



MANGALORE UNIVERSITY
B.Sc. (Basic / Hons.) Food Technology

Preamble:

In keeping with the Govt. of India's NEP-2020 vision of a holistic and multidisciplinary Under-Graduate education that equips employable graduates with the required skills in domain as well as personality that are required in the 21st century, the Govt. of Karnataka constituted Subject-wise Committees to work towards envisaging, designing and drafting a common syllabus with hallmarks being multiple entry and exit points enabling horizontal and vertical mobility. This has now been adapted in Mangalore University with minor changes and shall be effective from the academic year 2021-22.

Salient features are as follows:

1. Discipline Core (DSC) or Domain-specific Core Courses in Food technology
2. Discipline Electives (DSE) or Elective Courses in the Core Subject or Discipline.
3. Open Electives (OE) are Elective Courses offered to students from non-core Subjects across disciplines.
4. Skill Enhancement Courses (SEC) that are domain-specific or generic.
5. 1 hour of Lecture or 2 hours of practical per week in a semester is assigned one credit.
Core discipline theory courses are of 3/4 credits, while practicals are of 2 credits

Program Outcomes (POs)

At the end of the program, Food technology graduates will be able to:

- PO 1. **Disciplinary Knowledge:** Bachelor degree in Food Technology helps to apply the knowledge of science, engineering fundamentals, and mathematical concepts to the solution in the field of food technology, science and other allied subjects
- PO 2. **Communication Skills:** Communicate effectively and write effective reports and design documentation, make effective presentations through seminars, project dissertations
- PO 3. **Critical thinking and analytical reasoning:** Recognize the need for, and have the preparation and ability to engage in independent/as an entrepreneur and life-long learning in the broadest context of technological change logical reasoning and capability of recognizing and distinguishing the various aspects of real-life problems.
- PO 4. **Problem Solving:** Identify, formulate, review research literature, and analyze complex Food Technology/applications problems and Design solutions for complex problems and design system components or processes that meet the specified needs with appropriate consideration for the food sustainability
- PO 5. **Research related skills:** Acquire the practical knowledge and demonstrate the ability to design, conduct/trouble shoot experiments and analyze data in the field of food technology

- PO 6. Information/digital Literacy:** The completion of this programme will enable the learner to use appropriate software's to apply for bulk scale/industrial production of technology-based food products
- PO 7. Self-directed learning:** The student completing this program will develop an ability of working independently and to make an in-depth study of various disciplines of food technology.
- PO 8. Moral and ethical awareness/reasoning:** Understand the impact of the professional food technology solutions in societal and environmental contexts, and apply ethical principles and commit to professional ethics and responsibilities
- PO 9. Lifelong learning:** This programme provides self-directed learning and lifelong learning skills to think independently and develop problem solving skills with respect to food industry
- PO 10.** Ability to peruse advanced studies and research in Allied fields of Food science.

Program Specific Outcomes (PSOs):

At the end of the program, Food Technology graduates will be able to:

- Define and have an overview on composition of various food materials, particularly lipids and protein composition which are applicable in the commercial field.
- Classify carbohydrates, vitamins and flavours and understand their importance in food products.
- Apply the knowledge of minerals and various natural food pigments at the industrial level and application of browning reactions in food products.
- Apply food processing technology skills of planning and processing for assessing and analysing food in a sustainable manner.
- Apply knowledge of principles and techniques of food processing and quality assurance for higher studies.
- Build their own products in innovative ways and increase their production area.
- Have a clear idea about the various changes that occurs during food development and use of enzyme technology in food production.
- Apply skills of food science and technology for research, development, and entrepreneurship.

Programme Structure for B.Sc. (Basic / Hons.) Food Technology with Food Technology as Programme Core Subject with Practical

Sem	Discipline Core Courses (Credits) (T+P=4+2; 3+2; 3)	Open Elective Courses	Ability Enhancement compulsory Courses 4hrs		Skill enhancement Courses			Total credits
					Skill based	Value Based (Credits) L+T+P		
I	FTT 1.1 Fundamentals of food technology (3) FTT 1.2 Principles of food science (3) FTT 1.3 Food safety (3) FTP 1.1 Fundamentals of food technology (2) FTP 1.2 Principles of food science (3)	OE 1 (3) Food safety	Languages (3+3)		SEC-1 (2)	Phy.Ed. Yoga (1)	Health & Wellness (1)	26
II	FTT 2.1 Food Chemistry (3) FTT 2.2 Post harvest handling (3) FTT 2.3 Food and Nutrition (3) FTP 2.1 Food chemistry (2) FTP 2.2 Post harvest handling (3)	OE 2 (3) Food and Nutrition	Languages (3+3)	EVS (2)		Phy.Ed. Sports (1)	NCC/NSS/ R&R (S&G)/Cult ural (1)	26
Exit option with Certificate in Food Technology (with a minimum of 48 credits)								
III	FTT 3.1 Food Analysis (3) FTT 3.2 Nutraceutical and functional foods (3) FTT 3.3 Processing of spices and plantation crops (3) FTP 3.1 Food Analysis Lab (2) FTP 3.2 Nutraceutical and functional foods (2)	OE 3 (3)	Languages (3+3)		SEC-2 (2)	Phy. Ed. Sports (1)	NCC/NSS/ R&R (S&G)/Cult ural (1)	26
IV	FTT 4.1 Food quality (3) FTT 4.2 Brewing and fermentation technology (3) FTT 4.3 Processing of plant products (3) FTP 4.1 Food quality (2) FTP 4.2 Processing of plant products (3)	OE 4 (3)	Languages (3+3)	Constituti on of India (2)		Phy. Ed. Sports (1)	NCC/NSS/ R&R (S&G)/Cult ural (1)	26
Exit option with Diploma in Food Technology (with a minimum of 96 credits)								
V	FTT 5.1 Food microbiology, contamination and preservation of foods (Major, 3) FTT 5.2 Food microbiology, contamination and preservation of foods (Minor, 3) FTT 5.3 Food biotechnology (Major, 3) FTT 5.4 Food biotechnology (Minor, 3) FTT 5.5 Bakery and Confectionaries Technology (3) FTP 5.1 Food microbiology, contamination and preservation of foods (Major, 2)	DSC E – 1 Emerging technologies in food processing (3) Vocational – Food sanitation, hygiene and waste management (3)			SEC-3 (2)	Phy. Ed. Sports (1)	NCC/NSS/ R&R (S&G)/Cult ural (1)	22

	FTP 5.2 Food microbiology, contamination and preservation of foods (Minor, 2) FTP 5.3 Food biotechnology (Major, 2) FTP 5.4 Food biotechnology (Minor, 2) FTP 5.5 Bakery and Confectionaries Technology (2)							
VI	FTT 6.1 Food processing technology (Major, 3) FTT 6.2 Processing of oils and fats (Major, 3) FTT 6.3 Fast foods and catering services (3) FTP 6.1 Food processing technology (Major, 2) FTP 6.2 Processing of oils and fats (Minor, 2)	DSC E – 2 Post harvest management (3) Vocational – Dairy Technology (3) Internship (2)			SEC-4 (2)	Phy. Ed. Sports (1)	NCC/NSS/R&R (S&G)/Cultural (1)	25
Exit option with BSc in Food Technology (with a minimum of 140 credits)								
VII	FTT 7.1 Processing Technology of meat, poultry and fish (3) FTT 7.2 Post harvest and storage engineering (3) FTT 7.3 Food refrigeration and cold storage (3) FTP 7.1 Processing Technology of meat, poultry and fish Lab (2) FTP 7.2 Post harvest and storage engineering Lab (2)	DSC E-3 Beverage Technology (3) Vocational – Food Entrepreneurship (3) FTT 7.5 Research Methodology (3)						21
VIII	FTT 8.1 Food adulteration and food toxicology and sensory evaluation (3) FTT 8.2 Food engineering and enzymes in food processing (3) FTT 8.3 Food Extrusion Technology (3)	DSC E-4 Food Laws and Regulations (3) Vocational – New food product development (3) FTT 8.5 Research Project* (6)						21
Award of BSc (Hons.) Degree in Food Technology (with a minimum of 180 credits)								

*In lieu of the research Project, two additional elective papers/Internship may be offered



MANGALORE UNIVERSITY

Scheme and Syllabus for B.Sc. (Basic / Hons.) Food Technology)

SEMESTER - 1								
Group	Course Code	Title of the Course	Instruction Hours / week	Duration of Exam (Hours)	Marks			Credits
					IA	Exam	Total	
Discipline Core Courses	FTT 1.1	Fundamentals of food technology	3	3	40	60	100	3
	FTT 1.2	Principles of food science	3	3	40	60	100	3
	FTT 1.3	Food safety	3	3	40	60	100	3
	FTP 1.1	Fundamentals of food technology Practical - 1	3	3	25	25	50	2
	FTP 1.2	Principles of food science Practical - 2	3	3	25	25	50	2
Open Elective Courses	FTE 1.1	Food safety	3	3	40	60	100	3
Total			18		500			16

SEMESTER - II								
Group	Course Code	Title of the Course	Instruction Hours / week	Duration of Exam (Hours)	Marks			Credits
					IA	Exam	Total	
Discipline Core Courses	FTT 2.1	Food Chemistry	3	3	40	60	100	3
	FTT 2.2	Post harvest handling	3	3	40	60	100	3
	FTT 2.3	Food and nutrition	3	3	40	60	100	3
	FTP 2.1	Food Chemistry Practical - 3	3	3	25	25	50	2
	FTP 2.2	Post harvest handling Practical - 4	3	3	25	25	50	2
Open Elective Courses	FTE 2.1	Food and Nutrition	3	3	40	60	100	3
Total			18		500			16

Pedagogy for student engagement is predominantly lectures. However, other pedagogies that enhance better student engagement may be adopted for each course. The list includes active/ experiential learning /course projects/ problem or project-based learning (PBL)/ case studies/ self-study like seminar, term paper or MOOC/ field visits / industrial visits / group activity / simulations / hackathons etc.

Assessment: Every course needs to include assessment for higher order thinking skills (applying/ analyzing/evaluating/creating). These shall necessarily be reflected also in the Question Papers, such that questions of all levels of difficulty are framed. Alternate assessment methods that help formative assessment (i.e. assessment for learning) may also be adopted.

- To study dextrinization in foods.
- Identification of pigments in fruits and vegetables and influence of pH on them.
- Quality inspection of animal foods.

References

1. Srilakshmi, B. 2003 Food science, New Age International Publishers, India.
2. Shakuntalamanay, N. M., 2004 Foods: Facts and Principles - New Age Publishers.
3. Swaminathan M., 2003 Food science, Chemistry & Experimental Foods, BAPPCO

FTT 1.2

PRINCIPLES OF FOOD SCIENCE

45 hours

Course Objectives:

1. To understand the importance of food chemistry, sensory evaluation process of food and study various microorganisms and their importance in industrial food technology
2. To have an in-depth understanding of water disposal, shelf life of the food material, packaging materials and food storage.

Course Outcomes:

At the end of the Course, students will be able to

- CO 1. Differentiate between the characteristics of various molecules, develop sensory evaluation skills and understand use of colloidal substance at the industrial level
- CO 2. Understand and apply beneficial microorganisms in food technologies in the industry
- CO 3. Comprehend utility of water source in the production area and approaches for waste water treatment.
- CO 4. Develop various packaging methods to sustainably improve its outcome in the food development process.

UNIT I

Food Chemistry

(2 hours)

Introduction to different food groups and importance of food chemistry. Characteristics of protein, carbohydrates, lipids, pigments, colloids, and enzymes.

Colloidal chemistry

(4 hours)

Characteristics and stabilization of colloidal system, properties and formation of emulsions, formation, stability and destruction of foam, application of colloidal chemistry to food preparation.

Sensory evaluation of food

(4 hours)

Objectives, type of food panels, characteristics of panel member, layout of sensory evaluation laboratory, sensitivity tests, threshold value, paired comparison test, duotrio test, triangle test, hedonic scale, chemical dimension of basic tastes, Amoore's classification of odorous compounds. Sherman and Szczniak classification of food texture.

UNIT II

Growth of microorganisms in foods

(4 hours)

Food as a substrate for microorganism, factors affecting growth of microbes: pH, water activity, O-R potential, nutrient contents, inhibitory substance and biological structure.

Hurdle technology

(4 hours)

Principles and applications, Hurdle effect in fermented foods, shelf stable products, intermediate moisture foods, application of hurdle technology.

Minimal processing

(4 hours)

Minimal processing of foods with thermal methods and non thermal methods-safety criteria in minimally processed foods-Minimal processing in practice-fruits and vegetables-seafood-effect on quality-Future developments

UNIT III

Ohmic heating and High Pressure processing (5 hours)

Principles, equipment and processing, effect heat and pressure on food.

Water disposal (3 hours)

Waste water, hardness of water, break point chlorination, physical and chemical of impurities, BOD, COD, waste water treatment,

Water disposal (3 hours)

Sanitization of food processing plants and equipments, CIP system, sanitizers used in food industry.

UNIT IV

Shelf life of food material (3 Hours)

Objectives of packaging, packaging requirements of all major food groups, food contact materials,

Packaging materials (6 Hours)

Properties of the following packaging materials, edible, biobased and biodegradable food packaging materials, flexible packaging, New and active packaging technologies, food packaging closures and sealing systems, as well as optical, mechanical, and barrier properties of thermoplastic polymers

Packed storage (5 Hours)

Design and analysis of shelf life experiments and the shelf life estimation of foods, Factors effecting shelf life of the material during packed storage.

FTP 1.2 PRINCIPLES OF FOOD SCIENCE PRACTICAL

36 hrs – 3 hrs/week

Course Outcomes:

At the end of the Course, students will be able to:

- CO 1. Use techniques, instruments and equipment to analyse biochemical constituents found in food products
- CO 2. Evaluate food products based on sensory attributes
- CO 3. Estimate the microbiological content of food samples
- CO 4. Use Hand Refractometer and asses the nutritive qualities of food samples

1. Sensory evaluation of seafood on 10-point hedonic scale.
2. Sensory evaluation of vegetables.
3. Sensory evaluation of fruits.
4. Total bacterial count of the food sample.
5. Total mould count of the food sample
6. Determination of Free Fatty acids.
7. Determination of Peroxide value.
8. Determination of Total Volatile Base Nitrogen.
9. Determination of TBA.
10. Estimation of total salt content in butter.
11. Estimation of total ash content of the food
12. Preparation of brix solution and checking by hand refractometer

REFERENCES

1. Coles R, McDowell D and Kirwan MJ. Food Packaging Technology, CRC Press, 2003
2. De S. Outlines of Dairy Technology, Oxford Publishers, 1980
3. Deman JM. Principles of Food Chemistry, 2nd ed. Van Nostrand Reinhold, NY 1990
4. Frazier WC and Westhoff DC. Food Microbiology, TMH Publication, New Delhi, 2004
5. Jenkins WA and Harrington JP. Packaging Foods with Plastics, Technomic Publishing Company Inc., USA, 1991
6. Manay NS and Shadaksharaswamy M. Food-Facts and Principles, New Age International (P) Ltd. Publishers, New Delhi, 1987
7. Meyer LH. Food Chemistry, CBS Publication, New Delhi, 1987
8. Potter NH. Food Science, CBS Publication, New Delhi, 1998
9. Ramaswamy H and Marcott M. Food Processing Principles and Applications CRC Press, 2006
10. Ranganna S. Handbook of Analysis and Quality Control for Fruits and Vegetable Products, 2nd ed. TMH Education Pvt. Ltd, 1986

FTT 1.3

FOOD SAFETY

45 hours

Course Outcomes:

After successful completion of this Course, students will be able to:

- CO 1. Explain the application of food quality and food safety system
- CO 2. Identify the hazard of the food chain to ensure food safety
- CO 3. Examine the chemical and microbiological quality of food samples
- CO 4. Detect the adulteration in food samples
- CO 5. Review of legislative approaches for the management of food safety

Unit I

(15 hours)

Introduction to food safety: Introduction to concepts of food quality, food safety, food quality assurance and food quality management; objectives, importance and functions of quality control, Current challenges to food safety. Safety Act: Role of national and international regulatory agencies, Bureau of Indian Standards (BIS), AGMARK, Food Safety and Standards Authority of India (FSSAI), Introduction to WTO agreements: SPS and TBT agreements, Codex Alimentarius Commission, USFDA, International organization for standards (ISO) and its standards for food quality and safety (ISO 9000 series, ISO 22000, ISO 15161, ISO 14000).

Unit II

(15 hours)

Safety during processing: HACCP; Desirable safety features of some food processing equipment; Personal protective equipment; Safety from adulteration of food. Role of maintenance staff and plant operators; Preventive maintenance; Guidelines for good maintenance & safety precautions; Lubrication & lubricants; Work place improvement through '5S'.

Unit III

(15 hours)

Plant maintenance: Hygiene and sanitation requirement in food processing and fermentation industries; Cleaning, sanitizing and pest control in food processing; storage and service areas. Cleaning compounds, choosing, handling and storage of cleaning compounds.
Personal Hygiene: Hygienic food handling, employee health, training.

REFERENCES

- Motarjemi Y. Lelieveld H. (Ed.) Food Safety Management, A Practical Guide for the Food Industry, Academic Press, eBook ISBN: 9780123815057, Hardcover ISBN:9780123815040,
- Forsythe S J, Hayes P R. Food Hygiene, Microbiology & HACCP. Springer, 2012.
- Schmidt R.H., Rodrick G.E. Food Safety Handbook, John Wiley & Sons, Inc., 2003, Print ISBN: 9780471210641.

SEMESTER - II

FTT 2.1: FOOD CHEMISTRY 45 hours

Course Outcomes:

After successful completion of this Course, students will be able to:

- CO 1. Define and have an overview on food chemistry including composition and the importance of water.
- CO 2. Classify the carbohydrates, lipids, proteins, vitamins and flavour, minerals and natural food pigments used in food products.
- CO 3. Apply the knowledge of browning reactions in food products
- CO 4. Build own product in innovative way by understanding changes that occurs during food development and use of enzyme technology.

Unit I (15 hours)

Introduction: Physicochemical properties of water, water weak interactions in Aqueous Systems, ionization of water, weak acids, and weak bases, buffering against pH changes in biological systems, water as a reactant. The fitness of the aqueous environment for living organisms water activity and its influences on food quality and stability. Role of water in food.

Carbohydrates: Introduction, classification, structure, sources, properties and functions of carbohydrates, functional properties of sugars, starch, cellulose, glucans, hemicelluloses, gums, pectin substances, polysaccharides, Modified starch and dietary fibre. Dietary requirements of carbohydrates, inborn errors of carbohydrate metabolism.

Unit II (15 hours)

Amino acids and Proteins: Amino acids, occurrence, structure, classification, physical & chemical properties. Peptides, polypeptide, proteins & their properties, major source of proteins, classification, structure, properties, purification and denaturation of proteins, physicochemical and functional properties of protein derived from milk, egg protein, meat protein, fish muscle protein, oil seed protein and cereal protein. Protein-protein interaction, Protein-lipid interaction, protein-lipid complexes and protein-carbohydrate complexes. Modified proteins and application in food industry. Dietary requirements of proteins, metabolic defects such as Kwashiorkor associated with proteins.

Unit III (15 hours)

Enzymes: General introduction to Enzymes, classification and functions of Enzymes and its activity in different food systems, factors affecting rate of enzymatic action, commercial availability, immobilization of enzymes, importance of enzymes in food processing. Lipids: General introduction, classification, physical and chemical properties, functions and Dietary requirements of food lipids, refining of crude oil and fats, hydrogenation, winterization shortenings and low fat spreads. Vegetable and animal fat, margarine, lard, butter. Flavour changes in fats and oils, lipid oxidation, auto oxidation, factors affecting lipid oxidation and

its biological significance, metabolic defects such as cardiovascular disease associated with lipids. Vitamins: Physiological and biochemical role of fat and water soluble vitamins, functions and sources. Vitamin C, Vitamin B complex, Iron and Folic acid. Requirements and recommended allowances. Deficiency diseases.

FTP 2.1 **FOOD CHEMISTRY PRACTICAL** 36 hrs – 3 hrs/week

Course Outcomes:

After successful completion of this Course, students will be able to:

- CO 1. Test the principles underlying analytical techniques of food products.
- CO 2. Evaluate quantitatively total protein, total sugar and total lipid content in different food samples.
- CO 3. Estimate food contents using different methods.
- CO 4. Understand the non-enzymatic process by extraction process and estimate the non-protein nitrogenous substances in the various food samples

1. Safety measures in the Laboratory
2. Qualitative Tests of Carbohydrate (Molisch's Test, Fehling's Test, Benedict Test, Iodine Test, etc.)
3. Quantitative Determination of Carbohydrate by Phenol Sulphuric acid method
4. Isolation of starch from given sample.
5. Determination of total sugar/reducing sugar in food. 200
6. Determination of iodine value/acid value/saponification value of oil
7. Test for detection of different oils (Baudouin test, Halphens test, hexabromide test)
8. Estimation of lysine content
9. Determination of ascorbic acid by dye method
10. Determination of phosphorus/estimation of calcium
11. Estimation of tannins from food
12. Determination of total carotenoids

REFERENCES

- Meyer L H. Food Chemistry, The AVI Publishing Co Inc., Connecticut, MA, USA, 1974
- Eskin NAM, Henderson HM and Townsed RJ. Biochemistry of Foods, Academic Press, New York, 1971
- Brady JW. Introductory Food Chemistry, Cornell University Press, Ithaca, USA, 2013
- H.-D. Belitz, W. Grosch and Schieberle P. Food Chemistry, 4th Ed. Springer- Verlag. Berlin Heidelberg, 2009
- Meyer, L.H. Food Chemistry. CBS publishers and Distributors, New Delhi, 1987

FTT 2.2: **POST HARVEST HANDLING** **45 hours**

Course Outcomes:

After successful completion of this Course, students will be able to:

- CO 1. Comprehend the need for preservation, canning and bottling process for vegetable and fruit products.
- CO 2. Understand the rationale behind processing and drying techniques of fruits and vegetables leading to a final product with enhanced characteristics and shelf life.
- CO 3. Evaluate the reactions and changes taking place in fruits and vegetables, beverages and spices during overall processing.

CO 4. Apply the methodologies to preserve the harvest and turn it into multiple uses.

Unit I

(12 hours)

Introduction: Importance of post harvest management, Fruits and vegetables as living products: Chemical composition, pre and post harvest changes, causes for post harvest losses- Pre-harvest Factors in Post-harvest Losses, improper harvesting, post harvest physiology, biological factors, environmental factors, improper handling, storage and transportation, Maturity- types of maturity, determination of maturity- physical, chemical, physiological, electronic methods, harvesting of fruits and vegetables

Unit II

(11 hours)

Plant growth regulators: Role in relation with storage, physical and chemical treatment to increase shelf life conditions. Food additives: Used in vegetable processing and preservation. Fruits and vegetable juices: preparation of juice, syrups, squashes. Concentration and drying of juices, packaging of dried fruits and vegetables. Spices: spice production and processing of various spices, antioxidant activity of spices, storage of spices and spice extractives. Coffee, tea and cocoa- production, processing and types

Unit III

(11 hours)

Production of food grain and post harvest losses in India, General problems of storage of food grains, Factors responsible for the storage losses at commercial and farm level. Role of Moisture in spoilage of stored grain, moisture migration, measurement of moisture content in food grain and milled products.

Unit IV

(11 hours)

Mode of Action of insecticides, rodenticides & fungicides. Tolerance limit of pesticide residues, antidotes and precautions and safe handling of pesticides. Insects and pests of stored grain and milled products, Integrated Insect Pest Management, Sources and detection of infestation in stored food grains. Insecticide Act, Consumer protection Act & Stress Management. Role and function of Warehousing Development and Regulatory Authority and negotiability of Warehouse Receipt.

FTP 2.2 POST HARVEST HANDLING PRACTICAL 36 hrs – 3 hrs/week

Course Outcomes:

At the end of the Course, students will be able to:

- CO 1. Estimate the nutritional characteristics during food processing.
- CO 2. Determine the moisture content changes during processing of food.
- CO 3. Determine the organoleptic characteristics of food.
- CO 4. Evaluate the action of microorganisms on food.

- 1) Principles of Good Agricultural Practices and Good Hygiene Practices
- 2) Determination of TSS in different juices
- 3) Estimation of total yield in processing of fruits and vegetables
- 4) Evaluation of Physical characteristics of grains
- 5) Estimation of drip loss during frozen storage
- 6) Determination of pH of the food products
- 7) Preparation of Jam, jelly, squashes, cordial
- 8) Evaluation of maturity indices of fruits and vegetables
- 9) Estimation of benzoic acid in commercial foods

10) Evaluation of wax coated fruits

REFERENCES

- Girdharilal, Siddappaa, G.S and Tandon, G.L. Preservation of fruits & Vegetables, ICAR, New Delhi, 1998
- Crussess W B. Commercial Unit and Vegetable Products, W.V. Special Indian Edition, Pub: Agrobios India, 2004
- Manay, S. & Shadaksharaswami, M. Foods: Facts and Principles, New Age Publishers, 2004
- Ranganna S. Handbook of analysis and quality control for fruits and vegetable products, Tata Mc Graw-Hill publishing company limited, 2nd Ed., 1986
- Srivastava, R.P. and Kumar, S. Fruits and Vegetables Preservation- Principles and Practices. 3rd Ed. International Book Distributing Co., 2006
- Kent, N.L. Technology of Cereal, 5th Ed. Pergamon Press, 2003
- Chakraverty, Post Harvest Technology of Cereals, Pulses and Oilseeds, revised Ed., Oxford & IBH Publishing Co. Pvt Ltd., 1998
- Marshall, Rice Science and Technology, Wadsworth Ed., Marcel Dekker, New York, 1994
- Manay, S. and Sharaswamy, M. Food Facts and Principles. Wiley Eastern Ltd., 1987

FTT 2.3:

FOOD AND NUTRITION

45 hours

Course Outcomes:

After successful completion of this Course, students will be able to:

- CO 1. Understanding the basic processes involved in the preparation, transformation and conservation of foods of both animal and vegetable origin.
- CO 2. Understanding the microbiology, parasitology and toxicology of food.
- CO 3. Examining and evaluating the relationship between food and nutrition in health and/or illness.
- CO 4. Applying scientific knowledge of physiology, pathophysiology, nutrition and food to individual or group diet planning and counselling, both in healthy (dietetics) and ill (diet therapy) clients, at every stage of life.

Unit I

(15 hours)

Introduction: Understanding relationship between food, nutrition and health. Functions of food-physiological, psychological and social. Concept of balanced diet. Basic Food Groups, Food Pyramid, Nutritional labelling. Menu planning. Lipids – essential fatty acids, deficiency, food sources of EFA, Function of TGL. Sterols - cholesterol - function, food sources, phospholipids - function, ketone bodies – fat requirements - food sources, dietary lipids. Nutrients – Classification, Functions, Dietary sources, RDA. Minerals - Classification, digestion, functions, dietary sources, requirement, effects of deficiency of Ca, P, Na, K, I, F, Se.

Unit II

(15 hours)

Proteins: Amino acids - Indispensable and dispensable amino acids - special functions of amino acids. Protein deficiency - Protein Energy Malnutrition – Kwashiorkor and Marasmus - etiology, clinical features, treatment and prevention - Evaluation of protein quality - PER, BV, NPU and NPR, chemical score mutual and amino acid supplementation of proteins. Natural pigments: Chlorophyll, Flavanoids, Anthocyanins, Anthoxanthins. Methods of cooking: Dry, moist, frying and microwave cooking, Advantages, disadvantages and the

effect of various methods of cooking on foods, Changes in food during cooking using dry heat, moist heat, heated oil and microwave.

Unit III

(15 hours)

Basics of energy: Energy units - Kilocalories, Megajoules, determination of energy value of foods, using Bomb calorimeter, diagram of Bomb Calorimeter – gross calorific values, Physiological energy, value of foods, relation between oxygen used and calorific value.

Metabolism: Determination of energy requirements, direct calorimetry. Relation between Respiratory quotient and energy output - Specific dynamic action of food (Thermogenic food in REE) indirect calorimetry - Basal metabolism - definition, determination - benedict Roth basal Metabolism Apparatus - factors affecting BMR - determination of energy metabolism, during work - energy requirements for various types of activities, factorial methods for calculation of the daily energy requirements of an adult for varying degrees of physical activity - recommended allowances for calories, energy requirements of adults expressed in terms of reference man and reference woman – FAO committee and ICMR committee percent calories supplied by carbohydrates, fats and proteins in average Indian diets - Energy requirements for different age groups.

REFERENCES

- B. Srilakshmi, Food Science, New Age International Publishers (India), 2003.
- NIN, ICMR (1990). Nutritive Value of Indian Foods.
- Raina U, Kashyap S, Narula V, Thomas S, Suvira, Vir S, Chopra S (2010). Basics Food Preparation: A Complete Manual, Fourth Edition. Orient Black Swan Ltd.
- Seth V, Singh K (2005). Diet planning through the Life Cycle: Part 1. Normal Nutrition. A Practical Manual, Fourth edition, Elite Publishing House Pvt. Ltd.
- Guthrie H.A. - Introductory Nutrition C.V. Mosby Co. St. Louis, 2006.

Open Elective Courses SEMESTER - I

FTE 1.2: **FOOD SAFETY (OPEN ELECTIVE)** **45 hours**

Course Outcomes:

After successful completion of this Course, students will be able to:

- CO 1. Explain the application of food quality and food safety system
- CO 2. Identify the hazard of the food chain to ensure food safety
- CO 3. Examine the chemical and microbiological quality of food samples
- CO 4. Detect the adulteration in food samples
- CO 5. Review of legislative approaches for the management of food safety

Unit I **(15 hours)**

Introduction to food safety: Introduction to concepts of food quality, food safety, food quality assurance and food quality management; objectives, importance and functions of quality control, Current challenges to food safety.

Safety Act: Role of national and international regulatory agencies, Bureau of Indian Standards (BIS), AGMARK, Food Safety and Standards Authority of India (FSSAI), Introduction to WTO agreements: SPS and TBT agreements, Codex Alimentarius Commission, USFDA, International organization for standards (ISO) and its standards for food quality and safety (ISO 9000 series, ISO 22000, ISO 15161, ISO 14000).

Unit II **(15 hours)**

Safety during processing: HACCP; Desirable safety features of some food processing equipment; Personal protective equipment; Safety from adulteration of food. Role of maintenance staff and plant operators; Preventive maintenance; Guidelines for good maintenance & safety precautions; Lubrication & lubricants; Work place improvement through '5S'.

Unit III **(15 hours)**

Plant maintenance: Hygiene and sanitation requirement in food processing and fermentation industries; Cleaning, sanitizing and pest control in food processing; storage and service areas. **Personal Hygiene:** Hygienic food handling, employee health, training.

REFERENCES

- Motarjemi Y. Lelieveld H. (Ed.) Food Safety Management, A Practical Guide for the Food Industry, Academic Press, eBook ISBN: 9780123815057, Hardcover ISBN: 9780123815040,
- Forsythe S J, Hayes P R. Food Hygiene, Microbiology & HACCP. Springer, 2012.
- Schmidt R.H., Rodrick G.E. Food Safety Handbook, John Wiley & Sons, Inc., 2003, Print ISBN: 9780471210641.

SEMESTER - II

FTE 2.1: FOOD AND NUTRITION (OPEN ELECTIVE)

45 hours

Course Outcomes:

After successful completion of this Course, students will be able to:

- CO 1. Understanding the basic processes involved in the preparation, transformation and conservation of foods of both animal and vegetable origin.
- CO 2. Understanding the microbiology, parasitology and toxicology of food.
- CO 3. Examining and evaluating the relationship between food and nutrition in health and/or illness.
- CO 4. Applying scientific knowledge of physiology, pathophysiology, nutrition and food to individual or group diet planning and counselling, both in healthy (dietetics) and ill (diet therapy) clients, at every stage of life.

Unit I

(15 hours)

Fats and Lipids: Understanding relationship between food, nutrition and health. Functions of food-physiological, psychological and social. Concept of balanced diet. Lipids - Classification, Composition function – essential fatty acids, deficiency, food sources of EFA, Function of TGL, Characteristics of animal and vegetable fats, sterols - cholesterol - function, food sources, phospholipids - function, ketone bodies – fat requirements - food sources, dietary lipids and their relation to the causation of Atherosclerosis and Ischaemic heart disease. **Nutrients, vitamins and minerals:** Nutrients – Classification, Functions, Dietary sources, RDA. Fat soluble vitamins - A, D, E and K. Water soluble vitamins - thiamin, riboflavin, niacin, pyridoxine, folate, vitamin B12 and vitamin C. Minerals- Role of Ca, P, Fe, Na, K, I, F, Se.

Unit II

(15 hours)

Carbohydrates and proteins: Carbohydrates - Classification, digestion, functions, dietary sources, requirement, Clinical manifestations of deficiency and excess and factors affecting absorption of carbohydrates. Proteins - Composition - structure and classification, function of protein, Amino acids Indispensable and dispensable amino acids - special function of amino acids - protein deficiency - Protein Energy Malnutrition – Kwashiorkor and Marasmus - etiology, clinical features, treatment and prevention - Evaluation of protein quality - PER, BV, NPU and NPR, chemical score mutual and amino acid supplementation of proteins.

Unit III

(15 hours)

Basics of energy: Energy units - Kilocalories, Megajoules, determination of energy value of foods, using Bomb calorimeter, diagram of Bomb Calorimeter – gross calorific values, Physiological energy, value of foods, relation between oxygen used and calorific value.

Metabolism: Determination of energy requirements, direct calorimetry. Relation between Respiratory quotient and energy output - Specific dynamic action of food (Thermogenic food in REE) indirect calorimetry - Basal metabolism - definition, determination - benedict Roth basal Metabolism Apparatus - factors affecting BMR - determination of energy metabolism, during work - energy requirements for various types of activities, factorial methods for calculation of the daily energy requirements of an adult for varying degrees of physical activity - recommended allowances for calories, energy requirements of adults expressed in terms of reference man and reference woman – FAO committee and ICMR committee percent calories supplied by carbohydrates, fats and proteins in average Indian diets - Energy requirements for different age groups.

REFERENCES

- B. Srilakshmi, Food Science, New Age International Publishers (India), 2003.
- NIN, ICMR (1990). Nutritive Value of Indian Foods.
- Raina U, Kashyap S, Narula V, Thomas S, Suvira, Vir S, Chopra S (2010). Basics Food Preparation: A Complete Manual, Fourth Edition. Orient Black Swan Ltd.
- Seth V, Singh K (2005). Diet planning through the Life Cycle: Part 1. Normal Nutrition. A Practical Manual, Fourth edition, Elite Publishing House Pvt. Ltd.
- Guthrie H.A. - Introductory Nutrition C.V. Mosby Co. St. Louis, 2006.

Model Question Paper (Theory – Discipline Core Courses)
I Semester B.Sc. Basic and Hons. (Food Technology)
Examination Month & Year
COURSE CODE AND TITLE

Time: 3 Hours

Max. Marks: 60

Answer any four of the following choosing one full question from each unit: (4x15=60)

UNIT – 1

- 1.
- a)
- b)
- c)

(3+5+7=15)

OR

- 2.
- a)
- b)
- c)

(3+5+7=15)

UNIT – 2

- 3.
- a)
- b)
- c)

(4+4+7=15)

OR

- 4.
- a)
- b)
- c)

(4+4+7=15)

UNIT – 3

- 5.
- a)
- b)
- c)

(4+4+7=15)

OR

- 6.
- a)
- b)
- c)

(4+4+7=15)

UNIT – 4

- 7.
- a)
- b)
- c)

(3+5+7=15)

OR

- 9.
- a)
- b)
- c)

(4+4+7=15)

In each question:

- a. Shall be questions based on basic conceptual understanding etc.
- b. Shall be questions based on deeper understanding, analytical, problem solving skills etc.
- c. Shall be questions based on critical thinking, higher order thinking skills etc.

MODEL QUESTION PAPER
I Semester B.Sc. (Basic / Hons.) Food Technology Practical Examination Month & Year
COURSE CODE AND TITLE

Time:	Max. Marks: 30
I. Major:	10 marks
II. Minor:	5 marks
IV. Spotters:	2×2.5=5 marks
a.	
b.	
V. Viva.	5 marks
VI. Record.	5 marks
