

**Restructured Curriculum with Credit based Semester System
(CBCS) for B.Sc. Food Science and Technology
Three Years (Semester: I-VI)**

(w. e. f. Academic Session 2018-19)



DEPARTMENT APPLIED BIOLOGY

SCHOOL OF BIOLOGICAL SCIENCES

University of Science & Technology, Meghalaya

(Techno-City, 9th Mile, Baridua, Ri-Bhoi, Meghalaya-793101)

STRUCTURE OF B. SC. FOOD SCIENCE AND TECHNOLOGY UNDER CBCS

Core Course/ Hard core

1. FST- 101 INTRODUCTION TO FOOD SCIENCE AND TECHNOLOGY
2. FST- 102 FOOD CHEMISTRY
3. FST- 103 BIOCHEMISTRY AND NUTRITION
4. FST- 201 UNIT OPERATION IN FOOD PROCESSING
5. FST- 202 TECHNOLOGY OF FRUITS AND VEGETABLES PROCESSING
6. FST- 203 BASIC AND FOOD MICROBIOLOGY
7. FST-301 INSTRUMENTAL TECHNIQUES IN FOOD ANALYSIS
8. FST-302 CEREAL PULSES AND OIL SEED TECHNOLOGY
9. FST-303 DAIRY TECHNOLOGY
10. FST-401 TECHNOLOGY OF BEVERAGE, PLANTATION CROPS AND SPICES
11. FST-402 BAKERY, CONFECTIONERY AND EXTRUDED FOODS
12. FST-403 FOOD PACKAGING TECHNOLOGY
13. FST-501 MEAT, POULTRY & FISH TECHNOLOGY
14. FST-502 FOOD QUALITY, STANDARDS AND REGULATIONS
15. FST- 503 BUSINESS MANAGEMENT AND ENTREPRENEURSHIP
16. FST-601: INDUSTRIAL TRAINING & REPORT WRITING
17. FST-602 SEMINAR

Ability Enhancement Compulsory Courses (AECC)

1. FST- 105(BEN-711) COMMUNICATIVE ENGLISH
2. FST- 205 ENVIRONMENTAL STUDIES

Generic Electives (GE)

1. FST- 104 FOOD PROCESSING & PRESERVATION
2. FST-204 SENSORY EVALUATION OF FOODS
3. FST-305 FOOD PROCESS ENGINEERING
4. FST-405 STATISTICS AND DOCUMENTATION SKILL

Discipline specific elective (DSE)/ soft core (Any Four)

1. FST-504 NEUTRACEUTICALS AND HEALTH FOODS
2. FST-505 TEA PLANTATION TECHNOLOGY
3. FST-506 FOOD BIOTECHNOLOGY AND TOXICOLOGY
4. FST-603 PROJECT/DISSERTATION
5. FST-604 AROMATIC AND MEDICINAL PLANT
6. FST-605 FOOD HYGEINE AND SANITATION

Skill enhancement courses (SEC)

1. FST-304 FOOD FERMENTATION TECHNOLOGY
2. FST-404 FOOD PRODUCT DEVELOPMENT

Non-Credit Compulsory Course

1. HVP 760: FUNDAMENTALS OF HUMAN VALUES AND PROFESSIONAL ETHICS

PROPOSED SCHEME FOR CHOICE BASED CREDIT SYSTEM FOR B. SC. FOOD SCIENCE AND TECHNOLOGY

Semester	CORE COURSE (14)	Elective: Discipline Specific DSE (4)	Elective: Generic (GE) (4)	Ability Enhancement Compulsory Course (AECC) (2)	Skill Enhancement Course (SEC) (2)
I	FST- 101 INTRODUCTION TO FOOD SCIENCE AND TECHNOLOGY FST- 102 FOOD CHEMISTRY FST- 103 BIOCHEMISTRY AND NUTRITION		FST- 104 FOOD PROCESSING & PRESERVATION	BEN 711/ FST 105: COMMUNICATIVE ENGLISH	
II	FST- 201 UNIT OPERATIONS IN FOOD PROCESSING FST- 202 TECHNOLOGY OF FRUITS AND VEGETABLES PROCESSING FST- 203 BASIC AND FOOD MICROBIOLOGY		FST-204 SENSORY EVALUATION OF FOODS	FST- 205 ENVIRONMENTAL STUDIES	
III	FST-301 INSTRUMENTAL TECHNIQUES IN FOOD ANALYSIS FST-302 CEREAL PULSES AND OILSEED TECHNOLOGY FST-303 DAIRY TECHNOLOGY		FST-305 FOOD PROCESS ENGINEERING		FST-304 FOOD FERMENTATION TECHNOLOGY
IV	FST-401 TECHNOLOGY OF BEVERAGE, PLANTATION CROPS AND SPICES FST-402 BAKERY, CONFECTIONERY AND EXTRUDED FOODS FST-403 FOOD PACKAGING TECHNOLOGY		FST-405 Statistics and data analysis		FST-404 FOOD PRODUCT DEVELOPMENT
V	FST-501 MEAT, POULTRY & FISH TECHNOLOGY FST-502 FOOD QUALITY STANDARDS AND REGULATIONS FST- 503 BUSINESS MANAGEMENT AND ENTREPRENEURSHIP	FST-504 NEUTRACEUTICALS AND HEALTH FOODS FST-505 TEA PLANTATION TECHNOLOGY FST-506 FOOD BIOTECHNOLOGY AND TOXICOLOGY		HVP 760: FUNDAMENTALS OF HUMAN VALUES AND PROFESSIONAL ETHICS Non-Credit Compulsory Course	
VI	FST-601: INDUSTRIAL TRAINING & REPORT WRITING FST-602 SEMINAR	FST-603 PROJECT/DISSERTATION FST-604 AROMATIC AND MEDICINAL PLANT FST-605 FOOD HYGEINE AND SANITATION			

Restructured Curriculum with Credit based Semester System for Undergraduate
Programme in **B.Sc. Food Science and Technology**

Syllabus Contents

Semester	COURSE CODE	Paper Code	Title of the Paper	Credits	Nature	Distribution of Marks		
						T/P	Internal	End Semester
I	C1	FST- 101	INTRODUCTION TO FOOD SCIENCE AND TECHNOLOGY	4	T	30	70	100
	C2	FST- 102	FOOD CHEMISTRY	4	T	30	70	100
	C3	FST- 103	BIOCHEMISTRY AND NUTRITION	4	T	30	70	100
	GE1	FST- 104	FOOD PROCESSING & PRESERVATION	4	T	30	70	100
	AECC1	(BEN 711) FST 105	COMMUNICATIVE ENGLISH	4	T	30	70	100
	P-1	FST-106	PRACTICAL –I	4	P	30	70	100
			TOTAL	24	-	180	420	600
II	C4	FST- 201	UNIT OPERATIONS IN FOOD PROCESSING	4	T	30	70	100
	C5	FST- 202	TECHNOLOGY OF FRUITS AND VEGETABLES PROCESSING	4	T	30	70	100
	C6	FST- 203	BASIC AND FOOD MICROBIOLOGY	4	T	30	70	100
	GE2	FST- 204	SENSORY EVALUATION OF FOODS	4	T	30	70	100
	AECC	FST- 205 (BEV 720)	ENVIRONMENTAL STUDIES	4	T	30	70	100
	P-2	FST-206	PRACTICAL –II	4	P	30	70	100
		TOTAL	24		180	420	600	
III	C7	FST-301	INSTRUMENTAL TECHNIQUES IN FOOD ANALYSIS	4	T	30	70	100
	C8	FST-302	CEREAL, PULSES AND OILSEED TECHNOLOGY	4	T	30	70	100
	C9	FST-303	DAIRY TECHNOLOGY	4	T	30	70	100
	SEC1	FST-304	FOOD FERMENTATION TECHNOLOGY	4	T	30	70	100
	GE3	FST-305	FOOD PROCESS ENGINEERING	4	T	30	70	100
	P-3	FST-306	PRACTICAL –III	4	P	30	70	100
		TOTAL	24		180	420	600	
IV	C10	FST-401	TECHNOLOGY OF BEVERAGE, PLANTATION CROPS AND SPICES	4	T	30	70	150

	C11	FST-402	BAKERY, CONFECTIONARY AND EXTRUDED FOODS	4	T	30	70	100
	C12	FST-403	FOOD PACKAGING TECHNOLOGY	4	T	30	70	100
	SEC2	FST-404	FOOD PRODUCT DEVELOPMENT	4	T	30	70	100
	GE4	FST-405	STATISTICS AND DATA ANALYSIS	4	T	30	70	100
	P-4	FST-406	PRACTICAL –IV	4	P	30	70	100
			TOTAL	24		180	420	600
V	C13	FST-501	MEAT, POULTRY & FISH TECHNOLOGY	4	T	30	70	100
	C14	FST-502	FOOD QUALITY STANDARDS AND REGULATIONS	4	T	30	70	100
	C15	FST-503	BUSINESS MANAGEMENT AND ENTREPRENEURSHIP	4	T	30	70	100
	DSE 1,2 Elective (Any Two)	FST-504	NEUTRACEUTICALS AND FUNCTIONAL FOODS	4	T	30	70	100
		FST-505	TEA PLANTATION TECHNOLOGY					
FST-506		FOOD BIOTECHNOLOGY AND TOXICOLOGY						
P-5	FST-507	PRACTICAL -V	4	P	30	70	100	
			TOTAL	24	-	180	420	600
VI	C16	FST-601	INDUSTRIAL TRAINING & REPORT WRITING	12	P	30	70	100
	C17	FST-602	SEMINAR	1	P	15	35	50
	DSE3	FST-603	PROJECT/ DISSERTATION	6	P	30	70	100
	DSE4 Elective (any one)	FST-604	AROMATIC AND MEDICINAL PLANT	4	T	30	70	100
		FST-604	FOOD HYGEINE AND SANITATION					
P-6	FST-606	PRACTICAL -VI	1	P	15	35	50	
NC-1	HV-740	FUNDAMENTAL OF HUMAN VALUES AND PROFESSIONAL ETHICS	NC	-	-	-	-	
			TOTAL	24	-	125	275	400
<p>C-Core Course DSE-Discipline Specific Elective GE-Generic Electives AECC-Ability Enhancement Compulsory Courses SEC- Skill Enhancement Elective Courses T= Theory; P= Practical (<i>Lab/Fieldwork/Dissertation/Project etc.</i>) NC= Non credit S= Satisfactory NS= Non satisfactory</p>								

PROGRAM OUTCOMES (PO)

Under Graduate Professional Degree Programmes

B. Sc. Food Science & Technology programme incorporates the utilization of logical standards and techniques in assembling and protection of food items; additionally covering the regions of food preparing and packaging that provides students with a lot career opportunities. Principle target of this course is to train the students to have understanding about composition of the food, their healthful, physio-synthetic, microbiological properties, various systems identified with food prevention and handling and to ponder the significance of food quality, plant sanitation, sustenance laws and guidelines, food engineering and packaging in food industry. Students having degree on B. Sc. Food Science & Technology are in huge demand in the food processing or production industry that creates more employment in the food production industry so that better service can be given to the customers. There are endless career opportunities in the field of food production where a professional is highly required to ensure that the food which is getting produced and supplied provide highest quality to the customers. This course mostly focuses on making students able to understand the formation of food, the importance of the nutrition available in it, microbiological properties of food, various techniques which get used in food preservation and processing the food. All these area provide a huge employment opportunity in food industry.

PROGRAMME SPECIFIC OUTCOMES (PSO)

Programme Name: B.Sc. Food Science and Technology

Programme Code: BFST

PSO1. Understand the concepts of different areas of food science and technology.

PSO2. Understand the food composition and its physicochemical, nutritional, microbiological and sensory aspects.

PSO3. Comprehend the processing and preservation techniques of cereals, pulses, plantation crops, oilseeds, spices, fruits and vegetables, meat, fish, poultry, milk & milk products.

PSO4. Understand various concepts of food engineering, food packaging, food laws and regulations (national and international), food safety and quality assurance and food plant sanitation.

PSO5. Become a successful entrepreneur, professional and pursue higher education, apply skill based knowledge in food industry.

Details of Courses for B.Sc. Food Science and Technology

SEMESTER I

FST-101: INTRODUCTION TO FOOD SCIENCE AND TECHNOLOGY (CREDITS: 4)

CO1: (0.20) To understand the history and evolution of food processing and to make aware about the career and present scenario of Food and nutrition.

CO2 : (0.25) Students will get thorough knowledge of the structure and composition of cereals, pulses and oil-seeds.

CO3: (0.15) To give complete description of meat and meat products and their processing

CO4: (0.15) To learn about the technologies behind the processing of milk and their products.

CO5: (0.25) .To learn about traditional Indian foods and genetically modified and organic foods.

Theory

UNIT -1

Food industry: History and developments of important food industries in India.

Introduction: Basics of food science & technology; relationship with other disciplines; career opportunities. Significance of food science and technology. Global and national food and nutrition situation.

UNIT -2

Food from Plant Sources

Food grains: cereals; structure and composition of cereals, post harvest processing, foods from cereals. Grain legumes; composition of legumes, processing of pulses. Oilseeds: characteristics, processing of oilseeds. Horticultural crops: structure and composition, post harvest technology.

UNIT -3

Foods of Animal Origin

Meat and meat products: livestock, poultry and meat production, wholesome meat production, processed meats, eggs and egg products, egg quality, shell egg processing, spoilage and preservation of shell egg, packaging and transport of shell eggs, egg products. Milk and milk products; clean production of market milk, milk processing. Fish and fishery products; aquatic animal production, processing, deterioration of fish and shellfish.

UNIT -4

Other Foods

Traditional Indian foods; honey; composition, uses and health benefits, safety concerns. Genetically modified foods; technology, benefits, risks, regulations. Infant foods; traditional infant foods, commercial infant foods and formulae, concerns and regulations. Organic foods; advantages, concerns and regulations.

Books Recommended

Potter, N.N. and Hotchkiss, J.H. 2007. Food science. The AVI Pub. Co. Inc., Westport, Connecticut, USA.

Bawa. A.S, O.P Chauhan etal. Food Science. New India Publishing agency, 2013

FST-102: FOOD CHEMISTRY (CREDITS: 4)

CO1: (0.15) To provide thorough understanding of different properties of water and their effect in shelf life

CO2: (0.25) To understand the chemical structure and the different reactions of various components of food

CO3: (0.20) To provide comprehensive knowledge about the physical and functional properties of the proteins

CO4: (0.25) To provide comprehensive knowledge about the physical and functional properties of different vitamins

CO5:(0.15) To understand the basic characteristic and stability of colors, flavor, enzyme and other aromatic compounds

Theory

UNIT -1

Water: types, properties, structure, water activity, sorption isotherms, effect on shelf life of food.

UNIT -2

Carbohydrates: classification, structure, physical and chemical properties, browning reactions; enzymatic browning, caramelization, Maillard reaction, dietary fiber. Lipids: classification, structure, fatty acids, properties, rancidity, emulsifiers, antioxidant.

UNIT -3

Proteins: classification, structure, amino acids, chemical, physical and functional properties.
Mineral elements: introduction, chemical and functional properties.

UNIT -4

Vitamins: classification, properties, structure, stability.
Fortification – Need and Types.
Colors and pigments: functions, properties, stability.

UNIT -5

Flavors: characteristics – taste and other saporous substances, aromatic compounds.
Enzymes: nature, functions, classification. Important enzymes in food processing.

Books Recommended

1. Damodaran, S., Parkin, K.L. and Fennema, O.R. 2008. Fennema, s food chemistry. CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.
2. DeMan, J.M. 2007. Principles of food chemistry. Springer Verlag, Heidelberg, Germany.
3. Belitz, H.D, Groschm, W. and Schieberle, P. 2004. Food chemistry. Springer Verlag, Heidelberg, Germany.

FST- 103: BIOCHEMISTRY AND NUTRITION (CREDITS: 4)

CO1: (0.20) To understand the concept of food, nutrients, diet, balanced diet.

CO2: (0.15) To classify foods into various food groups and understand the food pyramid.

CO3: (0.15) To understand various different nutrients present in food, its types, sources and dietary requirements in the body.

CO4: (0.25) To have a basic knowledge about the various important functions of the different nutrients required to maintain proper health

CO5: (0.25) To understand digestion and absorption of various nutrients inside the human body.

Theory

UNIT -1

Introduction: definitions, food, nutrients, diet, balanced diet, food groups, food guide pyramid, meal planning. Eating food: smell, taste, satiety.

Water: functions, sources, regulation in body, water and electrolytic balance, dietary requirements, content in food.

UNIT -2

Carbohydrates: types, role in body, dietary fiber, sweeteners, dietary requirements, content in food.

Fats and oils: types, functions, dietary requirements, content in food, fat substitutes.

UNIT -3

Proteins: amino acids, protein synthesis, classification, functions, quality of proteins, dietary requirements, content in foods.

Vitamins: classification, role in body, content in food. Mineral elements: types, requirements, sources, functions.

UNIT -4

Digestion: alimentary tract, digestive juices, secretions, digestion of carbohydrate, TCA cycle, glycolysis, glycogenolysis, glyconeogenesis pathway, ETC.

Absorption and metabolism of nutrients: carbohydrates, protein, lipids. Nutrient and dietary deficiency disorders: malnutrition, obesity, coronary diseases, diabetes, lactose and gluten intolerance, dental caries – symptoms, causes, prevention.

Books Recommended

1. Geissler, C. and Powers, H. 2010. Human nutrition. Churchill Livingstone, London, UK.
2. Awan, J.A. 2007. Elements of food and nutrition. Unitech Communications, Faisalabad- Pakistan.
3. Bamji, M.S., Rao, N.P. and Reddy, V. 2004. Textbook of human nutrition. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India.
4. Eastwood, M. 2003. Principles of human nutrition. John Wiley & Sons, Inc., New York, USA.

FST-104: FOOD PROCESSING & PRESERVATION (CREDITS: 4)

CO1: (0.25) To impart knowledge about post harvest handling of foods for food processing

CO2: (0.25) To learn about various heat processing methods and their effects on the nutritional aspects of food

CO3: (0.15) To provide complete knowledge of all the chemical additives used in foods and standards

CO4: (0.20) To understand the fermentation process and its usage in preparation of different products

CO5: (0.15) To learn about the sciences behind the fermented products

Theory

UNIT -1

Postharvest handling and preparation of foods for food processing: introduction, properties of raw materials, storage and transportation of raw materials. Preparatory operations: cleaning, sorting, grading, size reduction, blanching, sulphiting, minimal processing technology.

UNIT -2

Heat processing: methods – thermisation, pasteurization, HTST, commercial sterilization, UHT. Canning: unit operations. Retort operation: equipment. Effect of heat processing: nutrients, microorganisms. Low temperature preservation: refrigeration: methods and equipments. Cold storage: requirements, insulation, air circulation, humidity, refrigeration load, controlled atmospheric storage.

UNIT -3

Freezing: theory, equipment and changes in foods. Evaporation and dehydration: evaporation – concentration and condensation, principles, equipments, applications. Drying – principles, equipments, types of driers – cabinet (tray), kiln, tunnel, conveyer (belt), fluidized, pneumatic (flash), rotary. Dehydration: applications, dehydrated products – vegetables, fruits and milk.

UNIT -4

Use of chemical additives: contaminants, adulterants, additives. Food additives: classification, criteria for selection, GRAS additives, permissible limits, food safety, E-numbers. Preservation by fermentation technology: principles, objectives, types - alcoholic, acetic and lactic fermentations.

UNIT -5

Fermented foods: bread, wine, vinegar, yoghurt, sausages, pickles. Food irradiation: principles, applications, equipments, safety aspect, effect on food properties, detection methods.

Books Recommended

1. Awan, J.A. 2009. Food processing and preservation. Unitech Communications, Faisalabad, Pakistan.
2. Awan, J.A. and Rehman, S.U. 2009. Food preservation manual. Unitech Communications, Faisalabad, Pakistan.
3. Rahman, M.S. 2007. Handbook of food preservation. CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.
4. Brennan, JG. 2006. Food processing handbook. Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany.
5. Fellow, P.J. 2005. Food processing technology: principles and practices, 2nd ed. CRC Press, Taylor & Francis Group, Boca Raton, Florida.

BEN 711/ FST 105: COMMUNICATIVE ENGLISH (CREDITS: 4)

Theory

Unit 1: Literary Texts (Poetry) This particular unit will help the students to enjoy, understand and interpret poems and develop a taste for fine poetry. The texts that have been chosen to be included are as follows:

- “The Poison Tree” by William Blake
- “The Daffodils” by William Wordsworth
- “If” by Rudyard Kipling.

Unit 2: Literary Texts (Prose)

This particular unit will help the students to foster a taste for literary prose pieces. The texts that have been chosen to be included are as follows:

- “The Stolen Bacillus” by H.G. Wells

- “The Verger” by Somerset Maugham
- “Shooting an Elephant” by George Orwell.

Unit 3: Grammar and Usage:

Determiners, Tenses, Voice, Direct and Indirect Speech, Punctuation, Word Formation, Antonyms and Synonyms, Homophones, One-word substitution. Idioms and Phrases.

Unit 4: Writing Skills:

This part would include areas like official correspondence, Letter (Formal and Informal), Circular, Notice, Writing Cvs/ Resume, Essay writing, e-mail writing, Blog writing, Story Writing, Paragraph writing. The second section of this part will include **Comprehension** and **Precis Writing** that will enable the students to understand a particular passage and then express their opinions in their own language. This will enhance the student's reading and writing abilities.

Suggested Readings:

2. Nilanjana Gupta, *Communicate With Confidence*, Anthem Press.
3. V. Shyamala, *Effective English Communication for You*, Emerald Publisher.
4. Krishnamohan and Meera Bannerji, *Developing Communication Skills*.
5. R.K. Madhukar, *Business Communication*, Vikash Publishing house Pvt. Ltd.
6. Shalin Sharma, *Concepts of Professional Communication*, Acme Learning
7. Daniel Jones, *English Phonetics*.
8. R.K. Bansal and Harrison, *Spoken English for India*, Sec. Ed. Madras Orient Longman.
9. Donald Treadwell and Jill B. Treadwell, *Public Relations Writing*, Sec. Ed. Sage Publications, Inc.
10. P.D. Chaturvedi and Mukesh Chaturvedi, *Business Communication Concepts, Cases and Applications*, Sec. Ed. Manipal Press Limited.
11. Sarah Trenholm and Arthur Jensen, *Interpersonal Communication*, Sixth Ed. Oxford University Press.
12. Pulak Bhattacharyya (ed), *Musings- II: A Collection of English Prose*, Book Land Publishers.
13. David V. Erdman(ed), *The Complete Poetry and Prose of William Blake*, Anchor Publishers.
14. Maugham, Somerset, 65 Short Stories, Heinemann: London, 1988[rpt] Henry Reed(ed), *The Complete Poetical Works of William Wordsworth*, Troutman and Hayes Publishers

FST-106 : Practical –I (CREDITS: 4)

CO1: (0.20) To acquaint students with the various laboratory instruments used in food processing analysis

CO2: (0.25) To give comprehensive knowledge to students regarding practical laboratory works related to the preliminary analysis of the food materials.

CO3: (0.25) To give detailed understanding of the analytical processes to be used in food processing and preservation laboratories

CO4: (0.15) To increase the better documentation and communication abilities of students

CO5: (0.15) To provide students better computing skills through practical exposures.

FOOD SCIENCE AND FOOD CHEMISTRY LAB.

Practical

Use of laboratory equipments. Estimation of moisture, fat, protein, carbohydrates, fiber and ash in food samples.

Determination of soluble solids, total solids, pH, acidity, total sugars, specific gravity.

Determination of calorific value of foods.

Detection of presence of starch by Iodine test.
Determination of water activity of different food materials.
Determination of minerals.

FOOD PROCESSING & PRESERVATION LAB

Blanching and sulphiting of selected fruits, vegetables. Freezing of fruits and vegetables. Drying and Dehydration of fruits and vegetables. Drying foods in tray dryer and fluidized bed dryer, vacuum freeze dryer.

Use of food additives in preservation of food products. Preservation of vegetables with vinegar, and pickles. Evaluation of bottled, frozen and dehydrated products. Visit to food industries.

SEMESTER- II

FST-201: UNIT OPERATION IN FOOD PROCESSING (CREDITS: 4)

CO1: (0.15) Students will have a thorough understanding of all the unit operations related to food system

CO2: (0.25) This course provide thorough understanding of heat transfer, mass transfer as well as Energy transfer fundamentals

CO3: (0.20) The course gives the idea about different fluid flow behavior in food

CO4: (0.15) The students will get complete knowledge of different filtration methods used in food system

CO5: (0.25) The course also includes all the non thermal preservation techniques

Theory

UNIT 1

Energy and mass balance: heat transfer fundamentals – conduction, convection and radiation. Mass balance equations and Pearson’s Law. Distillation: Distillation, Steam distillation, applications and equipment – determination of height equivalent of theoretical plate (HETP) – McCabe-Thiele method – reflux ratio. Molecular distillation, theory and examples. Mass transfer phenomenon applied to food systems

UNIT -2

Fluid flow in food processing: Liquid Transport Systems – Pipes and Pumps, PUMPS- Definition, classification, positive displacement and centrifugal pumps, factors affecting choice

Of a pump, Properties of liquids - Density, Pressure, Surface tension and Viscosity. Air-water mixture: psychometric charts and their application.

UNIT- 3

Rheology of food products: stress, deformation and other aspects. Newtonian and non Newtonian fluids, laminar and turbulent fluid, The Continuity equation, Reynolds number, Energy equation for steady flow of fluids – pressure, kinetic energy, potential energy, frictional loss, power requirements of a pump.

UNIT -4

Membrane filtration technology: Principles of other food processing such as-RO, UF, dialysis, osmosis, microfiltration and nano filtration -outlines.

UNIT -5

Non-thermal preservation: Hydrostatic pressure, dielectric heating, microwave processing, high pressure, pulsed electric field, hurdle technology, irradiation.

Books Recommended

1. McCabe, W.L., Smith, J.C and Harriott, P. 2005. Unit operations of chemical engineering. McGraw Hill Inc., New York, USA.
2. Earle, R.L. and Earle, M. D. 2004. Unit operations in food processing (web edition). The New Zealand Institute of Food Science and Technology. Available at: <http://www.nzifst.org.nz/unitoperations/>.
3. Jeankopolis, C.J. 2004. Transport processes and separation process. Prentice Hall Professional Technical Reference, New Jersey, USA.
4. Gustavo, A and Barbosa-Canovas, V. 2002. Unit operations in food engineering. CRC Press, Taylor & Francis Group, Boca Raton, Florida.

FST-202: TECHNOLOGY OF FRUITS AND VEGETABLES PROCESSING (CREDITS: 4)

CO1: (0.25) Students will have thorough understanding of various methods to identify any disorder in fresh fruits and vegetables.

CO2: (0.20) Students will get thorough idea of the techniques used to increase palatability of fruits and vegetables.

CO3: (0.25) Students will get to know all the processing techniques to make value added products from fruits and vegetables.

CO4: (0.15) Students will have thorough knowledge of different transportation, packaging and storing techniques of fresh as well as processed products.

CO5: (0.15) Students will get to know the methods used for increasing shelf life.

Theory

UNIT -1

Postharvest technology: introduction, production, losses, causes, trade. Fruit ripening: changes during ripening, recommended conditions, commercial practices, water loss, respiration activity. Harvesting and handling methods. Maturity assessment of different fruits and vegetables.

Ripening process: respiration, climacteric and non-climacteric patterns, pectin substances, ripening conditions. Postharvest physiology of fruits and vegetables.

UNIT -2

General properties of fruits and vegetables: chemical composition, nutritional aspects, structural features, choice of processing technologies. Maintaining post-harvest quality of fruits and vegetables: quality criteria, quality deterioration – measurement and maintenance. Spoilage factors (chemical, enzymatic, biological) and their control.

UNIT -3

Preparatory Operations: Cleaning, sorting, grading, peeling and blanching methods. Postharvest treatments: coatings, curing, vapor heat treatment, hot water treatment, degreening. Storage: refrigerated, CA, hypobaric, MAS. Packaging: types, design, modified atmospheric packaging, Recycling. Cold chain: Zero energy cool chamber, packing house operations, transportation. Safety and quality of fruits and vegetables.

UNIT -4

Processed fruit products: Jam- (definition, standards, method of manufacture); Jelly- (definition, standards, method of manufacture); Marmalades- (definition, standards, method of manufacture). Juice (Extraction, Clarification, pasteurization, Preservation) Unfermented beverages- classification, standards and preparation of Natural juice, sweetened juice, RTS, Nectar, Cordial, Squash, Crush, Syrup.

Other products: sauerkraut, mango slices, mango leather, fruit cheese, fruit butter, fruit toffee. Utilization of fruits and vegetable waste.

UNIT -5

Processed vegetable products: Potato Processing- manufacture of potato chips, French fries and potato

flour. Tomato processing- manufacture and standards of tomato juice, tomato puree, tomato paste, tomato ketchup, tomato soup.

Books Recommended

Chakraverty, A., Mujumdar, A.S., Raghavan, G.S.V., Ramaswamy, H.S. 2003. Handbook of postharvest technology: cereals, fruits, vegetables, tea, and spices, Marcel Dekker, Inc., New York, USA.

Thompson, A.K. 2003. Fruit and vegetables harvesting, handling and storage. Blackwell Science Pub., Cambridge, UK.

Awan, J.A and Rehman, S.U. 2009. Food preservation manual. Unitech Communications, Faisalabad, Pakistan.

Jongen, W. (Ed). 2002. Fruit and vegetable processing – improving quality. Woodhead Publishing. Ltd., Abington, Cambridge, UK.

Srivastava, R.P. and Sanjeev, K. 2002. Fruit and vegetable preservation: principles and practices. International Book Distributing Co., Lucknow, India.

Dauthy, M.E. 1995. Fruit and vegetable processing. FAO Agricultural Services Bulletin No. 119. Food and Agriculture Organization of the United Nations, Rome, Italy.

FST-203: BASIC AND FOOD MICROBIOLOGY (CREDITS: 4)

CO1: (0.25) To acquaint students the cellular structure and characteristics of different types of microorganisms.

CO2: (0.15) To help students understand the growth pattern, and the control agents for different microorganisms.

CO3: (0.25) To provide students a thorough understanding of various factors responsible for food spoilage.

CO4: (0.20) To make students understand the specifications of various contamination sources and disease developed in certain processed products.

CO5: (0.15) Students will also have an exposure to various equipments, reagents and techniques used for microbial analysis of food products.

Theory

UNIT-1

Introduction to microbiology: Historical background and branches of microbiology. Significance of microorganisms in food, Cell theory, difference between prokaryotic and eukaryotic cells, Haeckel's Kingdom protista, Whittaker five kingdom classification, Germ theory and Koch's postulates, Characteristics of bacteria, yeasts, moulds, viruses. Structures and types of microbial cells (bacteria, yeast and mold). Working principle of light microscopes (Dark-field, Bright-field, Fluorescence and Phase contrast microscopes) and electron microscopes, Simple and differential staining techniques.

UNIT-2

Microbial Growth: Growth curve and its different phases, Factors affecting microbial growth, Generation time, Synchronous and Asynchronous growth, Culture maintenance and preservation.

UNIT-3

Microbial Spoilage of foods: Contamination of foods, Microbial spoilage of milk & milk products, meat, fish, poultry & egg products, fruits & vegetable products, Cereal grains, bakery and confectionery products, fermented and canned foods.

UNIT-4

Food borne diseases: Food intoxications (Botulism, Staphylococcal Gastroenteritis) and infections (Salmonella, Shigella, *Clostridium perfringenes*, *Bacillus cereus* and *E.coli* infections), Mycotoxins

(Aflatoxin, Patulin, Ochratoxin) and their causative agents

UNIT-5

Control of micro-organisms: Concept of TDT, F, z and D-value, Microbial spores, Physical & chemical anti-microbial agents - .Temperature, Osmotic pressure, Radiations, Surface tension, Filtration, Phenols, Alcohols, Halogens (iodine and chlorine), Heavy metals, Detergents, Quaternary Ammonium compounds, Aldehydes, Ethylene oxide.

Books Recommended

1. Tortora, G.J., Funke, B.R. and Case, C.L. 2009. Microbiology: an introduction. The Benjamin/Cummings Pub. Co, Redwood City, California, USA.
2. Frazier, W.C. and Westhoff, D.C. 2008. Food microbiology. McGraw Hill Book Co, New York, USA.
3. Awan, J.A. and Rahman, S.U. 2005. Microbiology manual. Unitech Communications, Faisalabad, Pakistan.
4. Banwart, G.J. 2004. Basic food microbiology, 2nd ed. CBS Publishers and Distributors, New Delhi, India.

FST-204: SENSORY EVALUATION OF FOODS (CREDITS: 4)

CO1: (0.25) To acquaint with sensory quality parameters of food

CO2: (0.15) To provide comprehensive knowledge about the methods of sensory evaluation of foods.

CO3: (0.20) To study the impact of food processing on its sensory and nutritional quality.

CO4: (0.15) To understand the different problems related to sensory.

CO5: (0.25) To give thorough understanding of different tests used in sensory evaluation.

THEORY

UNIT- 1

Taste: Introduction and importance of taste, Structure and physiology of taste organs- tongue, papillae, taste buds, salivary glands, Mechanism of taste perception, Chemical dimensions of basic tastes- sweet, salt, sour, bitter and umami, Factors affecting taste quality, reaction time, taste modification, absolute and recognition, threshold Taste abnormalities, Taste measurement.

Odour: Introduction, definition and importance of odour and flavor Anatomy of nose, physiology of odor perception, mechanism of odor perception, Odor classification, chemical specificity of odor. Odor measurement using different techniques – primitive to recent techniques. Merits and demerits of each method. Olfactory abnormalities

UNIT-2

Color: Introduction and importance of colour. Dimensions of color and attributes of color, appearance factors, gloss etc. Perception of color. Color abnormalities, Measurement of color; Munsell color system, CIE color system, Hunter color system, spectrophotometry and colorimetry etc.

Texture: Introduction, definition and importance of texture, Phases of oral processing, Texture perception, receptors involved in texture perception, Texture classification, Texture measurement – basic rheological models, forces involved in texture measurement.

UNIT -3

Introduction to sensory analysis; general testing conditions, Requirements of sensory laboratory; organizing sensory evaluation programme. Selection of sensory panelists; Factors influencing sensory measurements; Sensory quality parameters -Size and shape, texture, aroma, taste, color and gloss.

UNIT -4

Different tests for sensory evaluation– discrimination, descriptive, affective; Flavor profile and Ranking

tests.

Books Recommended

Kemp, S.E., Hollywood, T and Hort, J. 2009. Sensory evaluation: a practical handbook. John Wiley & Sons Inc., New York, USA.

Chambers, E. and Wolf, M.B. 2005. Sensory testing methods. American Society for Testing and Materials, West Conshohocken, Pennsylvania, USA.

Stone, H. and Sidel, J.L. 2004. Sensory evaluation practices. Elsevier Academic Press, California, USA.

Carpenter, R.P., Hasdell, T.A. and Lyon, D.H. (Eds). 2000. Guidelines for sensory analysis in food product development and quality control. Aspen Publishers, Inc., Gaithersburg, Maryland, USA.

Lawless, H.T. and Heymann, H. 1998. Sensory evaluation of food: principles and practices. Kluwer Academic Publishers, Massachusetts, USA.

BEV 720 (FST 205): ENVIRONMENTAL STUDIES (CREDITS: 4)

CO1: To provide knowledge about the multidisciplinary nature of environmental science

CO2: To give comprehensive knowledge about various resources and their impact on human life.

CO3: To understand the concept of ecosystem, biodiversity and their conservation

CO4: To acquaint and understand environmental pollution, climate change, global warming and how rise in human population impacts environmental issues.

CO5: To access the nearby areas for potential threats to the environment.

Theory

UNIT-1: Multidisciplinary nature of environmental studies:

Definition, scope and importance environmental studies. Relationship of environmental science with other branches of sciences. Need for public awareness regarding environment.

UNIT-2: Natural Resources:

Renewable and non-renewable resources:

Natural resources and associated problems. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT-3: Ecosystems

Concept of an ecosystem. Structure and function of an ecosystem. Concept of producers, consumers and decomposers. Energy flow in the ecosystem. Food chains, food webs and ecological pyramids. Ecological succession.

UNIT-4: Biodiversity and its conservation

Definition of genetic, specific and ecosystem diversity.

FST -206: Practical –II (CREDITS: 4)

CO1: (0.15) To give detailed practical knowledge about the various unit operations related to processing of food materials.

CO2: (0.25) To teach students the practical techniques for processing of fruits and vegetables.

CO3: (0.15) To prepare and understand the science behind production of fruits and vegetable based products

CO4: (0.25) To provide students a knowledge about the various spoilage organisms, their growth, culture media, enumeration and isolation techniques used for microbiological analysis of food products.

CO5: (0.20) To teach students the analytical techniques of food materials for sensory evaluations.

UNIT OPERATIONS LAB

Practical:

1. Units and dimensions and their conversion
2. Mass and energy balance
3. Heat transfer in foods
4. Application of psychometrics chart
5. Rheological properties of food materials
6. Studies on membranes separation processes.
7. Solvent extraction method for edible oil by soxhlet method.

FRUITS AND VEGETABLES PROCESSING LAB

Practical :

Determining harvest maturity of different fruits and vegetables. Grading and sorting. Changes in physical and chemical quality parameters of fruits during storage - weight loss, acidity, TSS, vitamin C. Effect of packaging materials on stored fruits and vegetables. Effect of different chemicals - anti-sprouting, anti-ripening. Preparation of fruits and vegetables products: dried, frozen and canned. Manufacturing of pickle, juice concentrate, and ready to serve juices, squashes, syrups and fruit candies. Visit to fruit and vegetable processing units.

FOOD MICROBIOLOGY LAB

Practical

Safety in microbiological laboratory. Basic functions and handling of laboratory equipments. Use of microscope. Sterilization and disinfection of glassware. Preparation of culture media. Staining of microorganisms and their structures. Bacterial cultivation, growth measurement. Characteristics of bacterial colonies. Bacterial and fungal morphology. Micrometry.

Isolation, identification and characterization of micro organisms: morphology, biochemical. Enumeration of microorganisms in food and water samples (total count, SPC, Yeast and Mold, viable count, MPN). Examination of foods for pathogenic organisms (*Escherichia coli*, Coliform, *Salmonella* and *Listeria monocytogenes*).

SENSORY EVALUATION OF FOODS

Practical

Training of panelists by difference tests such as triangle test, paired comparison test, hedonic scale, duo-trio test. Color, threshold determination and ranking. Consumer test analysis.

SEMESTER- III

FST-301: INSTRUMENTAL TECHNIQUES IN FOOD ANALYSIS (CREDITS: 4)

CO1: (0.20) To give thorough understanding basic chemical properties of solutions.

CO2: (0.25) Students will have a thorough understanding on the working principle and instrumentation of various instruments used in food analysis.

CO3 :(0.25) The course will provide of fundamentals of chemical solutions.

CO4:(0.15) Students will become expertise in all the sophisticated instrumentation

CO5: (0.15) The students will know the importance of various methods to identify any malfunction aspect of food and different microbial assays.

Theory

UNIT-1

Preparation of chemical solutions: Concept of molar and normal solutions.

pH and Buffers: Importance and measurement of pH.

UNIT-2

Chromatographic techniques: General principles. Partition and adsorption chromatography. Paper, thin layer, gas liquid, ion exchange and affinity chromatography. Gel filtration. Introduction to High Pressure Liquid Chromatography.

UNIT-3

Spectroscopy: Concepts; Laws of photometry; Beer-Lambert's law; Visible and UV spectroscopy; Principles and applications of colourimetry; Atomic Absorption Spectrometer; X-ray diffraction; NMR

UNIT-4

Fluorimetry: Spectrofluorimeters. Flame photometry and atomic absorption spectrophotometry. Use of radioisotopes.

UNIT-5

Microbiological assays. Microscopy

Books Recommended

1. Otles, S. 2009. Handbook of food analysis instruments. CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.
2. Nielson, S.S. 2003. Food analysis, Kluwer Academic/Plenum Pub., New York, USA.
3. Pomeranz, Y. and Meloan, C.E. 2000. Food analysis: theory and practice. CBS Publishers, New Delhi, India.

FST-302: CEREAL, PULSES AND OILSEED TECHNOLOGY (CREDITS: 4)

CO1: (0.15) To acquaint with production and consumption trends of different types of cereals, pulses and oilseeds.

CO2: (0.25) To provide students knowledge about the structure, and composition of different cereals, pulses and oilseeds.

CO3: (0.20) To teach quality evaluation, and processing technologies of various cereals, pulses and oilseeds.

CO4: (0.25) To provide insight of Product development and value addition of various cereals, pulses and oilseeds.

CO5: (0.15) To provide the students the science behind the spoilages in food.

Theory

UNIT- 1

Cereal grains: importance, production, structure, composition, nutrition: Grain grades and grading. Storage: methods, types, role of temperature and moisture, safe storage methods. Dry milling process: cleaning, tempering, conditioning.

Grinding process: types of grinding machines. Sieving process: principles, types of sifters. Flour treatment and quality assessment. Rheology of dough and batters.

UNIT- 2

Wheat: Types, milling, flour grade, flour treatments (bleaching, maturing), flour for various purposes, Products and By-products.

Rice: Physicochemical properties, milling (mechanical & solvent extraction), parboiling, ageing of rice, utilization of by products.

Rye and triticale: milling (flour), uses. Corn – Milling (wet & dry), cornflakes, corn flour.

Barley: Milling (pearl barley, barley flakes & flour, Malting and brewing).

Oats: Milling (oatmeal, oat flour & oat flakes).

Sorghum and millets: Traditional & commercial milling (dry & wet).

UNIT- 3

TECHNOLOGY OF PULSES

Milling of pulses, Dry milling, Wet milling, and Improved milling method.

UNIT- 4

TECHNOLOGY OF OILSEEDS

Oil seeds Processing: Groundnut, Mustard, Soybean, Sunflower, Safflower, Sesame and other oil seeds processing. Extraction of oil and refining. Extraction methods: rendering, expression, solvent extraction. Processing: degumming, refining, bleaching, deodorization, fractionation, winterization, hydrogenation, interesterification, esterification, emulsification, stabilization. Sources of protein (defatted flour, protein concentrates and isolates), properties and uses, protein texturization, fiber spinning.

UNIT- 5

Spoilage: oxidative and hydrolytic rancidity – chemistry, prevention - use of antioxidants. Manufacture of frying oils, margarine, and mayonnaise. Byproducts of fats and oils industry and their uses.

Books Recommended

Bent A, Bennion EB & Bamford GST. 1997. The Technology of Cake Making. 6th Ed. Blackie.

Jackson EB. 1999. Sugar Confectionery Manufacture. 2nd Ed. Aspen Publ.

Junk WR & Pancost HM. 1973. Hand Book of Sugars for Processors. Chemists and Technologists. AVI Publ.

Manley DJR. 1983. Technology of Biscuits, Crackers, and Cookies. Ellis Horwood.

Matz SA. 1992. Bakery Technology and Engineering. 3rd Ed. Chapman & Hall.

Pomeranz Y. 1987. Modern Cereal Science and Technology. MVCH Publ.

FST-303: DAIRY TECHNOLOGY (CREDITS: 4)

CO1: (0.15) To know the need and importance of dairy industries

CO2: (0.20) To know the compositional and technological aspects of milk

CO3: (0.25) To learn about the unit operation used in milk processing

CO4: (0.15) Students will have a thorough understanding of processing and preservation of milk

CO5: (0.25) To impart the importance of various milk based products, its standard specification and various defects found in them.

Theory

UNIT-1

Milk: production statistics, importance, standards, Definition, composition and nutritive value of milk, Factors affecting composition of milk; buying and collection of milk; cooling and transportation of milk; analyses at different levels; transportation. Physico-chemical properties of milk; microbiology of milk; milk and public health; clean milk production; special milks.

UNIT-2

Unit operations in milk processing: cream separation, bacto-fugation, filtration, thermization, standardization, homogenization, pasteurization, sterilization, UHT, aseptic packaging, storage, distribution, effect on milk constituents.

UNIT-3

Technology, composition, nutritive value, process of manufacture, defects - their causes and prevention of Milk products: evaporated, condensed and powder milks, butter, yogurt, cheese, ice cream.

UNIT-4

Indigenous milk products: khoa, gulabjamun, burfi, rabri, paneer, dahi, lassi, kheer, desi ghee etc. Milk by-products: Definition; classification; composition; principle of utilization; methods of utilization.

Books Recommended

Aneja RP, Mathur BN, Chandan RC & Banerjee AK. 2002. Technology of Indian Milk Products. Dairy India Publ.

De S.1980. Outlines of Dairy Technology. Oxford Univ. Press. Henderson JL. 1971. Fluid Milk Industry. AVI Publ.

Rathore NS et al. 2008. Fundamentals of Dairy Technology - Theory & Practices. Himanshu Publ Spreer E. 1993. Milk and Dairy Products. Marcel Dekker.

Walstra P. 1999. Dairy Technology. Marcel Dekker.

Walstra P. (Ed.). 2006. Dairy Science and Technology. 2nd Ed. Taylor & Francis.

Web BH, Johnson AH & Lford JA. 1987. Fundamental of Dairy Chemistry. 3rd Ed. AVI Publ.

FST-304: FOOD FERMENTATION TECHNOLOGY (CREDITS: 4)

CO1: (0.15) To provide students understanding of the origin of fermentation processes, its history and media formulation

CO2: (0.25) To give a comprehensive knowledge of the concepts of fermentation processes

CO3: (0.20) To understand the various factors that impact fermentation processes

CO4: (0.25) To understand the technology and processing involved in purification and extraction of various industrially important fermented products

CO5: (0.15) To acquaint students with the various microorganisms involved in different types of value added fermented food products

Theory

UNIT-1

History of fermentation. Introduction to fermentation processes, Media formulation and process optimization.

UNIT-2

Concepts of basic mode of fermentation processes: Bioreactor designs; Types of fermentation and fermenters; Concepts of basic modes of fermentation- Batch, fed batch and continuous; Conventional fermentation v/s biotransformation; Solid substrate, surface and submerged fermentation; Fermentation economics; Fermentation media; Fermenters design- mechanically agitated; Pneumatic and hydrodynamic fermenters; Large scale animal and plant cell cultivation and air sterilization; Upstream processing: Media formulation; Sterilization; Aeration and agitation in bioprocess; Measurement and control of bioprocess parameters; Scale up and scale down process.

UNIT-3

Downstream processing: Bioseparation - filtration, centrifugation, sedimentation, flocculation; Cell disruption; Liquid-liquid extraction; Purification by chromatographic techniques; Reverse osmosis and ultra filtration; Drying; Crystallization; Storage and packaging; Treatment of effluent and its disposal.

UNIT-4

Microorganisms used in food fermentation: Types of cultures, starter cultures: maintenance, propagation and activation of cultures. Fermented Foods-types, methods of manufacture for vinegar, sauerkraut, tempeh, miso, soya sauce, bakery foods and traditional Indian foods.

Food related fermentations: Microbial biomass, Single cell protein, baker's yeast and enzyme production.

Books Recommended

- Stanburry P.P. and Whitaker, A. 1984. Principles of Fermentation Technology. Pergamon Press, Oxford UK.
- Steinkraus, K.H. 1983. Handbook of Indigenous Fermented Foods. Marcel Dekker, New York.
- Biely, J.E. and Ollis D.F. Bio Chemical Engineering Fundamentals (1986) McGraw Hills.
- Moo-young M. Comprehensive Biotechnology Vol. 1-4 Pergamon Press Oxford.
- Nagodawithana T & Reed G. 1993. Enzymes in Food Processing. Academic Press.
- Tucker GA & Woods LFJ. 1991. Enzymes in Food Processing.
- Whitehurst R & Law B. 2002. Enzymes in Food Technology. Blackwell Publ.

FST-305: FOOD PROCESS ENGINEERING (CREDIT: 4)

- CO1: (0.15)** To provide basics of Food Engineering.
- CO2: (0.20)** To impart knowledge of engineering approach in material handling
- CO3: (0.15)** To teach different Engineering units and their dimensions
- CO4: (0.25)** To understand all the engineering properties of packaging materials
- CO5: (0.25)** To impart basic knowledge of Milling , its equipment and different methods used

Theory

UNIT-1

Introduction :Dimensions – Primary and Secondary, Engineering Units – Base units, Derived units and supplementary units, System – State of a system, extensive and intensive properties, Density – Solid, Particle and Bulk density, Concentration, Temperature, Pressure, Enthalpy, Power and area Phase diagram of water.

UNIT-2

Food engineering: Introduction, trends, Physical, mechanical, biological, thermal and rheological properties of Agricultural raw materials.

Engineering approach in materials handling: cleaning, sorting, grading, size reduction - equipments and their applications. Storage structures: refrigeration, air conditioning and freezing units. Mobile refrigeration units. Equipments used for packing of fruits, vegetables and their products. Extraction process for agricultural products: oil seeds, fruits.

UNIT-3

Milling: crushing efficiency, Methods of Milling, Milling Equipment, Milling Equipment for Solid Foods, Milling Equipment for Liquid Foods (Emulsification and Homogenization), Efficiency of Milling, Methods of Separation

Storage: direct damages; indirect damages; traditional and modern storage structure; storage of agricultural perishables.

UNIT-4

Heat transfer in food: heat measurement, transfer and control; steam and its use in industry.

Applications of refrigeration and freezing: principles, insulation, cold storages - design, equipment, applications. Sterilization, evaporation, drying, pasteurizes.

UNIT-5

Engineering properties of packaging materials: diffusion through membrane, gas permeation mechanism. **Materials handling**: equipments. Energy for food engineering: steam, fuel utilization, electric power utilization, Boilers, steam generators, retorts, fans, blowers: types, selection. Thermodynamic laws, energy balance for open systems, dynamic response of sensors.

Books Recommended

- Keith, W. 2007. Handbook of waste management and co-product recovery in food processing, Vol. I. CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.
- Ramaswamy, H.S. and Marcotte, M. 2005. Food processing: principles and applications. CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.
- Smith, J.S. and Hui, Y.H. 2004. Food processing: principles and applications. Blackwell Pub. Co., Oxford, England.
- Pandey, H., Sharma, H.K., Chauhan, R.C., Sarkar, B.C. and Bera, M.B. 2004. Experiments in food process engineering. CBS Publishers, New Delhi, India.
- Sahay, K.K. and Singh, K.K. 2001. Unit operations of agricultural processing. Vikas Pub. House, New Delhi, India.
- Barbosa-Canovas, G.V., Fito, P. and Ortega-Rodriguez, E. 1997. Food engineering 2000, Springer Verlag, Heidelberg, Germany.
- Farrall, W. 1993. Engineering for dairy and food products. John Wiley & Sons Inc., New York, USA.

FST 306: Practical –III (CREDITS: 4)

- CO1: (0.15)** To give them comprehensive demonstration of Sophisticated instrument and estimation of different parameters using them
- CO2: (0.25)** To provide them thorough understanding of milling of cereal grains, their grading and all tests for quality assessment related to them
- CO3: (0.25)** To impart knowledge of all the platform tests of milk along with physico- chemical and microbiological analysis
- CO4: (0.20)** To study the development of different fermented drinks and fermented products.
- CO5: (0.15)** To study different instrument related to heat transfer, pasteurization and selection of pumps.

INSTRUMENTAL TECHNIQUES IN FOOD ANALYSIS LAB

Practical

Demonstration of HPLC and GC for analysis of bioactive compounds, antioxidant, pesticides, fatty acids etc. Estimation of food components using UV-VIS spectrophotometer.

Determination of organic acids by chromatography.

Visit to food testing /NABL laboratory.

CEREAL, PULSES AND OILSEED TECHNOLOGY

Practical

Grading of grains. Milling of cereal grain through different mills. Tests for flour quality assessment. Visit to wheat, maize and rice processing industries. Determination of gluten content in refined wheat flour.

Extraction of oils and fats. Determination of physical and chemical constants: color, cold test, melting point, smoke point, specific gravity, solid fat index, refractive index, acid value, peroxide value, iodine value, saponification value. Visit to oil and fat industries.

DAIRY TECHNOLOGY LAB

Practical

Milk sampling methods.

Reception tests: Sensory test, sedimentation, pH, acidity; lactometer reading, clot on boiling, alcohol test. Preparation of flavored milk and milk products. Physico-chemical and microbiological analysis of milk and milk products.

Tests for adulterants.

Visit to commercial dairy farms and milk processing plants.

FOOD FERMENTATION TECHNOLOGY

Practical

Production of Baker's Yeast

Development of a fermented food/drink utilizing plant products /animal products or by products as substrate

Media formulation and sterilization

Study of fermentation of pulses and millets
Study of dough raising power of yeasts
Production of fermented products viz. sauerkraut, idli, curd etc.

FOOD PROCESS ENGINEERING

Practical

Study of pasteurizers, Study on heat exchangers and determination of overall heat transfer coefficient of shell and tube heat exchangers. Visit to cold stores and freezing units.

Colloigative properties, Selection/design of pumps and fans using characteristic curves. Heat transfer in foods. Mass transfer. Size reduction and screening. Refrigeration. Freezing. Food storage, Milling.

SEMESTER- IV

FST-401: TECHNOLOGY OF BEVERAGE, PLANTATION CROPS AND SPICES (CREDITS: 4)

CO1: (0.15) To impart the importance of various fermentation methods used for beverage preparation for respective flavor development

CO2: (0.20) To understand different types of beverage and their processing

CO3: (0.25) To provide complete knowledge of different plantation crops with their processing and preservation techniques

CO4: (0.15) To teach the extraction method of different spices with their usage

CO5: (0.15) To learn about processing techniques used in tea, coffee and cocoa production.

Theory

UNIT-1

Beverage industry in India. Beverages: classification – still, carbonated, alcoholic. Beverage ingredients: water, fruit components, sweeteners, flavorings, colorings, preservatives. Manufacture of soft drinks: mixing, pasteurization, homogenization, filling, packing and storage. Carbonation: History, CO₂, gas volume.

UNIT-2

Soft drinks: ingredient specifications, manufacturing problems, changes in color, appearance, flavor. Packaging: types, interactions. Shelf life Issues: microbiological problems.

Bottled water: legislation, water treatment, filling, quality issues.

Fermented beverages: introduction, types, role of microorganisms. Regulations and standards. Statuary requirement: labeling, nutrition claims.

UNIT-3

Tea Processing: Chemical composition and processing of tea. Processing of instant tea.

Coffee Processing: Structure of coffee cherry, Dry and wet processing of coffee cherry. Roasting, Grinding, Brewing of coffee beans, Spray and Freeze drying of coffee. Manufacture of Instant coffee, monsooned coffee and decaffeinated coffee. Coffee-chicory mixture.

UNIT-4

Cocoa processing: Fermentation of cocoa beans, processing of cocoa beans. Manufacture of cocoa products- chocolate, cocoa powder & cocoa butter, drinking cocoa, instant cocoa, drinking chocolate. Sugar bloom and fat bloom in chocolates.

UNIT-5

Processing of Plantation crops: Processing of Cashew nuts, Cashew-apple juice, Cashew-apple juice, Almonds, Almond oil, Peanuts, Peanut oil, Peanut butter, Dates, Date products, Saffron, Figs, Apricots

(dried, canned frozen), Raisins, Plums. Their uses.

Processing of Spices: Definition, Processing of Spices, and Extraction of essential oils and oleoresins from spices, Spice products. Processing and uses – Pepper, Small Cardamom, Black Cardamom, Ginger, Chilies, Turmeric, Asafoetida, Aniseeds, Cloves.

Books Recommended

1. Ashurst, P.R. and Hargitt, R. 2009. Soft drink and fruit juice problems solved. Woodhead Publishing. Ltd., Abington, Cambridge, UK.
2. Shachman, M. 2000. The soft drinks companions: A technical handbook for the beverage industry. CRC Press Taylor & Francis Group, Boca Raton, Florida, USA.
3. Varnam, H.A. and Sutherland, J.M. 1999. Beverages: technology, chemistry and microbiology. CRC Press Taylor & Francis Group, Boca Raton, Florida, USA.

FST-402: BAKERY, CONFECTIONERY AND EXTRUDED FOODS (CREDITS: 4)

CO1: (0.20) The course provides sciences behind bakery product.

CO2: (0.15) The course will provide basic functions of all the ingredients used in different products

CO3: (0.15) To know about technologies used in Chewing gum and chocolates.

CO4: (0.25) To provide thorough knowledge of all the instruments used in bakery and confectionary

CO5:(0.25) Students will get complete knowledge of functions of extruders along with the different extruded products

Theory

UNIT-1

Science of bakery product: Raw materials: grains, milling; grades of flours; types of flours – Chorleywood bread flour, patent, soft, whole meal, brown and low moisture flours; leavening agents; flour treatments; fats; emulsifiers; colors; flavors; antioxidants; sugars; dairy ingredients; gums and gelling agents. Bread making: chemistry of dough development, making of bread, types of breads. Products other than bread: pastry, biscuits, wafers, cakes and other chemically leavened products.

UNIT-2

Confectionery: significance, classification, industries in India. Sugar confectionery: ingredients, manufacturing - high boiled sweets, caramel, toffee, fudge, gums. Sugar free confectionery: need, ingredients, manufacture. Chewing gum technology. Chocolate, confectionery.

UNIT-3

Snack foods: history, status, manufacture - potato, nuts, cereal, meat and fish based. Puffed and baked snacks. Seasonings: ingredients, formulations, applications. Quality control. Packaging. Production of breakfast cereals. Feed and industrial uses of cereals.

UNIT-4

Extruded foods: Objectives and importance of extrusion in food product development; Components and functions of an extruder; Classification of extruder; Advantages and disadvantages of different types of extrusion; Change of functional properties of food components during extrusion; Pre and post extrusion treatments; Use of extruder as bioreactor; Manufacturing process of extruded products.

Books Recommended

1. Edward, W.P. 2007. The science of bakery products. The Royal Society of Chemistry, Cambridge, UK. UK.
 2. Hui, Y.H., Corke, H., Leyn, I.D. and Cross, N. 2006. Bakery product science and technology. Blackwell Pub. Co., London, UK.
 3. Khetarpaul, N., Grewal, R.B. and Jood, S. 2005. Bakery science and cereal technology. Daya Pub. House, New Delhi, India.
- Riaz, M.N (ed). 2003. Extruders in food applications. Technomic Pub. Co. Inc., Lancaster, Pennsylvania, USA.

Guy, R. 2001. Extrusion cooking technology and applications. Woodhead Publishing Ltd., Abington, Cambridge, UK.

FST- 403:FOOD PACKAGING TECHNOLOGY (CREDITS: 4)

CO1: (0.25) To provide comprehensive overview of the scientific and technical aspects of food packaging.

CO2: (0.15) To instill knowledge on packaging machinery, systems, testing and regulations of packaging.

CO3: (0.15) To impart the effect of various environmental factors on the stability of food.

CO4: (0.20) To develop comprehensive understanding of different packaging tests.

CO5 : (0.25) To know the importance of selective packaging related to food products.

Theory

UNIT-1

Introduction: Importance, definition and function of food packaging, types of packaging materials, Glass (construction of jars and bottles, optical, thermal and mechanical properties of glass), Metal (types of base metal sheets, construction of metal cans, lacquering), Plastics- substituted olefins, tetrafluoro ethylene, PET, polyamides, polyesters.

Unit-2

Environmental factors and food stability: Effect of oxygen and light, Light Protection characteristics of packages, permeability to gases and vapors, methods of measuring permeability, permeability to fixed gases, permeability to humidified gases, flow through pin holes, cracks and imperfect seals, permeability of multilayer materials.

UNIT-3

Packaging tests: tensile strength, compression, bursting, tear and impact test for packages, integrity testing of packages, cushioning effect on packaged foods, deterioration of packaged foods, shelf life calculation for packaged foods.

UNIT-4

Packaging equipment and machinery: Vacuum, CA and MA packaging machine; gas packaging machine; seal and shrink packaging machine; form and fill sealing machine; Shrink packaging, aseptic packaging systems ; aseptic and retortable pouches; bottling machines; carton making machines. Flexible and laminated pouches, aluminum as packaging material. Bio-degradable packaging. Active packaging. Food labeling: importance, types, methods, bar coding.

UNIT-5

Selective packaging: Important considerations in packaging of fruits and vegetables, meat, fish and poultry, milk and dairy products, cereal and bakery products.

Books Recommended

Lee, D.S., Yam, K.M and Piergiovanni, L. 2008. Food packaging science and technology. CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.

EIRI (Engineers India Research Institute). 2007. Handbook of packaging technology. Engineers India Research Institute, New Delhi, India.

Robertson, G.L. 2006. Food packaging: principles and practices. CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.

FST-404: FOOD PRODUCT DEVELOPMENT (CREDITS: 4)

CO1: (0.25) To introduce students to the food product development process, design, development and commercialization

CO2: (0.20) To understand the role of consumers in the development of a new food product.

CO3: (0.25) To give a comprehensive knowledge about the entire process of product development, the factors affecting the success, failure and marketability of a food product.

CO4: (0.15) To know the ethics of food production and consumption

CO5:(0.15) To understand the cases of various new products launched in the market and understand the reactions of customers to them through case study

Theory

UNIT-1

Food product development: process, strategy, design, development, commercialization, evaluation. Key to new product success and failure.

UNIT-2

Consumer in food product development: consumer behavior, food choices, sensory needs, consumer role. Preference mapping and food product development: conducting trials, analyzing, recent developments.

UNIT-3

Case study of consumer-oriented food product development: reduced-calorie foods - Consumer trends and healthy eating, marketing and technological challenges, success factors.

Case study: reduced-calorie on-the-go beverages. The ethics of food production and consumption.

UNIT-4

Concept of product development: product success and failure, factors for success, process of product development, managing for product's success. Innovation strategy - possibilities for innovation, building up strategy, product development programme.

The product development process - product strategy, product design and process development, product commercialization, product launch and evaluation.

Recommended Books

1. Earle, M., Earle, R. and Anderson, A. 2001. Food product development. Woodhead Publishing Ltd., Abington, Cambridge, UK.

2. Earle M. and Earle, R. 2007. Case studies in food product development. Woodhead Publishing Ltd., Abington, Cambridge, UK.

3. Frewer, L and Trijp, H. 2007. Understanding consumers of food products. Woodhead Publishing Ltd., Abington, Cambridge, UK.

FST-405: STATISTICS AND DATA ANALYSIS (CREDITS : 4)

CO1. The students will be exposed to various research methods and statistical tools required.

CO2. to analyze the experimental data in food research and industry.

CO3. The focus will be on providing knowledge related to research process, data collection and data analysis etc.

Theory

UNIT-1

Scientific Approach to Research: Meaning, significance, variables

Research Process: Formulating the problem, objectives, hypothesis, Experimental design, sample design, collecting data, analysis of data, interpretation, and preparation of report.

UNIT-2

Sampling Techniques: Probability and non probability sampling. Experimental designs: Randomized Block design.

UNIT-3

Measurements: measurement scale, Frequency distribution, graphical presentation of data. Measures of Central Tendency: Mean median and mode, their uses.

UNIT-4

Measures of variability: Mean deviations, Quartile deviation, standard deviation, their uses. Correlation: Spearman and Pearson's techniques of correlation, Linear regression.

UNIT-5

Tests of significance of difference between means: t-test, F-test, One way ANOVA. Applications to food quality assessments

Books Recommended

Aggarwal BL. 2003. Basic Statistics. New Age.

Kothari CR. 1989. Research Methodology. Wiley Eastern.

Gupta SP. 2004. Statistical Methods. S. Chand & Sons

FST-406: PRACTICAL –IV (CREDITS: 4)

CO1: (0.15) To understand water treatment analysis.

CO2: (0.15) To prepare different carbonated beverages along with their analysis.

CO3: (0.25) To study all the bakery equipments and preparation of different baked products.

CO4: (0.20) To analyze different packaging parameters and determination of shelf life and film thickness.

CO5: (0.25) To impart thorough knowledge of all the steps required for the development of a new product.

TECHNOLOGY OF BEVERAGE, PLANTATION CROPS AND SPICES

Practical

Water treatment and analysis. Formulation and preparation of carbonated beverages. Analysis of beverages: chemical, microbiological, sensory. Manufacture of fermented beverages .Visit to beverage industries. total solids; moisture and volatile oil content of spices; detection of microbial quality and adulteration in spices; aromatic compounds in spices; capsaicin content, curcumin content of turmeric; storage and packaging of spices; visit to spice processing Units.

BAKERY, CONFECTIONARY AND EXTRUDED FOODS LAB

Practical

Study of bakery equipments

Quality test for wheat flour used in the baked products. Maltose Number, Water Absorption, Sedimentation value, Alcohol Acidity.

Preparation and quality evaluation of bread/bun/pizza.

Preparation and quality evaluation of noodles.

Preparation and quality evaluation of puffs.

Preparation and quality evaluation of cakes

Preparation and quality evaluation of biscuits

Preparation and quality evaluation of nan khatai

Preparation and quality evaluation of cookies

Effect of syrup consistency and temperature on the quality characteristics of hardboiled sweets

Preparation and quality evaluation of chocolate. Visit to bakery and confectionery industries.

FOOD PACKAGING TECHNOLOGY LAB

Practical

Packaging tests: tensile strength, compression, bursting, tear and impact test for packages, Requirements of foods for specific packaging material. Can testing. Determination of shelf-life in various packaging materials. Determination of film thickness. Visit to packaging industries.

FOOD PRODUCT DEVELOPMENT

Practical

Food product development projects - strategy, design, development, commercialization, launch and evaluation. Practical aspects and sensory evaluation techniques. Chemical and instrumental quality analysis.

SEMESTER- V

FST- 501: MEAT, POULTRY & FISH TECHNOLOGY (CREDITS: 4)

CO1: (0.25) To impart the complete understanding of compositional and technological aspects of meat, poultry and fish.

CO2: (0.15) To provide their sources and importance in national economy.

CO3: (0.15) To study the chemical and microscopic structure of meat

CO4: (0.20) To provide different processing techniques used in meat, poultry and fish based products.

CO5 : (0.25) To give students a basic knowledge about methods of slaughtering & meat Processing.

Theory

UNIT-1

Introduction: Sources of meat and meat products in India, its importance in national economy. Per capita consumption of meat, poultry and fish. Present status of meat, poultry and fish industries in India. Chemical composition and microscopic structure of meat.

UNIT-2

Methods of slaughtering & meat processing- Pre-slaughter care, Ante mortem inspection of meat animals. Methods of stunning, slaughtering and dressing of meat animals and poultry birds Post mortem examinations of meat-Rigor mortis. Factor affecting post mortem changes, properties and shelf life of meat. Methods of meat tenderization. Meat curing- types and factors affecting quality of cured meats. Preparation of smoked meats, pickled meats, sausages and hamburgers. Methods of meat preservation- refrigeration, thermal processing and dehydration.

UNIT-3

Poultry products- Structure, composition, nutritive value and functional properties of eggs. Grading of eggs. Factors affecting egg quality and measures of egg quality. Preservation of eggs by different methods- freezing, dehydration and coating.

UNIT-4

Fish products- Types of fish, composition, structure, post mortem changes in fish. Handling of fresh water fish. Nutritional quality of fish. Preservation of fish by drying, salting, curing, freezing, canning, fish spoilage, shellfish, fish products; fish meal, fish flour, fish oils.

Books Recommended

Kerry, J., Kerry, J. and Ledward, D. 2007. Meat processing: improving quality. Woodhead Publishing Ltd., Abington, Cambridge, England.

NIIR Board of Consultants and Engineers. 2005. Preservation of meat and poultry products. Asia Pacific

- Business Press Inc., Kalma Nagar, Delhi.
- Riaz, M.N. and Chaudry, M.M. 2003. Halal food production. CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.
- Mead, G.C. 2004. Poultry meat processing and quality. Woodhead Publishing Ltd., Abington, Cambridge, UK.
- Long, A. 2008. Fish processing technology. Cyber Tech. Publications. New Delhi, India.
- Ninawe, A.S. and Rathnakumar, K. 2008. Fish processing technology and product development. Narendra Publishing House, New Delhi, India.
- Bremner, H.A. 2005. Safety and quality issues in fish processing. Woodhead Publishing Ltd., Abington, Cambridge, UK.
- Hall, G.M. 2001. Fish processing technology. Blackwell Pub Co., Cambridge, UK.

FST-502: FOOD QUALITY, STANDARDS AND REGULATIONS (CREDITS: 4)

- CO1: (0.20)** To learn about the objectives and need of quality in food products
- CO2: (0.25)** To acquaint with food quality parameters, adulteration and control systems, in a food industry
- CO3: (0.15)** To give students a basic knowledge about food labeling and its parameters
- CO4: (0.15)** To provide students a deep understanding about the various food standards, laws and regulations,
- CO5: (0.25)** Students will have a thorough understanding of concept of hygiene considerations and sanitation in during food processing.

Theory

UNIT-1

Introduction: Concept, objectives and need for quality, difference between quality control and quality assurance, method of quality control.

Food adulteration: adulterants, health hazards, methods of detection.

UNIT-2

Food labeling: Perspectives on nutrition labeling, food labeling logo. Islamic food laws and regulations: sources, principles, lawful foods, unlawful foods. Consumer laws in India.

Food quality management: history, importance, systems.

UNIT-3

Food laws: Objectives, requirements and benefits of food standards (FSSA, PFA, BIS, AGMARK, FPO and FDA), FPO standards for fruits and vegetable products.

Food Safety Management Systems (FSMS) – ISO22000:2005. Codex Alimentarius Commission (CAC) guidelines for food quality management, PAS99 series- their objectives and principles.

UNIT -4

Hygiene Considerations: General Hygiene and sanitation in food industry, Good manufacturing practices (GMP): personal cleanliness, buildings and facilities, sanitary operations, sanitary facilities and controls, equipment and utensils, production and process control, warehousing and Distribution, traceability and recall. Hazard analysis and critical control points (HACCP) system: history, prerequisites, preliminary steps, principles.

Books Recommended

- CAC (Codex Alimentarius Commission). 2007. Codex Alimentarius Commission – Procedural manual. Joint FAO/WHO Food Standards Programme. FAO, Rome, Italy.
- ISO (International Standards Organization). 2005. Food safety management systems – requirements for an organization in the food chain. Case Postale, Geneva, Switzerland.
- Lelieveld, H.L.M., Mostert M.A. and Holah, J. (Editor). 2005. Good manufacturing practices in the food

industry. In: Handbook of hygiene control in the food industry. Woodhead Publishing Ltd., Abington, Cambridge, UK.

Blanchfield, J.R. 1998. Good manufacturing practices. Institute of Food Science and Technology, London, UK.

FST-503: BUSINESS MANAGEMENT AND ENTREPRENEURSHIP (CREDITS: 4)

CO1: Understand the meaning and concept of entrepreneurship development.

CO2: Sensitized and oriented towards identifying entrepreneurial opportunities and market potential.

CO3: Gain knowledge setting up of an enterprise and its management.

CO4: To provide thorough knowledge of accounting and finance.

Theory

UNIT-1

Accounting and Finance: Taking decision on starting a venture; Assessment of feasibility of a given venture/new venture; Approach a bank for a loan; Sources of financial assistance; Making a business proposal/Plan for seeking loans from financial institution and Banks; Funds from bank for capital expenditure and for working; Statutory and legal requirements for starting a company/venture; Budget planning and cash flow management; Basics in accounting practices: concepts of balance sheet, P&L account, and double entry bookkeeping; Estimation of income, expenditure, profit, income tax etc.

UNIT-2

Marketing: Assessment of market demand for potential product(s) of interest; Market conditions, segments; Prediction of market changes; Identifying needs of customers including gaps in the market, packaging the product; Market linkages, branding issues; Developing distribution channels; Pricing/Policies/Competition; Promotion/ Advertising; Services Marketing.

Negotiations/Strategy: With financiers, bankers etc.; With government/law enforcement authorities; With companies/ Institutions for technology transfer; Dispute resolution skills; External environment/ changes; Crisis/ Avoiding/ Managing; Broader vision–Global thinking

UNIT-3

Information Technology: How to use IT for business administration; Use of IT in improving business performance; Available software for better financial management; E-business setup, management.

Human Resource Development (HRD): Leadership skills; Managerial skills; Organization structure, pros & cons of different structures; Team building, teamwork; Appraisal; Rewards in small scale set up.

UNIT-4

Fundamentals of Entrepreneurship: Support mechanism for entrepreneurship in India

Role of knowledge centre and R&D: Knowledge centers like universities and research institutions; Role of technology and upgradation; Assessment of scale of development of Technology; Managing Technology Transfer; Regulations for transfer of foreign technologies; Technology transfer agencies. Funding agencies in India: schemes, loans.

Elective course: FST 504: NEUTRACEUTICALS AND FUNCTIONAL FOODS (CREDITS: 4)

CO1: (0.25) To develop comprehensive understanding of different nutraceutical and functional foods.

CO2: (0.20) To provide knowledge about different types of nutraceutical compounds and their food sources.

CO3: (0.15) To understand the potential of various functional foods in promoting human health.

CO4: (0.15) To learn about fabrication and formulation of different functional foods.

CO5:(0.25) To understand the legal aspects about the stability, safety, consumer acceptance, marketing and regulatory issues of nutraceutical and other functional foods

Theory

UNIT 1

Introduction: Background, status of nutraceuticals and functional food market, definitions, difference between nutraceuticals and functional foods, types of nutraceutical compounds and their health benefits, current scenario.

UNIT 2

Nutraceuticals: Types of nutraceutical compounds – Photochemical, phytosterols and other bioactive compounds, peptides and proteins, carbohydrates (dietary fibers, oligosaccharides and resistant starch), prebiotics, probiotics and symbiotic, lipids (Conjugated Linoleic Acid, omega-3 fatty acids, fat replacers), vitamins and minerals; their sources and role in promoting human health.

UNIT 3

Functional Foods :Cereal and cereal products, Milk and milk products, egg, oils, meat and products, sea foods, nuts and oilseeds, functional fruits and vegetables, herbs and spices, beverages (tea, wine etc), Fermented foods – their health benefits and role in conditions like cardiovascular diseases, hypertension, diabetes etc. Future prospects of functional foods and nutraceuticals and their potential for use in improving health. Development in processing of functional foods. Formulation and fabrication of functional foods.

UNIT 4

Legal Aspects : Stability of nutraceuticals. Safety, Consumer acceptance and assessment of health claims, labeling, marketing and regulatory issues related to nutraceuticals and functional foods.

Elective Course: FST- 505: TEA PLANTATION TECHNOLOGY (CREDITS: 4)

CO1: (0.25) To provide the knowledge about historical background of cultivation of tea.

CO2: (0.25) To impart complete understanding of manufacturing of different types of tea.

CO3: (0.15) To learn the potential of tea in promoting human health.

CO4: (0.20) To understand quality analysis of different varieties of tea.

CO5: (0.15) To study different tea based products.

Theory

UNIT-1

History of tea: Historical background of tea cultivation, Geographical locations of tea in world, Tea growing countries, Classifications of tea, objectives and importance of tea Science.

Tea Botany: Botanical description and classifications of tea. Tea agro types, Taxonomical position of tea. Vegetative and reproductive parts of tea plant; life cycle and growth pattern of tea.

UNIT-2

Clinical Effect of Tea: Tea's role in cardiovascular health, Tea's role in Cancer risk reduction, Tea's role in oral health, Tea and reduced risk of kidney stone, Tea and reduced risk of osteoporosis.

Manufacture of Black Tea: Quality analysis of green leaf; Principle Stages of Processing. Physical and Chemical withering of tea; Effect of withering on quality of tea; Biochemical changes during withering.

Orthodox vs. un-orthodox manufacture: Leaf conditioning, CTC Process. Biochemical changes during fermentation, factors affecting fermentation; Methods of fermentation, Hygienic control.

Drying: Types of dryer, factors considering during drying, drying time, Sorting & Grading, Storage &

Packaging, Recovery percentage.

UNIT-3

Tea Tasting: tasting of liquor and testing terminology. Manufacture and characteristics of Black tea, Green tea & semi-fermented tea. Quality control of Tea.

UNIT-4

Tea Processing: Present status of tea processing in India & Abroad. Recent advances in tea processing technology. Prospects of future growth in tea processing in India. Factors affecting quality parameters; physical, chemical and rheological tests, quality evaluation and grading of tea.

Tea aroma precursors; tea flavor; tea grades; storing of tea. Tea concentrates, decaffeinated tea, flavored tea; herbal tea, instant tea manufacture.

Textbooks

Banerjee, B. *Tea Production and Processing*. Oxford & IBH Pub. Co., 1st Edition, 1993.

References

Jain, N.K. *Global Advances in Tea Science*. Aravali Books International, 1st Edition, 1999.

Varnam AH & Sutherland JP. *Beverages: Technology, Chemistry and Microbiology*. Chapman & Hall. 1994.

Elective Course: FST- 506: FOOD BIOTECHNOLOGY AND TOXICOLOGY (CREDITS: 4)

CO1: (0.25) To provide students the fundamentals and application of biotechnology in relation to food processing, food fermentations,

CO2: (0.25) To acquaint with application of micro-organisms for the production of Industrial products with particular reference to foods and food ingredients.

CO3: (0.20) To gain an understanding of microbial, chemical and natural toxicants and allergens those are indigenously present and developed during food processing.

CO4:(0.15) To learn about toxicity of water

CO5(0.15) To provide understanding about the systems for food safety surveillance with an aim of producing safe food, assess risk and develop detoxification strategies for the same

Theory

UNIT-1

Biotechnology: introduction, history. Microbial metabolism. Developments in metabolic and biochemical engineering: metabolites, range of fermentation processes, components of fermentation processes. Isolation and preservation of industrially important microorganisms.

UNIT-2

Industrial fermentations: media, design and types of fermentors, process variables in fermentation, recovery, purification of fermentation products. Production of organic acids, enzymes, amino acids, single cell proteins, carotenoids and fermented food products. Microbial genetics: conjugation, transduction, transformation. GMO in food biotechnology. Legal and social aspects of food biotechnology.

UNIT-3

Toxicology: definition, dose-response, absorption, translocation, storage excretion, food toxicology. Toxicity by naturally occurring food toxins: plant origin – accidental toxicity, haemagglutinins, goitrogens, cyanogens, lathyrogens, others; animal origin – honey, quail, eggs, milk, meat, fish. Toxicity by extraneous chemicals: agricultural chemicals, food processing, packaging, additives, adulterants. Toxicity from water.

UNIT-4

Microbial toxins: mycotoxins – moulds, mushrooms.

Bacterial food intoxication; bacterial food infections.

Food allergy and intolerance.

Systems for food safety surveillance – GMP, TQM, HACCP and FSMS-ISO22000:2005.

Books Recommended

El-Mansi, F.M.T, Bryee, C.F.A, Demain, A.L. and Allman, A.R. 2007. Fermentation microbiology and biotechnology. CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.

Shetty, K., Paliyath, G, Pometto, A. and Levin, RE. 2005. Food Biotechnology. Marcel Dekker Inc., New York, USA.

Borem, A., Santos, F.R. and Bowen, D.E. 2004. Understanding biotechnology. Pearson Education Inc., New Jersey, USA.

Awan, J.A. and Anjum, F.M. 2010. Food toxicology. Unitech Communications, Faisalabad, Pakistan.

Shibamoto, T and Bjeldanes, L. 2009. Introduction to food toxicology, 2nd ed. Academic Press, London..

CAC (Codex Alimentarius Commission). 2007. Codex Alimentarius Commission – Procedural manual. Joint FAO/WHO Food Standards Programme. FAO, Rome, Italy.

ISO (International Standards Organization). 2005. Food safety management systems – requirements for an organization in the food chain. Case Postale, Geneva, Switzerland.

FST-507: PRACTICAL –V (CREDITS: 4)

CO1: (0.25) To give students practical knowledge about the various processing technologies of meat, poultry and fish products.

CO2: (0.25) To impart knowledge regarding safety and quality standards that need to be maintained in a food processing industry

CO3: (0.15) To teach students about the steps and the procedure of auditing and the important documents to be maintained during the process

CO4: (0.15) To give a comprehensive knowledge about the practicality of setting up a new business and entrepreneurship development.

CO5: (0.20) Visit to different industries of meat, fish and poultry.

MEAT, POULTRY & FISH TECHNOLOGY

Practical

1. Fish, Meat cutting and handling.
2. Dressing of poultry.
3. Evaluation of the quality of meat, poultry and fish,
4. Canning, freezing, dehydration cured product of fish and meat.
5. Meat based soup and its quality control.
6. Measures of egg quality, egg powder etc.
7. Analysis of fish and fish products.
8. Fish protein concentrate uses.
9. Visit to meat/ fish /poultry processing industries.

FOOD QUALITY STANDARDS AND REGULATIONS

Practical

To conduct Hazard Analysis & Risk Assessment of identified hazards

Determination of CCP through CCP Decision Tree

Formation of CCP Monitoring Checklist

Identification of PRP's (GHP & GMP) of food plant

Preparation of detail flow diagram of manufacturing process & identification of potential hazards of food at each step/process

Preparation of sample pages of Quality Manual

Preparation of sample pages of Management System Procedure (MSP)

Preparation of sample pages of Standard Operating Procedure (SOP)
Preparation of sample pages of Formats for Quality Management System
Preparation of on-site audit plan
Preparation of an Audit Checklist /Observation Sheet
To conduct Document Review (Adequacy Audit) before Audit
To conduct opening meeting of audit
To conduct Closing Meeting
Preparation of Audit Plan Schedule before an Internal Audit
To conduct an Audit Meeting before conducting Internal/External Audit
Preparation of Corrective /Preventive Action Recommendation for the organization after Audit (Report Writing)
Preparation of report by audited after correction of non-conformities
To conduct audit Follow-up

BUSINESS MANAGEMENT AND ENTREPRENEURSHIP

Practical

Case Study

Candidates should be made to start a, mock paper company, systematically following all the procedures.

•The market analysis developed by them will be used to choose the product or services.

A product or service is created in paper and positioned in the market. As a product or services available only in paper to be sold in the market through the existing links. At this juncture, the pricing of the product or the service needs to be finalized; linking the distribution system until the product or services reaches the end consumer.

Candidates who have developed such product or service could present the same as a project work to the Panel of Experts, including representatives from industry sector. If the presented product or service is found to have real potential, the candidates would be exposed to the next level of actual implementation of the project. Go to any venture capital website (like sequoiacap.com) and prepare a proposal for funding from venture capital.

1. Elective Course: NUTRACEUTICALS AND FUNCTIONAL FOODS

PRACTICAL

1. Identification of various nutraceuticals and functional foods available in the market
2. Preparation and evaluation of carotenoid enriched food.
3. Preparation and evaluation of lycopene enriched food.
4. Preparation and evaluation of dietary fiber content in cereals and their products
5. Preparation and evaluation of anthocyanins in food sample
6. Preparation and evaluation of probiotic/prebiotic foods

3. Elective Course: TEA PLANTATION TECHNOLOGY

Practical

Morphological study: Root, stem, leaf, flower and fruit of tea.

Anatomical study: Root, stem, leaf, flower of tea. Identify the different tea variety through the external characteristics.

Phyto-chemical analysis of tea; Preparation of iced and flavoured tea beverage; Visit to relevant processing units.

2. Elective Course: FOOD BIOTECHNOLOGY AND TOXICOLOGY

Practical

Isolation, purification and maintenance of yeast and bacterial cultures. Aerobic and anaerobic fermentation and production of various fermented food products. Determination of survival curves using physical and chemical mutagens.

Protocol for detection & quantification of toxins in food, Detection of pesticide residues, antibiotic residues, hormones and veterinary drugs, & heavy metals; Analysis of microbial & plant toxins; Immunoassays.

SEMESTER- VI

FST-601: INDUSTRIAL TRAINING & REPORT WRITING (CREDITS: 12)

CO1: (0.20) To expose the students to actual working environment and enhance their knowledge and skill from what they have learned in the college

CO2: (0.15) To instill the good qualities of integrity, responsibility and self confidence

CO3: (0.25) To enhance students' familiarity with the world of work and enable them to reflect constructively in issues related to work

CO4: (0.25) To develop employability skills, intellectual skills, core of key skills, personal attributes and

CO5: (0.15) To develop knowledge about how organizations work.

Each student shall undertake project work assigned to him related to the area of food technology, either in a food Industry or in the department, under the supervision of a faculty member. Industrial project/training will include study of food processing and preservation industries- raw materials used, unit operations and processes involved in processing of different types of food products and their environmental issues. The work will be allotted specifying the different aspects to be carried out by the student. Weekly progress report has to be submitted by each student (in the prescribed format) to the supervisor/course teacher whether undergoing industrial training or departmental project work. At the end of the semester the student will submit a final report on his work. Preparation, submission and presentation of the report (3 Hard copies of report and a soft copy of report and presentation)

**Note:* Students have to be physically present for the presentations related to Project work thrice during the course of semester VI.

FST-602: SEMINAR (CREDIT: 1)

CO1: (0.25) To provide platforms for practicing professional communication techniques and skills

CO2: (0.25) To offer chances to debate issues related to the respective topics, share experiences and exchange perspectives

CO3: (0.25) To provide chance for in depth study on a particular topic

CO4: (0.25) To increase their presentation skills as well as confidence

The seminar, on any topic pertaining to food technology, would involve:

a) Exhaustive literature review, comprising of at least 100 references, based on various reputed journals (peer reviewed), conference proceedings, latest books, etc.

b) Preparation, submission and presentation of a review paper (1 Hard copy of paper and a soft copy of paper and presentation).

c) Secondary data analysis and its interpretation to bring out the finding and

d) Preparation, submission and presentation of the seminar report (3 Hard copies of seminar report and a soft copy of seminar report and presentation)

FST-603: PROJECT / DISSERTATION (CREDITS: 6)

CO1: (0.35) The main objective of Project and viva voice is to inculcate Research interest among students

CO2: (0.35) To mentor students to design and conduct original and ethical research.

CO3:(0.30) To carry out projects which help to improve lifestyle of local people

Objectives – To mentor the students to design and conduct original and ethical research. They should be able to write a dissertation in the APA format. The research done can either be empirical/data based (quantitative, qualitative, or mixed-methods) or it can be in the form of a critical review of research and theory.

RECOMMENDED READINGS:

APA manual for dissertation

Evaluation: Viva jointly by one internal and one external examiner.

Elective Course: FST-604: AROMATIC AND MEDICINAL PLANT (CREDITS: 4)

CO1: (0.20) To provide complete understanding of flavors, their composition and method of extraction

CO2: (0.15) To impart knowledge of biogenesis of flavor in food

CO3: (0.25) To identify different sources of off flavors and their corrective methods

CO4: (0.15) To teach the scope and importance of crude drugs and their processing

CO5: (0.25) To get full description of the analysis phytochemicals and their applications

Theory

UNIT:1

Sources of flavors (natural, processed and added), Flavor composites (natural, semi-synthetic and synthetic). Biogenesis of flavours in food – natural and processed foods (Maillard Reaction and Lipid Oxidation).

UNIT-2

Analysis of flavors (Subjective and objective); Formulations of flavors, adulteration, Flavor emulsions, Flavors production in fermented foods, Off-flavors in foods. Odor recognition and thresholds tests; Analysis of different types of flavors such as whole and powdered spices, essential oils, oleoresins, synthetic flavors, plated and dispersed spices-general tests, tests of limited application and specific tests; sensory analysis of flavors; monitoring flavors during food processing; preparation of flavor emulsions and their stability; study of off-flavors in different foods.

UNIT-3

Crude Drugs: Scope & Importance, Classification (Taxonomical, Morphological Chemical, Pharmacological); Cultivation, Collection & processing of Crude Drugs. Cultivation and Utilization of Medicinal & Aromatic Plants in India.

UNIT-4

Analysis and Types of Phytochemicals: Methods of Drug evaluation (Morphological, Microscopic, Physical & Chemical). Preliminary screening, Assay of Drugs – Biological evaluation / assays, Microbiological methods. Carbohydrates & derived products; Glycosides - extraction methods (*Digitalis*, *Aloe*, *Dioscorea*); Tannins (Hydrolysable & Condensed types); Volatile Oils - extraction methods (Clove, *Mentha*); Alkaloids - extraction methods (*Taxus*, *Papaver*, *Cinchona*); Flavonoids- extraction methods, Resins- extraction methods.

Applications of Phytochemicals: Application of phytochemicals in industry and healthcare; Biocides, Biofungicides, Biopesticides.

Elective Course: FST-605: FOOD HYGIENE AND SANITATION (CREDITS: 4)

CO1: (0.20) To study design of plant and processing equipment.

CO2: (0.25) To develop comprehensive understanding of waste product handling and management.

CO3: (0.25) To understand cold chain management

CO4: (0.15) To learn about the designing of warehouse storage

CO5: (0.15) To provide technologies used in ETP Plant manufacturing

Theory

UNIT:1

Food Plant Layout and Equipment Design

General principles of food plant Design and layout, Design of food processing equipments: Size Reduction, mixing, separation, extraction, filtration, centrifugation, distillation and, gas absorption equipments.

UNIT:2

Warehousing and Cold Chain Management

Food hygiene and safety in transportation, with a focus on warehouse storage and refrigerated ships- Safe food storage at shopping outlets: use of coolers/chillers/freezers, length of time in storage, design of warehouses.

Scope of Cold Chain for enhancing marketing potentials of perishables in domestic and international markets

Principles of Cold Chain Creation and Management. Physicochemical changes in stored products during storage Air tight, Non-air tight, Underground, Conventional & Modern storage structures for fruits, vegetables, meat and marine products. Aerated, refrigerated and controlled atmospheric storage. Layout and Design of storage structures, economics of storage structures

UNIT- 3

Food Plant Hygiene and Sanitation

Waste disposal, Control methods using Physical and Chemical Agents, Pest and Rodent Control, ETP Design and Layout. Food storage sanitation, transport sanitation and water sanitation.

By-products utilization obtained from dairy plant, egg & poultry processing industry and meat

Industry. Wastewater and solid waste treatment: Waste-types-solid and liquid waste characterization, physical, chemical, biological, aerobic, anaerobic, primary, secondary and tertiary (advanced) treatments.

Recommended Readings:

1. Norman G. Marriott and Robert B. Gravani. (2006). Principles of Food Sanitation, 5th edition
2. Rao, D. G. (2010). Fundamentals of Food Engineering, PHI learning Private Ltd.
3. Fellows P. (2000). Food Processing Technology, 2nd Edition. Woodhead Publishing Limited and CRC Press LLC
4. James A (2013) The supply chain handbook, distribution group.
5. FAO, US (1984) Design and operations of cold store in developing

FST-606: PRACTICAL –VI (CREDIT:1)

CO1: (0.15) To teach techniques of sensory analysis of various aromatic compounds and flavours.

CO2: (0.25) To provide knowledge regarding unsuitable flavours in different foods.

CO3: (0.15) To provide practical knowledge regarding designing of a food processing plant, warehouse or cold storage.

CO4: (0.25) To impart knowledge regarding the analysis of effluents, sanitizers, disinfectants.

CO5: (0.20) To understand and study the effluent treatment and sanitization facility required in a food processing industry

Elective Course: AROMATIC AND MEDICINAL PLANT

Practical

Odor recognition and thresholds tests, Analysis of different types of flavors such as whole and powdered spices, essential oils, oleoresins, synthetic flavors, plated and dispersed spices-general tests. Sensory analysis of flavors; monitoring flavors during food processing.

Preparation of flavor emulsions and their stability. Study of off-flavors in different foods.

Elective Course: FOOD HYGEINE AND SANITATION

PRACTICAL

Design and layout of various food processing systems and food service areas. Design and layout of cold storage and warehouse. Determination of physico-chemical properties of wastewater. Preparation of a sanitation schedule for food preparation area. Testing of sanitizers and disinfectants. Study of Phenol coefficient of sanitizers. Determination of BOD (biological oxygen demand)/ COD in waste water. Study of waste water treatment system/ETP.

HVP 760: FUNDAMENTALS OF HUMAN VALUES AND PROFESSIONAL ETHICS **[Non-Credit Compulsory Course]**

CO1. To introduce the students about the importance of human values and professional ethics.

CO2. To understand the ethical concerns in professional and personal space.

Unit-1: Ethics and Human Values

Definition, Importance and Relevance in present-day Society.

Indian Constitutional Values: Fundamental Rights and Duties; Freedom, Equality, Fraternity, Justice; Directive Principles of State Policy.

Religious and Cultural Values: Values embedded in different religions; Religious Tolerance.

Unit-2: Basic Human Virtues

Concept of Honesty, Punctuality, Responsibility, Courtesy, Discipline, Courage, Compassion, Empathy and Restrain

Family responsibilities: Duties as a Member of the Society, Guidance to youngsters; Gender Equality.

Social Concerns: Evils of Dowry & Caste System, Racial Discrimination, Suicidal Tendencies, Substance Abuse and Addiction.

Unit-3: Introduction to Professional Ethics

Need, Importance and Goals; Ethical Values in Different Professions: Dignity of Labour, Respect for Authority, Code of Conduct, Conflicts of Interest.

Occupational Crime; Sexual and Mental Harassment in work place.

Professional Rights: Employee Rights, Intellectual Property Rights (IPR).

Unit-4: Ethics in Professional and Global Space

Cyber Ethics and Etiquette.

Correct and Judicious use of Mobile Phones/electronic gadgets, Social Networking in professional space.

Environmental Ethics; Ethics in Research.

Suggested Readings:

- 1) Jayashree Suresh and B S Raghavan- *Human Values and Professional Ethics: Values and Ethics of Profession*. S Chand, 2005.
- 2) Martin, Clancy, Wayne Vaught, and Robert Solomon (eds.)- *Ethics Across the Professions: A Reader for Professional Ethics*. Oxford: Oxford University Press, 2010.
- 3) R.R. Gaur, R. Sangal and G.P. Bagaria- *A Foundation Course in Human Values and Professional Ethics* (Paperback). Excel Books, 2010
- 4) Terrence M. Kelly- *Professional Ethics: A Trust-Based Approach*. Lexington Books, 2018.
- 5) R. S. Naagarazan- *Professional Ethics and Human Values*. New Age International (Second ed.), 2019.
