SNDT Women's University, Mumbai

M.Sc.
(Home Science- Nutrition and Food Processing)

NEP-2020 Syllabus

w.e.f. Academic Year 2023-24

Programme Template

Programme Degree		M.Sc.
Specialization		(Nutrition and Food Processing)
Preamble		The Postgraduate Programme in Nutrition and Food Processing focuses on food science research and its applications, providing an understanding of the various technological advancement with reference to food industry. The Programme builds on strong foundations in food science and nutrition to provide research insight into applied elements of food chemistry, processing technologies, creative product development, food safety and quality. It also provides students with the opportunity to explore entrepreneurship through industrial relationships.
Programme Specific Outcomes (POs)		After completing this programme, Learner will -
	1.	Develop capacities in the areas of Food Science and chemistry, Food Safety and Quality, Food Processing, Human Nutrition and Food Product Development.
	2.	Become professionals in these and related areas, who can work effectively and efficiently in academics, research, food industry, training, extension and community service.
	3.	Develop abilities to pursue higher education and research in Food Science, Nutrition and Food Processing.
	4	Participate effectively as responsible and ethical professionals who can contribute substantially to national development and improve quality of life of citizens.
Eligibility Criteria for the Programme		A) Students who have a minimum 50% or B Grade in an Undergraduate program with degree in B.Sc. Food Science and Quality Control, Food Science and Nutrition, Foods and Nutrition, Clinical Nutrition and Dietetics, Nutrition and Dietetics, Public Health and Nutrition, Applied Nutrition, B.Sc. Home Science (Hon. with Food Science and Nutrition/FoodTechnology). B) Students who have a minimum 60% or A Grade in Undergraduate program with degree in B.Sc. or B. Voc. in Food Technology/ Food Processing, Post-Harvest Technology, B. Tech (Food), Food Technology and Management, Microbiology, Biotechnology.
Intake (For SNDT WU Departments and		30+30

Conducted Colleges)		

M.Sc. (Nutrition and Food Processing)

Year I

Code	Courses	Type of Course	Credits	Marks	Int	Ext
Semester I						
114511	Introduction to Food Biochemistry	Major (Core)	4	100	50	50
114512	Food Science and Chemistry	Major (Core)	4	100	50	50
114523	Food Science Pr	Major (Core)	4	100	50	50
114514	Human Nutrition I- Macronutrients	Major (Core)	2	50	50	0
124515/ 124516	Public Health and Epidemiology OR Entrepreneurship development	Major (Elective)	4	100	50	50
134511 134512	Research Methodology OR Methods of Investigation- Research in Food	Minor Stream (RM)	4	100	50	50
End of Semester 1			**22**	**550**	**300**	**250**
Semester II						
214511	Basic Food Microbiology and Safety (Th. and Pr.)	Major (Core)	4 (2+2)	100	50	50
214512	Principles of Food Preservation and Processing	Major (Core)	4	100	50	50
214523	Food Analysis and Quality Control (Pr.)	Major (Core)	4 (1+3)	100	50	50

214514	Human Nutrition II- Micronutrients	Major (Core)	2	50	0	50
224511 224512 224513	Food Packaging-I OR Food Waste Management OR Sustainability & ESG	Major (Elective)	4	100	50	50
244541	Internship	OJT	4	100	50	50
End of Semester 2			**22**	**550**	**250**	**300**

Exit option (44 credits):
Post Graduate Diploma in Nutrition & Food Science

Year II

Code	Courses	Type of Course	Credits	Marks	Int	Ext
Semester III						
314511	Advanced Food Microbiology and Safety (Th. and Pr.)	Major (Core)	4 (2+2)	100	50	50
314512	Statistical Applications in Research	Major (Core)	4	100	50	50
314513	Food Laws and Standards	Major (Core)	4	100	50	50
314524	Sensory evaluation (Pr.)	Major (Core)	2	50	0	50
324511/ 324512/ 324513	Functional Foods and Nutraceuticals OR Nutrition in Health and Fitness OR Food Packaging II	Major (Elective)	4	100	50	50
354531	Food Product Development	Research Project	4	100	50	50
End of Semester 3			**22**	**550**	**250**	**300**
Semester IV						
414511	Recent Methods in Food Processing, Preservation and Packaging	Major (Core)	4	100	50	50
414522	Food Processing Pr.	Major (Core)	4	100	50	50
414513	Research Applications in Nutrition and Food Processing	Major (Core)	4	100	50	50
424511/ 424512	Institutional Management OR Digital Marketing	Major (Elective)	4	100	50	50
454531	Dissertation	RP	6	150	100	50
End of Semester 4			**22**	**550**	**300**	**250**

Major (elective) subjects will be offered only if there are minimum 10 students for the respective course.

Syllabus Contents

Semester I

1.1Major (Core)

Course Title	**Introduction to Food Biochemistry**
Course Credits	4
Course Outcomes	After going through the course, learners will be able to
	1. Elaborate on both basic and applied biochemistry related to food science and technology
	2. Elaborate and apply the specific food biochemical concepts
	3. Elaborate on the fundamentals of cell.
	4. Elaborate the basic functions of food constituents with the chemistry perspective.
	5. Explore the various factors that affect the chemical and physical changes of food components during processing and storage condition.
Module 1 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Elaborate on basic biochemistry and cellular components
	2. Analyze and elaborate on cell structure and function
	3. Elaborate on enzyme activity in food processing
Content Outline	1. Cell structure: Membrane structure, cell organelles, and transport of metabolites across membranes 2. Enzymes • Enzyme specificity, regulation of enzyme activity, and inhibition • Enzyme Classification and Nomenclature • Biocatalysis • Enzyme Activities • Enzymes in Food Processing • Protein Cross-linking in Food – Structure, • Applications, • Chymosin in Cheese Making
Module 2 (Credit 1)	

Learning Outcomes	After learning the module, learners will be able to
	1. Elaborate on the biochemical principles in fruit and vegetable processing
Content Outline	• Biochemistry of Fruits • Biochemistry of Vegetable Processing • Starch synthesis in the roots and tubers • Non-Enzymatic Browning in Cookies, Crackers and Breakfast Cereals • Bakery and Cereal Products • Biochemistry of Beer Fermentation
Module 3 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Elaborate on the biochemistry behind processing of milk
	2. Identify natural food pigments and effect of processing on pigments
Content Outline	• Biochemistry and Probiotics • Biological Activities and Production of Marine-Derived Peptides • Natural Food Pigments • Dairy Products Chemistry and Biochemistry of Milk Constituents • Biochemistry of Milk Processing Equid Milk: Chemistry, Biochemistry and Processing
Module 4 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Elaborate on the processing and the biochemical changes in processing of meat and poultry.
	2. Apply the knowledge of processing and the biochemical changes in processing of sea foods
Content Outline	• Biochemistry of Raw Meat and Poultry • Biochemistry of Processing Meat and Poultry • Biochemistry of Fermented Meat • Biochemistry of Seafood Processing

Assignments towards Comprehensive Continuous Evaluation (CCE):

- Poster making related to the biochemical processes.
- Diagrammatic representation of Processes with reference to specific products.

Bibliography:

- Food Biochemistry and Food Processing (2012) Benjamin K. Simpson, Blackwell Publishing
- Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2000): 25th Ed. Harpers Biochemistry. Macmillan Worth Publishers.
- Nelson, D.L. and Cox, M.M. (2000): 3rd Ed. Lehninger's Principles of Biochemistry, Macmillan Worth Publishers.
- Devlin, T.M. (1997): 4th Ed. Text book of Biochemistry with Clinical Correlations, Wiley Liss Inc
- Stryer, L. (1998): 4th Ed. Biochemistry, WH Freeman and Co.
- Conn, E.E., Stumpf, P.K., Bruening, G. and Doi, R.H. (2001): 5th Ed. Outlines of Biochemistry, John Wiley and Sons.
- Voet, D. Voet, J.G. and Pratt, C.W. (1999). Fundamentals of Biochemistry.
- Tietz, N.W. (1976) Fundamentals of Clinical Chemistry. WB Saunders Co.
- King, E.J. and Wootton, I.D.P. (1956). 3rd ed. Micro-Analysis in Medical Biochemistry. J and A Churchill Ltd.
- Plummer, D.T. (1987). 3rd ed. An Introduction to Practical Biochemistry. McGraw-Hill Book Co.

1.2 Major (Core)

Course Title	**Food Science and Chemistry**
Course Credits	4
Course Outcomes	After going through the course, learners will be able to
	1. Elaborate and discuss the food composition, properties, and significance of various food constituents.
	2. Identify changes occurring in various food stuffs after harvest, during storage and transportation, as a result of processing and cooking.
	3. Apply this knowledge for food product development.
Module 1 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Analyze and discuss water activity and its role in food chemistry
	2. Identify and elaborate on the structure of carbohydrate, its types and role in food industry
Content Outline	1. Water, Ice and Food Dispersions- a. Structure and properties of water and ice - Types of water, solutions, and colligative properties - Water activity and Food spoilage, Sorption phenomena - Phase transition of foods containing water - Relation between viscosity and temperature, WLF equation - Water – solute interactions - Heat transfer during processing b. Colloidal salts, stabilization of colloidal systems, Rheology of food dispersions c. Gels: Structure, formation, strength, types and permanence d. Foams: Structure, formation and stabilization 2. Carbohydrates- Polysaccharides, sugars and sweeteners a. Reactions of mono and oligosaccharides b. Use of Polysaccharides in foods: Non-starch Polysaccharides
Module 2 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Elaborate on Amino acids, protein isolates, protein concentrates, peptides

	2. Identify and differentiate between types of enzymes and role of enzymes in food industry
	3. Analyze the science behind meat, fish, egg, poultry and effect of cooking, processing and storage on pulses, meat, fish, poultry
Content Outline	1. Chemistry of Amino acids, peptides, proteins and Science of Protein Foods- a. Review of structure, physicochemical properties, functional properties of amino acids, peptides and proteins b. Chemical and enzymatic modifications- denaturation, non-enzymatic browning, and other chemical changes c. Processing induced physical, chemical and nutritional changes d. Texturized proteins e. Protein isolates, concentrates f. Protein hydrolysate, 2. Enzymes- a. Review of nomenclature, properties and isolation Nature of enzymes, stability and action. b. Factors influencing enzymes- enzyme inactivation and control c. Enzymes in food processing and modification- Proteolytic enzymes, oxidases, lipases, enzymes decomposing carbohydrates and applications d. Immobilised enzymes in food processing. e. Enzymes in waste management f. Enzymes and health/nutrition/food issues 3. Milk and Milk Products- a. Composition. Physical and functional properties. b. Denaturation c. Effects of processing and storage. d. Cultured milk, yogurt, butter, whey, cheese, concentrated and dried products, frozen desserts, dairy product substitutes. 4. Meat and Poultry- a. Muscle composition, characteristics and structure. b. Post mortem changes. c. Processing, preservation and their effects. Heat-induced changes in meat. d. Variables in meat preparation. Tenderizers. e. Meat Products. 5. Eggs- a. Structure and Composition. Changes during storage. b. Functional properties of eggs, use in cookery. c. Egg processing. d. Low cholesterol egg substitutes. 6. Fish and Sea Food- a. Types and Composition b. Storage and changes during storage. Changes during processing. c. By-products and newer products.

	7. Pulses and Legumes- a. Structure, composition b. Processing. c. Toxic constituents.
Module 3 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Elaborate on the types of fat, uses, role and fat replacers
	2. Identify and Analyze properties of fats, fat deterioration, role of antioxidants, emulsions
	3. Identify use and types of flavours used in food processing, effect of processing on flavours and aromas
Content Outline	1. Lipids- Fats, Oils and related products- a. Review of nomenclature, classification, sources, composition, and properties b. Role of lipids in food flavour. Effects of processing on chemical structure and physical properties- Precursors of aroma compounds c. Functional properties of fat and uses in food preparations, inter-esterification of fats. d. Lipids exposed to frying conditions, hydrogenated fat and irradiated foods e. Lipid-protein complexes, emulsions: formation, stability, surfactants and emulsifiers f. Fat deterioration and antioxidants g. Fat substitutes 2. Nuts and Oilseeds- Composition, Oil extraction and by-products 3. Flavors- a. Individual aroma compounds- vegetable, fruit and spice/condiment flavors, flavors from lactic acid/ethanol fermentation, flavors volatiles from fats and oils, flavor volatiles in muscle foods and milk b. Composition, flavorings extracts – natural and synthetic c. Thermally induced process flavors d. Natural and synthetic flavors e. Interactions with other constituents
Module 4 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Elaborate on the anatomy of vegetable and fruits, effect of cooking, processing, and storage.
	2. Identify products made using fruits and vegetables, its processing and changes during preservation

Content Outline	1. Fruits, Vegetables and Processed Products a. Plant anatomy, gross composition, structural features and activities of living systems. b. Enzymes in fruits and vegetables. Flavour constituents. Plant phenolics. Pigments. c. Post harvest changes. Texture of fruits and vegetables. d. Effects of storage, processing and preservation 2. Processed Foods: a. Squashes, Pickles, fruit/vegetable–based, vinegar, pickles. b. Beverages: Synthetic and natural, alcoholic and non-alcoholic, carbonated and non-carbonated, coffee, tea, cocoa. Malted drinks. c. Bakery products, dehydrated products.
Assignments/Activities towards Comprehensive Continuous Evaluation (CCE) • Debate on artificial sweetener consumption. • Survey of different food items from different food groups.	

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Journals:

- Journal of Food Science
- Advances in Food Research
- Journal of Food Science and Technology
- Journal of Agricultural and Food Chemistry
- Cereal Science
- Journal of Dairy Science
- Journal of the Oil Chemists' Society

1.3 Major (Core)

Course Title	**Food Science (Pr.)**
Course Credits	4
Course Outcomes	After going through the course, learners will be able to
	1. Identify changes occurring in various foods as a result of processing and cooking.
	2. Apply theoretical knowledge in various food preparations and product formulation
Module 1 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Identify boiling and freezing point of water
	2. Observe and analyze effect of heat on sugar and starch
Content Outline	1. Effect of solutes on boiling point and freezing point of water 2. Effect of types of water on characteristics of cooked vegetables, pulses and cereals. 3. Sugar and Jaggery Cookery- a. Relative sweetness, solubility and sizes of sugars, stages of sugar cookery, caramelization, crystallization, factors affecting crystal formation. 4. Starches, Vegetable gums and Cereals- a. Microscopic examination of structure of starch from different sources. b. Dextrinization, gelatinization, retrogradation, thickening power. Factors affecting gels and gluten formation Starch hydrolysis, viscosity measurement. 5. Jams and Jellies- a. Pectin content of fruits, role of acid, pectin and sugar in jam and jelly preparation. b. Use of gums as emulsifiers/stabilizers.

Module 2 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Elaborate on fat cookery, role of fat and factor affecting fat absorption
	2. Identify and apply effect of cooking, heating, acid, salt, sugar, alkali, and enzymes on milk, preparation of milk products
	3. Discuss on pulses, Egg, meat, cookery. Identify the Role of egg as binding agent, emulsion, gelling agent, thickening agent, structure of egg and properties
Content Outline	1. Fats and Oils- a. Flash point, melting point and smoking point. b. Role of fats and oils in cookery as: shortening agent, frying medium. c. Factors affecting fat absorption. d. Fat crystals. e. Plasticity of fats. f. Permanent and semi-permanent emulsions. 2. Milk and Milk Products: a. Scalding, denaturation. b. Effect of acid, salt, alkali, sugar, heat, enzymes, polyphenols on milk. Khoa, curd, paneer, cheese (ripened and unripened). 3. Eggs- a. Structure, assessing egg quality. b. Use of egg in cookery- Emulsions, air incorporation, thickening, binding, gelling. c. Method of egg cookery and effect of heat. d. Egg white foams and factors affecting foams. 4. Pulses- a. Effect of various cooking and processing methods on various characteristics. b. Functional properties of pulses and their products. 5. Meat and Poultry- a. Methods affecting tenderness of meat b. Effect of various ingredients and methods of cooking on colour, volume, texture, flavour, aroma and water holding capacity.
Module 3 (Credit 1)	

Learning Outcomes	After learning the module, learners will be able to
	1.Observe the effect of cooking on fish, vegetable, and fruits
	2. Identify types of leavening agent and elaborate on its role
Content Outline	1. Fish and Sea Food- a. Effects of different cooking methods on various fish and seafoods 2. Gelatine- Gelation, gel strength and factors affecting gelation and ability to foam. 3. Fruits and Vegetables- a. Pigments: Effects of cooking, metal ions, pH on pigments. b. Effect of various cooking processes on different characteristics of vegetables. c. Prevention of enzymatic browning. 4. Leavened Products- a. Leavening power of different leavening agents b. Use of microorganisms (bacteria, lactic acid, yeast), steam, egg and, chemical leavening agents.
Module 4 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1.Identify types of beverages and frozen foods,
	2. Experiment with emulsions, and observe surface tension
Content Outline	1. Beverages- Factors affecting quality of beverages. 2. Frozen Desserts- a. Factors affecting ice crystal formation. b. Quality characteristics of frozen desserts. 3. Emulsions- Water-in-oil and oil-in-water. 4. Surface tension- Measurement in hydrophilic and hydrophobic liquids and emulsions.

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

- Application of different cooking methods for various commonly consumed recipes.
- Development of products using practical knowledge gained through modules.

Bibliography:

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- Tindall, H.D. (1983): Vegetables in the Tropics, MacMillian, Press, London.

Journals:

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- Cereal Science
- Journal of Dairy Science
- Journal of the Oil Chemists' Society

1.4 Major (Core)

Course Title	**Human Nutrition I - Macronutrients**
Course Credits	2
Course Outcomes	After going through the course, learners will be able to
	1. Gain in-depth knowledge of the physiological and metabolic role of macronutrients, fat soluble vitamins and electrolytes and their importance in human nutrition.
	2. Enable the understanding of basis of human nutritional requirements and recommendations through the life cycle and translate the knowledge into practical guidelines for dietary needs.
	3. Familiarize with the recent advances in nutrition and apply this knowledge in planning for public health programmes.
Module 1 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Summarize the nutrient requirements in health.
	2. Elaborate on the importance of body composition. Get acquainted with the methods for assessing body composition
	3. Apply the measurement of energy expenditure and regulation of energy metabolism
	4. Elaborate on the regulation of metabolism and estimate energy requirements

Content Outline	1. Human Nutritional Requirements – Development and Recent Concepts. a. Methods of determining human nutrient needs b. Description of basic terms and concepts in relation to human nutritional requirements. c. Guidelines and Recommendations d. Development of International and National Nutritional requirements e. Translation of nutritional requirements into Dietary Guidelines 2. Body Composition a. Significance of body composition and changes through the life cycle. b. Methods for assessing body composition (both classical and recent) and their applications. 3. Energy a. Components of energy requirements: BMR, RMR, thermic effect of feeding, physical activity. Factors affecting energy requirements, methods of measuring energy expenditure. b. Estimating energy requirements of individuals and groups. c. Regulation of energy metabolism and body weight: Control of food intake – role of leptin and other hormones.
Module 2 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Discuss on the physiology and metabolism of macro nutrients. Identify the role of Nutrients in gene expression.
	2. Identify the role of non-nutritive components of food in health and disease.
	3. Elaborate on the nutritional significance of different fatty acids
	4. Gain knowledge and apply national and international dietary guidance in diets

Content Outline	1. Carbohydrates a. Review of nutritional significance of carbohydrates and changing trends in dietary intake of different types of carbohydrates and their implications b. Dietary fibre: Types, sources, role and mechanism of action c. Resistant starch, fructo-oligosaccharides, other oligosaccharides: Chemical composition and physiological significance d. Glycemic Index and glycemic load e. Carbohydrates and gene expression 2. Proteins a. Overview of role of muscle, liver and GI tract in protein metabolism b. Amino acid and peptide transporters c. Therapeutic applications of specific amino acids d. Peptides of physiological significance e. Proteins, amino acids and gene expression 3. Lipids - Nutritional significance of fatty acids – SFA, MUFA, PUFA- functions and deficiency a. Role of n-3 and n-6 fatty acids b. Prostaglandins c. Trans Fatty Acids d. Conjugated linoleic acid e. Nutritional Requirements and dietary guidelines (International and National) for visible and invisible fats in diets. 4. Lipids and gene expression 5. Water 6. Physiological role of water in the body
Assignments/Activities towards Comprehensive Continuous Evaluation (CCE) • Poster making for role of Different macronutrients • Changes in requirements across the lifespan	

Bibliography:

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- International Life Sciences Institute Present Knowledge in Nutrition – latest edition
- Shils, M.E.; Olson, J.; Shike, M. and Roos, C. (2013): Modern Nutrition in Health and Disease. 11th edition. Williams and Williams. A Beverly Co. London.
- WHO Technical Report Series.
- World Reviews of Nutrition and Dietetics.

Journals:

- Nutrition Reviews
- Journal of Nutrition
- American Journal of Clinical Nutrition
- British Journal of Nutrition
- European Journal of Clinical Nutrition
- International Journal of Vitamin and Nutrition Research
- International Journal of Food Science and Nutrition
- Nutrition Research
- Annual Nutrition Metabolism

1.5.1 Major (Elective)

Course Title	**Public Health and Epidemiology**
Course Credits	4
Course Outcomes	After going through the course, learners will be able to
	1. Develop a holistic knowledge base and understanding of the nature of important nutritional problems and their prevention and control for the disadvantaged and upper socio-economic strata in society
	2. Identify the causes /determinants and consequences of nutritional problems in society
	3. Identify various nutrition and health interventions, programmes and policies.
Module 1 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Elaborate on concept of public nutrition.
	2. Define Indicators of health and determine Health Status.
Content Outline	1. Concept of public nutrition a. Relationship between health and nutrition b. Role of public nutritionists in the health care delivery c. Sectors and Public Policies relevant to nutrition and health. 2. Primary Health Care of the Community a. National Health Care Delivery System b. Determinants of Health Status c. Indicators of Health
Module 2 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Elaborate on Population Dynamics and methods used for assessment of nutritional status
	2. Define and describe factors affecting food security

Content Outline	1. Population Dynamics a. Demographic transition b. Population structure c. Fertility behaviour d. Population policy e. Fertility f. Inter-relationship between Nutrition and Quality of Life 2. Food and Nutrition Security a. Food production b. Access c. Distribution d. Availability e. Losses f. Consumption 3. Food Security a. Socio-cultural aspects and Dietary Patterns b. Their implications for Nutrition and Health 4. Nutritional Status a. Determinants of nutritional status of individual and populations b. Nutrition and Non-nutritional indicators c. Socio-cultural d. Biologic e. Environmental f. Economic 5. Assessment of nutritional status of individuals of different ages- a. MUAC, Wt. for age, Ht. for age, Wt. for Ht., Ponderal index, BMI b. Applications and limitations in different field situations- choice of an indicator
Module 3 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Elaborate on various nutritional problems and deficiencies.
	2. Identify National Policies and programmes.
Content Outline	1. Major Nutritional Problems – etiology, prevalence, clinical manifestations, preventive and therapeutic measures for: a. Macro and micro nutrient deficiencies b. Other nutritional problems like lathyrism, dropsy, aflatoxicosis, alcoholism and fluorosis. c. Overweight, obesity, and chronic degenerative

	diseases d. National Food, Nutrition and Health Policies 2. Infectious Diseases, prevention, and control- a. Aetiology of Chronic and Infectious Diseases b. Investigation of Outbreak c. Temporal and geographical trends of selected diseases- Malaria, Leishmaniasis (Kala-azar)
Module 4 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Plan action programmes to combat nutritional problems.
	2. Develop strategies required to improve nutritional status.
Content Outline	1. Plan of action and programmes 2. Approaches and Strategies for improving nutritional status and health: a. Programmatic options- their advantages and demerits. -Feasibility -Political support -Available resources (human, financial, infrastructural) b. Case studies of selected strategies and programmes: their rationale and context, how to select interventions from a range of possible options: c. Health-based interventions, Food-based interventions including fortification and genetic improvement of foods, supplementary feeding, d. Nutrition education for behaviour change. e. Health economics and economics of malnutrition- Its impact on productivity and national development d. Cost-Benefit e. Cost effectiveness f. Cost efficiency
Assignments/Activities towards Comprehensive Continuous Evaluation (CCE) • Survey on different national policies made for benefit of public • Posters/Visits to different sections of society to educate on various topics of concern.	

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1.5.2 Major (Elective)

Course Title	**Entrepreneurship development**
Course Credits	4
Course Outcomes	After going through the course, learners will be able to
	1. Acknowledge the concept of entrepreneurship.
	2. Acquire knowledge about the world of entrepreneurs
	3. Acquire and inculcate entrepreneurial values, attitudes, qualities and desires
Module 1 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Identify the types of entrepreneurships.
	2. Identify and apply available techniques for opportunity development,
Content Outline	Introduction to Entrepreneurship: - Definition, Concept and Need for entrepreneurship. - Types of entrepreneurs: Spontaneous, Motivated and Induced. - Kinds of Entrepreneurship: Proprietary, Partnership and Group Entrepreneurship. Exploring the World of Entrepreneurs: - Legendary, Business, Social and Environmental, Artistic and Aesthetic Entrepreneurs - Entrepreneurs in Shadows, failed entrepreneurship - New Internet Entrepreneurs
Module 2 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Examine elements of a successful business venture
	2. Apply the process of innovation
Content Outline	1. Entrepreneurship development programme 2. SWOT analysis 3. Incubation, innovation and commercialisation of ideas
Module 3 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Identify the benefits of women entrepreneurs to the society.

	2. Recognize the problems faced by women entrepreneurs.
Content Outline	1. Women entrepreneurship a. Role and importance, problems faced by women 2. Corporate entrepreneurship a. Role and mobility of entrepreneur
Module 4 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Analyze the various schemes available
	2. Develop proposal for Government funding
Content Outline	1. Government schemes, incentives for promotion of entrepreneurship 2. Government schemes for MSME/SSI 3. Export and import policies for food processing sector 4. Venture capital 5. Planning and evaluation of project 6. Project feasibility and post planning and running of project
Assignments/Activities towards Comprehensive Continuous Evaluation (CCE) • Develop unique products/items and organize their sale. • Mock Sales pitch for funding for business venture. • Organize a small exhibition/fair for fellow students/teachers.	

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1.6.1 Minor Stream

Course Title	**Methods of Investigation- Research in foods (Pr.)**
Course Credits	4
Course Outcomes	After going through the course, learners will be able to
	1. Learn various modern instrumental techniques in food analysis.
	2.Identify the applications, strengths and limitations of different methods.
Module 1 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Elaborate on the basic principles involved and applications of advanced techniques available for food analysis.
	2. Apply the principles of laboratory techniques and acquire proficiency in laboratory techniques.
Content Outline	1. Colorimetry for estimation of nutrients 2. Photometry- Flame photometry for estimation of nutrients 3. Flourimetry- use in fresh and processed foods 4. Spectrometric- methods for estimating food quality- a. UV and visible molecular absorption spectrometry. b. Atomic Absorption Spectrometry, Atomic Emission Spectrometry, ICP. c. Fluorescence Spectrometry d. Atomic Mass Spectrometry e. Infrared Spectrometry
Module 2 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Elaborate on the basic chromatographic techniques used in food analysis their principle.
	1. Apply chromatographic techniques to estimate various nutrients in foods.

Content Outline	1. Chromatography for estimation of nutrients in food and detecting additives, pesticides, and contaminants in food a. Paper chromatography b. Ion Exchange Chromatography c. Thin Layer Chromatography d. Column Chromatography e. Gas Liquid Chromatography f. High performance liquid Chromatography g. Super critical fluid extraction Chromatography
Module 3 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Gain knowledge of advanced analytical techniques and applications in food analysis.
	2. Elaborate and perform texture analysis of various food products.
Content Outline	1. Electrophoresis for protein and mineral estimation in foods and Centrifugation method in milk industry a. Principles and applications in paper and gel electrophoresis 2. Radiochemical Methods- Use of radio isotopes. 3. Viscosity and Consistency- a. Measurements of Food. b. Measurements of Rheological properties. c. Instrumental Measurement of Texture of Foods- Dough, Pasta, Baked Products, Fruits and Vegetables, Dairy Products, Meat, Starch.
Module 4 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Identify the significance of calibration of instruments.
	2. Learn the possible errors and their control.
Content Outline	1. Specific gravity, freezing point, melting point, refractive index of foods 2. Gel strength of foods 2. Brix, Densitometry, Refractometry, Polarimetry of sugar or confectionary 3. Measurement of Colour in foods 4. Relative Humidity and Water Activity of food 5. Aeration / Overrun Measurement of milk products 6. Calibration of Instruments, Basic Analytical Chemistry errors, Statistical analysis

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

- Continuous assessment and practical performance of practical conducted by the learner.
- Assessment of skills in using the equipements.

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1.6.2 Minor Stream

Course Title	**Research Methodology (Th)**
Course Credits	4
Course Outcomes	After learning the module, learners will be able to -
	1. Develop a scientific approach and know the processes of research
	2. Develop the competence for selecting methods and tools appropriate for research topics
	3. Discuss the concepts of statistical measures of central tendency, dispersion, variability and probability
Module 1 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to -
	1. Explain process of research and its relationship to knowledge andscience. 2. Identify research process based on actual researchesconducted. 3. Recognize process of research problemformulation.
Content Outline	**The Research Process** a. Scientific approach to enquiry in comparison to native, common senseapproach b. Knowledge, theory andresearch c. Role, need and scope of research in the discipline of Home Science **Assignment** : *Differentiate between investigative reporting and research report (with examples to be brought by students asexercise)* **Steps in Research Process and Elements of Research** a. Identifying interest areas and prioritizing Selection of topic and considerations inselection b. Review of related literature andresearch c.Variables- types of variables including discrete and continuous variables Conceptual definitions and operational definitions d. Concepts, hypotheses andtheories e Hypothesis- meaning, attributes of a sound hypothesis, Stating the hypothesis and types of hypothesis Hypothesis testing**-** null hypothesis, sample distribution, level of significance, critical regions, Type I and Type II errors f. Research Design Research questions, objectives and assumptions **Ethics in Research**
Module 2 (Credit 1)	
	After learning the module, learners will be able to -

Learning Outcomes	1. Apply different types of researchprocedures. 2. Design research studies by knowing methods ofresearch.
Content Outline	**Types of Research** a. Basic and Applied research, Qualitative and Quantitativeresearch (brief review ofdifferences) b. Historicalresearch c. Descriptive research methods – survey, case study, correlational study, content analysis, causal-comparativeresearch d. Analytic studies- pre-experimental, experimental research,quasi experimentalresearch e. Qualitative research,Ethnography Evaluative research- general characteristics, use of qualitative methods in enquiry Scope and importance in Home Science.
Module 3 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to - 1. Explain different techniques ofsampling. 2. Apply sampling procedures for specific researchproblems.
Content Outline	**Sampling** a. Rationale, characteristics- meaning, concept of population and sample, andutility b. Types of sampling and generalizability ofresults c. Probability sampling - simple random sample, systematicrandom sample, stratified random sampling etc - random and non-random samples, random numbers anduse d.. Non-probability sampling - purposive samples, incidental samples, quota samples, snowball samples e.. General consideration in determination of sample size
Module 4 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to - 1. Differentiate the tools of datacollection. 2. Design different tools of datacollection.
	Tools for Data Collection a.Primary and secondary methods of data collection b.Different types of questionnaires, rating scales, check lists, schedules, attitude scales, inventories, standardized tests, interviews, observation Development of tools, estimation of reliability and validity oftools Procedure for preparation of the tool, administration of tools for datacollection Procedure for datacollection

	Planning for data analysis-coding ofresponses

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

- Recognize different Types of variables.
- Hypothesis formations and research questions from Research readings –students identify hypothesis/research questions – Discussion
- Construction of tools for data collection a) types of questions b) Questionnaire c) interview schedule d) observation d) scales
- Differentiate between (a) basic and applied research (Exercise to be based on actual research papers published in accredited journals) (b) qualitative and quantitative research
- Based on Journal contents undertake a critical appraisal of studies/research papers and discuss types of Research with examples.
- For given topic students to frame and discuss the different possibilities of methods and tools.

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Syllabus Contents

Second Semester

2.1 Major (Core)

214511	**Basic Food Microbiology and Safety** (Th. & Pr.)
Course Credits	4 (2+2)
Course Outcomes	After going through the course, learners will be able to -
	1. Differentiate the role of micro-organisms in humans and environment.
	2. Analyze the importance of micro-organisms in food spoilage and to learn advanced, techniques used in food preservation.
	3. Explore the recent procedures adopted in various food operations to prevent food- borne disorders and legal aspects involved in these areas.
Module 1(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Recognize the importance of food microbiology, spoilage, preservation & fermentation.
	2. Explore the factors affecting the survival & growth of micro-organisms.
Content Outline	History, scope and importance of food microbiology Food spoilage, preservation, fermentation, QA/QC **Micro-organisms and food**: - Their primary sources in foods, morphology, cultural characteristics and biochemical activities. - Airborne bacteria, fungi - Microorganisms found in soil - Microorganisms in water - Normal flora of skin, nose, throat, GI tract **Factors affecting the survival and growth of microorganisms in food.** - Intrinsic and Extrinsic parameters that affect microbial growth.

	- Intrinsic factors for growth- Generalized, nutrient effect, pH, buffer, anaerobic/aerobic conditions, moisture content, temperature, gaseous atmosphere - Implicit factors- properties of microorganisms-response **Food Preservation and application to different types of foods:** a. Physical methods – Drying, freeze-drying cold storage, heat treatments(pasteurization), TDT, TDP Irradiation (UV, microwave, ionization), high pressure processing, Aseptic packaging, modified atmosphere b. Chemical preservatives and Natural antimicrobial compounds. c. Biologically based preservation systems and Probiotic bacteria. **Uses of Microorganisms**: Fermented foods, (Yeast, lactobacillus) Fermented milk, Cheese, vegetables, beer, vinegar Genetically modified foods, marine foods.
Module 2(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Apply various methods of microbial examinations.
	2. Assess the spoilage of different food groups.
Content Outline	**Microbiological examination-Methods of Isolation and detection of microorganisms or their products in food.** - Conventional methods - Rapid methods (Newer techniques) - Immunological methods: Fluorescent, antibody, Radio immunoassay, ELISA etc. - Chemical methods: Thermostable nuclear, ATP measurement and PCR (Polymers chain reactions) - only principles in brief. **Spoilage of different groups of foods:** a. Cereal and cereal products b. Vegetables & fruits c. Meat & meat products d. Eggs and poultry e. Fish and other seafoods f. Milk and milk products g. Canned food
Course Title	**Basic Food Microbiology and Safety (Pr)**
Course Credits	2
Course Outcomes	After going through the course, learners will be able to

	1. Prepare common laboratory media & special media for cultivation of micro-organisms.
	2.Carry out bacteriological analysis of food
Module 3(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1.Isolate micro-organisms through laboratory process.
Content Outline	Preparation of common laboratory media and special media for cultivation of bacteria, yeast & molds. Staining of Bacteria: Gram's staining, acid-fast, spore, capsule and flagellar staining, Motility of bacteria, Staining of yeast and molds. Cultivation and Identification of important molds and yeasts. (slides and mold culture). Study of environment around us as sources of transmission of microorganisms in foods. Assessment of surface sanitation of food preparation units - swab and rinse techniques. Isolation of microorganisms: Different methods and maintenance of cultures of microorganisms.
Module 4(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1.Bacteriologically analyze different foods.
Content Outline	**Bacteriological analysis of Foods**: Both processed and unprocessed like vegetables and fruits, cereals, spices and canned foods, using conventional methods, yeast and mold count in foods. Bacteriological analysis of water and milk, Total count, MPN Coliform (Count) and MBRT, IMVIC etc.
Assignments/Activities towards Comprehensive Continuous Evaluation (CCE): • Undertake bacteriological analysis of food. • Survey of commercially available fermented food products. • Presentation on specific molds and yeasts.	

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- Technologists (India) CFTRI – MYSORE.
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2.2 Major (Core)

Course Title	**Principles of Food Preservation and Processing**
Course Credits	4
Course Outcomes	After going through the course, learners will be able to
	1. Know the principles of food preservation.
	2. Identify and apply the principles of food processing techniques and apply the principles to specific food commodities.
	3. Know the principles of cleaning and sanitation.
	4. Be familiar with laws and regulations that govern the Food Industry.
	5. Be aware of current issues and trends in the Food Industry.
Module 1 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Elaborate on the principles of food processing.
	2. Explore methods of food preservation and importance of water activity.
Content Outline	1. Introduction to process operations a. General principles of food preservation b. Asepsis, removal of microorganisms c. Maintenance of anaerobic conditions 2. Methods of food preservation 3. Water Activity and Food Preservation a. Free and Bound water b. Effect of water activity on quality of food constituents during storage (proteins, lipids, and carbohydrates) c. Effect on physical and nutritional quality d. Water activity and food stability

	e. Effect of packaging material on water activity 4. Preservation through temperature reduction a. Storage of food at chilling temperature behavior b. Refrigeration c. Controlled Atmosphere Storage (CAS) d. Modified Atmosphere Storage (MAS) e. Chilling defects f. Freezing –principles, fundamental aspects of freezing -Freezing process –technological aspects -Freezing damage - osmotic damage, solute damage - Structural damage
Module 2 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1.Elaborate on high temperature food processing techniques.
	2.Recognize the role of food additives in food preservation.
Content Outline	1. Preservation by use of High Temperatures 2. Concentration of food, Evaporation, Freeze concentration, Membrane process for concentration 3. Drying or Dehydration of food (Food Preservation through water removal) a. Transport of water in foods b. Different methods of dehydration c. Cabinet drying, sun / solar drying d. Osmo drying, Osmo - vac drying, e. Freeze drying- Introduction, principle, processing, preservation f. Vacuum drying g. Quality aspects of dehydrated products h. Physical and chemical changes in food i. Nutritional changes and recent advances 4. Blanching, sterilization, pasteurization 5. Food Additives: -Natural food additives as preservatives a. Sugar b. Acidulants (citric acid, malic acid, tartaric acid, lactic acid, acetic acid c. Thickeners (modified starches and gums) d. Stabilizers e. Emulsifiers (GMS, soya) f. Colours (natural and synthetic)

	g. Vitamins h. Minerals i. Salt, gases, spices, smokes, oils, vinegar - Chemical Preservatives a. Sorbic acid, its potassium salts b. Calcium and sodium propionates c. Sodium benzoates, parabens e. Antioxidants – functions, products and applications, regulatory status, trends, issues and developments 6. Enzymes - applications in fruit and vegetable processing, trends issues and developments
Module 3 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1.Elaborate on preservation of food using sugar, salt
	2. Discuss and apply tomato processing, fermentation technique, pickling
Content Outline	• Preservation using high Sugar, Product technology for- a. Jam, Jellies, Marmalade b. Squashes, syrups, cordials, concentrate etc. c. Intermediate moisture fruits (candies/ muramba's, tutti-frutti /glazed fruits) • Processing and preservation of Tomato products- Tomato juice, Ketchup, Sauce, Paste, Soup, concentrate, puree, Chutneys and allied traditional products. • Salted products- a. Acidified brined fruits and vegetables b. Fish salting c. Salted amala supari d. Processing, packaging, preservation • Processing and preservation of different Pickles, quality evaluation and storage. • Fermentation products- Process, preservation of- a. Wine making (grape and others) b. Beer making c. Traditional fermented food products- d. *Dhokla, Idli*, Curd, Tempe, Soya sauce, vegetable fermented products e. Various alcohol based products f. Yeast fermented products

<table>
<tr><td colspan="2">Module 4 (Credit 1)</td></tr>
<tr><td rowspan="3">Learning Outcomes</td><td>After learning the module, learners will be able to</td></tr>
<tr><td>1.Elaborate on the preservation of fruits and vegetables using canning</td></tr>
<tr><td>2.Elaborate on the preservation of foods using radiations</td></tr>
<tr><td>Content Outline</td><td>• Canning and bottling-
a. Commercial canning operation, Containers used for canning, Machinery and equipment's used in processing
b. Canning of vegetables and their products, Canning of fruits and their products (sweet corn, baby corn, pineapple slices, fruit juice, tomato pulp, strawberry, mushrooms)
c. Home scale canning and bottling in standy pouches for vegetables, pulp, gulab jamun, dairy products.
d. Spoilage of canned food and its quality evaluation

• Irradiation of food
a. Principle,
b. Quality / Technological aspects
c. Commercial applications
• UV rays application in food industry

• Microwave technique, its application in food preservation (surface sterilization of food)
• Food Plant sanitation, waste management and disposal
• Environmental Aspects of Food Processing (Eco friendly)
• Roles and use of water in food processing</td></tr>
<tr><td colspan="2">Assignments/Activities towards Comprehensive Continuous Evaluation (CCE):

• Write a note on food preservation principles.
• Enlist various Food additives used in foods.
• Elaborate of types of dehydrators and its application.
• Project on the process of canning with example.
• Enlist fermented foods available in Indian market commercially.</td></tr>
</table>

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2.3 Major (Core)

Course Title	**Food Analysis and Quality Control (Practical)**
Course Credits	(1+3)
Course Outcomes	After going through the course, learners will be able to-
	1. Recognize the importance of quality assurance in food industry.
	2. Carry out various tests and assess quality, using standards for quality assessment and food safety.
	3.Conduct various tests used to detect food adulterants.
Module 1(Credit 0.5)	
Learning Outcomes	After learning the module, learners will be able to -
	1. execute quality assurance programmes.
Content Outline	Introduction to quality assurance and food safety. Current concepts of quality control. **Quality Assurance Programme:** Quality plan, documentation of records, product standards, product and purchase specifications, process control and HACCP, hygiene and housekeeping, corrective action, quality and programme and total quality process.
Module 2(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1.Undertake Product analysis.
	2.Assess purity & quality of food additives & contaminants.
Content Outline	**Product Evaluation**: • Sampling for product evaluation and line control. • Statistical quality and process control • Specifications and food standards. International, National – Mandatory, Voluntary. • Sample preparation • Reporting results and reliability of analysis. Assessment of purity and quality using appropriate standard tests and Detection / Estimation of Food Additives and Contaminants- qualitative and quantitative methods for: • Water including mineral water. • Cereals and cereal products • Pulses and legumes • Flesh foods
Module 3(Credit 1.5)	
Learning Outcomes	After learning the module, learners will be able to
	1.Evaluate Product analysis.
	2.Assess purity & quality of food additives & contaminants.
Content Outline	• Milk and milk products • Ice creams and sherbets • Confectionery • Fats and oils including butter, ghee and hydrogenated fat. • Fried snacks and high fat foods

Module 4(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1.Evaluate Product analysis.
	2.Assess purity & quality of food additives & contaminants.
Content Outline	• Spices and condiments and salt, pickles, sauces and chutneys. • Tea and coffee • Canned, dehydrated, frozen and bottled fruit/vegetable products • Specific food ingredients such as glycerine, vinegar. • Fruit juices, concentrates and beverages.
Assignments/Activities towards Comprehensive Continuous Evaluation (CCE) • Survey on products available in the market • Application and classification based on the method of preservation used • Certification course HACCP	

2.4 Major (Core)

Course Title	**Human Nutrition II (Micronutrients) (Theory)**
Course Credits	2
Course Outcomes	After going through the course, learners will be able to
	1. Recognize the physiological and metabolic role of vitamins and minerals in human nutrition.
	2. Evaluate the pharmacological actions of various vitamins & minerals along with their implications.
Module 1(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Acknowledge the metabolism of fat and watersoluble vitamins.
	2. Explore the pharmacological & therapeutic role of fat and water-soluble vitamins.
Content Outline	For each of the vitamins & minerals, the following will be discussed: • Historical background • Structure and chemistry • Food sources • Metabolism (digestion, absorption, transport, storage and elimination), Bioavailability and factors affecting bioavailability. • Biochemical and physiological functions • Assessment of status • Interaction with other nutrients, regulation of gene expression (wherever applicable) • Pharmacological and therapeutic effects • Requirements, methods for estimating requirements and recommended daily allowance. • Deficiency, overload and toxicity. **Fat Soluble Vitamins** Vitamin A and Beta Carotene Vitamin D Vitamin E Vitamin K
	Water Soluble Vitamins a. Ascorbic acid b. Thiamin c. Riboflavin d. Niacin

	e. Pyridoxine f. Folic acid g. Vitamin B_{12} h. Biotin i. Pantothenic acid
Module 2(Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1.Acknowledge the metabolism of macro-minerals and micro-minerals.
	2.Explore the pharmacological & therapeutic role of macro-minerals and micro-minerals.
Content Outline	**Macrominerals** a. Calcium and Phosphorus b. Magnesium c. Sodium, Potassium, Chloride
	Microminerals a. Iron b. Copper c. Manganese d. Iodine e. Fluoride f: Zinc g. Selenium h. Cobalt i. Chromium j. Molybdenum
Assignments/Activities towards Comprehensive Continuous Evaluation (CCE) • Market survey on micronutrient fortification of food • Importance of micro nutrient supplement • Antioxidant property of micronutrient • How to minimize loses of micro nutrient while cooking	

Bibliography:

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- British Journal of Nutrition
- European Journal of Clinical Nutrition
- International Journal of Vitamin and Nutrition Research
- International Journal of Food Science and Nutrition
- Nutrition Research
- Annals of Nutrition & Metabolism

2.5.1Major (Elective)

Course Title	**Food Packaging- I**
Course Credits	4
Course Outcomes	After going through the course, learners will be able to
	1. State functions of packaging.
	2. Describe the various forms of packaging materials commonly used in food industry.
	3. Explain the principles and process involved in packaging.
	4. Interpret packaging standards and legislation in food packaging materials.
	5. Describe some of the recent developments in food packaging materials.
Module 1 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Recognizethe concept of packaging and different packaging systems.
	2.Discuss the importance and function of food packaging.
Content Outline	1. Packaging – Concept of Packaging, Production, Components of packaging. 2. Packaging of foods, requirement, importance, scope, frame work of packaging strategy, environmental considerations 3. Packaging systems, types- flexible and rigid; retail and bulk; levels of packaging, packaging for exports
Module 2 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1.Identify types of packaging techniques and their impact on product.
	2. Identify and apply role of packaging in improving shelf life of food.

Content Outline	1. Classification of Packages a. Primary, Secondary and Tertiary b. Special Box / Carton, Shrink, Aerosol, Vacuum, Boil-in-bag, Tetra pack, Squeeze tubes, Biodegradable, Laminated etc. c. Significance and functions d. Construction of Packages, Process Chart e. Shelf-life testing 2. Different types of packaging materials, their key properties, and applications- a. Metal cans and aluminium b. Plastic packaging, different types of polymers used in food packaging and their barrier properties. Types of plastic packaging materials; c. Glass containers used in food packaging, manufacture of glass and glass containers, closures for glass containers. d. Paper and paper board packaging, modification of barrier properties and characteristics of paper/ boards.
Module 3 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Elaborate on the different packaging techniques used for various foods.
	2. Elaborate on the aseptic packaging system.
Content Outline	1. Packaging of Processed Food Products, dehydrated products, Ready to eat/ cook foods 2. Packaging of Meat, Fish and Poultry 3. Packaging of Fresh Foods 4. Packaging of Dairy Products 5. Packaging of Bakery and Confectionery 6. Packaging of fruit juices 7. Aseptic Packaging – Sterilization of Packaging Materials, Using Aseptic System, process of aseptic packaging
Module 4 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1.Recognize FSSAI guidelines for packaging and labeling.
	2. Identify and apply testing techniques and disposal methods for various packaging materials.

Content Outline	1. Package testing 2. Testing methods for flexible materials, rigid materials and semi rigid materials 3. Tests for paper, glass containers, metal containers 4. FSSAI Food Packaging and Labelling regulations, guidelines and act 5. Disposal and recycling of packaging waste
Assignments/Activities towards Comprehensive Continuous Evaluation (CCE): • Identify various packaging material of the market sample • Explain role of packaging in increasing shelf life. • Elaborate different package testing techniques.	

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2.5.2 Major (Elective)

Course Title	**Food Waste Management**
Course Credits	4
Course Outcomes	After going through the course, learners will be able to
	1. Elaborate on the key concept of waste management
	2. Sensitizeabout the problem of waste generation and its impact on environment and human health.
	3. Get knowledge about existing legislation, knowledge, and practices regarding Waste Management in the country.
	4. Build a career in the fields of Environmental Hygiene, Waste Water and Solid Waste Management
Module 1 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Identify and Elaborate on the types of wastes
	2. Recognize the characterization and utilization of by-products
Content Outline	1. Problem of Wastes 2. Types of Solid Waste, Categories of solid waste, Effects of Excess Waste Generation, Waste Characterisation 3. Characterization and utilization of by-products from cereals, pulses, oilseeds, fruits, vegetables, plantation, dairy, eggs, meat, fish and poultry processing industries. 4. Elements of importance in efficient management of wastes from aforesaid food industries. 5. Standards for emission or discharge of environmental pollutants from food processing industries 6. Characterization of food industries effluents, in terms of parameters of importance
Module 2 (Credit 1)	

Learning Outcomes	After learning the module, learners will be able to
	1. Elaborate on effluent treatment techniques
	2. Identify and discuss parameters of effluent treatment
Content Outline	1. Concept of treating food industry effluents: Screening, sedimentation, floatation as per and primary treatments, biological oxidations: objectives, organisms, reactions, oxygen requirements, aeration devices. 2. Effect on characteristic parameters of effluents in treatments using lagoons, trickling filters, activated sludge process, oxidation ditches, rotating biological contracters and their variations and advanced modifications.
Module 3 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Elaborate on the advanced water treatment system
	2. Application on the utilization of bio waste
Content Outline	1. Advanced waste water treatment systems: physical, physicochemical and chemical treatments. Coagulation and flocculation, disinfection, handling and disposal of sludge and treated effluents conforming to EPA provisions. Bio filters and Bio clarifiers, Ion exchange treatment of waste water, Drinking-Water treatment, Recovery of useful materials from effluents by different methods. 2. Utilisation of by products
Module 4 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Elaborate on the waste management system, and its application

	2. Identify practices followed and success stories in waste management
Content Outline	1. Approaches to Effluent Waste Management- Basic unit operations in wastewater treatment, Anaerobic digestion of organic residues and wastes, fundamentals and applications of anaerobic digestion for sustainable treatment of food industry wastewater, Effluent treatment strategies for dairy/ brewery/ winery, Common biological treatment processes and on-site treatment systems. 2. Case studies, commercially viable practices and success stories of value-added products of waste and by-products from processing of different plant and animal food products, Food waste for pulp & paper, flavorings and aromas production
Assignments/Activities towards Comprehensive Continuous Evaluation (CCE) • Explain waste management techniques • Visit report on effluent treatment plant in food industry • Elaborate on advanced effluent treatment techniques	

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2.5.3 Major (Elective)

Course Title	**Sustainability and Environmental, Social Governance**
Course Credits	4
Course Outcomes	After going through the course, learners will be able to
	1. Elaborate and apply the principles, challenges, and opportunities within the field of sustainability and sustainability infrastructure.
	2. Acquire knowledge about air quality, water management, waste reduction
	3. Recognize environmental ethics, and green finance.
	4. Describe how ESG operates as a process for mitigating environmental and social risks in practice.
	5. Explain the shifting role of investors, in particular institutional investors, with respect to embracing environmental and social issues.
Module 1 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Elaborate on the sustainability and its importance.
	2. Develop an encompassing understanding of sustainability issues.
Content Outline	1. Introduction to Sustainability • General introduction of Sustainability • Defining Sustainability and its Dimensions • Historical Evolution of Sustainability • Sustainable development goals 2.Air Quality and Pollution Control • Understanding air pollution sources and effects • Air quality monitoring and management • Sustainable air quality improvement strategies
Module 2 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Identifychallenges in waste management, recycling and reducing waste.
	2. Recognize the importance of circular economy.

Content Outline	1. Water Resources Management • Principles of Water Management and Conservation • Challenges in Water Scarcity and Quality • Sustainable Water Management Techniques 2. Waste Management and Circular Economy • Solid Waste Generation and Disposal Challenges • Strategies for Reducing, Reusing, and Recycling Waste • Introduction to Circular Economy and its principles
Module 3 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Discuss the conflicts which are involved in the sustainability concept on the local, national as well as on the global level.
	2. Identify different stakeholders in a challenge to sustainability, and analyze the political and economic structures that connect them.
Content Outline	1. Environmental Ethics and Governance • Ethical Considerations in Sustainability decision making of Environmental Policies and Regulations • Role of Stakeholders in Sustainability Governance 2. Green Finance and Economics • Principles of Green Finance and Sustainable Investments • Evaluating Environmental and Social Impact in Finance • Financing Models for Renewable Energy and Conservation Projects 3. Sustainable Infrastructure • Green Building Design and Construction • Energy-Efficient Infrastructure Planning • Integration of Sustainable Technologies in Infrastructure
Module 4 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Elaborate on the embedment of sustainability issues in environmental, societal, and economic systems, and the relevance of the conditions, interrelations, and dynamics of these systems.
	2. Use ESG management and investing as climate impact and risk management tools.

Content Outline	1. Biodiversity and Ecosystem Services • Importance of Biodiversity and Ecosystem Health • Ecosystem Services Valuation and Conservation • Restoration Ecology and Biodiversity Enhancement 2. Climate Change and Adaptation • Understanding Climate Change Science and Impacts • Mitigation and Adaptation Strategies • Role of Individuals and Communities in Climate Action
Assignments/Activities towards Comprehensive Continuous Evaluation (CCE): • Quizzes • Group Discussions and Debates • Case Study Analysis • Research Papers • Capstone Project Presentation and Report • Field Visits	

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2.6 OJT

Course Title	**Internship**
Course Credits	4
Course Outcomes	After going through the course, learners will be able to
	1. Acquire professional skills in various departments of food industry /quality testing laboratories.
	2. Understand working environment of food industry.
	3. Get Acquitted with the various aspects of entrepreneurship.
	4. Understand the scope, functions, and job responsibilities in various department of organization.
Learning Outcomes	After learning the module, learners will be able to
	1. Gain an understanding of workplace dynamics, professional expectations.
	2.Refine and clarify professional and career goals through critical analysis of the internship experience or research project.
Content Outline	1. Every candidate shall undergo professional training for 30 days in large scale/ MSME/ food processing units/ Food and water testing laboratory. 2. Internal and External evaluation will be carried out to assess the progress of the work during Internship 3. At the end of the professional training the student must submit a report for which viva will be conducted by an External Examiner.
	a. Orientation to in plant training b. Documentation c. Project report preparation d. Presentation