR, Raman, NMR and ESR; mass spectrometry; Atomic Absorption spectroscopy(AAS); spectrofluorimetry ; Inductively coupled plasma spectrometry (ICP).</p>	13	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	<p>Chromatography and Thermal analysis Principle, elementary idea and applications of the following chromatographic techniques in food analysis: column, TLC, paper, ion-exchange and gel permeation chromatography. Gas chromatography, HPLC and size exclusion chromatography. Principle, procedure and applications of Thermo Gravimetry, dilatometry, DTA and DSC in food analysis.</p>	13	CO 1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

IV	Separation Techniques in food analysis: Principle, procedure and applications of the following techniques in food analysis - Gel filtration, membrane filtration, electrophoresis, sedimentation, ultrafiltration, ultracentrifugation, solid phase extraction, solvent and non solvent liquid Extraction, supercritical fluid extraction, isoelectric focusing, isotopic techniques, manometric techniques. Process involving phase separation-liquid-liquid extraction, Crystallization – Theory of Distillation-Raoult’s law- solvent-solvent extraction; Distillation process - simple distillation, fractional distillation, and vacuum distillation.	13	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	Electrochemical analysis: Principle, instrumentation and applications of the following electrochemical techniques in food analysis: Potentiometric, conductometric, coulometric and voltametric methods. Preparation of Buffer solutions-pH meter.	13	CO 1, CO 2, CO 3, CO 4, CO 5	K1, K2, K3, K4, K5, K6

Text Books

1. Nielsen, S.S. (1998). Food Analysis, 2nd Edition. Aspen Publication, Gaithersberg, Maryland.
2. N. Norman Potter, (1994) Food Science, 5th Edition, CBS publishers and distributors, New Delhi.
3. Food Analysis: Theory and Practice. Y. Pomeranz & C.E. Meloan, Chapman and Hall
4. Food Analysis: Principles and Techniques. D.W. Gruenwedel and J.R. Whitaker, Marcel Dekker
5. Analytical Chemistry of Foods. C.S. James, Blackie Academic and Professional L.H.Meyer, (1994) Food Chemistry, Latest Edition, CBS publishers and distributors, New Delhi.
6. Procter, A. and Meullenet, J.F. (1998). Food Analysis, 2nd Edition. Aspen Publication, Gaithersberg, Maryland
7. H.K. Chopra and P.S. Panesar, (2010) Food Chemistry, Latest Edition, Narosa Publishing House

Suggested Readings

1. Introduction to Food Analysis. S.S. Nielsen, (1998) Aspen Publishers - The best general overview of food analysis techniques currently available. (Required).
2. Rui M. S. Cruz, Igor Khmelinskii, Margarida Vieira, (2014) Methods in Food Analysis, CRC Press
3. Leo M.L. Nollet, Fidel Toldra (2015) Handbook of Food Analysis, Third Edition - Two Volume Set CRC Press
4. Ignacio Arana (2016) Physical Properties of Foods: Novel Measurement Techniques and Applications, CRC Press
5. Food Analysis: Theory and Practice. Y. Pomeranz and C.E. Meloan, Chapman and Hall
6. Food Analysis: Principles and Techniques. D.W. Gruenwedel and J.R. Whitaker, Marcel Dekker Professional

Web Resources

1. <https://onlinelibrary.wiley.com/doi/pdf/10.1002/9781118846315.ch3>
2. <https://www.intechopen.com/chapters/39943>
3. <https://www.iciq.org/research/research-support-area/chromatography>
4. <https://separationtechniques.chemistryconferences.org/events-list/separation-techniques-in-food-chemistry>
5. <http://rubingulaboski.synthasite.com/resources/Electrochemistry%20in%20food-gulaboski%20in%20HANDBOOK.pdf>

CO – COGNITIVE LEVEL MAPPING

CO 1	Understand and recall the basic principle of various techniques in food analysis.	K1, K2
CO 2	Apply and interpret suitable procedures for different qualitative and quantitative analysis of food.	K3
CO 3	Outline and analyse the advantages of conventional and instrumentation techniques for the analysis of food components.	K4
CO 4	Predict and justify suitable sampling method, separation, purification, spectroscopic techniques to characterize different food constituents.	K5
CO 5	Prescribe and validate various analytical techniques for the analysis of food components.	K6

COURSE DESCRIPTOR

Course Code	PFP2MC02
Course Title	SCIENTIFIC RESEARCH METHODOLOGY
Credits	3
Hours/Week	3
Category	Major Core (MC) – Theory
Semester	II
Regulation	2022
Course Overview	
<ol style="list-style-type: none"> 1. This course focusses on the systematic research process and statistical methods and tools in food and consumer research. 2. The course imparts knowledge on modules like experimental designs, scale of measurements used in sensory evaluation, sampling methods, data analysis and presentation. 3. The course aims to deliver information on data collection using various tools and databases in science and technology. 4. The contents of the course provides an hands-on experience on computing basic statistics by using spreadsheets. 5. This course prepares the students to carry out independent research; understand the methodology of writing a thesis and publishing a research article. 	
Course Objectives	
<ol style="list-style-type: none"> 1. To understand the basics concepts and methodologies in research and statistics. 2. To identify appropriate experimental designs and techniques for research in food industry. 3. To prepare systematic literature review, data collection tools and computer assisted data presentation. 4. To compare the use of various statistical methods and their appropriateness in different research designs. 5. To formulate a research proposal and develop skills in scientific writing and publishing. 	
Prerequisites: Writing skills and an aptitude for research.	

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	<p>Introduction to scientific research methodology</p> <p>Research and Research Methodology: Meaning of research; objectives of research; Types of research- qualitative and quantitative research and its application in food processing; selection of a research problem.</p> <p>Research Design: Basic concepts concerning testing of hypothesis; and principles relating to experimental design.</p> <p>Features of translational research and their application in Food Technology.</p>	6	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6
II	<p>Data collection</p> <p>Sampling methods: random sampling methods and non-random sampling methods; size of sample; sampling and non-sampling errors.</p> <p>Collection of data: Tools for collecting primary data; guidelines for constructing primary data; sources of secondary data and tertiary data. Use of secondary and exploratory data to answer the research question.</p> <p>Use of Measurement Scales- Nominal, ordinal, ratio and interval scales, sensory scales. Experimental errors; tests of validity; reliability and practicality.</p>	6	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6
III	<p>Data Analysis</p> <p>Descriptive statistics- Measures of Central tendency, Measures of dispersion.</p> <p>Inferential Statistics –Hypothesis testing, Associations, test of significance – t test, ANOVA, Correlation analysis</p>	12	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6
IV	<p>Application of computer in food technology</p> <p>Data preparation using spread sheets –</p>	8	CO1 CO2	K1, K2, K3, K4, K5, K6

	<p>Editing, coding, classification, tabulations and graphical representation.</p> <p>Use SPSS Package and MS Excel for data analysis.</p> <p>Risk prone analysis number.</p> <p>Databases and indexes in food research.</p>		<p>CO3</p> <p>CO4</p> <p>CO5</p>	
V	<p>Scientific Reporting</p> <p>Scientific writing- research proposal, thesis, and journal articles. Requirement of technical communications. Bibliography – Reference manager software-Endnote, Mendeley, Zotero. Presenting Insights and findings using written reports and oral presentation.</p> <p>Ethics in research: Plagiarism, and Their Prevention. Softwares –Plagiarism X, Urkund, Plagscan, Dupli Checker, Paperater.</p>	7	<p>CO1</p> <p>CO2</p> <p>CO3</p> <p>CO4</p> <p>CO5</p>	<p>K1, K2, K3,</p> <p>K4, K5, K6</p>
<p>Text Books</p> <ol style="list-style-type: none"> 1. Gupta; S.P.(2002) Statistical methods; Sultan Chand and Sons; 31st Revised Edition 2. Kothari C.R (2002) Research Methodology- Methods and Techniques; New Age International; New Delhi. 3. Gurumani, N. (2004) “An Introduction to Bio Statistics”, MJP Publishers. 4. Singh, Y K (2006)Fundamental Of Research Methodology And Statistics, First Edition, New Age International (P) Ltd., Publishers, New Delhi 				
<p>Suggested Reading</p> <ol style="list-style-type: none"> 1. John A. Bower (2013) Statistical Methods for Food Science: Introductory Procedures for the Food Practitioner John Wiley & Sons. 2. Paul Singh (1996) Computer Applications in Food Technology: Use of Spreadsheets in Graphical, Statistical, and Process Analyses, Academic Press. 				
<p>Web Resources</p> <p>https://nptel.ac.in/noc/courses/noc22/SEM1/noc22-ge15</p> <p>https://onlinecourses.swayam2.ac.in/nou22_cm06/preview</p>				

Course Outcomes (COs) and Cognitive Level Mapping

Cos	CO Description	Cognitive Level
CO 1	To define and compare various types, designs and concepts of research methodology and statistics.	K1, K2
CO 2	To apply concepts of research methodology and statistics to explore novel research avenues and improve scientific writing skills.	K3
CO 3	To compare and select appropriate statistical tools for specific research design.	K4
CO 4	To evaluate and choose appropriate methods for planning, designing, collecting data, analyzing, interpreting and reporting the research findings.	K5
CO 5	To integrate theoretical and practical knowledge in research to propose solutions for comprehensible research problems in food industries.	K6

COURSE DESCRIPTOR

Course Code	PFP2MC03
Course Title	PLANT PRODUCT PROCESSING
Credits	5
Hours/Week	5
Category	Major Core (MC) – Theory
Semester	II
Regulation	2022
<p>Course Overview</p> <ol style="list-style-type: none"> 1. Plant product processing encompasses operational techniques to improve physiochemical properties, nutritional quality, production and process efficiency of agriculture and horticulture products. 2. The contents of this course provides theoretical knowledge and practical applications of processed plant-based products. 3. It provides knowledge on various technological advancements in the field of agricultural food processing techniques. 4. The course aims to impart information on training human resources in developing novel products of agricultural origin. 5. The course is structured to provide guidelines on the importance of different agricultural produce, its by-products during processing and food waste management techniques. 	
<p>Course Objectives</p> <ol style="list-style-type: none"> 1. To understand the principles and methods involved in the processing of agricultural and horticultural foods. 2. To impart knowledge on the fundamentals involved in various preservation and storage of food from plant origin. 3. To highlight the importance of different value addition techniques in food composition during processing operations. 4. To develop proficiency skills in processing, storing and packaging of plant based food products with quality assurance. 5. To sensitize the students to the nuances involved in the recent technological advances in processing agricultural produce. 	
<p>Prerequisites: Basic knowledge of food science and processing.</p>	

SYLLABUS

Units	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	<p>Cereal and Cereal Processing:</p> <ul style="list-style-type: none"> • Classification; physicochemical characteristics and nutritive properties of cereal grain; Harvesting techniques and cultivation of the following major cereals of India: Wheat, Rice and Maize. • Post-harvest technology of major cereal grains – Rice, Wheat and Maize • By Products from Rice, Wheat and Maize Milling and waste utilisation • Nutritional and Milling significance of Millets and products of millet processing and market utilisation. 	15	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6
II	<p>Pulse and Legume Processing</p> <ul style="list-style-type: none"> • Chemistry of legumes and pulses: Major and minor components. Functional and physicochemical properties of proteins, starch, fibers and non-starch polysaccharides in pulses and legumes • Pulse Technologies: Postharvest technology, modern milling technology. • Quality standards and evaluation of pulses. 	10	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6
III	<p>Fruits and Vegetable Processing</p> <ul style="list-style-type: none"> • Classification, psychometrics, Physiological Responses and Biochemical Changes • Postharvest processing: Cleaning, Precooling, Washing, Sorting and grading, packing operations, storage systems – MAP, CAP, Ethylene technology, Irradiation, Temperature controlled transportation. • Processing and preservation techniques of fruit and vegetable products – Dehydration, canning, spreads, beverages. • Quality control – Process and product certification of fruits and vegetables. 	15	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6

IV	Plant Based Fats and Oils Processing <ul style="list-style-type: none"> • Classification of plant based oils – Sources, Nutritional composition and Properties • Post-harvest Technology of plant oils – Recovery of oils, refining, fat substitutes, modification of fats and oils. • Processing of plant oils and fats – value added products, Margarine processing, Mayonnaise processing, coconut product, Nut based products. Packaging of edible oils. • Quality control – Process and product certification of Nuts, oilseeds and its products. 	15	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6
V	Spices and Plantation crop processing: <ul style="list-style-type: none"> • Importance of plantation crops and their significance in India • Sugar cane cultivation and post-harvest techniques and processing operations -Sugar refining and grading -Sugar related processed products Confectionaries-caramel sugar related product, sugar coating and sugar cookery. • Cocoa cultivation and post-harvest techniques and Chocolate manufacturing process and cocoa processed products • Major and Minor Indian Spices: Processing techniques - Quality evaluation and certification . 	10	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Naik, H.R., & Amin, T. (2021). Food Processing and Preservation (1st ed.). CRC Press. <https://doi.org/10.1201/9781003243250>
2. Sahay, K.M. and Singh, K.K. 2007. Unit operations in Agricultural Processing, Vikas Publishing House, New Delhi
3. Salunkhe, D.K. and Kadam, S.S. (2005) “Handbook of Fruit Science and Technology: Production, Composition, Storage, and Processing”, Marcel Dekker.
4. Yahia, Elhadi M. (2019) Postharvest Technology of Perishable Horticultural Commodities. Oxford, United Kingdom : Woodhead Publishing <https://doi.org/10.1016/C2016-0-04890-8>
5. Delcour. A. Jan and Hosney R.Carl (2010) Principles of Cereal Science and Technology, AACC International

Suggested Reading

1. Smith.J.Scott and Hi.Y.H (2008) Food Processing –Principles and applications, John Wiley & Sons.
2. Tiwari, B. K., Gowen, A., & McKenna, B. M. (2011). Pulse foods: Processing, quality and nutraceutical applications. London: Academic Press
3. Clark, S., Jung, S., & Lamsal, B. (Eds.). (2014). Food Processing. John Wiley & Sons, Ltd. <https://doi.org/10.1002/9781118846315>
4. Panda.H (2011) – Complete book on Sugarcane processing and by products of molasses. Asia Pacific Business Press Inc.

Web Resources

1. <https://www.digitalgreen.org/>
2. <https://www.anthropocenemagazine.org>

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Level
CO 1	To understand and recall the fundamental concepts related to the structure, composition and processing of plant products.	K1, K2
CO 2	To assess the different processing techniques adopted for agricultural produce.	K3
CO 3	To analyse the various milling by-products of agricultural produce and their nutritional significance and acceptance among consumers.	K4
CO 4	To choose appropriate testing parameters for quality control of processed food products.	K5
CO 5	To construct and integrate process flow operations and technology involved in post-harvest management of plant products.	K6

COURSE DESCRIPTOR

Course Code	PFP2MC04
Course Title	ANALYSIS OF MICRONUTRIENTS AND BIOACTIVE COMPONENTS
Credits	2
Hours/Week	4
Category	Major Core (MC) - Lab
Semester	II
Regulation	2022
<p>Course Overview</p> <ol style="list-style-type: none"> 1. The course focusses on the principle and methods used in assessing the micronutrients and bioactive component of food samples. 2. This course provides the fundamental knowledge and practical skills in handling laboratory equipment related to food analysis. 3. The experiments listed in the course focusses on the techniques involved in the separation and estimation of food components. 4. It covers the identification, separation and characterization of phytochemicals and bioactive components in food. 5. The course offers hands-on experience to detect and analyse the chemical constituents present in food samples. 	
<p>Course Objectives</p> <ol style="list-style-type: none"> 1. To understand the fundamental laboratory skills for performing food analytical experiments. 2. To examine and interpret the observations of the experimental results pertaining to food analysis. 3. To detect and identify micronutrient and bioactive components in food samples using titrimetric and instrumental analysis. 4. To acquire hands-on experience in the use of chromatographic and spectrophotometric techniques. 5. To translate and apply the acquired laboratory skills in assessing food components present in raw and processed foods. 	
Prerequisites	Basic knowledge in chemistry

SYLLABUS				
S.No	Experiments	HOURS	COs	COGNITIVE LEVEL
1.	<p>Quantitative Experiments:</p> <ol style="list-style-type: none"> 1. Estimation of hardness of water by EDTA method. 2. Estimation of ascorbic acid in lemon juice 3. Estimation of calcium in milk sample by complexometric titration 4. Determination of citric acid in lemon juice. 5. Estimation of iron (II) by potentiometric titration. 6. Estimation of iodine in Iodised salt. 7. Estimation of oxalic acid in tomato juice by permanganometry titration. 8. Estimation of polyphenols - total anthocyanin / tannins from fruit juices. 9. Estimation of calcium content in milk products using gravimetric analysis 10. Estimation of available CO₂ in baking powder 	26	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6
2.	<p>Qualitative Experiments:</p> <ol style="list-style-type: none"> 1. Separation and identification of β-Carotene in foods. 2. Qualitative estimation for the presence of phytochemicals in food sources. 3. Isolation of casein from milk sample. 4. Analysis of salt in butter sample by conductometric titration. 5. Analysis of salt using Mohr's method 6. Titratable acidity using different food products 	16	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6
3.	<p>Demonstration experiments:</p> <ol style="list-style-type: none"> 1. Separation of plant pigments by column chromatographic technique. 2. Analysis of Fe²⁺/Fe³⁺ in food sample by UV spectrophotometer. 	10		

Text Books and lab manual

1. Neilson Suzanne S (2003) Food analysis. Plenum Publishing Corporation, U.S.A.
2. B. R. Puri, L. R. Sharma and M. S. Pathania (2007) Principle of Physical Chemistry 38th edition S. Nagin Chand and Co.
3. Geetha Swaminathan and Mary George S. (2010) Laboratory Chemical Methods in Food Analysis, Margham Publications, 3rd edition.
4. N.S. Gnanapragasam and G. Ramamurthy (2002) Organic Chemistry – Lab manual S. Viswanathan Co. Pvt.

Suggested Readings

1. Bassett, J., et al., Vogel's Textbook of Quantitative Inorganic Analysis, (4th edition), ELBS, Longman, (1985).
2. FSSAI lab manual (2012)-Methods for analysis of foods - Test for food additives. (2012) FSSAI

Web Resources

<https://bit.ly/3C9SZDK>

Course Outcomes (COs)

CO 1	To recall and explain the principles related to the analysis of micronutrient and bioactive compounds in food.	K1, K2
CO 2	To examine and analyze the different components present in the food samples.	K3
CO 3	To determine and differentiate the various food chemical components by quantitative and qualitative methods.	K4
CO 4	To choose and recommend a suitable analytical procedure for the detection of food constituents.	K5
CO 5	To compile the obtained results and apply the outcome in a food industrial sector.	K6

COURSE DESCRIPTOR	
Course Code	PFP2MC05
Course Title	BAKING AND CONFECTIONERY LAB
Credits	2
Hours/week	3
Category	Major Core (MC) - Lab
Semester	II
Regulation	2022
Course overview:	
<ol style="list-style-type: none"> 1. Baking and confectionery industry in India has gained momentum with regard to its expansion of products having a wide range of innovative products appealing to consumers. 2. The course delivers the significance of the ingredients, processing techniques and value addition in both baking and confectionery products. 3. The experiments covered in the course are designed to widen the horizon in understanding the role of the traditional and non-traditional ingredients in the preparation of baked and confectionery goods. 4. The course focusses on the processing techniques and marketability of the finished products through workshops and industrial visit to baking and confectionery units. 5. The course offers practical demonstrations for basic confectionery and bakery preparations with innovations in the food industry. 	
Course Objectives:	
<ol style="list-style-type: none"> 1. To introduce the students to the basic concepts and principles of baking and confectionery products and hone the practical skills. 2. To practise the methods, techniques and applications of candy making and baking in a laboratory set up. 3. To sensitize the students to the sources and properties of raw materials related to the manufacturing of baked and confectionery products. 4. To compare traditional and modern baking and confectionery techniques, preparation methods and storage practices to produce high quality products. 5. To enable the students to appreciate and evolve new formulations with novel ingredients in baking and confectionery sectors. 	
Prerequisites:	Basic knowledge in life science and an aptitude to explore practical skills in new avenues in baking and confectionery.

SYLLABUS

UNIT	CONTENTS	Hours	COs	Cognitive level
I	<p>Baking Technology:</p> <p>1 Preparation of different types of bread using varied methods, quality evaluation and shelf life studies.</p> <p>2. Determination of Gluten content and Dough raising capacity of the dough – Preparation of gluten-free baked products.</p> <p>3 Determining the role and effect of flour, yeast, fat and sugar in the bread making process</p> <p>4. Sedimentation value and water absorption capacity of wheat flour.</p> <p>5. Preparation of different types of cakes and pastries using different methods, quality evaluation of cakes and evaluation of different types of toppings</p> <p>6. Preparation of other bakery products and indigenous baked goods: rusks, crackers, buns, muffins, pizza and kulcha.</p> <p>7. Experiment on leavening action of baking powder, sodium- bicarbonate and ammonium-bi-carbonate</p> <p>8. Participation in a baking workshop on fundamental techniques and processing principles.</p>	20	<p>CO 1</p> <p>CO 2</p> <p>CO 3</p> <p>CO 4</p> <p>CO 5</p>	<p>K1, K2, K3,</p> <p>K4, K5, K6</p>
II	<p>Confectionery Technology:</p> <p>8. Different stages of sugar cookery and preparation of indigenous products based on the stages. Preparation of sugar solutions and evaluation using Refractometry and Brix</p> <p>9. Preparation and quality evaluation of non-crystalline candies: NonCrystalline candies; Hard candies (Tablets, lollipop), caramels, toffees and nougats</p> <p>10. Preparation and quality evaluation of Crystalline candies: Fondant, fudge and Marshmallow</p> <p>11. Preparation of Cocoa, Chocolate and related products</p>	19	<p>CO 1</p> <p>CO 2</p> <p>CO 3</p> <p>CO 4</p> <p>CO 5</p>	<p>K1, K2, K3,</p> <p>K4, K5, K6</p>
III	12. Visit to Baking and Confectionery units			

Textbooks for reference:

1. Lees and Jackson (1994) Sugar Confectionery and Chocolate Manufacture by, 1st Ed. London: Chapman & Hall, 1973, Reprinted
2. Justin J. Alikonis. Candy Technology (1979) AVI publishing company, Inc., Westport, Connecticut
3. Dubey SC (2002) Basic Baking. The Society of Indian Bakers, New Delhi.
4. Manley D (2000) Technology of Biscuits, Crackers & Cookies, 2nd Ed. CRC Press.

Suggestive Readings:

1. John Kingslee (2006) "A professional Text to bakery and confectionary", New Age International
2. Jeffrey Hamelman (2004) "Bread: A baker's book of techniques and recipes", John Wiley and Sons
3. Samuel.A. Matz (1997) "Bakery Technology and Engineering", Chapman & Hall, 3rd Edition, CBS Publishers
4. Francis FJ (2000) "Wiley Encyclopaedia of Food Science & Technology", John Wiley & Sons.

Web resources:

1. <https://guides.baker.edu/>
2. <https://www.joyofbaking.com/>
3. <https://www.candyindustry.com/>
4. <http://www.innovativebakeryresources.com/>

Course Outcomes (Cos)

BAKING AND CONFECTIONERY LAB (MC)		Cognitive Level
CO 1	To identify the role and significance of raw materials in baked and confectionery products.	K1, K2
CO 2	To classify and compare the role of traditional and non-traditional ingredients in baking and confectionery products.	K3
CO 3	To develop and experiment the various processing techniques in the preparation of different baked and sugar related goods.	K4
CO 4	To test and evaluate new products in both the segments of bakery and confectionery products for better consumer acceptability and innovative sensory appeal.	K5
CO 5	To generate and propose novel processing technologies in relation to baking and confectionery products for better shelf life and storage stability.	K6

COURSE DESCRIPTOR

Course Code	PFP2MC06
Course Title	FRUITS AND VEGETABLES PROCESSING LAB
Credits	2
Hours/Week	3
Category	Major Core (MC) - Lab
Semester	II
Regulation	2022
<p>Course Overview:</p> <ol style="list-style-type: none"> 1.The Indian food industry is expanding and there is a huge demand for various types of fruits and vegetables and its processed products and this course aims to understand the various marketable processed fruits and vegetable products. 2.This course focusses on the analysis of fruits and vegetable products to better understand their quality parameters. 3.The course covers the fundamental scientific principles underpinning the methodology of thermal processing in fruit and vegetable industry. 4.This course explores the changes in chemical and physical constituents of fruit and vegetable processing in fresh,dehydrated,frozen and canned fruit and vegetable products. 5.This course is structured to evolve cost effective methods of processed fruit and vegetable formulations suitable for food industry applications. 	
<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. To understand the scientific basis for the formulation of fruit and vegetable products. 2. To develop novel products by integrating the theoretical principles and practical skills. 3. To evaluate and understand the influence of physiochemical parameters on the shelf life of fruits and vegetables for better storage stability. 4. To explore industrial practices adopted to minimize losses during processing through fruit and vegetable waste utilisation 5. To integrate different processing principles in identifying defects in processed products and recommend suitable solutions. 	
Prerequisites	Basic knowledge on unit operations in food processing.

SYLLABUS

Unit	Content	Hours	COs	Cognitive level
I	<p>1. Preparation of Jams, Jellies and Marmalades . Estimation of Total soluble solids, acidity and percentage Brix in the prepared fruit products.</p> <p>2. Determination of percentage Brine, percentage Brix, Vacuum, drained weight of thermally processed fruits and vegetable products (Canned/Bottled/Flexibly packaged).</p> <p>3. Preparation of fruit juice and determination of acidity , Estimation of formol number by titrimetric method.</p> <p>4. Practices in judging the maturity of fruits and vegetables. Influence of pH, thermal processing and freezing on the pigments in fruits and vegetables.</p> <p>5. Cost effective method to determine the effect of ethylene gas on fruits ripening.</p> <p>6. Preparation of sauzes and ketch up, examination of physical parameters and viscosity.</p> <p>7. Preparation of indigenous fermented product and its microbial analysis.</p> <p>8. Traditional and Osmotic dehydration of fruits and vegetables with salt and sugar.</p> <p>9. Determine the presence of peroxidase, sulphur dioxide in dehydrated fruits and vegetables.</p> <p>10. Determination of rehydration ratio in dehydrated fruits and vegetables.</p>	29	<p>CO 1</p> <p>CO 2</p> <p>CO 3</p> <p>CO 4</p> <p>CO 5</p>	<p>K1, K2, K3,</p> <p>K4, K5, K6</p>
II	<p style="text-align: center;">INSTRUMENTAL APPLICATIONS:</p> <p>11. Determination of pH in kimchi and its interpretation studies.</p> <p>12. Estimation of Iron in green leafy vegetables</p>	10	<p>CO 1</p> <p>CO 2</p> <p>CO 3</p> <p>CO 4</p> <p>CO 5</p>	<p>K1, K2, K3,</p> <p>K4, K5, K6</p>

	<p>after permeating heat treatment using potentiometric titration.</p> <p>13.Determining the electrical conductance of water , fruit juices using conductivity meter.</p>			
<p>Text Books for references:</p> <ol style="list-style-type: none"> 1.FSSAI manual of analysis of foods, fruits and vegetable products(2016) 2.B.C.Muzumdar and K. Muzumdar (2003) Methods of Physico-Chemical analysis of fruits: 3.Daya publishers, New Delhi, 2003. 4.S.Rangann (2011), Manual of analysis of fruit and vegetable products, 2nd Ed, Tata McGraw – Hill Publishing company Ltd, New Delhi. 5.Fellows PJ (2005). Food Processing Technology: Principle and Practice. 2nd Ed. CRC Press. 				
<p>Suggested Readings:</p> <ol style="list-style-type: none"> 1.Fruits & Vegetables Processing Hand Book,Engineers India Research Institute ISBN: 9788186732328, 9788186732328. 2.Hand book of fruits and vegetables processing (2012), Second edition, John Wiley and sons publications. 				
<p>Web Resources:</p> <p>http://pubs.sciepub.com/ajfst/2/6/6/index.html</p> <p>https://old.fssai.gov.in/Portals/0/Pdf/Manual_Fruits_Veg_25_05_2016.pdf</p>				

Course Outcomes (COs) and Cognitive Level Mapping

Cos	CO Description	Cognitive Level
CO 1	Recognize the fundamental principles of food processing in the formulation of fruit and vegetable products.	K1, K2
CO 2	Develop new products with novel ingredients and techniques for preservation and better storage conditions.	K3
CO 3	Compare and analyse physiochemical and organoleptic properties raw and processed fruit and vegetable products in tune with food industry standards.	K4
CO 4	Assess and predict the quality of processed products using the principles of sensory science in product development and optimization.	K5
CO 5	Formulate and propose novel processing techniques in the area of fruit and vegetable manufacturing sector.	K6

COURSE DESCRIPTOR	
Course Code	PFP3MC01
Course Title	MEAT, POULTRY, SEAFOOD PROCESSING
Credits	6
Hours/week	6
Category	Major Core (MC-Theory)
Semester	III
Regulation	2022
Course Overview:	
<ol style="list-style-type: none"> 1. Meat, poultry and seafood have carved a special niche in the food processing industry. 2. The aim of the course is to understand livestock management, slaughtering techniques, physiochemical nature of meat, processing and storage facilities. 3. The course provides details on the structure, nutritional composition and quality parameters of meat, seafood, egg and poultry. 4. The units of the course covers in-depth information on the processing techniques and good manufacturing practices adopted in the meat, seafood, egg and poultry processing sectors. 5. The course delivers the required knowledge on the quality assessment techniques adopted in the meat manufacturing plant. 	
Course Objectives:	
<ol style="list-style-type: none"> 1.To gain fundamental knowledge on the composition and nutritive value of foods from animal origin. 2.To familiarize the importance and significance of processing operations in the manufacture of animal meat, poultry, egg and seafoods and its products. 3. To sensitize the technological operation of handling, processing, preservation and bi-product utilization of animal meat, poultry and seafood products. 4. To provide an in-depth understanding on the unit operations in animal food manufacturing unit and challenges of waste management techniques. 5. To acquire an understanding of the safety, hygiene and quality parameters and regulations associate with all classes of meat industry. 	
Prerequisites:	Basic knowledge in life science and food science.

SYLLABUS				
UNIT	CONTENTS	HOURS	COs	Cognitive level
I	<p>INTRODUCTION TO MEAT PROCESSING</p> <p>Types of meat and its source - chemical composition and microscopic structure of meat and meat products</p> <p>Unit operations in meat processing - Ante mortem handling – Stunning Techniques - Slaughtering of meat - Post mortem handling of meat – Processing operations- packaging and storage eat quality evaluation: inspection and grading of meat.</p> <p>Color, flavors, microbiology and spoilage factors of meat and meat products.</p> <p>Recent trends in meat processing.</p>	15	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6
II	<p>PROCESSED MEAT AND MEAT PRODUCTS</p> <p>Processing and preservation of meat - Aging; pickling; smoking. Dried and Cured meat. Canned meat; chilling; frozen meat- Cooked and Refrigerated meat; Sausages; Irradiation and Hurdle concept; methods of stabilization of meat emulsion and meat extension - Byproducts utilization.</p> <p>Factors affecting post-mortem changes; properties and shelf-life of meat; meat tenderization and meat quality evaluation – Recall and Traceability</p> <p>Meat plant sanitation and safety -Safety standards in meat industry - Meat food product order - HACCP-ISO-9000 standards.</p>	15	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6
III	<p>SEAFOOD PROCESSING</p> <p>Types of fish; composition; structure; and spoilage factors of fish; microbiological quality of fresh fish; Post-mortem changes in fish; handling and transportation of fish -</p>	16	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6

	Bacteriology of fish; Processing and Preservation techniques of seafoods - Chilling of fish; Freezing and Individual quick freezing -Canning and smoking operations; Salting and drying of fish; pickling; radiation processing - Fish and fish products and by-product utilisation - Seafood quality Assurance; Advances in fishery by products technology and waste utilization.			
IV	<p>POULTRY PROCESSING</p> <p>Introduction: Types and characteristics of poultry products; composition; nutritive value-Poultry: Classes of poultry meat, classification, composition- tenderness, flavor and colour -Unit operations involved in poultry processing; slaughtering of poultry; Ante mortem and post mortem examination of poultry birds - Pre-slaughter care; handling; transport and dressing of a poultry bird; Cuts of poultry bird - Inspection and grading.</p>	16	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6
V	<p>EGG PROCESSING</p> <p>Eggs: Formation, structure, composition and nutritive value of egg white and egg yolk; Structure; composition; nutritive value; calculation of nutritive value and functional properties of eggs;</p> <p>Egg quality characteristics: Internal Quality - Haugh's unit – Terms indicating defective quality; microbial spoilage of eggs - types of spoilage in eggs - indications - organisms causing spoilage.</p> <p>Preservation and maintenance of eggs: Preservation of shell eggs - Egg cleaning – Oil Treatment - Cold storage - Thermo stabilization - Immersion in liquids; egg grading; egg powder processing - preservation of Albumin and yolk - powder production.</p> <p>Evaluation of egg quality: Candling, floating</p>	16	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6

	in water, and grading of eggs; storage of Eggs; egg Products – Frozen, Pasteurized, Dehydrated, Desugared; egg substitutes.			
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Textbooks for reference:

1. Joseph Kerry, John Kerry and David Led wood (2002) — Meat Processing, Woodhead Publishing Limited, England, CRC Press.
2. P.S. Murano (2003) Understanding food science and technology, Thomson Wordsworth Publishers.

Suggestive Readings:

1. Fidel Toldraj (2010) Handbook of Meat Processing, John Wiley & Sons.
2. Owens.M. Casey, Alvarado.Z. Christine and Sams.R. Alan (2010) Poultry Meat Processing, Taylor & Francis Group, CRC Press
3. Mead, G (2004) Poultry Meat Processing and Quality, Woodhead Publishing, England
4. Botana.M. Luis (2008) Seafood and Freshwater Toxins, Taylor & Francis Group, CRC Press

Web resources:

1. <https://www.meatproductsofindia.com>
2. <https://nrcmeat.icar.gov.in>

Cognitive Level Mapping		
CO 1	To recognise the structure, nutritional composition, procurement techniques, processing operations of animal, poultry and seafood commodities.	K1, K2
CO 2	To classify the different types of meat, poultry and seafoods based on their processing techniques and evolve techniques to increase their sensory and nutritional quality.	K3
CO 3	To illustrate the manufacturing process of different products made from animal meat, poultry and seafood and create flowcharts for the operations.	K4
CO 4	To assess the physiochemical and biological changes with regard to quality and storage stability of meat, poultry and seafood products based on different processing techniques.	K5
CO 5	To generate novel ideas in developing newer food products and processing technologies for extending the shelf life of meat, poultry seafood and egg products.	K6

COURSE DESCRIPTOR				
Course Code	PFP3MC02			
Course Title	DAIRY AND BEVERAGE PROCESSING			
Credits	6			
Hrs/week	5			
Category	Major Core (MC-Theory)			
Semester	III			
Regulation	2022			
Course Overview:				
<p>1. Dairy sector is a vital food processing segment contributing to the economy of our country in addition to providing nutritional support.</p> <p>2. The course is designed to highlight the global and national dairy development, focusing on milk production practices, institutional activities and schemes related to dairy development specifically in India.</p> <p>3. The units in the course also aims to deliver the basic information on the nutritional, physical and chemical properties of milk and the nuances involved in setting up a dairy plant and features the versatility of milk and its products from the farm to the consumer.</p> <p>4. The course also features the fundamental concepts on the source, composition and consumption of alcoholic and non-alcoholic beverages.</p> <p>5. The course focusses on imparting the processing significance of beverages and utilization of novel ingredients in the manufacturing process of beverages.</p>				
Course Objectives:				
<p>1. To recognize the details pertaining to the properties of milk, milk products and beverages.</p> <p>2. To understand the milk production practices in India and across the globe.</p> <p>3. To familiarize with the processing techniques of milk, milk products and beverages.</p> <p>4. To classify and categorize different indigenous and conventional milk products.</p> <p>5. To formulate and evolve novel products in the dairy and beverage industry.</p>				
Prerequisites:	Basic knowledge in life science and food science.			
SYLLABUS				
		Hours	COs	Cognitive level
UNIT	CONTENTS			
I	<p>Milk and Milk Production – An introduction</p> <p>Dairy development in India — Milk and Milk Products Order '92 – Nutritive value of milk ICMR recommendation of nutrients.</p> <p>Introduction to dairy production, processing and</p>	15	<p>CO 1</p> <p>CO 2</p> <p>CO 3</p> <p>CO 4</p> <p>CO 5</p>	<p>K1, K2, K3,</p> <p>K4, K5, K6</p>

	<p>consumption- -Physio chemical properties of milk; color, taste, pH and buffering capacity, viscosity, surface tension, freezing, boiling point, thermal and optical properties, redox potential, electrical conductivity.</p> <p>Dairy scenario in India - Composition, factors affecting composition and yield of milk and Dairy Cooperatives – NDRI, NDDB, TCMPPF - Operation Flood. Milk and Milk Products Order '92 is a repealed order and hence can be removed. It is integrated into FSS act. First and second wave of dairy revolution (sufficiency to efficiency)</p>			
II	<p>Market milk industry:</p> <p>Milk production in India and Tamil Nadu with reference to Global milk production –Systems of collection of milk Reception, quality evaluation Platform tests -Various stages of processing- Filtration, Clarification, Homogenization, Pasteurization-LTST, HTST,UHT, sterilisation - Packaging, storage, transportation and distribution- Standardized milk, toned milk, double toned milk, recombined milk, sterilized milk, filled milk, flavoured milk, and cream.</p>	15	<p>CO 1</p> <p>CO 2</p> <p>CO 3</p> <p>CO 4</p> <p>CO 5</p>	<p>K1, K2, K3,</p> <p>K4, K5, K6</p>
III	<p>Processing of Milk products:</p> <p>Flow diagram and processing of condensed milk, dehydrated milk, evaporated milk, ice cream - Fermented milk products – butter, cheese, yoghurt, kefir, acidophilus milk and sour cream , Non-fermented milk products – Ghee, Ice cream and milk powder</p> <p>Indigenous milk products - Present status, method of manufacture of traditional Indian fermented and non-fermented dairy products.</p> <p>Classification of traditional dairy products and processing</p> <p>Cleaning in place-Dairy effluent treatment and disposal.</p>	10	<p>CO 1</p> <p>CO 2</p> <p>CO 3</p> <p>CO 4</p> <p>CO 5</p>	<p>K1, K2, K3,</p> <p>K4, K5, K6</p>

IV	Beverage processing: Beverage industry in India: Types of beverages and their importance- Manufacturing technology for juice-based beverages - synthetic beverages - Tea, coffee, cocoa beverages - Beverages using spices, plant extracts, herbs, nuts, dairy and imitation dairy-based beverages, sports drinks. Role of various ingredients of soft drinks, carbonation of soft drinks. Alcoholic beverages- types, manufacture and quality evaluation – Beer and Wine.	10	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6
V	Packaged water: Packaged drinking water: definition, types, and manufacturing processes. Quality evaluation of raw and processed water: methods of water treatment. BIS quality standards of bottled water; mineral water, natural spring water, flavoured water, carbonated water.	15	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6

Textbooks for reference:

1. David P. Steen & Phillip R. Ashurt, (2006) Carbonated Soft drinks, Blackwell Publishing Ltd- E book.
2. De Sukumar, (2007) Outlines of Dairy Technology, Oxford University Press.
3. Philip R. Ashurt, (2005). Chemistry and technology of Soft drinks and fruit juices, 2nd edition Blackwell Publishing Ltd. E book.

Suggestive Readings:

1. Tammy Foster and Purnendu, C. Vasavada, (2003) Beverage Quality and safety, 2nd edition. CRC Press - E book.
2. Walstra P, J.T.M. Wouters and T.J. Geurts, (2006) Dairy Science Technology, 2nd ed., CRC Press.
3. Spreer Edgar (2005) Milk and Dairy Product Technology, Marcel Dekker.

Web resources:

1. <https://www.india.gov.in/topics/agriculture/dairy>
2. <https://dairyprocessinghandbook.tetrapak.com/>
3. <https://nationaldairyfarm.com/>

Cognitive Level Mapping		
CO 1	To recognise the importance of dairy and beverage processing industry in India and identify the role and significance of the processing techniques adopted in the manufacture of products.	K1, K2
CO 2	To illustrate the process flowchart of the different milk products developed based on the techniques of fermentation, coagulation and concentration and demonstrate the significance of processing alcoholic and non-alcoholic beverages.	K3
CO 3	To outline the various processing techniques in the development of dairy products, beverages and dairy based beverages.	K4
CO 4	To evaluate the different methodologies for quality and safety assessment of the dairy products, beverages and packaged water for consumer acceptability and innovative appeal.	K5
CO 5	To propose plans for setting a dairy manufacturing unit and also create novel ideas in formulating beverages with value addition, better shelf life and storage stability.	K6

COURSE DESCRIPTOR	
Course Code	PFP3MC03
Course Title	DAIRY AND MEAT PROCESSING LAB
Credits	2
Hours/week	3
Category	Major Core (MC) - Lab
Semester	III
Regulation	2022
Course Overview:	
<p>1. Consumption of dairy and meat-based products have seen a significant rise in India and their processing techniques have gained equal momentum in our country.</p> <p>2. This lab course highlights the importance of understanding the applications and developing practical skills in the manufacturing operations of dairy and meat products.</p> <p>3. The experiments aim at imparting practical knowledge on the various physiochemical, microbiological and textural changes in dairy and meat-processed products.</p> <p>4. The course also emphasizes the action of various enzymes on the quality parameters of different dairy and meat processing techniques.</p> <p>5. The contents of the course involve experiments that are related to the shelf-life analysis of novel products for better storage quality.</p>	
Course objectives:	
<p>1. To acquire practical skills in techniques used for processing of meat and dairy products.</p> <p>2. To familiarize with the applications of additives used for milk product processing and quality analysis.</p> <p>3. To introduce the practical skills in processing and preservation of meat and dairy products for better quality and shelf life.</p> <p>4. To perform all the tests necessary for the microbiological quality of meat and dairy products.</p> <p>5. To formulate and develop novel products with meat and dairy and understand their marketability in the food industry.</p>	
Prerequisites:	Basic knowledge in life science and food science.

SYLLABUS		Hours	COs	Cognitive level
UNIT	CONTENTS			
I	<p>Dairy Processing: Raw material analysis</p> <p>1. Determination of preservatives of milk and quality analysis – MBRT and Clot on Boiling test- Milk adulteration test.</p> <p>- Antibiotic test (using strips)</p> <p>2. Preparation and analysis of Curd</p> <p>3. Preparation and analysis of Cottage cheese (paneer)</p> <p>4. Preparation and analysis of Ice cream/ Cream - Factors affecting ice crystal formation during ice cream making- role of additives in ice cream making process.</p> <p>5. Preparation and analysis of Butter/ Ghee.</p> <p>6. Preparation of Coagulated and non-coagulated dairy products/ Fermented/ Non-fermented/ concentrated / evaporated</p>	20	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6
II	<p>Meat Processing:</p> <p>6. Evaluation of meat quality; estimation of meat: bone ratios.</p> <p>7. Preservation of different sources of meat by dehydration, freezing and quality evaluation.</p> <p>8. Preparation of meat products with different tenderising agents and their quality variations.</p> <p>9. Preparation of fish-based products and assessment of the effect of enzymes in meat tenderization.</p> <p>10. Brining and pickling of seafoods and shelf-life enhancements</p>	19	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6
III	11. Visit to a local dairy plant			
<p>Textbooks for reference:</p> <p>1. Das H. (2005). Food Processing Operations Analysis, Asian Books.</p> <p>2. De Sukumar, (2007) Outlines of Dairy Technology, Oxford University Press.</p>				

Suggestive Readings:

1. Ramesh C. Chandan, Arun Kilara Nagendra Shah (Editors) 2008 Dairy Processing and Quality Assurance Hardcover, Wiley Blackwell Publisher
2. Spreer, Edgar, (2005). Milk and Dairy Product Technology, Marcel Dekker.
3. Y.H. Hui (2012)- Handbook of meat and Meat processing, CRC Press

Web resources:

1. https://www.academia.edu/8555891/Lab_Manual_Meat_science
2. <https://www.nabl-india.org>

DAIRY AND MEAT PROCESSING LAB (MC)		Cognitive Level
CO 1	To identify the role of raw materials in the production of dairy and meat-based products.	K1, K2
CO 2	To demonstrate the relationship between novel processing technologies and conventional methods to enhance the nutritional, physicochemical and functional properties of dairy and animal-based products.	K3
CO 3	To determine the various processing techniques in the preparation of different dairy and meat products baked and sugar related goods.	K4
CO 4	To select and compare commercial and laboratory products in dairy and meat processing for consumer acceptability and innovative appeal.	K5
CO 5	To propose novel processing technologies and formulate new products with better shelf life and storage stability.	K6

COURSE DESCRIPTOR

Course Code	PFP3MC04
Course Title	ANALYSIS OF FOOD ADDITIVES AND TOXINS
Credits	02
Hours/Week	03
Category	Major Core (MC) – Lab
Semester	III
Regulation	2022

Course Overview:

1. The laboratory ambience provided by this experimental paper would cultivate a skill for a position in an industry/research laboratory.
2. The paper aims at improving analytical skills and interpretation using graphical and experimental data.
3. The course provides practical knowledge on the application of food additives and the detection of toxins in food.
4. This laboratory experience would develop skills in scientific methods of planning, executing and reporting the experimental data.
5. This lab course offers hands-on training in performing the experiment to harness skills for food industries, entrepreneurial initiatives and research institutes.

Course Objectives:

1. To assess the presence of foreign particles, preservative and colours present in the food sample.
2. To utilize conductometric methods for quantitative estimations.
3. To evaluate qualitatively the adulterants present in food.
4. To determine qualitatively and quantitatively analyse the presence of heavy metals in food.
5. To generate and compile the experimental and graphical data and interpret the observations.

Prerequisites

Basic knowledge on Chemistry & lab skills

SYLLABUS

EXPT	CONTENT	HOURS	COs	COGNITIVE LEVEL
1	1. Quantitative estimation of hydrocyanic acid from beans. 2. Qualitative quick test for detection of	39	CO1, CO2, CO3,	K1,K2, K3,K4,

	<p>adulterants in milk and milk products.</p> <ol style="list-style-type: none"> 3. Qualitative determination of rancidity of fats, tests for adulterants in oils and fats 4. Qualitative estimation of heavy metals in a few foods – raw and processed foods. 5. Detection of foreign particles in food. 6. Determination of hydrogen ion concentration using acidbase titrations in food samples using conductometry. 7. Qualitative tests for hydrogenated fats, butter, and ghee. 8. Estimation of chlorophyll content of green vegetable 9. Estimation of Curcumin in Turmeric 10. Estimation of Preservatives in Foods 11. Estimation of Colours in Foods using TLC 12. Estimation of moisture in spices 13. Determination of adulteration of spices 14. Estimation of caffeine in tea and coffee 15. Extraction of organic natural colours from aromatic plants and vegetable <p>Demonstrative experiments</p> <ol style="list-style-type: none"> 16. Analysis of heavy metals using atomic absorption spectrophotometer. 17. Quantitative estimation of compounds in pesticides using HPLC. 		<p>CO4 CO5</p>	<p>K5,K6</p>
<p>Text Books</p> <ol style="list-style-type: none"> 1. Tests for some adulterants in food – Instruction manual part II, 2012. Food safety and standards Authority of India (FSSAI) 2. FSSAI lab manual 8, 2012. Methods for analysis of foods - Test for food additives. 3. FSSAI lab manual 8, 2012. Methods for analysis of foods. 				
<p>Suggested Readings</p> <ol style="list-style-type: none"> 1. Russel N.J and Goul Khuwer G.W (Ed) 2003 Food preservatives, Academic /plenum publishers, New York 2. Ranganna S.1986. Handbook of analysis and quality control for fruits and vegetable products,Tata McGraw-Hill publishing company limited, Second edition 				

Web Resources

1. <https://ocw.mit.edu/courses/chemical-engineering/10-626-electrochemical-energy-systems-spring-2014/lecture-notes/>
2. <https://www.uclmail.net/users/dn.cash/ThinLayerChromatography.pdf>
3. <https://www.pharmatutor.org/articles/review-on-determination-preservatives-food-stuffs-different-analytical-methods>.
4. <https://www.fda.gov/regulatory-information/search-fda-guidance-documents/guidance-industry-estimating-dietary-intake-substances-food>.
5. http://www.academia.edu/7205036/physicochemical_analysis_of_ghee_as_per_fssai_and_agmark_paramaners.

Course outcomes (COs)

ANALYSIS OF FOOD ADDITIVES AND TOXINS		Cognitive Level
CO 1	To describe the principles used in the estimation of foreign particles, preservatives and colours present in the food sample.	K1, K2
CO 2	To perform titrimetric analysis on food samples to identify the presence of food additives and toxins.	K3
CO 3	To analyse qualitatively the amount of adulterants in milk, fats, species and oils.	K4
CO 4	To determine quantitatively the concentration and quantity of the adulterants present in the given food sample.	K5
CO 5	To integrate the results and summarise the observation of the experimental data.	K6

COURSE DESCRIPTOR

Course Code	PFP3MC05
Course Title	NEW PRODUCT DEVELOPMENT LAB
Credits	2
Hours/Week	3
Category	Major Core (MC) – Lab
Semester	III
Regulation	2022
Course Overview	
<ol style="list-style-type: none"> 1. New Product Development laboratory provides an understanding of the product development process, illustrating the various novel approaches required for new food products emerging in the market. 2. The course offers an understanding of the standardisation of raw materials and integrate them with functional ingredients to develop innovative products. 3. This course aims to develop value addition to seasonal food products thereby reducing dependency and increasing its perennial availability. 4. The course equips to evaluate and compare the product characteristics with sensory scales and attributes. 5. New food product development prepares the students with required skills to work in food companies and understand nuances of product development as a business strategy. 	
Course Objectives	
<ol style="list-style-type: none"> 1. To recognize taste perceptions and attributes contributing to consumer acceptance of processed foods. 2. To develop processing techniques for convenience and speciality foods on a pilot scale. 3. To utilize raw materials in combination with other novel ingredients to produce value added food products. 4. To compare the yield of standardized products to improve productivity and product quality. 5. To formulate processing techniques and develop product evaluations with novel food ingredients required for entrepreneurial skills. 	
Prerequisites Basic knowledge of food processing.	

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	New Product Development <ol style="list-style-type: none"> 1. Introduction to the steps in new food product development. 2. Formulation of different Ready To 	30	CO1 CO2 CO3 CO4	K1, K2, K3, K4, K5, K6

	<p>Cook (RTC) and Ready To Service (RTS) foods – Precooked Cereal, legume based, dairy based, fat based products.</p> <ol style="list-style-type: none"> 3. Formulation of different Ready To Eat (RTE) foods – Instant snacks, Paneer based products, Mixed rice. 4. Preparation of different premixes – Rice mix, soup mix, cake mix, fortified weaning foods using malts. 5. Preparation of different enriched gummies – fruit and vegetable based, vitamin and mineral gummies 6. Formulation of foods with probiotics – Spirulina, fermented products, sea weeds. 7. Formulation of value-added extruded products – Incorporation of fiber/sprouts/vegetable extract. 8. Preparation of different gluten-free products. 9. Formulation of cakes and cocoa based products with sugar substitutes – Stevia, Xylitol, Erythritol 10. Formulation of cookies and Indian sweets with sugar substitutes – Stevia, Xylitol, Erythritol 11. Formulation of traditional recipes with novel and functional food ingredients – Soy protein, flax and chia seed powders, FOS, Gels, flower infusions, palm sugar. 		CO5	
II	<p>Consumer Testing and Sensory evaluation</p> <ol style="list-style-type: none"> 12. Evaluate food products by sensory perceptions using sensory evaluation <ul style="list-style-type: none"> • Difference test • Attribute difference test • Analytical descriptive test • Affective test • Preference test 	9	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6

	<ul style="list-style-type: none"> • Tests with sweetness, saltiness, sourness, bitterness and astringency using different concentration series. <p>13. Preparation of novel products with food and nutritional labeling and health claims on the food products.</p> <p>14. Visit to a food processing and packaging unit.</p>			
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Text Books

1. Carpenter Lyon & Hasdell, “Guidelines for Sensory Analysis in Food Product Development and Quality Control”, Springer, 2000
2. Earle, M. D., Earle, R. L., & Anderson, A. M. (2001). Food product development. Boca Raton, Fla: CRC Press.
3. Gordon L Robertson. 2006. Food Packaging: Principles and Practice. 2nd Ed. CRC Press
4. Harper J.M. Extrusion of Foods. Vol. 1 & 2 (1991) CRC Press, Inc.) Boca Raton, Aorida
5. Naik, H.R., & Amin, T. (2021). Food Processing and Preservation (1st ed.). CRC Press. <https://doi.org/10.1201/9781003243250>
6. V.K. Joshi (2006) Sensory science- Principles and Applications in Food Evaluation,Agrotech Publishing Academy, Udaipur.

Suggested Reading

1. Fast R.B & Cardwell E.F. Breakfast cereals and how they are made (2000) American Association of Cereal Chemists. St. Paul Minnesota
2. Lawless, Harry T.; Heymann, Hildegard (2010). [Food Science Text Series] Sensory Evaluation of Food, Springer, New York, NY
3. Moskowitz, H. R., et al. “Sensory & Consumer Research in Food Product Design & Development”, Wiley-Blackwell, 2006.

Web Resources

<https://iastate.pressbooks.pub/foodproductdevelopment>

Course Outcomes (COs) and Cognitive Level Mapping

Cos	CO Description	Cognitive Level
CO 1	To identify and recall the basic principles of new product development and its evaluation.	K1, K2
CO 2	To calculate the amount of ingredients required to develop a standardized novel food product.	K3
CO 3	To develop new products with suitable food processing and preservation technique.	K4
CO 4	To evaluate the role of ingredients in product formulation.	K5
CO 5	To propose and formulate a novel product with added functional and nutritional value.	K6

COURSE DESCRIPTOR

Course Code	PFP4MC01
Course Title	FOOD QUALITY, SAFETY AND FOOD LAWS.
Credits	6
Hours/week	05
Category	Major Core (MC) – Theory
Semester	IV
Regulation	2022
<p>Course overview</p> <ol style="list-style-type: none"> 1. The course will provide fundamental theoretical concepts on quality and safety attributes, systems in the food sector. 2. The content gives the opportunity for food handlers to identify causes for unsafe food production, draft corrective and prevention procedures to eliminate food related hazards. 3. This course discusses the principles and concepts for developing HACCP/FSMS procedures and plans. 4. The course focusses on the history and purpose of food law/standards and its importance in trade and commerce. 5. It discusses the legal requirements for an effective processing environment to produce safe food for human consumption. 	
<p>Course Objectives</p> <ol style="list-style-type: none"> 1. To gain an understanding on the food safety/quality aspects for food industries. 2. To apply the principles of safety and quality systems to control food risks/hazards and assure the quality of food products. 3. To develop procedures and approaches to identify food contamination and implement HACCP and FSMS plans. 4. To evaluate the required standards, laws and regulations to effectively handle food business operations. 5. To be aware and updated on current topics of importance to safe food production and legal requirements. 	
Prerequisite:	Knowledge on Food processing and Microbiology.

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVELS
I	<p>Quality programmes and systems for the food industry: Scope of food quality and food safety activities-Food safety as part of food quality. Food quality attributes -Quality assessment of food materials during and after processing. Role of Quality Control and Quality assurance in the food industries. Quality plan, Quality manuals. Quality improvement -Total Quality Management-Principle and implementation, Quality improvement tools, customer focus, cost implications of quality systems.</p>	15	CO1, CO2, CO3, CO4, CO5.	KI, K2, K3, K4, K5, K6.
2.	<p>Food safety Food safety -Definition and terms Safety in food procurement, handling, preparation storage and distribution. Food Adulteration- IPC provisions on food adulteration.Food allergens and its management. Food Biosecurity,Food defense, Food bioterrorism and protection measures.</p>	15	CO1, CO2, CO3, CO4, CO5.	KI, K2, K3, K4, K5, K6.
3.	<p>Food Safety Management System: Prerequisite programmes, Codex Alimentarius, logic sequence for the application of HACCP - 12 steps - CCP, HACCP plan, monitoring and corrective action, calibration of monitoring devices, Food inspection and product recall, withdrawal, documentation and record keeping validation of controls, verification, traceability and recall. Management commitment and</p>	15	CO1, CO2, CO3, CO4, CO5.	KI, K2, K3, K4, K5, K6.

	<p>responsibility.</p> <p>Role of HACCP in sanitation.</p> <p>Implementation and integrating HACCP system with FSMS/ISO 22000 standards</p> <p>Emerging concerns and newer approaches to food safety, GFSI initiatives.</p> <p>Certification/Certifying bodies, Accreditation and Auditing,</p>			
4	<p>International Food laws, regulations, standards and Food control systems/Guidelines to food safety</p> <p>Historical Perspectives of food laws and regulations- Purpose of laws to enforce safety and purity of food products- Harmonized Food Standards for international trade, WTO</p> <p>International regulatory bodies dealing with food standardization: Codex Alimentarius Commission, ISO, FAO/WHO standards, standard setting and advisory mechanism.</p> <p>Country specific standards EU, EPA, USFDA, FSMA.</p> <p>Retailer Standards an overview -BRC, SQF, IFS –relations with national laws.</p> <p>Current trends in Food Standardization.</p>	10	CO1, CO2, CO3, CO4, CO5.	KI, K2, K3, K4, K5, K6.
5	<p>National Food Laws:</p> <p>Government Regulatory System for Food</p> <p>Legal compliances specific to Food industry in relation to food quality/ safety in India.</p> <p>Mandatory and voluntary food laws.</p> <p>Food Safety & Standards Act 2006, Food safety and standard rules 2011 (as amended from time to time).</p> <p>FSSAI - Implementing Agencies, Governing bodies -penalties.</p>	10	CO1, CO2, CO3, CO4, CO5.	KI, K2, K3, K4, K5, K6.

	<p>Consumer Protection Act - Export import regulations -Environment Protection Act.</p> <p>Role of referral labs, FSSAI notified laboratories and State Food laboratories and functions. Role of Government in food safety risk analysis.</p> <p>Regulations in regard to safety assessment of food contaminants and pesticide residues, Safety aspects of water.</p> <p>FSS regulations as updated.</p> <p>Patenting and Indian legislations for Intellectual Property Rights (IPR).</p>			
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Text Books

1. Carol A. Wallace, William H. Sperber and Sara E. Mortimore (2018). Food Safety for the 21st Century Managing HACCP and Food Safety Throughout the Global Supply Chain, 2nd edition, John Wiley & Sons Ltd.
2. FSSAI Basic Food safety handbook/Manual for Food manufacturers, Processors and packers 2017.
3. Inteaz Alli, (2004). Food Quality Assurance Principles and Practices, CRC Press.
4. Mortimore S. and Wallace C (2013). HACCP, A practical approach, 3rd Edition, Chapman and Hill, London.
5. Ronald H. Schmidt and Gary E. Rodrick (2003), Food Safety Handbook, John Wiley & Sons, Inc.

Suggested Readings

1. Forsythe, S.J. (2010), The Microbiology of Safe Food, 2nd edition, Willey-Blackwell, U.K.
2. Lawley, R., Curtis L. and Davis, J. (2004) The Food Safety Hazard Guidebook, RSC publishing.
3. FSSAI Manual – Current Version.
4. Export/Import policy by Govt of India.

Web Resources

- <https://www.cdc.gov/foodsafety/cdc-and-food-safety.html>
- <https://www.fao.org/food-safety/en/> Websites of FSSAI

Course outcomes (CO) and Cognitive level mapping

COs	CO Description	Cognitive levels
CO1	Explain and classify the nomenclature related to food quality, safety and legality.	K1, K2
CO2	Apply the technical concepts and know how's to promote food quality and safe food handling techniques.	K3
CO3	Identify the food issues and develop solutions based on the food system standards and legal requirements.	K4
CO4	Evaluate the food safety/quality systems and suggest continual improvement programmes.	K5
CO5	Devise methods to ensure food safety in new arising situations, generate management systems and implement QMS and FSMS certification for FBO's.	K6

COURSE DESCRIPTOR	
Course Code	PFP4MC02
Course Title	FOOD ADDITIVES AND FOOD TOXICOLOGY
Credits	07
Hours/Week	06
Category	Major Core (MC) - Theory
Semester	IV
Regulation	2022
Course Overview:	
<ol style="list-style-type: none"> 1. This course describes the importance, classification and mechanism of action of preservatives and antioxidants. 2. This course also explains the chemistry of colourants, factors affecting the stability of colourants and structural modalities of flavouring agents. 3. It illustrates the principle and function of emulsifiers, stabilizers and flour enhancers. 4. The course also aims to provide the knowledge on various food toxins and their health impacts. 5. This course explains the types of contaminants and adulterants, their potential toxicity and detection. 	
Course Objectives:	
<ol style="list-style-type: none"> 6. To understand the definitions, types, functions and mode of action of additives. 7. To explain the stability of colourants and biosynthesis of flavouring agents. 8. To recognize the properties, role, applications and effects of emulsifiers and stabilizers. 9. To study the sources, classification, determination, impact and effect of toxicants. 10. To learn about toxicants generated during processing, packaging and contaminants from agrochemicals in food. 	
Prerequisites:	Basic knowledge on different food additives and toxicants.

SYLLABUS		HOURS	COs	Cognitive levels
UNIT	CONTENTS			
I	Food additives- Definitions, functional classifications, Intentional and unintentional additives; Regulations of food additives. Preservatives-Definition, classification and function of preservatives in food processing and preservation. acidulants – organic acids and esters, sulphur dioxide and its salts, nitrites and antibiotics. Surface preservation; Permitted chemical preservatives in foods. Antioxidants-natural and chemical antioxidants; mechanism of antioxidant function; primary and secondary antioxidants; selection and application of antioxidants in foods; permitted antioxidants in foods; Sequestrants, evaluation of antioxidant effectiveness. Chelating agents: types, uses and mode of action. Fortification and its uses	15	CO1 CO2 CO3 CO4 CO5	K1, K2, K3 K4, K5, K6
II	Food Colours: Types, Pigments in animals and plants tissues-carmine colour from insects; chemistry and colour (oxidation, discolouration); colour change on processing – influence of heat, pH and light. Technology of colour preservation–enzymic- metallo complex formation; Food Flavours: Taste structural basis-sweet, bitter, salt and sour taste models; Flavouring agents–concept and types; Flavour enhancers-MSG and maltol; astringency and pungency; vegetable and spice flavours; Odour: theory and sense of odour - flavours from shikimic acid pathway. Volatile terpenoids; Fish food flavours; thermally induced flavours.	15	CO1 CO2 CO3 CO4 CO5	K1, K2, K3 K4, K5, K6

III	Emulsifiers and stabilizers – Definition, properties and function; HLB value; permitted emulsifiers and stabilizers used in food; Flour improvers- Leavening agents - activity analysis of yeast and gas retention. Batters- gas productive and retention-baked product; Anticaking agents-pH control. Sweeteners-classification, Structure-comparison of different sweetness-adverse effects. physical and chemical properties of polyols, application in food industries, permitted polyols in foods. Bio sweeteners, restriction on the use of sweeteners in foods; Food acids – their function and application in foods; permitted food acids; nutritive additives; enrichment of foods.	16	C01 C02 C03 C04 C05	K1, K2, K3 K4, K5, K6
IV	Definition and Principles of Toxicology; Classification of toxic agents; Characteristics of exposure; Sources of toxins in food - toxins of plant and animal origin, antinutritives, microbial and marine toxins; Chemical and biological methods of determination of toxicants in foods and their management. Biotransformation and mechanisms of toxicity; Toxicological impact of food additives- azo dyes, sodium benzoate, sulfites, Monosodium glutamate, Saccharin, Amaranth, Annato and diacetyl. Food allergies: natural sources and chemistry of food allergens; handling of food allergies; Food sensitivities-anaphylactoid reactions, metabolic food disorders and idiosyncratic reactions.	16	C01 C02 C03 C04 C05	K1, K2, K3 K4, K5, K6
V	Toxicants generated during food processing- Nitrosamines, acrylamide, polyaromatic hydrocarbons, Heterocyclic amines, dioxins, nitrites and nitrates. Toxicants derived during Packaging; Contaminants and drug residues in food- agrochemicals and pesticide residues in foods, carbamate and organophosphate insecticides; heavy metal residues - Health	16	C01 C02 C03 C04 C05	K1, K2, K3 K4, K5, K6

	<p>impacts; persistent organic pollutants, veterinary drug residues- radioactive contamination of food, and other contaminants in food; Common food adulterants, their potential toxicity and detection; Endocrine disrupters in food.</p>			
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Textbooks for reference:

1. Branen, A.L., Davidson PM & Salminen S. 2001. Food Additives. 2nd Ed. Marcel Dekker.
2. Gerorge, A.B. 2004. Fenaroli's Handbook of Flavor Ingredients. 5 th Ed. CRC Press.
3. Madhavi, D.L., Deshpande, S.S & Salunkhe, D.K. 1996. Food Antioxidants: Technological, toxicological and Health Perspective. Marcel Dekker
4. Fennema, R.O (1997) Food Chemistry, Second Edition, Food Science & Technology series, Marcel Dekker, INC., New York.
5. Shibamoto, T., and Bjeldanes, L. F. (2009). Introduction to food toxicology.

Suggestive Readings:

1. Shabbir S. (2007). Food Borne Diseases. Humana Press
2. Tweedy BG. (1991). Pesticide Residues and Food Safety. Royal Society of Chemistry.
3. Rechcigl, M. (2018). *Handbook of naturally occurring food toxicants*. CRC press.

CO – Cognitive Level Mapping

	CO Description	Cognitive Level
CO 1	To understand and recall the definitions and principles of food additives, food colours, emulsifiers, stabilizers and toxicology.	K1, K2
CO 2	To analyse the presence of food preservatives, food colours, emulsifiers, food additives and toxic compounds present in food.	K3
CO 3	To illustrate the characteristics of food preservatives, flavouring agents, flavour enhancers and their impacts during processing.	K4
CO 4	To outline the importance and toxicity of preservatives, pigments, sweeteners, food additives, common food adulterants and endocrine disrupters in food.	K5
CO 5	To explain the role of food additives, chelating agents, fortification, leavening agents, and food adulterants.	K6

COURSE DESCRIPTOR

Course Code	PFP4MC03
Course Title	FOOD SAFETY LAB
Credits	2
Hours/week	04
Category	Major Core (MC) - Lab
Semester	IV
Regulation	2022
<p>Course overview</p> <ol style="list-style-type: none"> 1.The course creates awareness and imparts technical knowledge on the practical skills to design quality and safety systems for the food industry. 2.It outlines the practices to be followed for control of food related hazards/risks and monitoring of the food processing environment. 3.The contents of the course helps develop sound understanding to draft, design and handle food processing operations for the HACCP/ISO certifications in the food industry. 4.It gives a provision for training and obtaining food safety awareness course certification from approved agencies. 5. This course also will review the situations and prevailing conditions in the food sector and equip the students with current updates to face the challenges. 	
<p>Course Objectives</p> <ol style="list-style-type: none"> 1.To explore and apply the required food safety measures for safe food production. 2. To identify and make available practices, procedures and plans to eliminate problems that are a possible threat to food safety. 3.To prepare HACCP/FSMS based procedures, documents and establish food safety systems. 4.To demonstrate the ability to conduct food safety audits in the food industries to facilitate safe food production. 5.To evaluate and maintain the required updates in quality/safety systems and legal requirements for the food businesses. 	
Prerequisite :	Knowledge on food microbiology, processing, hygiene and sanitation.

SYLLABUS

S.No	Experiments	Hours	COs	Cognitive levels
1.	Sanitary considerations for designing the layout of a Food establishment <ul style="list-style-type: none"> • Draw the structure and layout of Food premises • Selecting and installing equipment based on Sanitation Standards. • Utilities • Hygiene guidelines for designing the manufacturing premises as per legal requirements • Elaborate GMP (Good Manufacturing Process), GHP (Good Hygiene Practices) Prerequisites. 	52	CO1, CO2, CO3, CO4, CO5.	K1, K2, K3 K4, K5, K6
2.	Drafting of GMP, SOP & SSOP for a food factory. <ul style="list-style-type: none"> • Identifying the key focus areas. • Step by step procedure to write a GMP,SOP,SSOP. 		CO1, CO2, CO3, CO4, CO5.	K1, K2, K3 K4, K5, K6
3.	Development of a food safety policy e.g., Jewellery policy, Personnel Hygiene policy		CO1, CO2, CO3, CO4, CO5.	K1, K2, K3 K4, K5, K6
4.	Development of <ul style="list-style-type: none"> • HACCP team • Product description. • Product flow diagram./Process flow including all inputs, outputs and interim loops. 		CO1, CO2, CO3, CO4, CO5.	K1, K2, K3 K4, K5, K6

5.	Development of FSMS Module <ul style="list-style-type: none"> Hazard identification Hazard analysis worksheet- Risk assessment 		CO1, CO2, CO3, CO4, CO5.	K1, K2, K3 K4, K5, K6
6.	Development of FSMS Module <ul style="list-style-type: none"> Determination of CCP (Critical Control Point) 		CO1, CO2, CO3, CO4, CO5.	K1, K2, K3 K4, K5, K6
7.	Development of FSMS Module Development of OPRP and FSMS/HACCP Plan		CO1, CO2, CO3, CO4, CO5.	K1, K2, K3 K4, K5, K6
8.	Internal Audit – Schedule, Preparation of an audit checklist. Case study.		CO1, CO2, CO3, CO4, CO5.	K1, K2, K3 K4, K5, K6
9.	Food laws identification of legal requirements for the following Food groups: (a) Fruit & Vegetable (b) Dairy (c) Meat & meat products (d) Fish & seafoods (e) RTE. Labelling of foods.		CO1, CO2, CO3, CO4, CO5.	K1, K2, K3 K4, K5, K6
10.	ISO 22000:2018 Certification course An overview and Structure of 22000, Clause wise Interpretation of ISO 22000, Case		CO1, CO2, CO3,	K1, K2, K3 K4, K5, K6

	Studies.		CO4, CO5.	
11.	Food safety Awareness (FOSTOC Training) (or)FEMA– Certification course.		CO1, CO2, CO3, CO4, CO5.	K1, K2, K3 K4, K5, K6

Text Books

1. Codex Alimentarius International Food standards (2011) General principles of food hygiene.
- 2.FSSAI Training Manual Food Safety Supervisor Course Advance (Level 2) Manufacturing. (2017).
- 3.FSSAI Basic Food safety handbook/Manual for Food manufacturers, Processors and packers (2017).
4. ISO 22000 (2018).Food safety management systems — Requirements for any organization in the food chain Second edition.

Suggested Readings

1. Lelieveld H. L. M., Mostert M. A and J. Holah(2005).Handbook of hygiene control in the food industry, Woodhead Publishing Limited and CRC Press LLC .
- 2.Mortimore S. and Wallace C (2013). HACCP, A practical approach, 3rd Edition, Chapman and Hill, London.

Web Resources

<https://archive.fssai.gov.in/home/compliance/FOOD-SAFETY-INSPECTION-CHECKLISTS-.html>

<https://www.fao.org/fao-who-codexalimentarius/codex-texts/all-standards/en/>

<https://www.bis.gov.in/index.php/system-certification-overview/auditor-handbook/>

<https://aoac-india.org/webinar-series-on-food-analysts-examination-and-fssai-act-2006-by-dr-lalitha-gowda/>

<https://law.resource.org/pub/bis/is.16021.2012>

[Websites of FSSAI](#)

Course outcomes (CO) and Cognitive level mapping

COs	CO Description	Cognitive levels
CO1	Recognize the terms and definitions related to food quality and safety.	K1, K2
CO2	Demonstrate the ability to explore and apply proper food handling techniques that will result in safe food production and processing environment.	K3
CO3	Identify and develop practices and procedures to eliminate problems that are a possible threat to food safety.	K4
CO4	Determine drafts and plans to execute the HACCP/FSMS and implement the food safety program in a food industry.	K5
CO5	Assemble and compile the required documents for auditing and obtaining the certifications for the Food Business Operations (FBO's).	K6

COURSE DESCRIPTOR

Course Code	PFP4PJ01
Course Title	PROJECT
Credits	5
Hours/week	15
Category	PROJECT (PJ)
Semester	IV
Regulation	2022
Course Objectives	
<ol style="list-style-type: none">1. To introduce the purpose and importance of research for future development and sustenance.2. To make the students plan and carry out the research work.3. To learn the methodology of writing thesis and research articles in journals.	
Prerequisite :	Interest in review writing and research

Evaluation of the Project Work:

The Controller of Examination appoints an External Examiner from the Panel of Examiners submitted by the Supervisor through the Head of the Department. Both the Supervisor and External Examiner will conduct the viva voce examination to the candidate and award marks.

Total Marks: 100

Quality of the Project Work and Dissertation : 50 Marks

Marks Oral Presentation : 25 Marks

Viva-voce : 25 Marks

There will be counseling for students regarding facilities available and about the Professors offering guidance. They can choose the topic of the project and the guide at the beginning of III semester. In case the student requires extension of time for submitting the dissertation, University rules will be followed.

COURSE DESCRIPTOR

Course Code	PFP2ME01
Course Title	FUNCTIONAL FOODS AND NUTRACEUTICALS
Credits	2
Hours/Week	4
Category	Major Elective (ME) – Theory
Semester	II
Regulation	2022
Course Overview	
<ol style="list-style-type: none"> 1. Functional foods and Nutraceuticals is associated with foods having bioactive substances providing health benefits and reduced risk of diseases. 2. The course is vital to elucidate the mechanism of action of the various bioactive substances. 3. The course imparts knowledge on the properties of phytochemicals and zoochemicals in prevention, treatment and management of non-communicable diseases. 4. The contents of the course reviews nutraceutical and herbal compounds available in the market, their health claims, and the evidence for their efficacy, safety, and adverse mechanisms in dietary supplement formulations. 5. The course aims to enthuse students to formulate and commercialize new products with functional ingredients that are nutritionally feasible, technically sound and compliant with national and international regulations. 	
Course Objectives	
<ol style="list-style-type: none"> 1. To recognize the impact of functional foods and nutraceuticals on health and wellness. 2. To compare and contrast the methods of classification, identification, extraction and characterization of functional foods and nutraceuticals. 3. To evaluate the safety implications and therapeutic applications of functional foods and nutraceuticals in the prevention, treatment and management of non-communicable diseases. 4. To critically examine the legal aspects and technical feasibility of formulating and labeling functional foods, dietary supplements and nutraceuticals with industry specifications. 5. To formulate bioactive functional food and nutraceutical products through a holistic approach that is in compliance with the health claims and regulatory framework. 	
Prerequisites Basic knowledge of food science and nutrition.	

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	<p>Concept of Functional Foods</p> <p>Background: Historical perspective and evolution of health care and functional foods; Concept and Definition; relationship between functional foods, nutraceuticals, health and disease. Effect of processing on functional food ingredients.</p> <p>Classification: Dietary Fiber, Fatty Acids, Herbals And Botanicals, Soy Components, Vitamins and Minerals, Phytochemicals, Probiotics. Prebiotics and Synbiotics</p>	13	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6
II	<p>Nutraceuticals as science</p> <p>Introduction: Definition, Classification of nutraceuticals based on chemical nature, structure; food source; amount of nutraceutical substance and mechanism of action.</p> <p>Phytochemicals as nutraceuticals: Identification and extraction of bioactive components from microbes, plant and animal sources.</p>	10	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6
III	<p>Functional Foods, Nutraceutical And Health</p> <p>Use of functional foods and nutraceuticals in the treatment of colonic health, cardiovascular health; cancer prevention; weight management.</p> <p>Use of functional foods and nutraceuticals in the treatment bone health; mental health; respiratory health and oral health.</p> <p>Use of functional foods and nutraceuticals in the treatment women's health and enhancement of sporting performance.</p>	13	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6
IV	<p>Efficacy, Safety and Toxic Interactions</p> <p>Efficacy and Safety: Metabolism and bioavailability of nutraceuticals; Meta-</p>	8	CO1 CO2 CO3	K1, K2, K3, K4, K5, K6

	analyses; and systematic reviews of nutraceutical clinical trials, Safety and beneficial interactions Nutraceutical interactions: Toxic contamination of nutraceuticals and food ingredient, interactions between nutraceuticals/nutrients and therapeutic drugs, herb and drug interactions.		CO4 CO5	
V	Regulations Governing Functional Foods And Nutraceuticals Health Claims Introduction of consumer marketing issues for Nutraceuticals and Functional Foods FSSAI regulations - Food Safety and Standards (Health Supplements, Nutraceuticals, Food for Special Dietary Use, Food for Special Medical Purpose, Functional Food, and Novel Food) Regulations, 2016 and Amendments. DISHA. Japan regulation -Foods for Specified Health Uses (FOSHU), Food for Special Dietary Uses (FOSDU), Foods with Nutritional Function Claims (FNFC) EU legislation, US legislation under NLEA-Health claims approved by FDA - Health Claims That Meet Significant Scientific Agreement (SSA); Qualified Health Claims; Structure/Function Claims; Nutrient Content Claims.	8	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6
Text Books				
<ol style="list-style-type: none"> 1. Aguilar, C.N., & Hagi, A.K. (Eds.). (2021). Functional Foods and Nutraceuticals for Human Health: Advancements in Natural Wellness and Disease Prevention (1st ed.). Apple Academic Press. https://doi.org/10.1201/9781003097358. 2. Brian Lockwood,(2007) Nutraceuticals A guide for healthcare professionals, Second edition, Pharmaceutical Press. 3. Gupta, R. C. (2016). Nutraceuticals: Efficacy, safety and toxicity. London : Academic Press. 4. Johnson I. and Williamson G. ed.(2003) Phytochemical functional foods, CRC Press, Boca Raton Boston New York Washington, DC. 5. Ram B. Singh (2021) Functional Foods and Nutraceuticals in Metabolic and Non-communicable Diseases 1 Academic Press. https://doi.org/10.1016/C2019-0-00254-3 				

Suggested Reading

1. Arnoldi, A. (2004) Functional foods, cardiovascular diseases and diabetes. Woodhead publishing limited and CRC press LLC.
2. Chukwuebuka Egbuna, Genevieve Dable Tupas (2020) Functional Foods and Nutraceuticals: Bioactive Components, Formulations and Innovations 1st ed. Springer International Publishing <http://doi.org/10.1007/978-3030-42319-3>
3. Eskin, N. A. M., & Tamir, S. (2006). Dictionary of nutraceuticals and functional foods. Boca Raton, FL: Taylor & Francis Group/CRC Press.
4. Salminen, S., Lee, Y.K (2009) Handbook of Probiotics and Prebiotics. John Wiley & Sons. Inc. New Jersey.
5. Shannon Brown (2009) Functional Foods and Beverages in the U.S. 4th Edition May New Orleans, LA.

Web Resources

1. https://onlinecourses.swayam2.ac.in/cec22_ag02/preview
2. <https://rb.gy/3azl33>
3. <https://bit.ly/34QLp4U>
4. <https://bit.ly/3BaDIZb>

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Level
CO 1	To identify and describe the meaning, classification, properties, structure and potential applications of functional foods and nutraceuticals.	K1, K2
CO 2	To illustrate the classification, efficacy, therapeutic applications and product formulations using bioactive substances.	K3
CO 3	To examine the regulatory compliance, technical feasibility, safety and adverse effects of nutraceuticals and dietary supplements.	K4
CO 4	To assess the efficacy of functional foods and nutraceuticals in normal health and therapeutic conditions.	K5
CO 5	To summarize the methods of identification, characterization, extraction, safety evaluation and regulations concerning phytochemicals and zoochemicals and its impact on lowering risk factors of chronic diseases.	K6

COURSE DESCRIPTOR	
Course Code	PFP2ME02
Course Title	MANAGEMENT OF LIFESTYLE DISEASES
Credits	2
Hours/week	4
Category	Major Elective (ME) Theory
Semester	II
Regulation	2022
<p>Course Overview:</p> <ol style="list-style-type: none"> 1.Globalisation and industrial revolution has widened the spread of lifestyle diseases at a faster pace leading to a heightened interest in nutrition and healthy lifestyle practices. 2. The aim of this course is to provide an in-depth understanding of the various aspects of lifestyle disease management and providing intervention models for the prevention and treatment of lifestyle-related diseases namely obesity,cardiovascular diseases, diabetes, some neurological conditions and cancers. 3. The different units of the course covers details pertaining to the principles and interventions that apply to individual health behaviours and food pattern for both short and long-term health outcomes. 4. Important aspects of the course covers information related to nutritional requirement for significant changes at every stage of the normal life cycle in order to maintain optimal state of health and wellness. 5.The course intends to create and inculcate healthy food habits and adopt positive behavioural changes to overcome and manage lifestyle diseases. 	
<p>Course Objectives:</p> <p>OBJECTIVES:</p> <ol style="list-style-type: none"> 1. To introduce basic concepts of health and wellness in the management of healthy lifestyle pattern. 2. To understand and evaluate the health status using nutritional assessment tools and providing comprehensive nutrition care process. 3. To provide a fundamental understanding on the etiology, pathophysiology and dietary management of non communicable diseases. 4.To inculcate the importance of food behaviours and its impact on physical, emotional and social well -being in promoting the quality of life to prevent lifestyle diseases. 5. To sensitizeze the importance of healthy food and lifestyle practices and its role at every stage in the life cycle. 	
Prerequisites:	Basic knowledge in life science and human nutrition.

SYLLABUS			COs	Cognitive level
UNIT	CONTENTS	HOURS		
I	<p>An Introduction to Health and Lifestyle Diseases</p> <ul style="list-style-type: none"> ○ Health - Definition and foundation of good health –Concepts of health and Disease – Requirements of good health ○ Health indicators – Dimensions and Determinants of health ○ Diseases- Classification and types – CDs and NCDs – An introduction ○ Lifestyle diseases - Definition and Risk factors - Diagnosis and classification of NCDs - Modifiable and Non-modifiable risk factors for NCDs – Global trends 2030 for NCDs 	10	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6
II	<p>Role of Nutrition in Management of Lifestyle Diseases</p> <ul style="list-style-type: none"> ○ The role of nutrition in treating and preventing common lifestyle diseases. ○ The Nutritional Care Process: Nutritional Assessment; Nutritional diagnosis; Nutritional intervention; Nutritional monitoring and evaluation. ○ Dietary guidelines and nutrition prescriptions Lifestyle Disease conditions ○ Integration of dietary management and physical activity 	10	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6
III	<p>Metabolic disorders and Dietary management</p> <ul style="list-style-type: none"> ○ Cardiovascular diseases -Prevalence - Epidemiology of the disease among different ethnic groups- Physiological symptoms and disturbances – Diagnostic criteria ○ Obesity, Diabetes Mellitus and Hypertension: Prevalence - Epidemiology of the disease among 	12	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6

	<p>different ethnic groups- Physiological symptoms and disturbances – Diagnostic criteria</p> <ul style="list-style-type: none"> ○ Etiology and pathogenesis in the onset of disease condition. ○ Importance of diet and exercise in treating, preventing and management of the disease condition 			
IV	<p>Cancer and Dietary management</p> <ul style="list-style-type: none"> ○ Prevalence, Characteristics and types - Etiology; Physiological symptoms and disturbances; diagnosis ○ Cancer therapy and its complications - Chemotherapy, Radiation therapy and Surgery. ○ Etiology and pathogenesis in the onset of disease condition. ○ Dietary management for cancer related to lifestyle and dietary imbalances. 	10	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6
V	<p>Holistic approach to lifestyle disease management:</p> <ul style="list-style-type: none"> ○ Physiological, Psychological and behavioural changes – Inter-relationship between stress and health ○ Importance of sleep – Sleep pattern and rhythm cycle and impact on health ○ Emotional and Mental Well-being – an intervention for lifestyle diseases 	10	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6

Textbooks for reference:

1. Kraus M. V. and L. K. Madan (2010)- Food; Nutrition and Therapy; W. B. Saunders Company; London; 12th Edition.
2. Robinson; C. H; M. R. Lawler; W. L. Chenoweth and A. E. Garwick (2004) Normal and Therapeutic Nutrition; 17th ed; Mac Millan Pub. Co
3. Kumar.K (2004) Guide to Prevention of Lifestyle Diseases, Deep and Deep Publications
4. Bharat B. Aggarwal, Sunil Krishnan, Sushovan Guha (2011) Inflammation, Lifestyle and Chronic Diseases: The Silent Link Oxidative Stress and Disease, CRC Press
5. James M.R (2013) Lifestyle Medicine, 2nd Edition, CRC Press.
6. Akira Miyazaki et al (2008) New Frontiers in Lifestyle-Related Disease, Springer.

Suggestive Readings:

1. Frates B, Bonnet JP, Joseph R, Peterson JA (2021) Understanding lifestyle medicine. Lifestyle Medicine Handbook: An Introduction to the Power of Healthy Habits. Monterey, CA, Healthy Learning.
2. Egger G, Binns A, Rossner S (2010). Chapter 1 Introduction to lifestyle medicine. In: Egger G, Binns A, Rossner Lifestyle Medicine: Managing Diseases of Lifestyle in the 21st Century. 2nd ed. North Ryde, Australia: McGraw-Hill.
3. DeCourten M, Egger G. Chapter 2 The epidemiology of chronic disease. In: Egger G, Binns A, Rossner Lifestyle Medicine: Managing Diseases of Lifestyle in the 21st Century. 2nd ed. North Ryde, Australia: McGraw-Hill; 2010.

Web resources:

1. <https://www.un.org>
2. <https://www.cdc.gov>
3. <https://www.hsph.harvard.edu> > nutrition source > disease.
4. <http://www.instituteoflifestylemedicine.org>

Course outcomes (CO) and Cognitive level mapping		
MANAGEMENT OF LIFESTYLE DISEASES (ME)		Cognitive Level
CO 1	To recognize the importance of health indicators and lifestyle pattern in determining the health and well-being of a society.	K1, K2
CO 2	To classify lifestyle and degenerative diseases and associate with food consumption and physical activity to prevent the onset of noncommunicable diseases.	K3
CO 3	To determine the etiology, pathophysiology and management of various disease conditions and select appropriate dietary habits in overcoming the disease condition.	K4
CO 4	To predict the prognosis of a lifestyle disease by adopting Nutrition Care Process in ameliorating the disease condition on a long term basis.	K5
CO 5	To create novel ideas in compiling dietary regime for normal and therapeutic conditions associated with lifestyle change and improper dietary habits.	K6

COURSE DESCRIPTOR	
Course Code	PFP3ME01
Course Title	SUSTAINABLE FOOD MANAGEMENT
Credits	2
Hours/Week	4
Category	Major Elective (ME)-Theory
Semester	III
Regulation	2022
Course Overview:	
<p>1. The course emphasizes the SMART goal- setting, power of networking, principles and functions of management in an organization.</p> <p>2. This course explores current issues related to food security, and agricultural sustainability from a local, regional, national and international perspective. It focusses on sustainable food production solutions such as inter cropping, regenerative agriculture highlighting the significance of food waste management.</p> <p>3. This course provides an understanding of the food supply chains, such as Public Distribution Systems, and agricultural subsidies offered by the government.</p> <p>4. The course focuses on product pricing strategies, food costing, pricing and distribution control.</p> <p>5. This course offers a better understanding of government initiatives/policies for the farmers and resource conservation.</p>	
Course objective:	
<p>1. To introduce the basic concepts of Management, Organizational behaviours, depreciation and appreciation systems.</p> <p>2. To emphasize the need for sustainable agriculture to achieve zero hunger.</p> <p>3. To understand Government policies on food supply chains and the constraints involved.</p> <p>4. To explore the food based dietary approaches; national and international policies that influences food systems.</p> <p>5. To provide information on the role of government and non-governmental organization in India and its contribution towards the progress of food sector and sustainability.</p>	
Prerequisites:	Knowledge on Food Science and Life Science.

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE MAPPING
I	<p>Basics on Management:</p> <p>Management: Concept of Management, Management Arts and Science, Management skills, levels of management. Fayol's administrative management, Managerial ethics. Workflow in the industry . Business forecasting: definition and methods of forecasting. Demand and supply analysis. Decision making: Characteristics, process of decision making and types of decisions. Machinery evaluation: appreciation and depreciation.</p>	10	CO1,CO2,CO3, CO4,CO5	K1,K2,K3,K4, K5,K6
II	<p>Sustainable food system:</p> <p>Food security at the national and house hold levels. Trade, irrigation policies, nutrition policies, fertilizers and credit, other policies, macro and development strategies. Farming and agricultural practices. Climate change and food security. Food Supply Chain management: PDS advantages and disadvantages. Agro forestry and agro ecology. Post harvest and Food waste management in India.</p>	12	CO1,CO2,CO3, CO4,CO5	K1,K2,K3,K4, K5,K6

III	<p>Pricing , food cost control and food buisness operations:</p> <p>Pricing: definition, factors affecting pricing, kinds of pricing, product pricing strategies.Introduction to Cost Control, Definition, Objectives and Advantages of Cost Control, Basic costing.Food costing: Calculation of food cost. Channels of distribution, middlemen and franchise, wholesaler and retailer.Food Buisness operators management, cloud kitchen operations.</p>	10	CO1,CO2,CO3, CO4,CO5	K1,K2,K3,K4, K5,K6
IV	<p>Organisation role in food processing:</p> <p>Overall view of central industries and the nature of work carried out - Facility and expertise available, CFTRI, DFRL, NIFTEM, NDRL, NDRI, NABI, NECC - Activities and role in food processing and manufacture. Spice board, coffee and tea development board.</p>	10	CO1,CO2,CO3, CO4,CO5	K1,K2,K3,K4, K5,K6
V	<p>Food manufacturing and Food Policies in India:</p> <p>Food manufacturing scenario in India: Agriculture as industrial setup and Agro based industries - forward and backward linkages. Food security policies in India- challenges and performances. Resilience based on local diversity foods.</p>	10	CO1,CO2,CO3, CO4,CO5	K1,K2,K3,K4, K5,K6

Textbooks for reference:

1. Monika Thakur, V.K. Modi, Renu Khedkar, Karuna Singh. Sustainable Food Waste Management: Concepts and Innovations (2021).
2. Robert Biel, Sustainable food systems (2018) UCL press.
3. Jos Mooij Food Policy and the Indian state : The public distribution system in India (1998).
4. Daniele Giovannucci et al., (2012). Food and Agriculture: The future of sustainability, United Nations Publishers.
5. Harold Koontz, Heinz Wehrich, Ramachandra Aryasri, (2010). Principles of Management, 12th edition, Tata McGraw Hill Pvt. Ltd.

Suggestive Readings:

1. "Biodiversity, Food and Nutrition: A New Agenda for Sustainable Food Systems" by Danny Hunter, Teresa Borelli and Eliot Gee.
2. WASTE: Uncovering the Global Food Scandal by Tristram Stuart.
3. Stuffed and Starved: Markets, Power and The Hidden Battle For The World Food System.
4. The Way We Eat: Why Our Food Choices Matter .

Web resources:

- <https://www.fao.org/3/y4671e/y4671e05.htm#TopOfPage>
<https://www.avristech.com/food-waste-management-in-india/>

COs	CO Description	Cognitive Level Mapping
CO 1	To recognize the mechanism of effective management systems in food sector and the initiatives taken at the regional, national and global levels on food sustainability.	K1, K2
CO 2	To examine the management principles governing food systems and the roles of government sectors and NGOs on food security.	K3
CO 3	To calculate the food cost and translate the knowledge obtained for an effective food business operations and food sustainability.	K4
CO 4	To assess the food manufacturing scenario, distribution patterns, food costing and minimizing post-harvest wastage in India,	K5
CO 5	To generate plans on decision making and goal setting to sensitize on food production to create awareness on food security /supply/ demand.	K6

COURSE DESCRIPTOR

Course Code	PFP3ME02
Course Title	ENTREPRENEURS FOR FOOD INDUSTRIES
Credits	2
Hours/Week	4
Category	Major Elective (ME) – Theory
Semester	III
Regulation	2022
Course Overview	
<ol style="list-style-type: none"> 1. The course on entrepreneurs for food industries encourages the entry into food processing sector by understanding the key issues faced by entrepreneurs at different stages of an enterprise. 2. The course lays foundation by outlining the elements in the entrepreneurial process from ideation to opportunity and from opportunity to a business plan. 3. The course offers understanding on food markets, consumer behavior, products, technology and legal standards in agri-entrepreneurship. 4. The contents of the course integrate functional aspects of entrepreneurship such as marketing, finance, manufacturing, and human resources. 5. The course also gives a basic understanding on the various governmental support systems available for the promotion and development of start-ups in food industries. 	
Course Objectives	
<ol style="list-style-type: none"> 1. To inculcate the skills necessary to start and sustain an entrepreneurial venture. 2. To analyze the business environment, recognize opportunities and generate business ideas. 3. To understand the process of setting up small enterprises. 4. To make critical decisions in marketing plan of food products. 5. To acquire knowledge necessary for new ventures required for resources and organizational matters. 	
Prerequisites: Nil	

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	Introduction to Entrepreneurship: Entrepreneur and entrepreneurship - Characteristics, nature and types, functions, significance and barriers. Recognizing Entrepreneurial Opportunities –	12	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6

	<p>Entrepreneurial models – process and success models, Opportunity canvas analysis: Entrepreneurial Mindset, entrepreneurial motivation and entrepreneurial behavior; industry condition, industry status, macroeconomic change, and competition; and value innovation and opportunity identification.</p> <p>Case study and Success stories related to food enterprises.</p>			
II	<p>Business Opportunity Identification</p> <p>Business and its environment – Types of business organizations, Micro and Macro environment, FMCG, Food Business Operators (FBO) in food industry, consumer behaviour models.</p> <p>Conducting market survey: Tools, Techniques and guidelines for a market survey, Digital marketing.</p> <p>Preparing a feasibility report: Project development of a proposal for establishing an enterprise and the techno-economic feasibility of the project</p>	10	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6
III	<p>Human Resources management for food business:</p> <p>Definition, HR planning. HR philosophy of food companies.</p> <p>Recruitment, Selection process and Communication – Job analysis, Job description, Job specification.</p> <p>Training and Development, Motivating employees’ Performance Appraisal and compensation, Conflict resolution.</p>	10	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6
IV	<p>Marketing mix</p> <p>Product, new product development, product life cycle- New food product - Definition – Concept, need and general characteristics of</p>	10	CO1 CO2 CO3 CO4	K1, K2, K3, K4, K5, K6

	<p>new food product; Classes of New Food products;</p> <p>Place: Marketing channel decision, retailing, wholesaling and distribution.</p> <p>Pricing decision, price determination.</p> <p>Promotion mix: (sales promotion, advertising, personnel selling, publicity).</p> <p>Ethics in Marketing</p>		CO5	
V	<p>Entrepreneurial Support System</p> <p>Major Schemes/Programmes of Government of India for Development of Food & Agro Based Enterprises.</p> <p>MSME – PMEGP, CGTMSE, CLCS, SFURTI, MSE-CDP, Honey Mission</p> <p>MOFPI – Kisan Sampada Yojana, PMFME scheme</p> <p>Ministry of Agriculture - Integrated Scheme for Agricultural Marketing (ISAM), Agriculture Infrastructure Fund</p> <p>APEDA – Infrastructure, Quality improvement, Marketing intelligence.</p> <p>Pradhan Mantri Mudra Yojana (PMMY)</p> <p>Regulatory bodies – FSSAI, AGMARK Certification, BIS, MPEDA, EIC, Directorate of Plant Protection, Quarantine and Storage.</p> <p>Entrepreneurial Support System - Commercial Banks, State Financial Corporations, Small Industries Development, NABARD, NSIC, Khadi Village and Industries.</p>	10	CO1 CO2 CO3 CO4 CO5	K1, K2, K3, K4, K5, K6
<p>Text Books</p> <ol style="list-style-type: none"> 1. Gupta .C.B and Srinivasan N.D(2005).Entrepreneurial Development, 6th edition, New offset press Delhi, India. 2. Jayashree Suresh (2011). Entrepreneurial Development, 5th edition, Margham Publications,Chennai. 3. Khanka SS (2012). Entrepreneurial Development, 4th edition, Chand and company Pvt ltd ., Delhi. 4. Kotler, P. Keller,K.L(2006). Marketing management,12th edition. Pearson 				

Education, Singapore.

5. Stephen P. Robbins, Mary Coutler and Neharkha Vohra (2010). Management, 10th edition, Baba Barkha Nath Printers.

Suggested Reading

1. Casson, Mark, and Peter J. Buckley. (2010) Entrepreneurship. Cheltenham (UK): E. Elgar
2. Hisrich, R. D., Peters, M. P., & Shepherd, D. A. (2020). Entrepreneurship. New York, NY: McGraw-Hill Education.
3. Kimball, C., & Entrepreneur Media, Inc. (2016). Start your own specialty food business: Your step-by-step guide to success.
4. Vasant Desai (2012). Fundamentals of Entrepreneurship and Small Business Management, Himalya Publishing House Pvt. Ltd., Mumbai .
5. Weber, David. (2012) The food truck handbook: start, grow, and succeed in the mobile food business. Hoboken, N.J.: Wiley.

Web Resources

<https://bit.ly/3rF9QeE>

<https://nptel.ac.in/courses/110/106/110106141>

<https://nptel.ac.in/courses/127/105/127105007>

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Level
CO 1	To identify and recognize entrepreneurial opportunities and services within the food industry.	K1, K2
CO 2	To develop an understanding about the nature and relevance of entrepreneurialism in creating and evaluating opportunities in the food business.	K3
CO 3	To determine the competencies and resources that entrepreneurs need to start, maintain, and grow an enterprise.	K4
CO 4	To evaluate internal and external business environment for strategic decision-making.	K5
CO 5	To integrate various entrepreneurial process to plan and launch a new venture with innovation and sustainability.	K6

COURSE DESCRIPTOR

Course Code	PFP3ID01
Course Title	FOOD BIOTECHNOLOGY
Credits	3
Hours/Week	6
Category	Interdisciplinary (ID) - Theory
Semester	III
Regulation	2022
Course Overview	
<ol style="list-style-type: none"> 1. Explore the origins of biotechnology, the legislation and social issues related to biotechnology in food 2. Gives the knowledge on the genetic manipulation of microorganisms for food production 3. The student will gain basic knowledge of GMOs/GMCs, Role of microorganism in food biotechnology and their various applications in food sector. 	
Course Objectives	
<ol style="list-style-type: none"> 1. To impart basic knowledge about components of different process equipment and unit operation associated with them 2. The student will gain basic knowledge of technology and methods for development of various food products. 3. To understand genetically modified microorganisms and their applications in foods 4. To understand the methodologies to improve production and modify the qualities of food. 5. To gain knowledge on the molecular methodologie of identification of foof pathogens 	
Prerequisites	Basic Knowledge on food science

SYLLABUS				
Unit	Content	Hours	COs	Cognitive level
I	<p>Fermentation in Food Biotechnology</p> <ul style="list-style-type: none"> • Types of Fermentation - Submerged Fermentation , Solid-State Fermentation • Submerged Fermentor Systems - Stirred Tank Bioreactor, Air Lift Bioreactor, Fluidized Bed Bioreactor, Microcarrier Bioreactor, Membrane Bioreactor, Photobioreactor. • Solid-State Fermentor Systems - Laboratory Scale SSF bioreactor, Industrial Scale SSF Bioreactor. • Stages in a Fermentation Process - Upstream Processing, Fermentation Medium ,Components of Industrial Fermentation Medium , Sterilization , Inoculation . Fermentation Process - Modes of Operation , Agitation , Aeration , Process Monitoring and Control • Scale up and scale downd 	16	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6
II	<p>Downstream Processing & Product recovery</p> <ul style="list-style-type: none"> • Separation of insoluble products - filtration, centrifugation, sedimentation, flocculation; Cell disruption • Separation of soluble products: liquid-liquid extraction, precipitation, chromatographic techniques, reverse osmosis, ultra and micro filtration, electrophoresis • Final purification: drying; crystallization; storage and packaging. 	16	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6
III	<p>Biotransformations in Food Industries</p> <ul style="list-style-type: none"> • Potential of Microbial and plant cells to carry out biotransformation • Reactions involved in biotransformations 	15	CO 1 CO 2 CO 3 CO 4	K1, K2, K3, K4, K5, K6

	<ul style="list-style-type: none"> • Design of biotransformation process – Selection of microorganisms, methods • Improvement of Biotransformation process -Optimisation of environmental conditions, strain improvement, eliminations of side chain • Product Isolation • Production of Vanilla by biotransformation 		CO 5	
IV	Genetically modified food <ul style="list-style-type: none"> • Genetically engineered proteins: Bovine Somatotropin in Milk • Genetically engineered bacteria: ChymosinLite beer, Tryptophan • Transgenic plants: Calgene Flavr Savr TM tomato, nutritionally improved crops • Edible vaccines: Cholera vaccine in potatoes • Transgenic Fish: Atlantic salmon 	15	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6
V	Molecular techniques to identify food Pathogens <ul style="list-style-type: none"> • Nucleic acid assay methods - Molecular subtyping - RFLP,RAPD, hybridization methods - FISH,Amplification Methods - PCR. • Rapid Methods - Quantum Dots, nanochemical Cantilevers, phage based assay, pyrosequencing, microarrays. Biosensor 	16	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6
Text Books <ol style="list-style-type: none"> 1. Anthony Pometto, Kalidas Shetty, Gopinadhan Paliyath, Robert E. Levin, 2005. Food Biotechnology. CRC Press, New York 2. Aly Farag, Robert Levin and Jianping Xu,2018. Molecular techniques in Food biology.Wiley & Sons,USA 3. Byong H.Lee, 2015. Fundamentals of Food Biotechnology. Wiley-Blackwell, USA 				

4. Kalidas Shetty Gopinadhan Paliyath Anthony Pometto Robert E. Levin, 2006. Food Biotechnology, second edition, CRC Press, New York
5. Roger Angold, Gordon A. Beech, John Taggart, 1989. Food Biotechnology, Cambridge University Press, New York

Suggested Readings

Johnson-Green, 2002. Introduction to Food Biotechnology, First Edition, CRC Press, New York

Gutiérrez, G., Barbosa-Cánovas, G.V., 2003. Food science and food biotechnology. CRC Press, New York.

Knut J. Heller., 2006. Genetically Engineered Food. Methods and Detection, Second Edition. Wiley, USA

Lee, B. H. (Byong H.), 2015. Fundamentals of food biotechnology, Second edition. John Wiley & Sons, USA

David Castle, Nola Ries., 2009. Nutrition and Genomics: Issues of Ethics, Law, Regulation and Communication. First Edition. Academic Press. UK

Web Resources

1. https://www.who.int/foodsafety/publications/biotech/biotech_en.pdf
2. <https://pborhome.files.wordpress.com/2019/08/food-biotechnology-second-edition-pdfdrive.com-.pdf>
3. https://foodinsight.org/wp-content/uploads/2013/04/Biotech-Comms-Guide_2013.pdf
4. <https://www.scirp.org/journal/fns/>

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Level
CO 1	To develop an understanding of the application of biotechnology in animal, plant and food production	K1, K2
CO 2	Comprehend the principle of microbial transformations and fermentations in food production	K3
CO 3	Knowledge about the beneficial role of microorganisms and different types of fermented foods	K4
CO 4	Apply the principles of sensory science in product development and optimization, studies of alternative processing of food	K5
CO 5	Gaining detailed knowledge of molecular methods in identification of food pathogens	K6

COURSE DESCRIPTOR	
Course Code	PFP2CD01
Course Title	DYNAMICS OF FOOD AND HEALTH
Credits	1
Hours/ week	3
Category	Cross Disciplinary (CD)
Semester	II
Regulation	2022
Course Overview:	
<ol style="list-style-type: none"> 1. Food is the basic necessity of humankind and the encompasses physiological, psychological and cultural functions in order to maintain normal health and well-being. 2. The aim of this course is to provide fundamental knowledge of the nutrients present in food and their functions in the human system. 3. The contents outlined in the course focusses on the basic information on physical activity pattern and its impact on health. 4. The course is designed to highlight the importance of making right food choices and fitness regimen for a healthy living. 5. The course focusses on interpreting food and nutrient labels, health claims of food products and dietary supplements available in the market. 	
Course Objectives:	
<ol style="list-style-type: none"> 1. To create awareness on the importance of food in health and well-being. 2. To introduce the basic concepts of healthy food choices and their relationship to a disease free life. 3. To understand the role of food, physical activity and emotional well-being in maintaining a productive positive and quality living. 4. To inculcate the importance of the nutrients and interpretation of food labels in making informed food choices in combating lifestyle diseases. 5. To apply the knowledge obtained in developing a healthy society. 	
Prerequisites:	Basic knowledge in life science and an aptitude to explore new avenues in the area of food and health.

SYLLABUS		Hours	Co	Cognitive level
UNIT	CONTENTS			
I	<p>Health and Well-being: Definition, Dimensions of health and factors affecting health. Definition of disease, Causes of lifestyle changes and disease onset. Measures to prevent health hazard - Health indicators - Physiological, psychological and socio - cultural factors leading to health and disease. National and Global burden of malnutrition.</p>	8	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6
II	<p>Food for health promotion: Definition and functions of Food – Nutritive value of foods and mechanism of metabolism and utilisation in the human system - Energy measurements, Energy balance: body weight and body composition, health implications, and weight control, BMR and BMI calculations, Factors influencing energy requirements</p>	8	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6
III	<p>Food and Balanced diet for Health improvement: Objectives and food selection for a balanced living. Health education – Definition, importance of holistic approach for health- Insight into improving informed food choices and balanced diet, importance of setting achievable goals and reaching the goal for a healthy living.</p>	8	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6
IV	<p>Assessment of Nutritional status and Nutrition Care Process Significance of Anthropometry- weight and height measurements; Identification of clinical signs of common nutritional</p>	8	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6

	disorders; Dietary assessment – FFQ and 24-hour diet recall; Outline of Nutrition Care Process and its relevance to optimising health promotion.			
V	Food, Fitness and healthy living: Definition of fitness and health; Role of nutrition in fitness; Importance and benefits of physical activity; Physical Activity – frequency, intensity, time and type with examples; Physical Activity Guidelines and physical activity pyramid; Diet and exercise for weight management; Food and Fad (dietary supplements) diets and their impact on health outcome. Interpretation of food and nutrient labelling, health claims	7	CO 1 CO 2 CO 3 CO 4 CO 5	K1, K2, K3, K4, K5, K6

Textbooks for reference:

1. Mahan L K and Escott Stump S (2013). Krause’s Food & Nutrition Therapy, 13th ed. Saunders-Elsevier.
2. Stacy Nix (2009). William’s Basic Nutrition and Diet Therapy, 13th Edition. Elsevier Mosby.

Suggestive Readings:

1. Wardlaw, Smith (2012) Contemporary Nutrition: A Functional Approach.
2. Williams Melvin (2004). Nutrition for health, fitness and sports. Mc Graw Hill.
3. Joshi AS (2010) Nutrition and Dietetics Tata Mc Graw Hill. 2nd edition,
4. ICMR (2010). Nutrient Requirements and Recommended Dietary Allowances for Indian
5. Martin Eastwood (2003) Principles of Human Nutrition, II Edition, Blackwell Publishing Company

Web resources:

1. <https://www.frontiersin.org/journals/nutrition>
2. <https://www.journalofexerciseandnutrition.com>
3. <https://www.foodandnutritionjournal.org>
4. <https://www.fao.org/nutrition/education/healthy-eating-resources/en/>
5. <https://www.hsph.harvard.edu/nutritionsource/>

DYNAMICS OF FOOD AND HEALTH (CD)		Cognitive Level
CO 1	To define the importance of health and well-being and recognize its significance to maintain the normal functions of the human system.	K1, K2
CO 2	To determine the relationship between healthy food choices and lifestyle pattern and identify the importance of lifestyle changes in relation to the onset of disease conditions.	K3
CO 3	To outline the different nutritional assessment tools for identifying nutritional status and to make the right food choices for optimal health and living.	K4
CO 4	To critically analyse the importance of balanced diet, health claims, dietary supplements and physical activity to sustain a healthy lifestyle for all age groups.	K5
CO 5	To integrate the knowledge gained in developing appropriate food and exercise regimen.	K6

COURSE DESCRIPTOR

Course Code	PFP3VA01	
Course Title	SCIENCE FOR SUSTAINABLE FUTURE	
Credits	1	
Hours/Week	2	
Category	Value Added Courses (VA)	
Semester	III	
Regulation	2022	
Course Overview		
<ol style="list-style-type: none"> 1. This course covers the essential aspects of food, water, air, and energy required for daily human life. 2. One of the goals of this paper is to provide information on disaster management. 3. This course emphasizes the significance of food quality and safety. 4. Other applications of this course include: different types of food additives and their effects on human health, biomass energy, fire safety management, and so on. 5. This course examines the role of information technology in the environment and human health. 		
Course Objectives		
<ol style="list-style-type: none"> 1. To understand the purpose of food safety and quality. 2. To be aware of the different water purification methods. 3. To assess the level of pollution in the environment. 4. To gain knowledge of disaster management. 5. To acquire knowledge for alternative energy sources for long-term development. 		
SYLLABUS		
Unit	CONTENT	Hours
I	FOOD QUALITY Food contamination and adulteration- Reasons-Types- Methods- Effects- Detection of food contaminants and adulterants, their prevention- Food laws and regulations in our country-Food additives and preservatives-Proper usage and harmful effects of additives on human health.	5
II	WATER PURIFICATION Sources of water-Common impurities-Hard and soft water-Cause of hardness-Types of hardness in water-BIS specifications of drinking water, Water used for food processing -Requirement of water for industries-Water purification process for domestic supply-Desalination of water by Reverse Osmosis.	5

III	<p>ENVIRONMENTAL POLLUTION & PREVENTION</p> <p>Causes, harmful effects and control measures of air, water, noise, soil, marine and thermal pollution- Solid waste management: causes, effects and control measures of municipal solid wastes- E-waste and its effect on human health-World food problems-Effects of modern agriculture,-fertilizer-pesticide problems.</p>	5
IV	<p>ALTERNATE ENERGY RESOURCES</p> <p>Renewable energy for food processing- Crop waste as a source of bioenergy- Biogas from organic sources- solar dryers, Solar bakeries and refrigerator- Biomass energy from food wastes-Clay pot refrigerators- Minimising carbon footprint- Hydrogen fuels-CNG- LPG- Role of an individual in conservation of natural resources-Equitable use of resources for sustainable life style.</p>	5
V	<p>SAFETY MANAGEMENT</p> <p>Disaster management: Floods-Cyclone-Landslides-Earthquakes-Tsunami, Role of Information technology in environment: Remote sensing, Data base, Geographical information system (GIS), Satellite data, World wide web-Role of Information technology in human health-Fire safety management.</p>	6

Text Books

1. B.Srilakshmi. 2018, Food Science, 7th multi-color edition, New age international publishers.
2. P.C. Jain, 2015, Engineering Chemistry, 17th edition, Dhanpat Rai publishing company.
3. SS.Dara and SS. Umare, 2003, Textbook of Engineering Chemistry, S.Chand and company.
4. D.A.Ravikrishnan, 2019-2020, Engineering Chemistry, Srikrishna Hitech Pulishing Company Pvt. Ltd.
5. Anubha Kaushik and C.P. Kaushik, 2009, Environmental Science And Engineering, 4th edition, New age international publishers.
6. B. K. Sharma (1994) Industrial Chemistry: Including Chemical Engineering, Goel
7. Thankamma Jacob (1976) Food adulteration, Macmillan Company India, 1st edition.

Suggested Readings

1. G.D.Gem Mathew (2013) Chemistry in everyday life, Vishal Publishing Co.1st edition.
2. K. Bagavathi Sundari (2006) Applied Chemistry, MJP Publishers, 1st edition.
3. Mary George and Geetha Swaminathan (2002) Laboratory Chemical Methods in Food Analysis, Margham Publications, Chennai, 2nd edition.
4. C. A. Heaton (1996) An Introduction to Industrial Chemistry, Springer Science & Business Media, 3rd edition.
5. A.K.De (1987) Environmental Chemistry, Wiley eastern Ltd, 2nd edition.

Web Resources

1. <https://www.britannica.com/topic/food-additive/Sweeteners>
2. <https://www.ncbi.nlm.nih.gov/books/NBK11769/>
3. <https://www.iwapublishing.com/news/disaster-management>
4. <http://ecoursesonline.iasri.res.in/mod/page/view.php?id=26278>
5. <https://theconversation.com/heres-how-food-waste-can-generate-clean-energy-176352>

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Level
CO 1	To discuss the fundamentals of chemistry in food, water and environment.	K1, K2
CO 2	To illustrate the importance of food quality, fuels, various types of pollution and its prevention.	K3
CO 3	To develop methods for purification of water and disaster management for a sustainable life style.	K4
CO 4	To evaluate the importance of detection of food contaminants, adulterants and safety management.	K5
CO 5	To create knowledge about various types of food additives, preservatives, environmental pollution and energy resources.	K6

LOCF BASED DIRECT ASSESSMENTS

COGNITIVE LEVEL (CL) AND COURSE OUTCOME (CO) BASED CIA QUESTION PAPER FORMAT (PG)

SECTION		Q. NO	COGNITIVE LEVEL (CL)						
			K1	K2	K3	K4	K5	K6	
A	(5 x 1 = 5) Answer ALL	1(a)	+						
		(b)	+						
		(c)	+						
		(d)	+						
		(e)	+						
	(5 x 1 = 5) Answer ALL	2(a)		+					
		(b)		+					
		(c)		+					
		(d)		+					
		(e)		+					
B	(1 x 8 = 8) Answer 1 out of 2	3			+				
		4			+				
C	(1 x 8 = 8) Answer 1 out of 2	5				+			
		6				+			
D	(1 x 12 = 12) Answer 1 out of 2	7					+		
		8					+		
E	(1 x 12 = 12) Answer 1 out of 2	9						+	
		10						+	
No. of CL based Questions with Max. marks			5 (5)	5 (5)	1 (8)	1 (8)	1 (12)	1 (12)	
No. of CO based Questions with Max. marks			CO1		CO2	CO3	CO4	CO5	
			10 (10)		1 (8)	1 (8)	1 (12)	1 (12)	

Forms of questions of **Section A** shall be MCQ, Fill in the blanks, True or False, Match the following, Definition, Missing letters. Questions of **Sections B, C, D and E** could be Open Choice/ built in choice/with sub sections. Component III shall be exclusively for cognitive levels K5 and K5 with 20 marks each. CIA shall be conducted for 50 marks with 90 min duration.

COGNITIVE LEVEL (CL) AND COURSE OUTCOME (CO) BASED END SEMESTER EXAMINATION QUESTION PAPER FORMAT (PG)

SECTION		Q. NO	COGNITIVE LEVEL (CL)					
			K1	K2	K3	K4	K5	K6
A	(5 x 1 = 5) Answer ALL	1(a)	+					
		(b)	+					
		(c)	+					
		(d)	+					
		(e)	+					
	(5 x 1 = 5) Answer ALL	2(a)		+				
		(b)		+				
		(c)		+				
		(d)		+				
		(e)		+				
B	(3 x 10 = 30) Answer 3 out of 5	3			+			
		4			+			
		5			+			
		6			+			
		7			+			
C	(2 x 12.5 = 25) Answer 2 out of 4	8				+		
		9				+		
		10				+		
		11				+		
D	(1 x 15 = 15) Answer 1 out of 2	12					+	
		13					+	
E	(1 x 20 = 20) Answer 1 out of 2	14						+
		15						+
No. of CL based Questions with Max. marks			5 (5)	5 (5)	3 (30)	2 (25)	1 (15)	1 (20)
No. of CO based Questions with Max. marks			CO1		CO2	CO3	CO4	CO5
			10 (10)		3 (30)	2 (25)	1 (15)	1 (20)

IMPORTANT

- Forms of questions of **Section A** shall be MCQ, Fill in the blanks, True or False, Match the following, Definition, Missing letters.
- Questions of **Sections B, C, D and E** could be Open Choice/ built in choice/questions with sub divisions.
- Maximum sub divisions in questions of Sections B, C shall be 2 and 4 in Sections D, E).

TOTAL MARKS DISTRIBUTION OF DIRECT ASSESSMENTS BASED ON CL AND CO (PG)

Course Outcome	CO1		CO2	CO3	CO4	CO5	TOTAL
Cognitive Levels	K1	K2	K3	K4	K5	K6	
CIA 1	5	5	8	8	12	12	50
CIA 2	5	5	8	8	12	12	50
Comp III	-	-	-	-	20	20	40
Semester	5	5	30	25	15	20	100
Total Marks (CL)	15 (6%)	15 (6%)	46 (19%)	41 (17%)	59 (25%)	64 (27%)	240
Total Marks (CO)	30 (12%)		46 (19%)	41 (17%)	59 (25%)	64 (27%)	240