DRAFT

National Education Policy-2020
Year- 2025

Common Minimum Syllabus for Uttarakhand State Universities and Colleges

Integrated Programme
Bachelor of Science (Food Technology)/ Honours Programme & Master of Science (Food Technology)

PROPOSED STRUCTURE FOR INTEGRATED UNDERGRADUATE & POSTGRADUATE FOOD TECHNOLOGY SYLLABUS

DEPARTMENT OF FOOD TECHNOLOGY
SURAJMAL AGARWAL PRIVATE KANYA MAHAVIDYALAYA
Kichha, Udham Singh Nagar Uttarakhand
(Affiliated to Kumaun University, Nainital, Uttarakhand)

List of Experts in drafting NEP (2020) syllabus (Home Science)

EXPERT COMMITTEE

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SYLLABUS PREPARATION COMMITTEE

S.N.	NAME	DESIGNATION	DEPARTMENT	AFFILIATION
1.	Dr. Sudhir Kumar	Head	Department of Food Technology, SAPKM, Kichha	Kumaun University, Nainital, Uttarakhand
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Contents

List of Papers (DSC, DSE, GE, AEC, VAC) with Semester Wise Titles for 'Food Technology'					
Year	**Semester**	**Course**	**Paper Title**	**Theory/ Practical**	**Credits**
UNDERGRADUATE CERTIFICATE IN FOOD TECHNOLOGY					
FIRST YEAR	**I**	DSC-1	Introductory Microbiology	Theory + Practical	2+2
		DSC-2	Introductory Biochemistry	Theory + Practical	3+1
		DSC-3	Principles of Human Nutrition	Theory	4
		GE-1	Professional Communication and Technical Writing	Theory	4
		AEC	Indian Language -1 (As offered by K.U.)		2
		SEC-1	Basic Concepts in Lab Techniques- I	Theory	2
		VAC-1	Technology and Trends in Value-Added Foods	Theory	2
		Practical	Practical- I	Practical	
	II	DSC-4	Analysis of Food Quality and Safety	Theory + Practical	2+2
		DSC-5	Food Process Equipment	Theory	4
		DSC-6	Food Laws and Legislation	Theory	4
		GE-2	Basic Computer Applications in Food Industry	Theory + Practical	3+1
		AEC	Indian Language -1 (As offered by K.U.)		2
		SEC-2	Basic Concepts in Lab Techniques- II	Practical	2
		VAC-2	Technology of Value-Added Egg Products	Theory	2
		Practical	Practical- II/	Practical	
Note-Visit to industry (Dairy / Biscuit/ Confectionary/ Beverage Industry) 15 days in plant training.					
UNDERGRADUATE DIPLOMA IN FOOD TECHNOLOGY					
SECOND YEAR	**III**	DSC-7	Food Chemistry	Theory + Practical	2+2
		DSC-8	Technology of Dairy Products	Theory + Practical	2+2
		DSC-9	Technology of Cereals, Pulses and Oilseeds	Theory + Practical	2+2

		DSE-1 or GE-3	Fundamentals of Food Technology or Environmental Studies	Theory + Practical Theory + Practical	3+1
		AEC	Indian Language -2 (As offered by K.U.)		2
		SEC-3	Technology of Mushroom Production	Theory	2
		VAC-3	Value-Added Processing of Mushroom	Theory	2
		Practical	Practical- III	Practical	
	IV	DSC-10	Principles of Food Preservation	Theory + Practical	3+1
		DSC-11	Processing of Spice and Plantation Crops	Theory + Practical	3+1
		DSC-12	Principles of Food and Dairy Microbiology	Theory + Practical	3+1
		DSE-2 or GE-4	Food Additives and Ingredients or Elements of Statistics	Theory + Practical Theory	3+1
		AEC	Indian Language -2 (As offered by K.U.)		2
		SEC-4	Food Authenticity and Fraud Detection	Theory	2
		VAC-4	Pickle Making Technology	Theory	2
		Practical	Practical-IV/	Practical	
Note- Visit to industry (Dairy / Biscuit/ Confectionary/ Beverage Industry) 30 days in-plant training.					
BACHELOR OF FOOD TECHNOLOGY (HONOURS)					
THIRD YEAR	**V**	DSC-13	Food Packaging Technology	Theory + Practical	3+1
		DSC-14	Food Storage Engineering	Theory + Practical	3+1
		DSC-15	Fruits and Vegetable Processing	Theory + Practical	3+1
		DSE- 3	Beverage Technology	Theory + Practical	3+1
		GE-5	Baking & Confectionery Technology	Theory + Practical	3+1
		SEC-5	Advances in Food Processing- I	Theory	2
		Practical	Practical- V	Practical	

	VI	DSC-16	Functional & Minimally Processed Foods	Theory + Practical	3+1
		DSC-17	Quality Control in Food Industry	Theory + Practical	2+2
		DSC-18	Technology of Meat and Meat Products	Theory + Practical	3+1
		DSE- 4	Fish Processing Technology	Theory + Practical	3+1
		GE-6	Energy Management in Food Industries	Theory + Practical	3+1
		SEC-6	Advances in Food Processing- II	Theory	2
		Practical	Practical- VI	Practical	
Note- Visit to industry (Dairy / Biscuit/ Confectionary/ Beverage Industry) 30 days in-plant training.					
BACHELOR OF FOOD TECHNOLOGY (HONOURS WITH RESEARCH)					
FOURTH YEAR	**VII**	DSC-19	Research Methodology		4
		DSE-5 DSE-6 DSE-7	Food Industry Waste Management Post-Harvest Management of Fruits and Vegetables Dairy Plant Engineering	Theory + Practical Theory + Practical Theory + Practical	3+1 2+2 3+1
		Or			
		DSE-5 DSE-6 GE-7	Food Industry Waste Management Post-Harvest Management of Fruits and Vegetables Marketing of Food Products	Theory + Practical Theory + Practical Theory	3+1 2+2 4
		Or			
		DSE-5 GE-7 GE-8	Food Industry Waste Management Marketing of Food Products Principles of Economics	Theory + Practical Theory Theory	3+1 4 4
		Practical	Practical- VII	Practical	
		Dissertation	Dissertation/ Thesis Research Work		6

	VIII	DSC-20	Entrepreneurship and Business Management	Theory	4
		DSE-8 DSE-9 DSE-10	Food Processing Technology Fat and Oil Processing Technology Food Fermentation Technology	Theory + Practical Theory + Practical Theory + Practical	2+2 2+2 3+1
		Or			
		DSE-8 DSE-9 GE-9	Food Processing Technology Fat and Oil Processing Technology Industrial Microbiology	Theory + Practical Theory + Practical Theory + Practical	2+2 2+2 3+1
		Or			
		DSE-8 GE-9 GE-10	Food Processing Technology Industrial Microbiology Food Extrusion Technology	Theory + Practical Theory + Practical Theory + Practical	2+2 3+1 3+1
		Practical	Practical- VIII	Practical	
		Dissertation	Dissertation/ Thesis Research Work		6
Note- Visit to industry (Dairy / Biscuit/ Confectionary/ Beverage Industry) 30 days in-plant training.					
MASTER OF FOOD TECHNOLOGY					
FIFTH YEAR	**IX**	DSC-21	Nutraceuticals and Functional Foods	Theory + Practical	3+1
		DSE-11 DSE-12 DSE-13	Principles of Food Engineering Technology of sugar confectionery and chocolate processing Food Microbiology	Theory + Practical Theory + Practical Theory + Practical	3+1 2+2 2+2
		Or			
		DSE-11 DSE-12 GE-11	Principles of Food Engineering Technology of sugar confectionery and chocolate processing Food additives, Contaminants and Toxicology	Theory + Practical Theory + Practical Theory + Practical	3+1 3+1 2+2
		Or			

		DSE-11 GE-11 GE-12	Principles of Food Engineering Food additives, Contaminants and Toxicology Technology of Milk and Milk Products	Theory + Practical Theory + Practical Theory + Practical	3+1 2+2 2+2
		Practical	Practical- IX	Practical	
		Dissertation	Dissertation/ Thesis Research Work		6
	X	DSC-22	Principles of Food Analysis and Sensory Evaluation	Theory + Practical	2+2
		DSE-14	Food Quality Systems and Management	Theory + Practical	2+2
		DSE-15 DSE-16	Enzymes in Food Processing Techniques in Food Analysis	Theory + Practical Theory + Practical	2+2 2+2
		Or			
		DSE-14 DSE-15 GE-13	Food Quality Systems and Management Enzymes in Food Processing Technology of Malting and Brewing	Theory + Practical Theory + Practical Theory + Practical	2+2 2+2 3+1
		Or			
		DSE-14 GE-13 GE-14	Food Quality Systems and Management Technology of Malting and Brewing Snack Food Technology	Theory + Practical Theory + Practical Theory + Practical	2+2 3+1 3+1
		Practical	Practical- X	Practical	
		Dissertation	Dissertation/ Thesis Research Work or Training		6
Note- Visit to industry (Dairy / Biscuit/ Confectionary/ Beverage Industry) 30 days in-plant training.					
Minimum standards for setting up labs / with reference to equipment.					

Abbreviations: -

DSC-Discipline Specific Course; DSE- Discipline Specific Electives; GE-Generic Electives; AEC-Ability Enhancement Course; VAC-Value Addition Course.

Program specific outcomes (PSOs) After this programme the learners will be able to	
PSO1	Demonstrate comprehensive knowledge and understanding of the food technology curriculum.
PSO2	Apply the principles of food science to preserve, process and package to assure the quality and safety of food products.
PSO3	Understand that the real-world problems in the food industry requires continuous acquisition of knowledge and its application to improve the safety and quality of a given food or process.
PSO4	Analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.
PSO5	Acquire knowledge and skills, including "learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.
PSO6	Use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources.
PSO7	Acquire professional competency and entrepreneurial skills for economic empowerment.
PSO8	Demonstrate the ability to acquire, analyse, interpret and appropriately present laboratory data.

Department of Food Technology

YEAR I - SEMESTER I

DISCIPLINE SPECIFIC COURSE (DSC)- Introductory Microbiology

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSC-Introductory Microbiology	4	2	0	2	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Undergraduate Certificate in Food Technology	**Year: First**	**Semester: First**
Food Technology		
Course Code: BFT-101	**Course Title: Introductory Microbiology**	

Course outcomes:

The student at the completion of the course will be able to:

1. Identify the important pathogens and spoilage microorganisms in food and the conditions under which they will grow, can be inactivated, killed or made harmless in foods.
2. Utilize laboratory techniques to identify microorganisms in food.
3. Know the role and significance of microbial inactivation, adaptation and environmental factors (i.e., aw, pH, temperature) on growth and response of microorganisms invarious environments.

Credits: 4	**DSC-1**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Systematic study of major groups of micro-organism of importance in food industry; Principles and methods of food preservation; Food spoilage and its causes.	5
II	Factors affecting growth and survival of microorganisms in foods- Intrinsic factors: pH, water activity, nutrients etc. and Extrinsic factors: relative humidity, temperature and gaseous atmosphere. Food in relation to diseases.	5
III	Microbiology of different foods- cereals and cereal products, sugar and sugar products, fruits and vegetables, meat and meat products, fish, egg and poultry, canned foods, milk and milk products, microbiological grading of different food products.	15
IV	Isolation and identification of micro-organisms involved in food spoilage; Enumeration and diagnosis of food poisoning organisms; microbial intoxication and infection- sources of contamination of food, pathogenic microorganisms and symptoms.	15
V	Beneficial effects of microorganism- alcoholic drinks, dairy products, bread, vinegar, pickled foods, single cell protein.	5
	PRACTICALS	

I	Familiarity with equipment to be used in Microbiology Laboratory	30
II	Cleaning, washing and sterilization of glasswares	
III	Preparation and sterilization of different media types	
IV	Preparation of PDA and YPSS medium	
V	Inoculation of PDA and YPSS medium and harvesting	

Suggested Readings:

1. Frazier, W.C. 1988. Food Microbiology. Tata McGraw Hill.
2. Blakebrough N. Biochemical and Biological engineering Sciences.
3. Murry Moo-young. Biomass Conversion Technology.

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR I - SEMESTER I

DISCIPLINE SPECIFIC COURSE (DSC)- Introductory Biochemistry

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if
		Lecture	Tutorial	Practical		
DSC-Introductory Biochemistry	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Undergraduate Certificate in Food Technology	**Year: First**	**Semester: First**
Food Technology		
Course Code: BFT-102	**Course Title: Introductory Biochemistry**	
Course outcomes: **The student at the completion of the course will be able to:** 1. Understand the structural organization and functions of differentbiomolecules. 2. Apply basic principles of chemistry to biological systems and molecularbiology.		
Credits: 4	**DSC-2**	
Max. Marks: 100		

Unit	Topics	No. of Hours
I	Introduction: Biochemistry & it's scope; Enzymes: structure, classification, functions, significance	5
II	Carbohydrates: occurrence, classification & structures; physicochemical and metabolic functions; biological role of carbohydrates; metabolism of carbohydrates - glycolysis and respiration, production of ATP, oxidative and substrate phosphorylation	5
III	Proteins: occurrence, classification & structures; physicochemical & metabolic functions; metabolism of proteins - breakdown of proteins, transamination, deamination, decarboxylation, nitrogen fixation;	15
IV	Lipids: Occurrence, Classification & Structure; Physicochemical and metabolic functions; Biological role of lipids; classification and biosynthesis; Biological role of lipids; breakdown of triglycerides and phospholipids; β-oxidation of long chain fatty acids, ketosis, biosynthesis of fatty acids, triglycerides and phospholipids	10
V	Nucleic Acids: Classification, structure & biosynthesis of nucleic acid; Metabolism RNA and DNA metabolism. Vitamins; Sources and classification, Chemistry and Metabolic functions, deficiency syndromes, Minerals; Sources and classification, Chemistry and Metabolic functions, deficiency syndromes.	10

	PRACTICALS	
I	Study on constitution of living matter with carbohydrates , lipids, proteins nucleic acids, enzymes, minerals and vitamins, hormones, metabolism of biological constituents	30
II	Study on biology with special reference to molecules of living matter	
III	Identification of different chemical groups of amino acids	
IV	Study of various water soluble vitamins	
V	Study of various fat soluble vitamins	

Suggested Readings:

1. N. Shakuntala Manay, Foods Facts and Principles
2. Biochemistry by S Rastogi Publisher, Tata Mcgraw Hill

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR I - SEMESTER I

DISCIPLINE SPECIFIC COURSE (DSC)- Principles of Human Nutrition

No. of Hours- 60

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSC-Principles of Human Nutrition	4	4	0	0	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Undergraduate Certificate in Food Technology	**Year: First**	**Semester: First**
Food Technology		
Course Code: BFT-103	**Course Title: Principles of Human Nutrition**	

Course outcomes:

The student at the completion of the course will be able to:

1. Students will be acquainted with the basic terms used in study of food and nutrition; relationship between food, nutrition and health; various functions of food and assessment of nutritional status.
2. Students will gain knowledge about the functions, dietary sources and clinical manifestations of deficiency/ excess of various macronutrients and micronutrients (vitamins minerals).
3. Students will gain knowledge about food groups, concept of balanced diets, difference between healthy and Fad Diets, factors affecting meal planning and understanding specific considerations for planning meal for different groups ofpeople.
4. Students will be able to understand the various methods of cooking and their effect on foods and the ways of reducing nutrient losses during cooking.

Credits: 4	**DSC-3**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Food, functions of food, nutrients and non-nutrients in foods, food groups; composition and importance of following foods: cereals, legumes and oilseeds, fruits and vegetables, milk and milk products, eggs, meat, fish and poultry, sugar and fats; balanced diet; meal planning and menu planning	10
II	Physiology of nutrition, digestive system, phases of digestion and absorption, metabolism as continuous life sustaining cellular process, delivering of nutrients through circulatory and lymphatic system, excretion of waste products via several routes	10

III	Macronutrients: Water- its metabolism, distribution of body water, structural and regulatory functions; Proteins and amino acids: classification, sources, functions and requirements, nitrogen balance, deficiency of protein	20
IV	Carbohydrates: classification, sources, deficiency of carbohydrate, functions and requirements; Lipids and fatty acids: classification, sources, deficiency of lipid, functions and requirements	10
V	Energy: food energy value; three basic types of functions of energy: basal metabolism, physical activity and thermogenesis and factors influencing them; energy imbalance	10

Suggested Readings:

1. Christian, J. L. and Gregor, J. L. 1985. Nutrition for Living. The Benjamin. Cummings Publishing House, Inc. 600p.
2. Groff, J. L. and Gropper, S. S. 2000. Advanced Nutrition and Metabolism. Wadsworth Thompson Learning, Australia. 584p.
3. Smolin, L. A. and Grosvenor, M. B. 1999. Nutrition: Science & Applications. Saunders College Publishing, New York. 597p.
4. Stipanuk, Martha. 2006. Biochemical, Physiological and Molecular Aspects of Human Nutrition. 2nd edition. Elsevier. New York. 1232p

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR I - SEMESTER I

GENERIC ELECTIVE (GE)- Professional Communication and Technical Writing

No. of Hours- 60

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
GE- Professional Communication and Technical Writing	4	4	0	0	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Undergraduate Certificate in Food Technology	**Year: First**	**Semester: First**
Food Technology		
Course Code: BFT-104	**Course Title: Professional Communication and Technical Writing**	

Course outcomes:

The student at the completion of the course will be able to:

1. Develop effective communication skills.
2. Write clear and concise technical reports
3. Read for content and quality of literature in the field
4. Communicate clear and concise technical presentations anddata
5. Improve work based on constructive criticism

Credits: 4	**GE-1**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Reading Comprehension- Factual- formulating translating global comprehension	10
II	Word formation, Preposition, Idiomatic expressions, Conditional sentences and Modal verbs, Synthesis and Transformation	10
III	Writing related concepts-writing process, aspects and basic principles of good writing Communication through writing- reasons and needs, word function, formulas of language, sentence and paragraph sense	20
IV	Introduction and importance of styles of writing-technical writing.	10
V	Types of reports-recommendations, proposals, progress report, oral reports, business letters and professional.	10

Suggested Readings:

1. The Bachelors of Arts by R.K. Narayan.
2. Alverez, Joseph A., The Elements of technical Writing, New York: Harcourt.
3. O' Conner, J.D., Better English Pronunciation, New Delhi University BookStall.

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR I - SEMESTER II

DISCIPLINE SPECIFIC COURSE (DSC)- Analysis of Food Quality and Safety

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSC- Analysis of Food Quality and Safety	4	2	0	2	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Undergraduate Certificate in Food Technology	**Year: First**	**Semester: Second**
Food Technology		
Course Code: BFT-201	**Course Title: Analysis of Food Quality and Safety**	

Course outcomes:

The student at the completion of the course will be able to:

1. Have a thorough knowledge about the applications various analytical and instrumental techniques.
2. Understand various areas of Food Safety & Quality Assurance.
3. Comprehend food quality managements systems.
4. Grasp knowledge of the quality assessments of food products.
5. Conceive the concept of adulteration in food products.

Credits: 4	**DSC-4**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Objective, function and importance of quality control; grades and standards; description of different quality control system (Codex, TQM, USFDA, BIS, HACCP, ISO 9000 series)	15
II	Cleaning and sanitation; permitted food additives; food adulteration and food safety.	5
III	Chemical changes in foods during processing; physical and rheological properties of foods.	5
IV	Changes in flavor components and natural food pigments during processing and storage; sensory evaluation methods for foods	5
V	Enzyme inhibitors: lathyrogens; goitrogens; cyanogenic glycosides; phenolics; oxalates; phytates; alkaloids; carcinogens; polycyclic aromatic hydrocarbons; allergens	15
	PRACTICALS	
I	Estimation of proximate principles (moisture, crude fiber, total ash, crude protein and fat)	30

II	Estimation of iron and calcium	
III	Estimation of sugars in fruits, starch in cereals and dietary fiber content of foods	
IV	Detection of mineral oil and argemone oil in edible oils	
V	Detection of adulterant in milk: Water and starch	

Suggested Readings:

1. Yeshajahu Pomeranz and Clifton E. M.. 2002. Food Analysis: Theory and Practice
2. R.D King. 1984. Developments in Food Analysis Techniques -2
3. Fox, J. 1993. Quality through design: the key to successful product development. (London: Mc Graw Hill)

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR I - SEMESTER II

DISCIPLINE SPECIFIC COURSE (DSC)- Food Process Equipment

No. of Hours- 60

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSC- Food Process Equipment	4	4	0	0	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Undergraduate Certificate in Food Technology	**Year: First**	**Semester: Second**
Food Technology		
Course Code: BFT-202	**Course Title: Food Process Equipment**	

Course outcomes:

The student at the completion of the course will be able to:

1. To introduce basic equipment design and various process control mechanisms and related engineering aspects.
2. To understand the design of vessels, food storage tank, and heat exchangers.

Credits: 4	**DSC-5**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Design principles and parameters for food processing equipment- general design methodology; selection of materials- material characteristics, commonly used materials	10
II	Design of handling equipment- belt conveyer, bucket conveyer, screw conveyer, pneumatic conveyer; design of milling equipment	10
III	Dryers- drying mechanism, classification of dryers, factors affecting drying process; heat exchangers- classification; pressure vessels; storage system	20
IV	Optimization of design with respect of process efficiency- methods; design of fluid conveyance system; design of evaporator, vapor separator and condenser	10
V	Equipment layout and ventilation in food processing plants, computer assisted design; storage system.	10

Suggested Readings:

1. Phirke, P. S.2004. Processing and Conveying Equipment Design. Jain Brothers, New Delhi.
2. Joshi, M.V. Process Equipment Design, 2nd Edition, Mac Millan India Limited, Delhi, 1981
3. Perry, R.H. and Chitton, C.H. Chemical Engineering' Handbook, Mcgraw Hill Kogakusha Ltd. Tokyo, 5th Edition, 1973

4. Spivakovsky, A. and Dyachkov, V., conveyors and related equipment, translated by Don Danemanis, Peace Publishers, Moscow.
5. Backhurst, J.R. and Harker, J.H., Process Plant Design, Heinmann Educational Books, London, 1973

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR I - SEMESTER II

DISCIPLINE SPECIFIC COURSE (DSC)- Food Laws and Legislation

No. of Hours- 60

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSC- Food Laws and Legislation	4	4	0	0	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Undergraduate Certificate in Food Technology	**Year: First**	**Semester: Second**
Food Technology		
Course Code: BFT-203	**Course Title: Food Laws and Legislation**	

Course outcomes:

The student at the completion of the course will be able to:

1. Understand the need and importance of food laws.
2. To provide a high level of health protection for consumers.
3. To ensure that only safe food and feed are placed on the market.
4. To protect consumers from foods that could be injurious to their health (laws on food safety) and from misleading information (laws on food labeling, advertising, and fair commercial practices.

Credits: 4	**DSC-6**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Concept and significance of Food Legislation, Introduction to Indian Food Laws and Legislation, Need for enforcing the laws	5
II	Prevention of Food Adulteration (PFA)- Introduction and objectives of the Act, Important definitions, Salient features of the Act; Bureau of Indian Standards (BIS)- Introduction and important definitions, Objectives and functions of the standard, Salient features of the standards, Activities of the standard	15
III	Agmark- Introduction and definitions, Salient features of the Act, List of commodities under AGMARK; Agricultural and Processed Food Products Export Development Authority (APEDA)- Introduction and definitions, Salient features, Objectives and significance	10
IV	FSSAI- Introduction and Objectives of FSSA, 2006, Features of FSSA, 2006, Composition of FSSAI, Functions of FSSAI, Introduction and definitions, Objectives, Salient features; International Standardization and Organization (ISO)- Introduction and definitions, Objectives, Salient features	15

V	Codex Alimenterius Commission(CAC)- Introduction and purpose of CODEX, Definitions, Scope of CODEX Standards, Structure of CAC, CODEX general principles of food hygiene: HACCP; Food Laws and legislation in EU, Middle East, SAARC and ASEAN.	15

Suggested Readings:

1. Dr. R.H. Jaju, A textbook of food laws and regulations, 2nd edition
2. Debasis Bagchi, Nutraceutical and functional food regulations in the united states and around the world

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR I - SEMESTER II

GENERIC ELECTIVE (GE)- Basic Computer Applications in Food Industry

No. of Hours- 30+60

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSC- Basic Computer Applications in Food Industry	4	2	0	2	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Undergraduate Certificate in Food Technology	**Year: First**	**Semester: Second**
Food Technology		
Course Code: BFT-204	**Course Title: Basic Computer Applications in Food Industry**	

Course outcomes:

The student at the completion of the course will be able to:

1. Students will learn the basic knowledge of computer applications and their implementation in various fields of Food Industries.
2. The use of computer system enables automated, objective, rapid and hygienic inspection of a wide range of raw and processed foods.
3. Machine vision has high recognition accuracy, however, under low light, high humidity, and high noise conditions, there are corresponding detectionerrors

Credits: 4	**GE-2**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Basics of Computers: Definition of a Computer, Characteristics of computers Components of a computer system- Block diagrams, Central Processing Units, Input/ Output Devices, Keyboard Shortcuts, Computer Memory (primary, auxiliary and cache memory) MS Windows – Desktop, Recycle bin, My Computer, Documents, Pictures, Music, Videos, Task Bar, Control Panel.	8
II	Operating Computer using GUI Based Operating System: What is an Operating System, The User Interface, Using Mouse, Using right Button of the Mouse and Moving Icons on the screen, Use of Common Icons, Status Bar, Using Menu and Menu-selection, Viewing/ Finding locations of File, and Folders, Creating and Renaming of files and folders, Opening and closing of different Windows, Using help, Creating Short cuts.	5

III	MS-Word: Features of MS-Word - MS-Word Window Components- Creating, Editing, Formatting and Printing of Documents, Headers and Footers, Insert/Draw Tables, Page Borders and Shading, Inserting Symbols, Shapes, Word Art, Page Numbers, Mail Merge.	5
IV	MS-Excel: Overview of Excel features – Creating a new worksheet, Selecting cells, Entering and editing Text, Numbers, Inserting Rows/Columns, Changing column widths and row heights, Formulae, Referencing cells, Changing font sizes and colors, Insertion of Charts, Auto fill, Sort.	5
V	MS-PowerPoint: Features of PowerPoint – Creating a Presentation, Inserting and Deleting Slides in a Presentation, Adding Clip Art/Pictures, Inserting Other Objects (Audio, Video), Resizing and scaling of an Object, Slide Transition, Custom Animation.	7
	PRACTICALS	
I	Working with computers operating the computer system, windows basics windows explorer navigation creating using and finding folders my documents, Recycle bin and virus scanning	60
II	Preparing the digital document using MS word Opening/creating file, saving file, document preparation, editing, formatting, page layout, spell and grammar check. Inserting object	
III	Creating presentation using Power Point slide layout, design, template and background. Inserting movies and sound. Inserting picture. Slide show: transition and animation	
IV	Creating work book and work sheet using MS Excel cell formatting. Data entry in work sheet. Chart wizard: title, axes, gridlines, legends, date label. Data Analyzing	
V	Creating web pages using Front Page formatting, inserting, linking pages	

Suggested Readings:

1. Introduction to computer science by ITL education solutions Ltd.
2. Programming with C written by K. R. Venugopal and Sudeep R. Prasad.
3. Computer Fundamentals by P. K. Singh. Introduction to Computers by Peter Norton.

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR II - SEMESTER III

DISCIPLINE SPECIFIC COURSE (DSC)- Food Chemistry

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSC- Food Chemistry	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Undergraduate Diploma in Food Technology	**Year: Second**	**Semester: Third**
Food Technology		
Course Code: BFT-301	**Course Title: Food Chemistry**	

Course outcomes:

The student at the completion of the course will be able to:

1. Know the chemistry underlying the properties and reactions of various food components
2. Have sufficient knowledge of food chemistry to control reactions in foods and know the major chemical reactions that limit shelf life of foods.
3. Use the laboratory techniques common to basic and applied food chemistry.
4. Know the principles behind analytical techniques associated with food.
5. Demonstrate practical proficiency in a food analysislaboratory

Credits: 4	**DSC-7**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Physico-chemical properties of foods- solution, osmotic pressure, acids, bases, pH, buffers, boiling point, freezing point, colloids, viscosity, surface tension, emulsions; water- moisture content of food, types of water, water activity, relative humidity	5
II	Enzymes- definition, classification, enzyme inhibition, factors affecting enzyme activity, enzyme immobilization, application of enzymes in food industry; browning- enzymatic and non-enzymatic browning	5
III	Carbohydrates - structure, functions of starches, dextrin, cellulose, fibers, hemicellulose, pectins, gums, function of sugar in food browning, dietary fibre; Lipids- classification, physical characteristics, structure and functions, effect on cooking properties of lipids in foods, rancidity	10
IV	Proteins- classification, physical characteristics, structures, functions, types of food proteins, effects on cooking properties of various animal & plant proteins, denaturation properties, proteins gels	10

V	Pigments and color- role and effects of cooking on chlorophyll's, myoglobin, hemoglobin, anthocyanins, flavonoids, tannins, carotenoids, quinones, xanthones, pectins; use of synthetic colours in food.	10
VI	Flavour- sensation of taste, smell, visual appearance, flavour texture of food; flavour compounds- terpeniods, flavonoids, sulphur compounds & others volatile flavour compounds and their role in sensoryevaluations	5
	PRACTICALS	
I	Proximate analysis of foods, physico-chemical properties of foods	30
II	Measurement of T.S.S., conductivity, pH, acidity etc	
III	Determination of Fats and Lipids	
IV	Determination of starch and carbohydrates	
V	Determination of protein content in food materials	

Suggested Readings:

1. Lillian Hoagland Meyer, Food Chemistry
2. Chemical, Biological, and Functional Aspects of Food Lipids, Second Edition By Anna Kolakowska, Zdzislaw Z. E. Sikorski, Anna Kolakowsk

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR II - SEMESTER III

DISCIPLINE SPECIFIC COURSE (DSC)- Technology of Dairy Products

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSC-Technology of Dairy Products	4	2	0	2	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Undergraduate Diploma in Food Technology	**Year: Second**	**Semester: Third**
Food Technology		
Course Code: BFT-302	**Course Title: Technology of Dairy Products**	

Course outcomes:

The student at the completion of the course will be able to:

1. Understand and describe the physic-chemical and functional properties of milk constituents (proteins, lipids, carbohydrates, minerals.
2. Understand and describe the microbiological composition of raw milk and their implications on food safety aspects of milk and dairy products.
3. Understand and describe the physical and technological principles of unit operations in milk processing: separation, standardization, homogenization, pasteurization, UHT, concentration, spray drying.
4. Understand and describe the technological sequences associated with manufacturing consumer milk, fermented milk products and cheese.
5. Understand and describe the application of microbial populations (starters) in milk processing

Credits: 4	**DSC-8**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Fluid Milk: composition of milk and factors affecting it; physico-chemical characteristics of milk and milk constituents; production and collection, cooling and transportation of milk; packaging, storage and distribution of pasteurized milk- whole, standardized, toned, double toned and skim milk	15
II	Test for milk quality and adulteration; UHT processed milk, flavored, sterilized milk; cleaning and sanitation of dairy equipment	7

III	Cream: definition, classification and physico-chemical properties of cream Butter: definition, classification, composition and methods of manufacture	7
IV	Ice cream: definition, classification, composition, constituents and their role; preparation of mixes and freezing of ice cream, over run, judging, grading and defects of ice cream	7
V	Evaporated and condensed milk: method of manufacture, packaging and storage; roller and spray drying of milk solids; instantization, flowability, dustiness, reconstituability, dispersability, wettability, sinkability; manufacture of casein, whey protein, and lactose from milk or use in formulated foods	9
	PRACTICALS	
I	Study of various plat form test of milk	30
II	Study of composition of milk and various factors affecting it	
III	Study on physico-chemical characteristics of milk, milk constituents, cream etc	
IV	Centrifugal separation of milk	
V	Spray drying of milk	

Suggested Readings:

1. 1. M.R. Adams and M.O. Moss. 2007. Food Microbiology.
2. James M Jay. 2000. Modern Food Microbiology.
3. W.C. Frazier. 1968. Food Microbiology

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR II - SEMESTER III

DISCIPLINE SPECIFIC COURSE (DSC)- Technology of Cereals, Pulses and Oilseeds

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSC-Technology of Cereals, Pulses and Oilseeds	4	2	0	2	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Undergraduate Diploma in Food Technology	**Year: Second**	**Semester: Third**
Food Technology		
Course Code: BFT-303	**Course Title: Technology of Cereals, Pulses and Oilseeds**	

Course outcomes:

The student at the completion of the course will be able to:

1. Comprehend the recent advancement in the major cereal grains, pulses and oilseeds quality and processing aspects.
2. Understand the mechanism underlying the interaction of various flour components and their role in end use quality
3. Grasp the basic and advanced milling methods for wheat, rice, maize, etc.
4. Know about by-product utilization of various grains.

Credits: 4	**DSC-9**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Structure and processing characteristic of cereal grains, legumes and oilseeds; post harvest- post processing practices for their safe storage; parboiling and milling of paddy; quality characteristics; curing and aging of rice; processed rice products	10
II	Wheatand its quality characteristics of milling into flour and semolina, flour milling, turbo grinding and air classification, flour grades and their suitability for baking purpose, assessment of flour quality and characteristics, milling of durum wheat, macaroni products	10
III	Ingredients, technology and quality parameters for baked products; bread, biscuits and cakes; breakfast cereals	5
IV	Dry and wet milling of corn, starches and its conversion products, malting of barley, pearling of millets, milling of legume-pulses by traditional and improved processes	10

V	Processing of oil seeds for direct use and consumption, oil and protein products, processing of extracted oil refining, hydrogenation, interestrification, processing of de-oiled cake into protein concentrates and isolates; textured protein, functional protein preparations, peanut butter, margarine andspread.	10
	PRACTICALS	
I	Experimental milling, physico-chemical tests for flour quality of wheat	30
II	Rheological properties of dough, test baking, physico-chemical tests of rice and evaluation of cooking quality	
III	Milling and parboiling of paddy	
IV	Determination of shelling/hulling index	
V	Preparation of protein concentrates and isolates	

Suggested Readings:

1. Chakraverty, A., Mujumdar, A. S., Raghvan, G. S. V. and Ramaswamy, H. S. 2003. Handbook of Post Harvest Technology: cereals, fruits, vegetables, tea and spices. Marcen Dekker Inc., New York

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR II - SEMESTER III

DISCIPLINE SPECIFIC ELECTIVE (DSE)- Fundamentals of Food Technology

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSE-Fundamentals of Food Technology	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Undergraduate Diploma in Food Technology	**Year: Second**	**Semester: Third**
Food Technology		
Course Code: BFT-304	**Course Title: Fundamentals of Food Technology**	

Course outcomes:

The student at the completion of the course will be able to:

1. An overview of the history of food processing technology and how food technology evolved with time since the ancient period till present scenario both in India and worldwide.
2. Knowledge of the structure, composition, nutritional quality and physicochemical changes that can take process during processing of food cereals and millets, pulses, fruits and vegetables and fats and oils, refining of oils
3. Knowledge of the structure and composition of animal foods, post mortem changes, nutritive value and processing methods used.

Credits: 4	**DSE-1**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Introduction to food technology and food processing; importance of food technology and food processing; objective of food processing; scope of food processing in India	5
II	Food preservation- principles and methods; preservation by high temperature-food drying and dehydration, pasteurization, sterilization, blanching, canning; preservation by low temperature- freezing and methods of freezing; preservation by chemicals; preservation by irradiation-types and doses	7
III	Food packaging- functions, characteristics, types of packaging, packaging materials- types and properties; fruits and vegetable processing- present scenario, canning,	15

	manufacturing of various products; processing of meat and meat products- composition, aging of meat, preservation methods, post mortem changes	
IV	Processing of milk and milk products- milk standards, physic-chemical properties of milk, methods	8
V	Processing of marine products- composition, classification, canning, preservation methods, cooking of fish; important food industries in India; role of food technology in national economy.	10
	PRACTICALS	
I	Determination of the composition of milk (specific gravity, acidity, pH)	30
II	Determination of the properties of milk (Fat content, total solids)	
III	HTST pasteurization of milk	
IV	Study of different packaging materials	
V	Determination of drying characteristics of fruits, vegetables, meat and marine products	

Suggested Readings:

1. Fellows, P. Food Processing Technology Principles and Practices. CRC Press, Boca Raton Boston New York Washington, DC.

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR II - SEMESTER III

GENERIC ELECTIVE (GE)- Environmental Studies

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
GE-Environmental Studies	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Undergraduate Diploma in Food Technology	**Year: Second**	**Semester: Third**
Food Technology		
Course Code: BFT-305	**Course Title: Environmental Studies**	

Course outcomes:

The student at the completion of the course will be able to:

1. Understand the facts about environment, natural resources and their interrelationship with living organisms.
2. Gain knowledge about the impact of global warming and pollution onthe ecosystem.
3. Handle the issues such as food processes and packaging, post-harvest loss along the supply chain, and food distribution mechanisms all having an important bearing on nutrition and health outcomes.

Credits: 4	**GE-3**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Definition, scope and importance; ecosystem- concept of an ecosystem, structure and function of an ecosystem, producer, consumer and decomposes, energy flow in the ecosystem, ecological succession, food chains, food webs and ecological pyramids; introduction, types, characteristic features, structures and function of the following ecosystems: forest ecosystem, grassland ecosystem, desert ecosystem and aquatic ecosystem;	10
II	Social issues and the environment- from unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, watershed management, resettlement and rehabilitation of people; its problem and concerns, case studies.	5
III	Environmental ethics, climatic change, wasteland reclamation, consumerism and waste products; Environmental Protection Act; Air (Prevention and control of pollution) Act; issues involved in enforcement of environmental legislation; public awareness; natural resources: forest resources, water resources, mineral resources,	10

	food resources, energy resources, land resources; role of an individual in conservation of natural resources; equitable use of resources for sustainable life style.	
IV	Biodiversity and its conservation- introduction, definition, genetic, species and ecosystem diversity; bio geographical classification of India; value of diversity, consumptive use, productive use, social, ethical aesthete and option values; biodiversity at global, national and local levels; India as mega-diversity nation; hot-spot of biodiversity; threat to biodiversity- habitat loss, poaching of wild life, man-wild life conflicts; endangered and endemic species of India; conservation of biodiversity; in-situ conservation of biodiversity	10
V	Environmental pollution- definition, causes, effect and control measures of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards; solid waste management- causes, effect and control measures of urban and industrial wastes; role of an individual in prevention of pollution; pollution case studies; disaster management- flood, earthquake, cyclone and landslides	10
	PRACTICALS	
I	Determination of Acidity and pH in water sample	30
II	Determination of Alkalinity and hardness in water sample	
III	Identification of different tools for measurement of Environmental pollution	
IV	Determination of chloride in water sample	
V	Visit of different polluted sites to assess their effect on pollution, monitoring of pollutant in ecosystem	

Suggested Readings:

1. Weiner, R.F. and Matthews, R., Environmental Engineering 4th edition, Butterworth Heinemann, New York
2. Gupta, K.M., Environmental Studies, Umesh Publication, Delhi

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR II - SEMESTER IV

DISCIPLINE SPECIFIC COURSE (DSC)- Principles of Food Preservation

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if
		Lecture	Tutorial	Practical		
DSC- Principles of Food Preservation	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Undergraduate Diploma in Food Technology	**Year: Second**	**Semester: Fourth**
Food Technology		
Course Code: BFT-401	**Course Title: Principles of Food Preservation**	

Course outcomes:

The student at the completion of the course will be able to:

1. Understand the microbial dynamics in food matrix and their application in food preservation
2. Understand basic science behind refrigeration, freezing and freeze drying.
3. Understand basic principles of heat preservation.
4. Understand basic principles of drying and dehydration.
5. Understand the concept of cold sterilization and methods of irradiation techniques.

Credits: 4	**DSC-10**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Food processing and preservation principles, method of preservation: pasteurization (definition, time-temperature combination and equipment) sterilization (definition, time-temperature combination and equipment), blanching (definition, time-temperature combination and equipment, adequacy in blanching), canning (definition, manufacturing process, defects of cans)	11
II	Freezing and Refrigeration: Introduction to refrigeration, cool storage; Freezing: introduction, principle of freezing, freezing methods- air freezing, plate freezing, liquid immersion freezing and cryogenic freezing	7
III	Changes during freezing, advantages and disadvantages of freezing and changes in food during freezing storage; introduction to thawing, changes during thawing and its effect on food	7
IV	Food drying/ dehydration: definition, free and bound moisture, concept of water activity, factors affecting drying, moisture content (wet basis and dry basis), drying	15

	methods and equipment: sun/solar drying, cabinet dryer, tunnel dryer, spray dryer, freeze dryer, fluidized bed dryer; changes in food during drying	
V	Food irradiation- definition, units of radiation, mechanism of actions, uses of radiation processing in food industry, kinds of ionizing radiation used in food irradiation; food fermentation	5
	PRACTICALS	
I	Estimation of water activity.	30
II	Study of processing and preservation equipment	
III	Freezing and dehydration of fruits, vegetables and meat	
IV	Preservation of syrups, squashes, juices, jams, jellies and pickles	
V	Study of canning process as a method of food preservation.	

Suggested Readings:

1. Fellows, P. Food Processing Technology Principles and Practices. CRC Press, Boca Raton Boston New York Washington, DC.
2. Jongen, W. M. F. 2002. Fruit and Vegetable Processing: Improving quality, Woodhead Publishing Ltd, England
3. Somogayi, L. P., Ramaswamy, H. S. and Hui, Y. H. 1996. Processing Fruits: Science and Technology, Vol 1. Biology, Principles and Applications. CRC Press, Florida
4. Smith, D. S., Cash, J. N., Nip, Y. K. and Hui, Y. H. 1997. Processing vegetables: Science and Technology. Technomic Publishing Company Inc, USA.
5. Dauthy, M. E. 1995. Fruit and Vegetable Processing. Food and Agriculture Organization of the United Nations, Rome

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR II - SEMESTER IV

DISCIPLINE SPECIFIC COURSE (DSC)- Processing of Spice and Plantation Crops

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSC- Processing of Spice and Plantation Crops	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Undergraduate Diploma in Food Technology	**Year: Second**	**Semester: Fourth**
Food Technology		
Course Code: BFT-402	**Course Title: Processing of Spice and Plantation Crops**	

Course outcomes:

The student at the completion of the course will be able to:

1. Understand scope, processing and production of spices and plantation crops
2. Know about processing methods for value addition of spices and condiments
3. Discuss standards, adulteration and packaging of spices and condiments

Credits: 4	**DSC-11**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Production and processing scenario of spice, flavour & plantation crops and its scope	5
II	Major Spices: Post Harvest Technology, composition, processed products of following spices- ginger, chilli, turmeric, onion, garlic, pepper, cardamom, areca nut, cashew nut, coconut	10
III	Minor Spices, herbs and leafy vegetables: tea, rubber and palm oil, processing and utilization of all spice, annie seed, sweet basil, caraway seed, cassia, cinnamon, clove, coriander, cumin, dill seed, fennel seed, nutmeg, mint, marjoram, rose merry, saffron, sage, savory, thyme, ajwain, asafoetida, curryleaves	15
IV	Tea- types, processing, quality control; coffee & cocoa: processing; vanilla and annatto processing	10
V	Flavour of major spices- spice oil and oleoresins; flavours of soft drinks; baking and confectionery; standards specification of spices; functional packaging of spices and spice products	5
	PRACTICALS	
I	Identification and characterization of flavouring compounds of spices.	30

II	Extraction of oil from clove, pepper, cardamom-chili	
III	Extraction of oleoresins-Turmeric, ginger, pepper, clove	
IV	Steam distillation of spices	
V	Determination of curumin content in turmeric	

Suggested Readings:

1. A. Chakravarty, A.S. Majumdar, G.S.V. Raghavan & H.S. Ramaswamy Hand Book of Post Harvest Technology, Cereals, Fruits, Vegetables, Tea & Spices
2. J.S. Pruthi Minor Spices and condiments crop management and Post HarvestTechnology

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR II - SEMESTER IV

DISCIPLINE SPECIFIC COURSE (DSC)- Principles of Food and Dairy Microbiology

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSC- Principles of Food and Dairy Microbiology	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Undergraduate Diploma in Food Technology	**Year: Second**	**Semester: Fourth**
Food Technology		
Course Code: BFT-403	**Course Title: Principles of Food and Dairy Microbiology**	

Course outcomes:

The student at the completion of the course will be able to:

1. Student will learn about application of microbes in dairy industry.
2. Study of microbes associated with raw milk and hygienic milk production system.
3. Importance of different microorganisms in the development of various milk products.

Credits: 4	**DSC-12**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Introductory concepts; role of intrinsic and extrinsic parameter that affect microbial growth of foods	11
II	Classification of new organism; control of microbial population; food Spoilage- causes, preventive measures	11
III	Microbiology of food fermentation or respiration; mechanism of energy production- oxidation and substrate level phosphorylation	12
IV	Fermenters- type, functions design and control, fermentation - mechanism, conditions and factors affecting fermentation	11
	PRACTICALS	
I	Introduction to lab equipment, instruments	30
II	Isolation and identification of some important food borne microorganisms	
III	Microbiological grading of milk and milk products on the basis of SPC, DMC, MBR, Coliform test and Rapid platform tests	
IV	Characterization and activity measurement of enzymes	
V	Preparation and inoculation of PDA	

Suggested Readings:

1. M.R. Adams and M.O. Moss. 2007**.** Food Microbiology.
2. James M Jay. 2000**.** Modern Food Microbiology.
3. W.C. Frazier. 1968. Food Microbiology.

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR II - SEMESTER IV

DISCIPLINE SPECIFIC ELECTIVE (DSE)- Food Additives and Ingredients

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSE- Food Additives and Ingredients	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Undergraduate Diploma in Food Technology	**Year: Second**	**Semester: Fourth**
Food Technology		
Course Code: BFT-404	**Course Title: Food Additives and Ingredients**	
Course outcomes: **The student at the completion of the course will be able to:** 1. Understand the role of food additives in manufacturing of food products. 2. Have the knowledge regarding permissible additives and their limits in the processed food.		
Credits: 4	**DSE-2**	
Max. Marks: 100		

Unit	Topics	No. of Hours
I	Scope, permitted food additives, general principles for the use of food additives; GRAS and international regulatory status (FAO, WHO, WTO) of food additives, functions, types, modes of action, consequences of use, risks and benefits of food additives	12
II	Nutritional additives, preservatives, antimicrobial agents, antioxidants, emulsifiers, enzymes, flavoring agents and flavor enhancers; uses and functions of acid, base, buffer systems	11
III	Chelating/sequestering agents; low calorie and non nutritive sweeteners, anti-caking agents, humectants, thickeners, firming agents; flour bleaching agents and bread improvers	11
IV	Anti microbial agents; food colour, pigments, their importance and utilization; flavoring agents and related substances; clarifying agents, methods used for safety evaluation, food additives and hypersensitivity	11
	PRACTICALS	
I	Study of properties and characteristics of different food additives	30
II	Study of various chemical and organic preservatives	

III	Study of antimicrobial agents, antioxidants, in processed food	
IV	Study of emulsifiers agent in processed food	
V	Determination Food colours and food additives	

Suggested Readings:

1. Alfred Larry Branen, 1. CRC Press, Cleveland.
2. Rao, D.G. 2005 Introduction to Biochemical Engineering, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
3. Bailey, J.E. and Ollis, D.V. 1994 Biochemical Engineering Fundamentals, McGraw-Hill book Company, New Delhi

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR II - SEMESTER IV

GENERIC ELECTIVE (GE)- Elements of Statistics

No. of Hours- 60

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
GE-Elements of Statistics	4	4	0	0	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Undergraduate Diploma in Food Technology	**Year: Second**	**Semester: Fourth**
Food Technology		
Course Code: BFT-405	**Course Title: Elements of Statistics**	

Course outcomes:

The student at the completion of the course will be able to:

1. Basic statistical concepts such as population size, sample size, sample space, variance, distribution, standard deviation, T-tests, hypothesis and so on are much needed in food technology to provide safe and quality food for consumers and people

Credits: 4	**GE-4**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Introduction to statistics: definition, functions, uses and limitations. Classification and tabulation of data; qualitative and quantitative classification, discrete and continuous variables, frequency tables, grouped and ungrouped data. Diagrammatic representation of data; one, two and three dimensional diagrams with application	10
II	Graphical representation of data; Histogram, frequency polygon, frequency curve, ogives; Measures of central tendency, introduction to basic concepts of logarithms, AM, GM, HM, median, mode with merits, demerits and uses, relationship between Am, GM and HM, quartile deviation from AM, median and mode, variance, standard deviation, coefficient variation	10
III	Measures of dispersion; range coefficients, inter quartile range, quartile deviation, coefficient of quartile deviation, mean deviation from AM, median and mode, variance, standard deviation, coefficient variation; Moments; raw	10

	moments, central moments for grouped and ungrouped data, relationship raw moments and central moments	
IV	Measures of skewness and kutosis. Definition of symmetrical distribution, skewness and kurtosis, relationship between mean, median and mode and between quartiles for symmetrical and skewed distributions; Probability theory. Introduction to simple problems of permutations and combinations, definition of random experiment sample space, events, mutually exclusive and equally likely events. Definition of probability, simple problems based on probability, addition and multiplication theorem of probability, conditional events and independent events	10
V	Correlation and linear regression analysis; definition of correlation its types, scatter diagrams. Karl Pearson's formula of correlation coefficients, properties of correlation coefficient, definition of regression, regression equations of Y on X and X on Y, relationship between correlation coefficient and regression coefficients. Problems based on correlation and regression; Discrete and continuous probability distributions; definition of random variable, discrete and continuous random variables probability distribution of random variable, concepts of discrete and continuous probability distribution, basic concept of binomial theorem, binomial distribution, normal distribution and applications	10
VI	Analysis of variance; definition of analysis of variance, Introduction to sampling methods; definition of population, random sample, sampling verses complete enumeration, use of random number table for selecting a simple random sample, simple random sampling with and withoutreplacements	10

Suggested Readings:

1. Elements of Statistics *A hand on primer* by Raghubar D. Sharma
2. Elements of Statistics by Dr. B.N. Asthana

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR III - SEMESTER V

DISCIPLINE SPECIFIC COURSE (DSC)- Food Packaging Technology

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSC- Food Packaging Technology	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Bachelor of Food Technology (Honours)	**Year: Third**	**Semester: Fifth**
Food Technology		
Course Code: BFT-501	**Course Title: Food Packaging Technology**	

Course outcomes:

The student at the completion of the course will be able to:

1. Comprehend the overview of the scientific and technical aspects of food packaging
2. Students can understand different aspects of food packaging materials
3. Students can understand packaging requirement and packaging designing of food
4. Students can be familiarized with basic principles of testing of packaging material and product from industrial point of view
5. Students will get detail information about FSSAI packaging laws and regulations
6. Students will acquire basic knowledge about packaging machinery and systems and their application in food

Credits: 4	**DSC-13**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Introduction and principles of food packaging, functions of food packaging, package requirements, properties of different packaging materials, types of packaging and packaging material	10
II	Package materials- classification of packages, paper as package material, its manufacture, types, advantages of corrugated and paperboard, etc.; traditional packaging	10
III	Glass as packaging material- manufacture, advantages and disadvantages; metal as packaging material- manufacture, advantages and disadvantages; plastic as packaging material- classification, properties and uses	10
IV	Chemical and physical properties of packaging materials; interaction between package and food; selection and evaluation of packaging materials and systems; quality testing of packaging materials	10

V	Aseptic packaging; active packaging; symbols used in package and labels; CIP systems and procedure; labeling requirements	5
	PRACTICALS	
I	Estimation of shelf life of fresh and preserved food using various packages such a metal container, glass container and flexible packages	30
II	Determination permeability of different plastic films	
III	Determination of Thickness, substance weight of packaging materials	
IV	Determination of Water vapour and gas transmission rate of flexible packaging materials	
V	Determination of water absorption capability of flexible packaging materials	

Suggested Readings:

1. Robertson G. L. 2005. Food Packaging: Principles and Practice. Marcel Dekker, New York, Basel, and Hong Kong. 2nd edition.
2. Food Packaging by Standey Sacharow and Roger c. Griffin
3. Blakistone B. A. 1999. Principle and Application of Modified Atmospheric packaging of Foods, ASPEN publication, Chapman & Hall, New York

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR III - SEMESTER V

DISCIPLINE SPECIFIC COURSE (DSC)- Food Storage Engineering

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSC- Food Storage Engineering	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Bachelor of Food Technology (Honours)	**Year: Third**	**Semester: Fifth**
Food Technology		
Course Code: BFT-502	**Course Title: Food Storage Engineering**	

Course outcomes:

The student at the completion of the course will be able to:

1. Able to earn knowledge in storage management system, thermal activity for proper preservation in the store.
2. Able to learn proper ventilation into the store room for temperature adjustment in respect to product shelf life.
3. Product load and heat load calculation, adjustment of heat passing zone.
4. Able to understand the modern tools for food extraction, dehydration and preservation.

Credits: 4	**DSC-14**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Introduction- post-harvest physiology of semi- perishables and perishables, climacteric and non-climacteric fruits, respiration, ripening, changes during ripening, ethylene bio-synthesis; Damages- direct damages, indirect damages, causes of spoilage in storage (moisture, temperature, humidity, respiration loss, heat of respiration, sprouting), destructive agents (rodents, birds, insects, etc.), sources of infestation and control	15
II	Storage structures- Traditional storage structures, improved storage structures, modern storage structures, godown layout, staking pattern and rodent proof godown design; Farm silos: Horizontal silos, tower silos, pit silos, trench silos, size and capacity of silos	10
III	Storage of grains- Respiration of grains, moisture and temperature changes in stored grains; conditioning of environment inside storage throughventilation Aeration and stored grain management- Purposes of aeration, aeration system design, aeration system operation	10

IV	Storage pests and control- Damage due to storage insects and pests, its control, seed coating, fumigations, etc.; Damage caused by rodents and its control	5
V	Storage of perishables- Cold storage, controlled and modified atmospheric storage, evaporative cooling storage, conditions for storage of perishable products, control of temperature and relative humidity inside storage	5
	PRACTICALS	
I	Study of working principle of spray dryer and spray drying process	30
II	Study of drum dryer and liquid food dehydration using drum drying	
III	Layout design, sizing, capacity and drawing of traditional storage structures	
IV	Design of CA storage for particular capacity and commodity	
V	Storage study in the MAP	

Suggested Readings:

1. P.H. Pandey. 2014. Principles and Practices of Agricultural Structures and Environmental Control. Kalyani Publishers, Ludhiana.
2. Myer Kutz. 2007. Handbook of Farm, Dairy, and Food Machinery. William Andrew, Inc., Norwich, NY, USA.
3. A.M. Michael and T.P. Ojha. 2004. Principal of Agricultural Engineering, Vol. I. Jain Brothers, New Delhi.
4. L.W. Newbaver and H.B. Walker. 2003. Farm Buildings Design. Prentice-Hall Inc., New Jersey,USA.

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR III - SEMESTER V

DISCIPLINE SPECIFIC COURSE (DSC)- Fruits and Vegetable Processing

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSC- Fruits and Vegetable Processing	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Bachelor of Food Technology (Honours)	**Year: Third**	**Semester: Fifth**
Food Technology		
Course Code: BFT-503	**Course Title: Fruits and Vegetable Processing**	

Course outcomes:

The student at the completion of the course will be able to:

1. Students will have a broad perspective of maturity indices and preservation of fruits and vegetables.
2. Students will have gathered detailed information on canning and bottling of fruits and vegetables
3. Students will gain knowledge on the processing and preservation of fruit beverages.
4. Students will have acquired in-depth knowledge of the essential constituents and processing of Jams, jellies and marmalade.

Credits: 4	**DSC-15**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Unit operations- receiving, washing, grading, peeling, size reduction, blanching, sulphiting/sulphuring, syruping/brining, exhausting, processing and packaging	10
II	Processing technology of the manufacture of new products from fruits and vegetables; beverages, preserve, sauces, pickles, soups, jam and jelly; preservation technologies	12
III	Packaging requirements; spoilage of processed fruits, vegetables and their control; nutritional evaluation of processed foods;	10
IV	Plant layout and hygiene; fruit and vegetable plant layout, design, personal hygiene, plant sanitation and waste disposal; quality control in fruits and vegetables processing industry	13
	PRACTICALS	

I	Equipment for fruits and vegetable processing	30
II	Plant-layout of food processing industry	
III	Can seaming operation.	
IV	Canning of fruits and vegetable.	
V	Preparation of jams, jellies, marmalade, preserved, and candies.	

Suggested Readings:

1. Satish Kumar Sharma, Post Harvest Management and Processing of Fruits and Vegetables
2. Jongen, Fruits and Vegetable Processing

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR III - SEMESTER V

DISCIPLINE SPECIFIC ELECTIVE (DSE)- Beverage Technology

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSE-Beverage Technology	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Bachelor of Food Technology (Honours)	**Year: Third**	**Semester: Fifth**
Food Technology		
Course Code: BFT-504	**Course Title: Beverage Technology**	

Course outcomes:

The student at the completion of the course will be able to:

1. Explain the essential compositional features of barley, water, hops, yeast and other ingredients as they pertain to brewing process performance and product quality
2. Explain the chemistry, biochemistry and physics underpinning the processing treatments that are used to render barley, water, hops, yeast and other components into forms suitable for brewing
3. Illustrate and describe the unit processes leading from raw material to packaged beverage
4. Name and give examples of the key microbial threats to beverage and outline how they are detected and dealt with
5. Summarize the basic principles of plant cleaning andsanitation
6. Explain the chemistry, biochemistry and physics of quality attributes, notably foam, gushing, color, haze and physical stability

Credits: 4	**DSE-3**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Introduction, classification, beverage industry in India, traditional beverages; manufacturing technology of mineral water, packaged drinking water and carbonated drinks; water quality, treatment and fortification process	15
II	Manufacturing, bottling, packaging, storage and transportation of fruit beverages-squash, cordial, nectar, crush; alcoholic beverages- wine, beer, distilled spirits	10
III	Milk beverages; selection and economics of different beverages packaging materials; selection, operation and maintenance of beverage machines/equipment	10

IV	Automation in beverage industries, quality control and safety in beverage industries, waste management in beverage industries, marketing of beverages	10
	PRACTICALS	
I	Preparation of different beverages	30
II	Effect of different ingredient on the quality of beverages	
III	Study of carbonated and non-carbonated beverages	
IV	Preparation of squash, cordial and nectar	
V	Study of alcoholic beverages and determination of alcohol content	

Suggested Readings:

1. Barnard Devis, Andrew Lockwood, Food and Beverage Management, ElsevierPublications
2. Alan H. Varnam and Jane P. Sutherland, Beverages Technology, Chemistry and Microbiology, Aspen Publication

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR III - SEMESTER V

GENERIC ELECTIVE (GE)- Baking and Confectionery Technology

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
GE- Baking and Confectionery Technology	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Bachelor of Food Technology (Honours)	**Year: Third**	**Semester: Fifth**
Food Technology		
Course Code: BFT-505	**Course Title: Baking and Confectionery Technology**	

Course outcomes:

The student at the completion of the course will be able to:

1. Students will be acquainted with the understanding of the raw material, processes and equipments used for preparation of various bakery products
2. Students will get an overview of modified bakery products for different health conditions
3. An insight into the manufacturing of breakfast cereals and macaroni products and their types
4. An overview of the bakery industry, type of bakery products and safety concerns

Credits: 4	**GE-5**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Introduction to baking; role of bakery ingredients and their functions; quality evaluation and functional properties used in baking; characterization and grading of wheat flour	15
II	Bread technology; quality control of bread making; baked products from soft wheat- cookies, biscuits, cake, pastry; macroni products	10
III	Storage of bakery ingredients; specification of raw materials used in bakery; packaging of baked products	10
IV	Confectionery- cocoa and chocolate manufacturing; stages of sugar cookery; confectionery products	10
	PRACTICALS	
I	Determination of Rheological properties of dough	30
II	Preparation of bakery items	
III	Texture measurement of bakery items	
IV	Determination of sensory properties of bakery items	
V	Stages of sugar cookery	

Suggested Readings:

1. Neelam Khetarpaul, Bakery Science and Cereal Technology. 2. N. Shakuntala Manay, Food Facts and Principles
Suggested Continuous Evaluation Methods: Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR III - SEMESTER VI

DISCIPLINE SPECIFIC COURSE (DSC)- Functional & Minimally Processed Foods

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSC-Functional & Minimally Processed Foods	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Bachelor of Food Technology (Honours)	**Year: Third**	**Semester: Sixth**
Food Technology		
Course Code: BFT-601	**Course Title: Functional & Minimally Processed Foods**	

Course outcomes:

The student at the completion of the course will be able to:

1. Maintain and deliver fresh products conveniently without losing its nutritional quality
2. Ensure that the product has a sufficient shelf life to allow distribution to intended consumers
3. Demonstrate knowledge and understanding of sensory evaluation and consumer testing methods and of their underlying principles
4. Design experiments to measure the sensory properties and consumer acceptance of foods, beverages and other consumer products

Credits: 4	**DSC-16**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Foods and its functions, Composition of foods, general and specific for different foods of plant and animal origin. Restoration, enrichment, fortification and supplementation of foods, Effect of processing on components, properties and nutritional value of foods	10
II	Basic tastes, threshold tests for basic tastes, subjective and objective sensory evaluation, different types of tests. Instrumental tests for sensory attributes-colour, texture and odour	10
III	Starch, hydrocolloids and gums: occurrence, functions in food systems, properties, gelatinization, retrogradation and modified starches. Fermentation technology: different fermented products	10

IV	Browning in foods: Enzymatic and non enzymatic- mechanism, method of prevention, relationship to health. Sugar and jaggery: Principles of sugar crystallization	5
V	Fats and oils: Properties, manufacture, uses in food systems (as cooking media and shortening). Rancidity- types, mechanism and prevention. Uses of fat replacers in processed foods	10
	PRACTICALS	
I	Sensory Analysis: Different types of sensory tests for basic tastes and sensory attributes of products	30
II	Starch gelatinization: factors affecting and measurement of viscosity	
III	Functional properties of proteins: Water and fat absorption, emulsion and foaming properties, (preparation of cakes).	
IV	Preparation of caramel and its usages in food processing.	
V	Use of oils and fats: as shortening and as frying media, effect of frying on physico-chemical properties.	

Suggested Readings:

1. Desroiser N. W. & Desroiser J. N. 1977. The Technology of Food Preservation. AVI Publication.
2. Potty V. H. and Mulky M. J. 1993. Food Processing. Oxford & IBH Publishing House.
3. Srilakshmi B. 2001. Food Science. New Age International.

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR III - SEMESTER VI

DISCIPLINE SPECIFIC COURSE (DSC)- Quality Control in Food Industry

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSC-Quality Control in Food Industry	4	2	0	2	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Bachelor of Food Technology (Honours)	**Year: Third**	**Semester: Sixth**
Food Technology		
Course Code: BFT-602	**Course Title: Quality Control in Food Industry**	

Course outcomes:

The student at the completion of the course will be able to:

1. To acquaint with food quality parameters and control systems, food standards, regulations, specifications.
2. Concepts of Total Quality Management, sanitary and hygienic practices.
3. Description of laboratory quality procedures and assessment of laboratory performance.

Credits: 4	**DSC-17**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Hygiene regulation, control of airborne contamination	10
II	HACCP implementation, Microbiological control methods	10
III	Instrumental measurements of sensory attribute of foods; appearance, color, volume, density and specific gravity	10
IV	Rheological and textural characteristics, Textural profile analysis, Relation between instrumental and sensory analysis of food quality attributes	15
	PRACTICALS	
I	Methods of evaluation of sensory quality of food products	30
II	To study the microbiological examination of food	
III	Preparation of HACCP control chart	
IV	Develop the relationship between objective and subjective methods	
V	Detection and estimation of food additives and adulterants.	

Suggested Readings:

1. Yeshajahu Pomeranz and Clifton E. Meloan. 2002. Food Analysis : Theory and Practice
2. R.D King. 1984. Developments in Food Analysis Techniques -2

3. R.P Srivastav and Sanjeev Kumar. 2003. Fruits and vegetable preservation Principles & Practices
4. Official methods of analysis of AOAC

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR III - SEMESTER VI

DISCIPLINE SPECIFIC COURSE (DSC)- Technology of Meat and Meat Products

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSC-Technology of Meat and Meat Products	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Bachelor of Food Technology (Honours)	**Year: Third**	**Semester: Sixth**
Food Technology		
Course Code: BFT-603	**Course Title: Technology of Meat and Meat Products**	

Course outcomes:

The student at the completion of the course will be able to:

1. Students will be acquainted with the need and importance of livestock industry. They will get knowledge about meat quality parameters and what are the factors thataffect it.
2. Students will acquire in-depth knowledge of the slaughter process of livestock, the importance of ante-mortem and post-mortem inspection, HACCP for slaughter process and utilization of by-products
3. Students will have acquired detailed knowledge about the various preservation techniques for meat.

Credits: 4	**DSC-18**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Meat industries in India – kinds of meat animals– pre-slaughter care – methods of stunning – slaughtering – dressing of meat	5
II	Post slaughter care and post-mortem inspection – classification and quality of meat, Aging, curing smoking, canning and irradiation preservation of meat, Freezing and dehydration of meat and meat products, curing agents and additives	10
III	Meat products – formed and sectioned meat – sausage products, hygiene and sanitary conditions in a meat processing plant	10
IV	Methods of preservation of meat and their products – spoilage of meat and their products – hygiene and sanitation, regulations, Recent development in meat processing	10

V	Quality processing, quality and safety control measures, Planning, Layout design consideration in meat processing unit, export regulation of meat products	10
	PRACTICALS	
I	Experiments in slaughtering, dressing of meat	3
II	To study of Curing and preservation of meat and meat products	3
III	Estimation of quality of meat.	3
IV	Preparation of value-added meat products	3
V	To study the canning, cooking, freezing, sausage making	3

Suggested Readings:

1. J. Gracey, David Collins & Robert Huey: Meat Hygiene

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR III - SEMESTER VI

DISCIPLINE SPECIFIC ELECTIVE (DSE)- Fish Processing Technology

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSE- Fish Processing Technology	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Bachelor of Food Technology (Honours)	**Year: Third**	**Semester: Sixth**
Food Technology		
Course Code: BFT-604	**Course Title: Fish Processing Technology**	

Course outcomes:

The student at the completion of the course will be able to:

1. Students will gain knowledge on fishery industry in India. Students will also learn on various freezing systems used for fishery, on board freezing and MAP
2. Students will be acquainted on smoking, curing and canning of fishes.
3. Students will acquire in-depth knowledge of fishery by-products, fermented fish and an introduction on concept of seafoods

Credits: 4	**DSE-4**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Importance of fisheries, Classification of aquatic animals; Composition and Nutritional Quality of Fish; Transportation and storage of fish	10
II	Unit operations in fish processing, preservation by curing, chilling and freezing of fish Drying, fish products, canning of fish products, modified atmosphere packaging of fish and fish products	15
III	Drying, fish products, canning of fish products, modified atmosphere packaging of fish and fish products	10
IV	HACCP and quality assurance of sea food	10
	PRACTICALS	
I	To study the drying behavior of fish and fish products	30
II	To determine the physical properties of fish	
III	To determine the composition of fish and fish products.	
IV	Canning of Fish.	
V	To study the quality control measures in fish processing	

Suggested Readings:

1. N.C. Flemming, S. Vallerga, N. Pinardi: Opertional Oceanography, Elsevier Publications
2. Principles of Aseptic Processing and Packing by Philip E. Nelson
3. Food packing and Shelf Life: A Practical Guide by Gordon L. Robertson

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR III - SEMESTER VI

GENERIC ELECTIVE (GE)- Energy Management in Food Industries

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
GE- Energy Management in Food Industries	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Bachelor of Food Technology (Honours)	**Year: Third**	**Semester: Sixth**
Food Technology		
Course Code: BFT-605	**Course Title: Energy Management in Food Industries**	

Course outcomes:

The student at the completion of the course will be able to:

1. Achieve and maintain optimum energy procurement and utilisation, throughout the organization
2. Minimise energy costs / waste without affecting production & quality
3. Develop new techniques to minimise environmental effects.

Credits: 4	**GE-6**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Energy: Basic concepts, energy sources, renewable and non renewable, energy auditing- definition, role and types, management of energy sources, efficiency and utilization, solar energy, drying of agricultural food products	5
II	Solar water heating system- types, design and mechanism; solar distillation- definition, design and mechanism; solar cooker- design and mechanism	10
III	Power generation through photovoltaic system- mechanism, components, advantages, limitations, fuel efficiency and performance of furnaces- testing methods and factors affecting furnace performance	10
IV	Biomass gasification- biogas production and application in food industry; heat energy recovery unit and its advantages; energy from vegetable and municipal solid waste	10
V	Wind energy- wind energy conversion system (WECS); classification and advantages of WECS; horizontal-axis wind turbine (HAWT)- principle,	10

	components, types; vertical-axis wind turbine (VAWT)- principle, components, types; wind energy for pumping and electric power generation	
	PRACTICALS	
I	Study of solar dryer and solar stills and its comparative performance	30
II	To study various solar distillation plants, solar water heaters and its efficiencies	
III	Study of various types of solar photovoltaic cells and design of solar based electrical systems	
IV	Energy audit study and management strategies in food processing plants	
V	Study of various types of gasifies, bio-mass gasifies and efficiencies	

Suggested Readings:

1. Handbook of water and energy management in food processing, Edited by J Klemes and R Smith and J-K Kim, Woodhead Publishing June 2008
2. Pimental D. 1980. Handbook of Energy Utilization in Agriculture. CRC Press.
3. Rai GD. 1998. Non-conventional Sources of Energy. Khanna Publ.
4. Twindal JW & Anthony D Wier 1986. Renewable Energy Sources. E & F. N. Spon Ltd.
5. Verma SR, Mittal JP & Surendra Singh. 1994. Energy Management and Conservation in Agricultural Production and Food Processing. USG Publ. & Distr., Ludhiana.

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR IV - SEMESTER VII

DISCIPLINE SPECIFIC COURSE (DSC)- Research Methodology

No. of Hours- 60

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSC-Research Methodology	4	4	0	0	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Bachelor of Food Technology (Honours with Research)	**Year: Fourth**	**Semester: Seventh**
Food Technology		
Course Code: BFT-701	**Course Title: Research Methodology**	

Course outcomes:

The student at the completion of the course will be able to:

1. To give scientific approach to research and its types.
2. To give knowledge about sampling design, measurements and their centraltendency.
3. To impart knowledge about experimental designs, measures of variability, correlation and various statistical tests.

Credits: 4	**DSC-19**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Research: significance, conceptualization of problem – hypothesis, Types of research – Research designs, fundamental, applied – action, exploratory, discipline, experimental, survey, case study and ex post facto. Longitudinal, cross sectional and correlational research.	15
II	Theory of probability – population sample. Sampling techniques: Research methods – Interview schedule, important methods and data collection, interpretation of results, observation, social mapping, participatory rapid assessment. Writing up research reports and proposal.	15
III	Statistics – meaning, role of statistics in research- descriptive research – classification, tabulation of data – graphic and diagrammatic representation of data. Measurement of central tendency, variation, dispersion, normal distribution – Mean, median, testing levels of significance – 'T' test, F test and X2 test.	15
IV	Correlation, coefficient of correlation – rank correlation, analysis of variance, types, regression and forecasting–Fitting regression curves, discrimination analysis.	15

Suggested Readings:

1. Elhance, D.L. (2008). Fundamentals of Statistics. Kitab Mahal, Patna.

2. Garret H.P. (2004). Statistics in Psychology and Education. Vallies Fotter and Simons Ltd. Bombay.
3. Kothari, C.R. (2008) Research Methodology. Wishwa Prakashan. New Delhi, India. Rao, K.V. (2007) Biostatistics. Jaypee Brothers medical publishers, New Delhi.
4. Sundar, R.P. & Richard, J. (2003). An Introduction to Biostatistics. Prentice Hall, New Delhi.

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR IV - SEMESTER VII

DISCIPLINE SPECIFIC ELECTIVE (DSE)- Food Industry Waste Management

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSE- Food Industry Waste Management	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Bachelor of Food Technology (Honours with Research)	**Year: Fourth**	**Semester: Seventh**
Food Technology		
Course Code: BFT-702	**Course Title: Food Industry Waste Management**	

Course outcomes:

The student at the completion of the course will be able to:

1. Understand the technologies of waste disposal, waste utilization and waste recycling
2. Understand the technologies involved in biological processes of waste treatment
3. Learn the rules of law connected to the waste treatment and about the analytical methods for waste analysis

Credits: 4	**DSE-5**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Introduction: Classification and characterization of food industrial wastes from fruit and vegetable processing industry, beverage industry, fish, meat and poultry industry, sugar industry and dairy industry	5
II	Waste disposal methods – physical, chemical and biological; Economical aspects of waste treatment and disposal	5
III	Treatment methods for liquid wastes from food process industries; Design of activated sludge process, Rotating biological contactors, Trickling filters, UASB, Biogas plant	10
IV	Treatment methods of solid wastes: Biological composting, drying and incineration; Design of solid waste management system: Landfill digester, Vermicomposting pit	15

V	Biofilters and bioclarifiers, Ion exchange treatment of waste water, Drinking-water treatment, Recovery of useful materials from effluents by different methods	10
	PRACTICALS	
I	Flow process chart of food plant	30
II	Waste utilization processes	
III	Various treatments for waste disposal analysis of cleaners & sanitizers	
IV	Study of generation of energy from anaerobic digestion	
V	Study of waste fired furnace	

Suggested Readings:

1. Verma, L. R. and Joshi, V. K. 2000. Post Harvest Technology of Fruits and Vegetables: Handling, Processing, Fermentation and Waste Management. Indus Publishing Company, New Delhi
2. Mooyong, M. Bio-mass Conversion Technology : Principles and Practices
3. Shuler, Michael L. and Kargi, Fikret Bio-process Engineering BasicConcepts

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR IV - SEMESTER VII

DISCIPLINE SPECIFIC ELECTIVE (DSE)- Post Harvest Management of Fruits and Vegetables

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSE- Post Harvest Management of Fruits and Vegetables	4	2	0	2	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Bachelor of Food Technology (Honours with Research)	**Year: Fourth**	**Semester: Seventh**
Food Technology		
Course Code: BFT-703	**Course Title: Post Harvest Management of Fruits and Vegetables**	

Course outcomes:

The student at the completion of the course will be able to:

1. Attain an overview on post-harvest losses and its impact on the Indian economy.
2. Understand about fruit and vegetable physiology, metabolic processes and various nutritional changes in fruits and vegetables along with post-harvest handling techniques.
3. Gain knowledge on different pre-processing operations involved before processing of fruits and vegetables.
4. Develop an understanding on various post-harvest disorders and diseases of fruits, minimising the losses by suitable packaging and minimal processing operations.

Credits: 4	**DSE-6**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Introduction to post harvest management: Definition of PHM, PHT, scope, responsibilities, post-harvest losses, possible measures to reduce the PHL; Morphology of fruits and vegetables: Introduction; parts of fruit; botanical classification of fruit; consumer classification of fruit; classification of fruits on the basis of origin; vegetables; fruits vs. vegetables	8
II	Physiology: Introduction; physiological development stages; respiration; respiration drift; climacteric fruit; non-climacteric fruit; aerobic and anaerobic respiration; RQ; factors affecting rate of respiration; transpiration Maturity of fruits and vegetables: Introduction; methods of identification of maturity, fruit ripening: introduction; changes during ripening	7

III	Deterioration of fruits & vegetables: Introduction; primary and secondary causes of losses	14

	Pre-harvest factors affecting quality: Introduction; preharvest factors related to plant; preharvest factors related to environment; preharvest factors related to chemicals Harvesting of fruits & vegetables: Introduction; definition; different methods of harvesting; factors during harvest affecting quality of produce; post-harvest handling: Iintroduction; postharvesthandling	
IV	Post-harvest commodity treatments: Introduction; precooling; waxing; sprout inhibition; disinfestation; fungicide application; hot water treatment; vapour heat treatment; irradiation; ripening and degreening; delaying ripening; curing of roots and tubers; dryings of root crops Pre-cooling: Introduction; effect of precooling on product quality; factors affecting precooling; cooling methods	8
V	Packinghouse operations: Introduction; dumping (loading and unloading); washing; drying; sorting & grading; commodity treatments; packaging; transportation Storage structures: Introduction; goal of storage systems; storage considerations; storage systems; low cost and high cost technology, MA, CA and hypobaric storage	8
	PRACTICALS	
I	Studies of maturing indices	30
II	Studies on use of chemicals for ripening and enhancing shelf life of fruits and vegetables	
III	Studies on various storage systems and structures	
IV	Studies on physiological disorders-chilling injury of banana and custard apple	
V	Processing of tomato products; preparation of papain /guava cheese	

Suggested Readings:

1. P. Jacob John, A Handbook on Post harvest Management of Fruits and Vegetables
2. Verma L. R. and Joshi V. K. , Post harvest Technology of Fruits and Vegetables – Vol. 1

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR IV - SEMESTER VII

DISCIPLINE SPECIFIC ELECTIVE (DSE)- Dairy Plant Engineering

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSE- Dairy Plant Engineering	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Bachelor of Food Technology (Honours with Research)	**Year: Fourth**	**Semester: Seventh**
Food Technology		
Course Code: BFT-704	**Course Title: Dairy Plant Engineering**	

Course outcomes:

The student at the completion of the course will be able to:

1. understand the processing of milk and its properties
2. learn how to prepare milk products
3. understand their quality testing and also storage sanitation and effluent treatment
4. acquire key knowledge of packaging, labeling and foodsafety

Credits: 4	**DSE-7**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Materials and sanitary features of the dairy equipment; Sanitary pipes and fittings, standard glass piping, plastic tubing, fittings and gaskets; Installation, care and maintenance of pipes & fittings; Milk storage tanks, silos, road tankers, tail tankers; Bottle & cans washing and CIP cleaning equipment	10
II	Mechanical Separation: Fundamentals involved in separation; Principles involved in filtration, Types, rates of filtration; Gravity settling, Sedimentation, Principles of centrifugal separation; Different types of centrifuges. Application in Dairy Industry, clarifiers, tri processors, cream separator	10
III	Homogenization: Classification, single stage and two stage homogenizer pumps, power requirement for homogenization; Care and maintenance of homogenizers, aseptic homogenizers	10
IV	Pasteurization: Batch, flash and continuous (HTST) pasteurizers; Pasteurizer control, Flow diversion valve; Different types of sterilizers, in- bottle	10

	sterilizers, autoclaves; Continuous sterilization plant, UHT sterilization; Aseptic packaging and equipment	
V	Filling Operation: Principles and working of different types of bottle fillers and capping machine; Pouch filling machine, Form-Fill-Seal Types	5
	PRACTICALS	
I	To study constructional details, operation and maintenance of TRAY DRYER	30
II	To study constructional details, operation and maintenance of DRUM DRYER	
III	To study constructional details, operation and maintenance of SPRAY DRYER	
IV	To study constructional details, operation and maintenance of butter/ ghee making equipment	
V	To study constructional details, operation and maintenance of cheese making equipment	

Suggested Readings:

1. Textbook of Dairy Engineering, by S Ravi Kumar (Author), B M Manjunatha (Author)
2. Dairy Plant Engineering and Management by Tufail Ahmed

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR IV - SEMESTER VII

GENERIC ELECTIVE (GE)- Marketing of Food Products

No. of Hours- 60

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
GE-Marketing of Food Products	4	4	0	0	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Bachelor of Food Technology (Honours with Research)	**Year: Fourth**	**Semester: Seventh**
Food Technology		
Course Code: BFT-705	**Course Title: Marketing of Food Products**	

Course outcomes:

The student at the completion of the course will be able to:

1. Build relationships with customers, raise brand awareness, develop new products, promote them through advertising, and even pay grocery stores for prominent shelf space, all with the goal of promoting sales.
2. Adapt the use of all 4 P's in developing value added product that will improve their competitive position in the market place by better satisfying consumer needs and wants.

Credits: 4	**GE-7**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Nature of products; cost concepts, cost curves and short run and long run equilibrium. Returns to scale and Economics of scale	15
II	Project preparation and feasibility analysis. Financial management. Demand, markets, marketing, market structure, marketing management and pricing strategies of firms	15
III	Marketing environment and Consumer buying behavior. Market segmentation, market measurement, market plan, marketing promotion, management of distribution and market	15
IV	Market Information System, export and government regulations, GATT and WTO	15

Suggested Readings:

1. Marketing Food Brands, Ranga Chimhundu
2. Marketing of Processed Fruits and Vegetables, Monalisa choudhary, Nayan Barua

3. International Marketing and Trade of Quality Food Products, **Maurizio Canavari**
Suggested Continuous Evaluation Methods: Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR IV - SEMESTER VII

GENERIC ELECTIVE (GE)- Principles of Economics

No. of Hours- 60

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
GE-Principles of Economics	4	4	0	0	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Bachelor of Food Technology (Honours with Research)	**Year: Fourth**	**Semester: Seventh**
Food Technology		
Course Code: BFT-706	**Course Title: Principles of Economics**	

Course outcomes:

The student at the completion of the course will be able to:

1. Gain knowledge in financial sector which will help them to starttheir business.
2. Help in increasing the economic health of the nation.
3. Prepare proper budget for their business.

Credits: 4	**GE-8**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Basic terms and concepts of Economics, Meaning and nature of Micro and Macro Economics, nature and scope of Agricultural Economics, its role and importance, characteristics of factors of production, measures to improve land productivity	20
II	Government policies Labour – division of labour, problems of unemployment under employment and disguised unemployment, capital formation in agriculture, forms of business organizations	10
III	Demand - law of demand – types of supply, law of supply – factors influencing supply, elasticity of supply	10
IV	Price determination under different market situations. –Government policy Characteristic features of developed and under developed economics	10
V	International trade in Agriculture – exim policy – role of W.T.O., International Trade in Agriculture. Financial institutions and their role; RBI, IDBI, IMF, NABARD, SIDBI	10

Suggested Readings:

1. K.K. Dravid – Economic Theory
2. Indian economy – Rudradutt and sundaram

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR IV - SEMESTER VIII

DISCIPLINE SPECIFIC COURSE (DSC)- Entrepreneurship and Business Management

No. of Hours- 60

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if
		Lecture	Tutorial	Practical		
DSC-Entrepreneurship and Business Management	4	4	0	0	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Bachelor of Food Technology (Honours with Research)	**Year: Fourth**	**Semester: Eighth**
Food Technology		
Course Code: BFT-801	**Course Title: Entrepreneurship and Business Management**	

Course outcomes:

The student at the completion of the course will be able to:

1. Explore entrepreneurial skills and management function of acompany
2. Pick up about foundation of entrepreneurship development and itstheories
3. Identify the type of entrepreneur and the steps involved in an entrepreneurial venture
4. Understand various steps involved in starting a venture and to explore marketing methods & new trends in entrepreneurship

Credits: 4	**DSC-20**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Entrepreneur- definition and qualities of an entrepreneur, types of industry– cottage and small-scale industry; market structure– macro and micro business, creating a business model, brand creation	10
II	Food Processing Plant- product and process designs; general and specific design; layout considerations; selection of equipment	10
III	Human Resource Management- recruitment; training; performance appraisals; worker's safety and welfare; employee's union	10
IV	Marketing Management- functions of marketing; market intelligence- survey techniques, demand and supply; market forecasting– consumer behaviour and trends; segmentation, targeting and positioning; marketing network; e-marketing and e-procuring	15

V	Advertising and Commercialization- objectives of advertising; advertising message; budgeting; media selection; personal selling and publicity; sales promotion	15

Suggested Readings:

1. Chhabra TN and Suria RK. 2001. Management Process and Perspectives. KitabMahal.
2. Jhingan ML. 2005. International Economics. 5th Ed. Virnda Publ.
3. Kotler P. 2000. Marketing Management. Prentice Hall.
4. Reddy SS, Ram PR, Sastry TVN and Bhavani ID. 2004. Agricultural Economics. Oxford & IBH.

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR IV - SEMESTER VIII

DISCIPLINE SPECIFIC ELECTIVE (DSE)- Food Processing Technology

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSE- Food Processing Technology	4	2	0	2	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Bachelor of Food Technology (Honours with Research)	**Year: Fourth**	**Semester: Eighth**
Food Technology		
Course Code: BFT-802	**Course Title: Food Processing Technology**	

Course outcomes:

The student at the completion of the course will be able to:

1. Develop an appreciation about need of different emerging techniques used in food processing and preservation.
2. Describe and discuss the processing of foods in terms of unit operations.
3. Evaluate mass and energy balances in processing equipment (i.e., heat exchangers, refrigeration equipment, packaging materials)
4. Apply their knowledge on high pressure processing, pulsed electric processing, irradiation and hurdle technology in various food industries.

Credits: 4	**DSE-8**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Freezing: requirements of refrigerated storage - controlled low temperature, air circulation and humidity, changes in food during refrigerated storage, progressive freezing, changes during freezing –concentration effect and ice crystal damage, freezer burn. Refrigeration load, factors determining freezing rate-food composition and non-compositional influences	8
II	Freezing methods -direct and indirect, still air sharp freezer, blast freezer, fluidized freezer, plate freezer, spiral freezer and cryogenic freezing**;** Normal drying curve, effect of food properties on dehydration, change in food during drying, drying methods and equipment, air convection dryer, tray	10

	dryer, tunnel dryer, continuous belt dryer, fluidized bed dryer, spray dryer, drum dryer, vacuum dryer, freeze-drying, foam mat drying	
III	Ionizing radiation and sources, unit of radiations, direct and indirect radiation effects, safety and wholesomeness of irradiated food. Microwave heating and application**;** Packaging: Properties of packaging material, factors determining the packaging requirements of various foods and brief description of packaging of frozen products, dried products, fats and oils and thermally processed foods	9
IV	Introduction, classification of Thermal Processes, Principles of thermal processing, Thermal resistance of microorganisms, Thermal Death Time, Lethality concept, characterization of heat penetration data, Thermal process Calculations	9
V	Elementary concept of material handling in food industry, equipment and functioning of belt conveyor, screw conveyor, bucket elevator and pneumatic conveyor; Principles and methods of: distillation, extraction, washing, filtration, sedimentation, sieving and centrifugation	9
	PRACTICALS	
I	Determination of thermal inactivation time of enzymes	30
II	Thermal processing of foods	
III	Dehydration of foods	
IV	Use of chemicals in preservation of foods	
V	Concentration of foods	

Suggested Readings:

1. P. Fellows, Food Processing Technology: Principles and Practice
2. Da-Wen Sun, Emerging Technologies for Food Processing
3. Jelen P., Introduction to Food Processing

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR IV - SEMESTER VIII

DISCIPLINE SPECIFIC ELECTIVE (DSE)- Fat and Oil Processing Technology

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSE- Fat and Oil Processing Technology	4	2	0	2	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Bachelor of Food Technology (Honours with Research)	**Year: Fourth**	**Semester: Eighth**
Food Technology		
Course Code: BFT-803	**Course Title: Fat and Oil Processing Technology**	

Course outcomes:

The student at the completion of the course will be able to:

1. Acquire the basic knowledge about the productionand processing technologies of fats and oils
2. Evaluate the diverse technologies and consequent chemical and physico-chemical details on different edible oils

Credits: 4	**DSE-9**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Introduction to oils and fats and their nomenclature; physical and chemical properties of fats and oils; nutritional importance of oils and fats	15
II	Source and physico-chemical properties of following oils:- a. Animal – Butter oil, lard and tallow b. Plant – Mustard, groundnut, sunflower, soybean, coconut, rice bran, cottonseed, linseed, etc	15
III	Extraction of oils/fats; problems during storage – rancidity, reversion	15
	PRACTICALS	
I	Determination of saponification value	30
II	Determination of peroxide value	
III	Determination of free fatty acids	
IV	Determination of refractive index	
V	Determination of moisture content	

Suggested Readings:

1. Food Oils and Fats, Technology, Utilization and Nutrition, Harry Lawson
2. Chemistry and Technology of Oils and Fats, M.M. Chakrabarty

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR IV - SEMESTER VIII

DISCIPLINE SPECIFIC ELECTIVE (DSE)- Food Fermentation Technology

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSE- Food Fermentation Technology	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Bachelor of Food Technology (Honours with Research)	**Year: Fourth**	**Semester: Eighth**
Food Technology		
Course Code: BFT-804	**Course Title: Food Fermentation Technology**	

Course outcomes:

The student at the completion of the course will be able to:

1. Able to design a food fermentation process starting from isolation, screening and preservation of microorganisms, selecting the fermentation conditions, and preparing the necessary step for isolation and harvesting of the products.

Credits: 4	**DSE-10**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Concept of fermented foods, scope & development in fermented foods & beverage industry; benefits of fermented foods	5
II	Food fermentation, stock culture and inoculum preparation; fermented milk products- Curd, Yoghurt, Acidophilic milk, Bulgarian milk, Koumiss and Kefir	10
III	Fermented legume products- soy sauce, miso, tempeh, idli; fermented fruitd and vegetable products- Sauerkraut, Kimchi, Cucumber pickles	10
IV	Fermented meat products- fermented meat sausages; fermented alcoholic beverages- Beer, wine, vinegar	10
V	Malting, brewing, steeping, germination, kilning and curing; chemical and biochemical changes during malting and mashing; separation of wort, wort boiling and hops addition; fermentation, separation, maturation, carbonation and packaging	10
	PRACTICALS	
I	Isolation and characterization of industrial cultures.	30
II	Fermented beverages - Production and analysis of wine and beer	
III	Baker's yeast production	

IV	Production and analysis of Vinegar	
V	Preparation of whey based fermented beverages.	

Suggested Readings:

1. Microbiology and Technology of Fermented Foods, 2nd Edition, Robert W.Hutkins
2. Food and Beverage Fermentation Technology, Abawari R A

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR IV - SEMESTER VIII

GENERIC ELECTIVE (GE)- Industrial Microbiology

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
GE-Industrial Microbiology	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Bachelor of Food Technology (Honours with Research)	**Year: Fourth**	**Semester: Eighth**
Food Technology		
Course Code: BFT-805	**Course Title: Industrial Microbiology**	

Course outcomes:

The student at the completion of the course will be able to:

1. Gain knowledge about the different cell organelles of microorganisms and their detailed functions
2. Gain knowledge of significance and activities of microorganismsin food
3. Learn the growth and control of microbes as well as different bacteriological techniques involved in microbiology
4. Learn about the biomolecules by studying their structures and types

Credits: 4	**GE-9**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	History of industrial microbiology; Primary and secondary metabolites produced by the microorganisms; Screening of microorganisms; Preservation of microorganisms; Organizations involved in microbiological work Fermentation media, Industrial sterilization	10
II	Fermenter: Components of a fermenter, parts of fermenters, peripheral parts and accessories, additional accessories and peripherals. Types of fermenters Types of fermentations; Alcoholic beverages: types, production and quality	10
III	Microorganisms involved Probiotics; Industrially important secondary metabolites, their production and downstream processing, biopesticides, antibiotics, enzymes, exopolysaccharides, biopolymers, steroids, biomers; Importance, role in fermented foods, organisms involved, beneficial effects	10

IV	Bacteriocins and Nisin Production of microbial enzymes; Downstream processing Cell disruption methods: Mechanical disruption methods and non-mechanical disruption methods; Extraction; Purification; Concentration; Product recovery	10
V	Microbial cell products i.e. Mushroom, SCP, Baker's yeast, blue green algae and sprulina Measures to improve yield of fermented products	5
	PRACTICALS	
I	Isolation of industrially important microbial strains and fermentation media	30
II	Types of fermentation processes	
III	Measurement of fermentation parameters	
IV	Down-stream processing	
V	Microbial production of industrial products	

Suggested Readings:

1. Industrial Microbiology: Fundamentals and Applications, A.K.Agarwal
2. Industrial Microbiology, KL Benson
3. Biotechnology Industrial Microbiology A Textbook, Clarke W

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR IV - SEMESTER VIII

GENERIC ELECTIVE (GE)- Food Extrusion Technology

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
GE- Food Extrusion Technology	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Bachelor of Food Technology (Honours with Research)	**Year: Fourth**	**Semester: Eighth**
Food Technology		
Course Code: BFT-806	**Course Title: Food Extrusion Technology**	

Course outcomes:

The student at the completion of the course will be able to:

1. Understand, demonstrate skills and apply knowledge in food extrusionprocessing
2. Formulate, process and understand quality parameters of the varied combinations of ingredients in food extruder

Credits: 4	**GE-10**
Max. Marks: 100	

Unit	Topics	No. of Hours
I	Extrusion: definition, introduction to extruders, principles and types; uses of extruders in the food industry	5
II	Single screw extruder: principle of working, net flow, factors affecting extrusion process	5
III	Twin screw extruder: counter rotating and co-rotating twin screw extruder; process characteristics of the twin screw extruder	10
IV	Pre-conditioning of raw materials used in extrusion process; chemical and nutritional changes in food during extrusion; classification of breakfast cereals	10
V	Raw materials, process and quality testing of vermicelli, spaghetti, pasta and macronic products; texturized vegetable protein: definition, processing techniques; Ready to eat breakfast cereals by extrusion cooking	15
	PRACTICALS	
I	Introduction of food extruders components and their functions	30
II	Determination of starch content in cereal flour	
III	Determination of quality parameters for available commercial extruded snack product	
IV	Texture profile analysis of extruded product	

V	Studies on development of weaning food by extrusion technology	

Suggested Readings:

1. Matza S., Extruded foods
2. N.D. Frame, Technology of Extrusion Cooking
3. Riaz M.N., Extruders in Food Application

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR V - SEMESTER IX

DISCIPLINE SPECIFIC COURSE (DSC)- Nutraceuticals and Functional Foods

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSC-Nutraceuticals and Functional Foods	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Master of Food Technology	**Year: Fifth**	**Semester: Ninth**
Food Technology		
Course Code: MFT-901	**Course Title: Nutraceuticals and Functional Foods**	

Course outcomes:

The student at the completion of the course will be able to:

1. Gain knowledge on sources of Nutraceuticals, Health foods and Specialty Foods
2. Acquire skills to categorize nutraceuticals.
3. Gain awareness on nutraceuticals of microbial origin.
4. Obtain knowledge of healthy foods and nutraceuticals in health anddiseases.
5. Understand the regulatory aspects of healthy foods and Nutraceuticals

Credits: 4	**DSC-21**
Max. Marks: 100	

Unit	Topics	No. of Lectures
I	Introduction to nutraceuticals: definitions, synonymous terms, basis of claims for a compound as a nutraceutical, regulatory issues for nutraceuticals including CODEX	5
II	Concept of angiogenesis and the role of nutraceuticals/functional foods, nutraceuticals for cardiovascular diseases, cancer, diabetes, cholesterol management, obesity, joint pain	10
III	Nutraceuticals for immune enhancement, age-related macular degeneration, endurance performance and mood disorders – compounds and their mechanisms of action, dosage levels, contradiction if any etc	10
IV	Manufacturing aspects of selected nutraceuticals such as lycopene, isoflavonoids, prebiotics and probiotics, glucosamine, phytosterols etc.;	10

	formulation of functional foods containing nutraceuticals – stability and analytical issues, labelling issues	
V	Clinical testing of nutraceuticals and health foods, interactions of prescription drugs and nutraceuticals, adverse effects and toxicity of nutraceuticals; nutrigenomics – an introduction and its relation to nutraceuticals	10
	PRACTICALS	
I	Market survey of existing health foods	30
II	Identification and estimation of selected nutraceuticals	
III	Production and quality evaluation of foods containing nutraceuticals	
IV	Development of labels for health foods	
V	Visit to relevant processing Units	

Suggested Readings:

1. Brigelius-Flohé, J &JoostHG. 2006. Nutritional Genomics: Impact on Health and Disease.Wiley VCH.
2. Cupp J & Tracy TS. 2003. Dietary Supplements: Toxicology and Clinical Pharmacology. Humana Press.
3. Gibson GR & William CM. 2000. Functional Foods - Concept to Product.
4. Goldberg I. 1994. Functional Foods: Designer Foods, Pharma Foods.
5. Losso JN. 2007. Angi-angiogenic Functional and Medicinal Foods. CRCPress.
6. Manson P.2001. Dietary Supplements. 2nd Ed. Pharmaceutical Press.
7. Campbell JE & Summers JL. 2004. Dietary Supplement Labeling Compliance.
8. Neeser JR & German BJ. 2004. Bioprocesses and Biotechnology for Nutraceuticals. Chapman & Hall.
9. Robert EC. 2006. Handbook of Nutraceuticals and Functional Foods. 2nd Ed. Wildman.
10. Shi J. (Ed.). 2006. Functional Food Ingredients and Nutraceuticals:Processing Technologies. CRC Press.
11. Webb GP. 2006. Dietary Supplements and Functional Foods. Blackwell Publ.

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR V - SEMESTER IX

DISCIPLINE SPECIFIC ELECTIVE (DSE)- Principles of Food Engineering

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSE-Principles of Food Engineering	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Master of Food Technology	**Year: Fifth**	**Semester: Ninth**
Food Technology		
Course Code: MFT-902	**Course Title: Principles of Food Engineering**	

Course outcomes:

The student at the completion of the course will be able to:

1. To acquaint with fundamentals of food engineering and its process
2. To understand the basics of designing of food plant and systems
3. To develop skills for determination of viscosity of various fluids
4. To develop skill for determining various thermal properties such as thermal conductivity, thermal diffusivity, calorific value and specific heat.
5. To develop skill for designing various pumping systems.
6. To gain knowledge about various types of freezers.

Credits: 4	**DSE-11**
Max. Marks: 100	

Unit	Topics	No. of Lectures
I	Introduction to food engineering; material and energy balances: basic principles, process flow diagrams, total mass balance, component mass balance, material balance problems involved in dilution, concentration and dehydration; heat balance calculations	10
II	Kinetics of biological reactions - kinetics of reactions occurring in processed foods, reaction velocity constant, order of reaction; quality changes during storage of foods; application of Arrhenius equation to biological reactions	10
III	Method for thermal process evaluation - Commercial sterility, pasteurization and sterilization methods based on slowest heating region; determination of the process time based on region of greatest temperature lag; the process equivalence in terms of minutes at 121.1°C	10

IV	Food chilling and freezing – Precooling and cold storage; CA and MA; Properties of frozen foods; freezing point depression; general introduction to enthalpy change during freezing; Plank's equation for predicting rates of product freezing; Cryogenic freezing and IQF; design of food freezing equipment such as air blast freezers, plate freezers and immersion freezers	10
V	Mechanical separation-filtration, membrane concentration, sieving, centrifugation, sedimentation, Mechanical handling-conveying and elevation. Size reduction and classification-mixing, kneading, blending	5
	PRACTICALS	
I	Estimation of microbial load in food materials	30
II	Experiment on properties of food through microwave oven heating	
III	Experiment on osmotic dehydration of foods	
IV	Determination of rehydration ratio of dehydrated foods	
V	Experiment on detection of adulterant	

Suggested Readings:

1. Aeldmam & Lunde Hand book of Food Engineering
2. Batty, J.C. and Folkman, S.L. 1983. Food Engineering Fundamentals. John Wiley and Sons, New York.
3. Fennema O.R. Ed. 1985, Principles of Food Science: Part-II Physical Principles of food.
4. Harper, J.C. 1975. Elements of Food Engineering. AVI, Westport.
5. Heldman, D.R. and Lund, D.B. Ed. 1992. Hand-book of Food Engineering Marcel Dekker, New York.
6. R.P. Singh Hand book of food Engineering.
7. T.Toledo. Fundamentals of Food Process Engineering

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR V - SEMESTER IX

DISCIPLINE SPECIFIC ELECTIVE (DSE)- Technology of Sugar Confectionery and Chocolate Processing

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSE-Technology of Sugar Confectionery And Chocolate Processing	4	2	0	2	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Master of Food Technology	**Year: Fifth**	**Semester: Ninth**
Food Technology		
Course Code: MFT-903	**Course Title: Technology of Sugar Confectionery and Chocolate Processing**	

Course outcomes:

The student at the completion of the course will be able to:

1. Identify commodities and specialist equipment associated with the production of sugar and chocolate confectionery items and demonstrate knowledge of their application.
2. Produce a range of chocolate candies, using appropriate pre-crystallisation methods.
3. Produce a range of sugar confectionery items, using appropriate cooking methods.
4. Describe and discuss the historical and cultural importance of commodities.
5. Describe and discuss the principles, techniques and methods used in the production of sugar and chocolate confectionery, including packaging and display methods.
6. Identify and apply relevant procedures for ensuring food hygiene and safety in accordance with AUT School of Hospitality and Tourism Food Safety Programme.

Credits: 4	**DSE-12**
Max. Marks: 100	

Unit	Topics	No. of Lectures
I	Raw Materials for Confectionery Manufacture Important properties – Sugar, glucose syrup, Dried milk products, cocoa, Specialty fats, Emulsifiers, Nut kernels, Alcoholic ingredients and other minor ingredients. General technical aspects of industrial sugar confectionery manufacture. Confectionery – composition, structure Quality aspects	10

II	Manufacture of Caramel Manufacture of Toffee and fudge Manufacture of Liquorices paste Manufacture of Count Lines Manufacture of Aerated confectionery High boiled sweets– Ingredients, Methods of manufacture– Product types	10
III	Manufacture of Lozenges Manufacture of Fruit confections Manufacture of sugar panned sweets Manufacture of gums & jellies Chewing gum Technology Flour confectionary	10
IV	Chocolate Processing Technology: Cocoa bean – harvesting, processing production of cocoa liquor cocoa butter processing cocoa butter substitutes. Manufacture of chocolate bars and covered confectionary: Molding, enrobing, panning, tempering, Other chocolate processes Quality control of chocolates	15
	PRACTICALS	
I	Tests for the Rheological Properties of Dough	30
II	Preparation of Advanced Bakery Products– sourdoughs, pastries, croissants, Doughnuts	
III	Determination of Nutritional Value of Bakery and Confectionery Products	
IV	To study the process of inversion, melting and caramelization in sucrose	
V	Preparation of candy and toffee and to perform quality assessment tests	

Suggested Readings:

1. Jackson, E.B.1999. **Sugar Confectionery Manufacture**. 2nd Edition. New york: Aspen Publication.
2. Junk, W.R. and Pancost, H.M. 1973**. Hand Book of Sugars for Processors**. Chemists and Technologists. New Delhi: AVI Publications.
3. Francis, F.J. 2000. **Wiley Encyclopaedia of Food Science & Technology**. India: John Wiley& Sons.

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR V - SEMESTER IX

DISCIPLINE SPECIFIC ELECTIVE (DSE)- Food Microbiology

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSE- Food Microbiology	4	2	0	2	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Master of Food Technology	**Year: Fifth**	**Semester: Ninth**
Food Technology		
Course Code: MFT-904	**Course Title: Food Microbiology**	

Course outcomes:

The student at the completion of the course will be able to:

1. To know the important genera of microorganisms associated with food and their characteristics, their growth pattern and parameters.
2. To understand the role of microbes in fermentation,spoilage and food borne diseases
3. To comprehend the role of the microorganisms in spoilage of foods and methods of their control.
4. To gain knowledge about the beneficial role of microorganisms and different types of fermented foods.
5. To identify the role of microorganisms in food borne diseases and control measures
6. To understand the laboratory techniques to detect, quantify, and identify microorganisms in foods

Credits: 4	**DSE-13**
Max. Marks: 100	

Unit	Topics	No. of Lectures
I	Types of micro-organism normally associated with food spoilage- mold, yeast, and bacteria. Factors influencing growth and survival of microorganisms in foods	10
II	Biochemical changes caused by micro-organisms.physical and chemical methods to control microorganisms	5
III	Food Spoilage: spoilage of fresh and processed products, fruits and vegetables, meat, poultry and fish, egg and poultry, grains and oilseeds, milk and milk products. Spoilage of canned foods.Antagonism and synergism in microorganisms	10
IV	Food Fermentations and microbes in food fermentation, traditional fermented foods of India and other Asian countries, probiotics and	10

	prebiotics; fermented foods based on milk, meat and vegetables, fermented beverages	
V	Food hygiene and sanitation: contamination during handling and processing and its control, indicator organisms; rapid methods in detection of microorganisms. Food poisoning (Staphylococcus, Bacillus, Listeria, Salmonella) and microbial toxins, food-borne infections and intoxicants, microbial toxins and mycotoxins	10
	PRACTICALS	
I	Microscopic examination of bacteria, and yeast and molds	30
II	Standard plate count	
III	Yeast and mould count	
IV	Detection and enumeration of pathogenic and indicator organisms in food	
V	Evaluation of microbiological quality of commonly consumed street foods	

Suggested Readings:

1. Banawart GJ. 1989. *Basic Food Microbiology*. 2nd Ed. AVI Publ.
2. Frazier J &Westhoff DC. 1988. *Food Microbiology*. 4th Ed. McGrawHill.
3. Garbutt J. 1997. *Essentials of Food Microbiology*. Arnold Heinemann.
4. Jay JM, Loessner MJ & Golden DA. 2005. *Modern Food Microbiology*. 7th Ed. Springer.
5. Ray B. 2004. *Fundamentals of Food Microbiology*.3rd Ed. CRC.
6. Robinson RK. (Ed.). 1983. *Dairy Microbiology*. Applied Science.
7. Steinkraus KS. 1996. *Handbook of Indigenous Fermented Foods*. Marcel Dekker.
8. Branen A.L. and Davidson, P.M. 1983. Antimicrobials in Foods. Marcel Dekker, New York.
9. Jay J.M. 1986. Modern Food Microbiology. 3rd Edn. VNR, New York.
10. Robinson, R.K. Ed. 1983. Dairy Microbiology. Applied Science, London

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR V - SEMESTER IX

GENERIC ELECTIVE (GE)- Food Additives, Contaminants and Toxicology

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
GE- Food Additives, Contaminants and Toxicology	4	2	0	2	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Master of Food Technology	**Year: Fifth**	**Semester: Ninth**
Food Technology		
Course Code: MFT-905	**Course Title: Food Additives, Contaminants and Toxicology**	

Course outcomes:

The student at the completion of the course will be able to:

1. Understand the role of food additives in manufacturing of food products.
2. Have the knowledge regarding permissible additives and their limits in the processed food.
3. Perceive the contaminants from various sources.
4. Comprehend the effects of contaminants on human health.
5. Identify the major sources of toxins in foods
6. Explain the concept of dose-response, generate and interpret dose-response curves
7. Describe and distinguish examples of toxins in foods of plant origin and discuss mechanisms and manifestations of toxicity relating to their exposure
8. Describe and distinguish examples of marine toxins and discuss mechanisms and manifestations of toxicity relating to their exposure

Credits: 4	**GE-11**
Max. Marks: 100	

Unit	Topics	No. of Lectures
I	Definition scope and general principles of food toxicology, manifestation of toxic effects, classification of food toxicants, factors affecting toxicity of compounds, methods used in safety evaluation-risk assessments	5
II	Toxicants and allergens in foods derived from plants, animals, marine, algae & mushroom, microbial toxins, food Poisoning, food borne infections and Disease	10
III	Food additives- definitions, classification and functions, preservatives, antioxidants, colours and flavours (synthetic and natural), emulsifiers,	10

	sequesterants, humectants, hydrocolloids, sweeteners, acidulants, buffering salts, anti-caking agents, etc. - chemistry, food uses and functions in formulations, indirect food additives, toxicological evaluation of food additives	
IV	Toxicology and food additives, toxicological aspects of nutrient supplements, chemicals from processing such as fumigants, chlorinated solvents, auto-oxidation products, carcinogens in smoked foods and pyrolysis, agrochemicals; heavy metals	10
V	Derived Food toxicants- processing & packaging, toxicants generated during food processing such as nitrosamines, acrylamide, benzene, dioxins and furans; persistent organic pollutants	10
	PRACTICALS	
I	Isolation, modification, and functional properties of native and modified Proteins	30
II	Extraction of essential oil and oleoresins	
III	Applications of additives and ingredients in foods	
IV	Protocol for detection and quantification of toxins in food	
V	Analysis of microbial & plant toxins	

Suggested Readings:

1. Branen A.L. and Davidson, P.M. 1983. Antimicrobials in Foods. Marcel Dekker, New York
2. Branen AL, Davidson PM &Salminen S. 2001. *Food Additives*. 2nd Ed. Marcel Dekker. New York.
3. Fennema, O.R. Ed. 1976. Principles of Food Science: Part-I Food Chemistry. MarcelDekker
4. Furia, T.E. 1980, Handbook of food additives, Vol I and Vol II.
5. Gerorge AB. 1996. *Encyclopedia of Food and Color Additives*. Vol. III. CRCPress.
6. Gerorge AB. 2004. *Fenaroli's Handbook of Flavor Ingredients*. 5th Ed. CRCPress.
7. Madhavi DL, Deshpande SS &Salunkhe DK. 1996. *Food Antioxidants: Technological, Toxicological and Health Perspective*. Marcel Dekker.
8. Morton ID & Macleod AJ .1990. *Food Flavours*. Part A, BC. Elsevier.
9. Nakai S &Modler HW. 2000. *Food Proteins. Processing Applications*. Wiley VCH.
10. Potter, N.N. 1978. Food Science. 3rd Ed. AVI, Westport.
11. Stephen AM. (Ed.). 2006. *Food Polysaccharides and Their Applications*. Marcel Dekker. New York

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR V - SEMESTER IX

GENERIC ELECTIVE (GE)- Technology of Milk and Milk Products

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
GE-Technology of Milk and Milk Products	4	2	0	2	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Master of Food Technology	**Year: Fifth**	**Semester: Ninth**
Food Technology		
Course Code: MFT-906	**Course Title: Technology of Milk and Milk Products**	

Course outcomes:

The student at the completion of the course will be able to:

1. Understand and describe the physic-chemical and functional properties of milk constituents (proteins, lipids, carbohydrates, minerals.
2. Understand and describe the microbiological composition of raw milk and their implications on food safety aspects of milk and dairy products.
3. Understand and describe the physical and technological principles of unit operations in milk processing: separation, standardization, homogenization, pasteurization, UHT, concentration, spray drying.
4. Understand and describe the technological sequences associated with manufacturing consumer milk, fermented milk products and cheese.
5. Understand and describe the application of microbial populations (starters) in milk processing

Credits: 4	**GE-12**
Max. Marks: 100	

Unit	Topics	No. of Lectures
I	Sources, and composition of milk, processing of market milk, standardization, toning of milk, homogenization, pasteurization, sterilization, storage, transportation and distribution of milk. Technology of fluid milk: collection, chilling, transportation, cream separation, standardization, pasteurization, sterilization, homogenization, packaging, storage and distribution of fluid milk, flavoured milk, enriched milk	10
II	Milk product processing-cream, butter, condensed milk, evaporated milk, whole and skimmed milk powder	5

III	Instantization of milk and milk products, ice cream, khoa, channa, paneer, milk sweets. Judging and grading of milk and its products	5
IV	Technology of fermented milk: principles and practices of manufacture, packaging, storage and marketing of dahi, cultured butter milk, acidophilus milk, yoghurt, shrikhand. Technology of cheese: standards of manufacture of hard, semi hard, soft and processed cheeses. Storage and marketing of cheese. Cheese defects and their control. Dairy equipment and sanitization	10
V	Technology of fat rich dairy products: manufacture, packaging, storage and marketing of butter and cream and butter defects and their control. Technology of frozen milk products: classification, standards manufacture, packaging, storage and marketing. Defects of frozen products and their control. Technology of concentrated, evaporated and dried milk: standards manufacture, packaging. Storage, defects and their control. Technology of Indigenous dairy products – Khoa (manufacture, classification and use) Paneer, Ghee. Technological aspects of casein manufacture; by-products utilization of dairy industry	15
	PRACTICALS	
I	Study on basics of reception of milk at the plant	30
II	platform tests in milk	
III	estimation and fat and SNF in milk	
IV	Operation of LTLT and HTST Pasteurization	
V	Cream separation & standardization of milk	

Suggested Readings:

1. B.L.Herrington .Milk and Milk Processing
2. Considine, D.M. Ed. 1982. Foods and Food Production Encyclopaedia, VNR, NewYork.
3. Dey, S. 1994. Outlines of Dairy Technology. Oxford Univ. Press, New Delhi.
4. Edgar Spreer .Milk and Dairy Technology
5. Fox Cheese – chemistry , physics & microbiology vol. I & II
6. Gregory D.Miller. Handbook of Dairy Foods and Nutrition.
7. MaCrae, R., Robinson, R.K. and Sadler, M.J. Ed. 1993. Encyclopaedia of Food Science, Food Technology and Nutrition Academic Press, London.
8. Robinson, R.K. (2 vol. set). 1986. Modern Dairy Technology Elsevier Applied Science, UK.
9. Rosenthal, I. 1991. Milk and Milk Products. VCH, New York.
10. Su Kumar De.Outlines of dairy technology.
11. Walastra, Geuts, Normen .Dairy Technology.
12. Warner, J.M. 1976. Principles of Dairy Processing. Wiley Eastern Ltd. New Delhi.
13. Yarpar, WJ. and Hall, C.W. 1975. Dairy Technology and Engineering AVI, Westport

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR V - SEMESTER X

DISCIPLINE SPECIFIC COURSE (DSC)- Principles of Food Analysis and Sensory Evaluation

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSC-Principles of Food Analysis and Sensory Evaluation	4	2	0	2	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Master of Food Technology	**Year: Fifth**	**Semester: Tenth**
Food Technology		
Course Code: MFT-1001	**Course Title: Principles of Food Analysis and Sensory Evaluation**	

Course outcomes:

The student at the completion of the course will be able to:

1. Describe human sensory perceptions and their relevance to the evaluation of food and beverage sensory properties
2. Demonstrate knowledge and understanding of sensory evaluation and consumer testing methods and of their underlying principles
3. Design experiments to measure the sensory properties and consumer acceptance of foods, beverages and other consumer products
4. Understand, select and apply basic univariate and multivariate statistical methods to the analysis of sensory and consumer data
5. Research the scientific literature and other relevant media
6. Integrate the necessary sensory and consumer testing steps into the quality assurance, product development and marketing processes following best practices
7. Manage projects in a team environment
8. Write reports and give oral presentations of results of sensory and consumer tests

Credits: 4	**DSC-22**
Max. Marks: 100	

Unit	Topics	No. of Lectures
I	Scope and importance of food evaluation in food industry. Importance of proximate composition analysis. Determination of different constituents in different food sample along with the principle involved in their estimation. Fractionation of ash and their importance in food analysis	8

II	Principles and methods involved in the estimation of calcium, phosphorus and iron in food samples, Principles and procedures involved in estimation of starch and sugars. Principles and procedures involved in estimation of vitamins: Vitamin A, C, Riboflavin and thiamine	10
III	Determination of enzymatic and non-enzymatic browning in food samples. Importance of rheological properties in food. Techniques and principles involved in their estimation	8
IV	Introduction to sensory analysis; general testing conditions, Requirements of sensory laboratory; organizing sensory evaluation programme. Selection of sensory panellists; Factors influencing sensory measurements; Sensory quality parameters -Size and shape, texture, aroma, taste, color and gloss; Detection, threshold and dilution tests	9
V	Different tests for sensory evaluation– discrimination, descriptive, affective; Flavour profile and tests; Ranking tests; Methods of sensory evaluation of different food products. Computer-aided sensory evaluation of food & beverage, statistical analysis of sensory data	10
	PRACTICALS	
I	Selection and training of sensory panel	30
II	Detection and threshold tests	
III	Ranking tests for taste, aroma colour and texture	
IV	Sensory evaluation of various food products using different scales, score cards and tests	
V	Estimation of color and texture	

Suggested Readings:

1. Amerine MA, Pangborn RM & Rossles EB. 1965. *Principles of Sensory Evaluation of Food.* Academic Press.
2. Early R.1995. *Guide to Quality Management Systems for Food Industries*. BlackieAcademic.
3. Jellinek G. 1985. *Sensory Evaluation of Food - Theory and Practice*. Ellis Horwoood.
4. Lawless HT & Klein BP. 1991. *Sensory Science Theory and Applicatons in Foods*. Marcel Dekker.
5. Macrae R, Rolonson Roles & Sadlu MJ.1994. *Encyclopedia of Food Science & Technology & Nutrition.* Vol. XI. Academic Press.
6. Maslowitz H. 2000. *Applied Sensory Analysis of Foods*. Vols. I, II. CRC Press.
7. Piggot JR. 1984. *Sensory Evaluation of Foods*. Elbview Applied Science Publ.
8. Potter NN & Hotchleiss JH. 1997. *Food Science*. 5th ed. CBS.
9. Rai SC & Bhatia VK. 1988. *Sensory Evaluation of Agricultural Products.* Indian Agricultural Statistics Research Institute (ICAR).
10. Stone H & Sidel JL. 1985. *Sensory Evaluation Practices*. Academic Press.
11. Watts CM, Ylimaki CL, Jaffery LE & Elias LG. 1989. *Basic Sensory Methods for Food Evaluation*. Int. Dev. Res. Centre, Canada

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR V - SEMESTER X

DISCIPLINE SPECIFIC ELECTIVE (DSE)- Food Quality Systems and Management

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSE- Food Quality Systems and Management	4	2	0	2	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Master of Food Technology	**Year: Fifth**	**Semester: Tenth**
Food Technology		
Course Code: MFT-1002	**Course Title: Food Quality Systems and Management**	

Course outcomes:

The student at the completion of the course will be able to:

1. Have a thorough knowledge about the applications various analytical and instrumental techniques.
2. Understand various areas of Food Safety & Quality Assurance.
3. Comprehend food quality managements systems.
4. Grasp knowledge of the quality assessments of food products.
5. Grasp the implementation of HACCP.

Credits: 4	**DSE-14**
Max. Marks: 100	

Unit	Topics	No. of Lectures
I	Concept of quality: Quality attributes- physical, chemical, nutritional, microbial, and sensory; their measurement and evaluation; Sensory *vis-àvis* instrumental methods for testing quality	5
II	Concepts of quality management: Objectives, importance and functions of quality control; Quality management systems in India; Sampling procedures and plans; Food Safety and Standards Act, 2006; Domestic regulations; Global Food Safety Initiative	10
III	Various organizations dealing with inspection, traceability and authentication, certification and quality assurance (PFA, FPO, MMPO, MPO, AGMARK, BIS); Labelling issues; International scenario, International food standards	10
IV	Quality assurance, Total Quality Management; GMP/GHP; GLP, GAP; Sanitary and hygienic practices; Quality manuals, documentation and audits; Indian &	10

	International quality systems and standards; Laboratory quality procedures and assessment of laboratory performance; Applications in different food industries; Food adulteration and food safety. IPR and Patent	
V	Sampling and specification of raw materials and finished products, Concept of Codex Alimentarius/ /USFDA/ISO 9000 series, rules and regulations for waste disposals. Food adulteration and food safety, HACCP	10
	PRACTICALS	
I	Testing and evaluation of quality attributes of raw and processed foods	30
II	Detection and estimation of food additives and adulterants	
III	Quality assurance procedure, GMP, GAP documentation	
IV	Preparation of quality policy & documentation	
V	Preparation of HACCP chart	

Suggested Readings:

1. Amerine MA *et al* 1965. *Principles of Sensory Evaluation of Food*. Academic Press.
2. Early R.1995. *Guide to Quality Management Systems for Food Industries*. BlackieAcademic.
3. Furia TE.1980. *Regulatory Status of Direct Food Additives*. CRCPress.
4. Jellinek G. 1985. *Sensory Evaluation of Food - Theory and Practice*. Ellis Horwoood.
5. Krammer A & Twigg BA.1973. *Quality Control in Food Industry*. Vol. I, II. AVI Publ.
6. Macrae R. *et al*.1994. *Encyclopedia of Food Science & Technology & Nutrition*. Vol. XVI. Academic Press.
7. Piggot JR. 1984. *Sensory Evaluation of Foods*. Elbview Applied Science.
8. Ranganna S. 2001. *Handbook of Analysis and Quality Control for Fruit and Vegetable Products*. 2nd Ed. Tata-McGraw-Hill.

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR V - SEMESTER X

DISCIPLINE SPECIFIC ELECTIVE (DSE)- Enzymes in Food Processing

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSE-Enzymes in Food Processing	4	2	0	2	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Master of Food Technology	**Year: Fifth**	**Semester: Tenth**
Food Technology		
Course Code: MFT-1003	**Course Title: Enzymes in Food Processing**	

Course outcomes:

The student at the completion of the course will be able to:

1. Assemble knowledge of the chemistry of proteins, their structure and general behavior to environmental conditions such as pH, temperature and solvents. Types of bonds important in maintenance of structure of proteins.
2. Evaluate differences among proteins and how these differences can be used in their separation.
3. Understand how protein concentration is measured, and how to identify which method is best for the purpose.
4. Explain the nature of the active site of an enzyme including "lock and key" analogy and concept of "induced fit."
5. Recognize factors that are important in accounting for the efficiency of enzyme catalysis. Be able to distinguish intra- vs intermolecular reactions, general acid-general base vs specific acid concept, nucleophilic and electrophilic catalysis. Generalize these concepts to other enzymes.
6. Summarize what is meant by zero order and first order reactions with respect to substrate concentration in enzymology.

Credits: 4	**DSE-15**
Max. Marks: 100	

Unit	Topics	No. of Lectures
I	Enzymes– classification, properties, characterization, kinetics and immobilization, fermentative production of enzymes (amylases, proteases, cellulases, pectinases, xylanases, lipases) used in food industry	5
II	Enzymes for production of protein hydrolysates and bioacti1ve peptides, maltodextrins and corn syrup solids (liquefaction, saccharification, dextrinization, isomerization for production of high fructose-corn-syrup), fructose and fructo-oligosaccharides	10

III	Role of enzymes in cheese making and whey processing, fruit juices (cell wall degrading enzymes for liquefaction, clarification, peeling, debittering, decolourization of very dark coloured juices such as anthocyanases)	10
IV	Role of enzymes in baking (fungal α-amylase for bread making, maltogenic α-amylases for anti-staling, xylases and pentosanases as dough conditioners, lipases or dough conditioning, oxidases as replacers of chemical oxidants, synergistic effect of enzymes), meat and meat processing (meat tenderization), egg processing	10
V	Enzyme processing for flavours (enzyme-aided extraction of plant materials for production of flavours, production of flavour enhancers such as nucleotides, flavours from hydrolysed vegetable/animal protein), enzymatic approach to tailor- made fats	10
	PRACTICALS	
I	Assay of enzymes for activity, specific activity, kinetics, stability (temperature, pH and storage)	30
II	Extraction and clarification of juices using enzymes	
III	Applications of enzymes in baking, starch and protein hydrolysis	
IV	Applications of enzymes in meat tenderization	
V	Cheese making	

Suggested Readings:

1. FlickingerMC & Drew SW. 1999. *Encyclopedia of Bioprocess Technology*. A Wiley- Inter Science Publ.
2. Kruger JE. *et al*. 1987. *Enzymes and their Role in Cereal Technology*. American Association of Cereal Chemists Inc.
3. Nagodawithana T & Reed G. 1993. *Enzymes in Food Processing*. Academic Press.
4. Tucker GA & Woods LFJ. 1991. *Enzymes in Food Processing*.
5. Whitehurst R & Law B. 2002. *Enzymes in Food Technology*. Blackwell Publ.

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR V - SEMESTER X

DISCIPLINE SPECIFIC ELECTIVE (DSE)- Techniques in Food Analysis

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
DSE-Techniques in Food Analysis	4	2	0	2	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Master of Food Technology	**Year: Fifth**	**Semester: Tenth**
Food Technology		
Course Code: MFT-1004	**Course Title: Techniques in Food Analysis**	

Course outcomes:

The student at the completion of the course will be able to:

1. Develop an understanding and methodologies of instrumental techniques in food analysis
2. Application and operating parameters of a spectrophotometer, AAS, GC, HPLC, NMR, FTIR, GC-MS, LC-MS.

Credits: 4	**DSE-16**
Max. Marks: 100	

Unit	Topics	No. of Lectures
I	Introduction to food regulations and standards; sampling methods; sample preparation for analysis; statistical evaluation of analytical data- official methods of food analysis; moisture in foods- determination by different methods; ash content of foods- wet and dry ashing, microwave ashing methods; significance of sulphated ash, water soluble ash and acid insoluble ash in foods; titratable acidity in foods, determination of dietary fiber and crude fiber	9
II	Determination of total fat in foods by different methods; analysis of oils and fats for physical and chemical parameters, quality standards and adulterants; different methods of determination of protein and amino acids in foods; determination of total carbohydrates, starch, disaccharides and simple sugars in foods	9
III	Spectroscopic techniques: basic principles- spectrophotometric analysis of food additives and food components, IR Spectroscopy in online determination of components in foods; AAS and ICP-AES in mineral elements	9

	and toxic metals analysis; use of fluorimeter in vitamin assay; specific use of tintometer in vanaspati analysis	
IV	Chromatographic techniques: basic principles and types of- paper chromatography, thin layer chromatography, column chromatography, ion exchange chromatography, HPTLC, HPLC, UHPLC, GC, GC-MS; types of detectors; uses and applications of chromatographic techniques	9
V	Basic principles and application of electrophoresis in food analysis; refractive indices of oils and fats; total soluble solids in fruit juice and honey; specific rotation of sugars, estimation of simple sugars and disaccharides by polarimeter; immunoassay techniques and its applications in foods	9
	PRACTICALS	
I	Estimation of Reducing and Non-Reducing Sugars in Honey by Lane Eynon Method	30
II	Estimation of Proteins in food using the Biuret Method	
III	Saponification, Iodine, and Acid Value of Edible Oils – fresh, stale and packed foods	
IV	Estimation of Lactose in Milk	
V	Estimation of Ascorbic Acid in Foods	

Suggested Readings:

1. Fung, D.Y.C. and Matthews, R. (1991): Instrumental Methods for Quality Assurance in Foods, Marcel Dekker, Inc. New York.
2. Skoog, D.A., Holler, F.H. and Nieman (1998): Principles of Instrumental Analysis Saunders College Publishing, Philadelphia. Department of Food Science and Technology 14
3. Gruenwedel, D.W.; Whitaker, J.R. (editors) (1984): Food Analysis Principles and techniques, Volumes 1 to 8, Marcel Dekker, Inc., New York.
4. Herschdoerfer, S.M. (ed) (1968 – 1987): Quality Control in the Food Industry, Vols. 1 to 4, Academic Press, London.
5. Pomeranz, Y. and MeLoan, C.E. (1996): Food Analysis: Theory and Practice; 3rd Edition, CBS Publishers and Distributors, New Delhi.
6. Wilson and John Walker ,Principles and Techniques of Biochemistry and Molecular Biology (2010), Keith Wilson and John Walker, Cambridge University Press

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR V - SEMESTER X

GENERIC ELECTIVE (GE)- Technology of Malting and Brewing

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
GE-Technology of Malting and Brewing	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Master of Food Technology	**Year: Fifth**	**Semester: Tenth**
Food Technology		
Course Code: MFT-1005	**Course Title: Technology of Malting and Brewing**	

Course outcomes:

The student at the completion of the course will be able to:

1. Acquire the knowledge and understand the science and technology of the brewing ofbeer
2. Acquire good knowledge of what constitutes beer quality, and why and how this is achieved by contemporary methods ofmanufacture

Credits: 4	**GE-13**
Max. Marks: 100	

Unit	Topics	No. of Lectures
I	Barley production and trade, composition and structure of barley; preparation and storage of barley for malting; suitability of different cereals for malting; characteristics of barley for malting and brewing; steeping techniques; germination of barley; morphological, enzymatic and chemical changes during malting; role of gibberellic acid in malting; techniques of malting; composition of malt; malting of wheat and other cereals	15
II	Kilning; changes during kilning; kilning techniques**;** quality evaluation of malt; special malts; milling techniques; significance of water quality in brewing process**;** mashing: changes during mashing, methods of mashing; treatment of cereals used as adjucts; properties and complications of using adjuncts of different sources; filtration of wort and sparging	10
III	Spent grain: composition and uses; techniques of wort boiling; changes during boiling; selection of hops; acidification of mash; wort cooling;	10

	methods of fermentation; management of primary fermentation; lagering: objectives and techniques	
IV	Beer- composition, filtration, racking, pasteurization and defects; application of malt in food- baking, infant food etc.; quality control–malt specifications and test procedures; brewing operations; constituents of hops; brewing adjuncts; bear quality– flavor, taste, alcohol content, chemical constituent etc.; head retention–factors affecting head retention; haze formation	10
	PRACTICALS	
I	Isolation of yeast from natural sources	30
II	Isolation of lactic acid bacteria from different sources	
III	Determination of water quality parameters for beverages	
IV	Evaluation of quality testing parameters of wines	
V	Determination of brewing quality parameters of tea and coffee	

Suggested Readings:

1. Malting and Brewing Science Vol. I: Lewis and Young(1981)
2. Malting and Brewing Science Vol. II: Lewis and Young(1982

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

Department of Food Technology

YEAR V - SEMESTER X

GENERIC ELECTIVE (GE)- Snack Food Technology

No. of Hours- 45+30

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
GE- Snack Food Technology	4	3	0	1	Passed 10+2 with science (ZBC, PCM, AGRICULTURE)	NIL

Programme/Class: Master of Food Technology	**Year: Fifth**	**Semester: Tenth**
Food Technology		
Course Code: MFT-1006	**Course Title: Snack Food Technology**	

Course outcomes:

The student at the completion of the course will be able to:

1. Know the technologies of grained- based snacks and traditional Indian snacks
2. Know the technologies related to fruit and vegetable related snacks like chips, wafers, salted, spiced and sweetened snacks
3. Learn the formulation of extruded snack foods, their colouring, flavouring and packaging
4. Gain knowledge about the equipment related to snack technology

Credits: 4	**GE-14**
Max. Marks: 100	

Unit	Topics	No. of Lectures
I	Grain-based snacks- technology for whole grains snacks – roasted, toasted, puffed, popped, flaked; technology for coated grain snacks – salted, spiced, sweetened	10
II	Technology for batter-based and dough-based products; technology for formulated products – chips, wafers, papads, instant premixes	15
III	Horticulture produce-based snacks- technology for fruit-based snacks; technology for vegetable-based snacks; technology for coated nuts	10
IV	Extruded snacks- formulation and processing technology, colouring and flavouring, packaging, machinery and equipment, use and care	10
	PRACTICALS	
I	Preparation of Snack Foods based on Cereals	30
II	Preparation of Snack Foods based on Pulses	
III	Preparation of Snack Foods based on Nuts	
IV	Development of Instant Food Pre-Mixes	
V	Determination of Shelf-Life and Quality Characteristics of Snack Foods	

Suggested Readings:

1. Edmund WL. Snack Foods Processing. AVI Publ.
2. Frame ND. 1994. The Technology of Extrusion Cooking. Blackie Academic.
3. Gordon BR. 1997. Snack Food.AVI Publ
4. Samuel AM. 1976. Snack Food Technology. AVI Publ

Suggested Continuous Evaluation Methods:

Seminar/ Presentation on any topic of the above syllabus• Test with multiple choice questions/ short and long answer questions• Attendance

****AEC, SEC, and VAC courses are taken/ chosen from the pool of AEC, SEC, and VAC courses offered by University.**

POINTS RAISED BY SECRETARY,
HIGHER EDUCATION,
GOVERNMENT OF UTTARAKHAND

- The Secretary, Higher Education, Government of Uttarakhand opined on the need for promoting entrepreneurship in the colleges, besides fostering collaborations at institutional, national, and international levels to enhance higher education in food processing and food technology.
- The institutes/universities should also focus on industry-relevant research, technology commercialization, and fostering entrepreneurship. His focus was to promote cutting-edge research, and establish robust industry linkages.
- He was of the view that an industrial visit can enhance learning by bridging the gap between theory and practice, providing real-world exposure to industry processes, and fostering a deeper understanding of food safety, quality assurance, and the application of theoretical concepts.
- Secretary, Higher Education, Government of Uttarakhand emphasized on setting minimum standards for developing food technology labs.

  To summarize in a nutshell, the following points were raised by Secretary, Higher Education, Government of Uttarakhand:

  1. Setting minimum standards, with reference to equipment for food technology labs.
  2. Industrial visits of students to food technology industries.

1. Minimum Standards for setting up food tech labs (as per the recommendations of ICAR)

A basic food technology equipment list includes instruments for measuring physical and chemical properties, as well as equipment for food preparation and processing. Essential items include balances/scales, pH meters, moisture analyzers, incubators, autoclaves, and equipment for chemical analysis like spectrophotometers, chromatography systems, and mass spectrometers. (Details of equipment are in Annexure 1).

I. Measurement and Analysis Equipment:

Balances and Scales: For precise weight measurement of ingredients and samples.
pH Meters: The pH level of food products affects their taste, texture, and safety. pH meters help in measuring the acidity or alkalinity of food products. They are crucial in processes like fermentation and ensuring the stability of preservatives.
Moisture Analyzers: Determine the water content of food, affecting shelf life and texture.
Spectrophotometers: Analyze chemical composition by measuring light absorption.
Chromatography Systems (Gas Chromatography (GC), High-Performance Liquid Chromatography (HPLC)): Separate and analyze various compounds in food.
Gas Chromatography (GC): GC is used to separate and analyze compounds that can be vaporized. It's particularly useful in detecting flavors, fragrances, and contaminants in food products.
High-Performance Liquid Chromatography (HPLC): HPLC is essential for identifying, quantifying, and purifying components in liquid samples. It's widely used in analyzing vitamins, preservatives, and additives in food.
Mass Spectrometry (MS): Identifies and quantifies the components in food samples. When combined with GC or HPLC, it provides detailed analysis of complex mixtures, aiding in food safety and quality control.
Spectroscopy Equipment
UV-Visible Spectrophotometers
These instruments measure the absorbance of UV and visible light by a sample. They are used to determine the concentration of substances, such as vitamins and colorants, in food products.
Infrared Spectrometers
Infrared spectrometers analyze the infrared light absorbed by a sample, providing information about its molecular composition. This is useful in identifying and quantifying different components in food.
Water Activity Meters: Measures the free water available in food, affecting spoilage.
Microscopes: For microscopic analysis of food samples and microorganisms.
ELISA Kits: For detecting specific proteins or antibodies in food samples.

II. Food Preparation and Processing Equipment:

Ovens, Grills, and Ventilation: Essential for cooking and processing food.
Freezers and Refrigerators: Maintain food safety by keeping temperatures below certain levels.
Food Processors, Blenders, Mixers: For preparing food ingredients.
Sinks: For washing and sanitation.
Water Tanks: For storing clean water.
Pots and Pans: Basic equipment for cooking.

Knives and Cutting Boards: Essential for food preparation.
Storage Containers and Shelving: For organized food storage.

III. Food Microbiology Equipment

Microscopes: For visual analysis of microorganisms.
Laminar Flow Cabinets: Provide a sterile environment for preparing media and cultures.
Autoclaves: Sterilize food samples, microbiological equipment and media using high pressure and steam.
Incubators: Maintain controlled temperature environment for culturing microorganisms or performing other incubation processes.
Water Baths: Used for maintaining consistent temperatures during experiments.
Centrifuges: Separate components in food samples by density. Also used for separating cells and debris in microbiological samples.
Media preparation equipment: Including hot plates, water distillers, and analytical balances.
Colony Counters: Colony counters are used to count the number of bacterial colonies on an agar plate. This helps in quantifying microbial load in food samples, which is vital for safety assessments.

IV. Texture Analysis Equipment

Texture Analyzers
Texture analyzers measure the physical properties of food, such as hardness, chewiness, and elasticity. This helps in developing products with the desired texture and consistency.
Rheometers
Rheometers assess the flow and deformation of food materials. They are essential in understanding the viscosity and rheological properties, which influence processing and quality.

V. Quality Control Equipment

Colorimeters: Colorimeters measure the color of food products, which can indicate quality and consistency. They are used in quality control to ensure that products meet visual standards.
Refractometers: Refractometers measure the refractive index of a sample, which correlates with its concentration. They are commonly used to determine sugar content in beverages and fruits.
Viscometers: Viscometers measure the viscosity of liquids, which affects the texture and mouthfeel of food products. They are used to ensure that products have the right consistency.

VI. Sample Preparation Equipment

Homogenizers: Homogenizers blend and emulsify samples to create uniform mixtures. This is important for consistent sample preparation and analysis.
Centrifuges: Centrifuges separate components based on density by spinning samples at high speeds. They are used in sample preparation to isolate specific components for further analysis.
Blenders and Mixers: Blenders and mixers are used to prepare food samples by thoroughly mixing ingredients. This ensures that samples are representative and uniform for testing.

VII. Packaging and Shelf-Life Testing Equipment

Vacuum Sealers: Vacuum sealers remove air from packaging to extend the shelf life of food products. They are used to test the effectiveness of packaging materials and methods.

Shelf-Life Chambers: Shelf-life chambers simulate various environmental conditions to test the stability and longevity of food products. This helps in determining the shelf-life and optimal storage conditions.

VIII. Safety and Hygiene Equipment

Fume Hoods: Fume hoods protect users from hazardous fumes and vapors during experiments. They ensure a safe working environment in the laboratory.

Safety Cabinets: Safety cabinets store chemicals and hazardous materials securely. They prevent accidents and contamination in the lab.

Personal Protective Equipment (PPE): PPE, including gloves, lab coats, and goggles, protect food technologists from exposure to harmful substances. Safety is paramount in any laboratory setting.

2. Industrial visit and in-plant training duration details:

2nd Semester	4th Semester	6th Semester	8th Semester	10th Semester
Visit to industry (Dairy / Biscuit/ Confectionary/ Beverage Industry) 15 days in-plant training.	**Visit to industry (Dairy / Biscuit/ Confectionary/ Beverage Industry) 30 days in-plant training.**	**Visit to industry (Dairy / Biscuit/ Confectionary/ Beverage Industry) 30 days in-plant training.**	**Visit to industry (Dairy / Biscuit/ Confectionary/ Beverage Industry) 30 days in-plant training.**	**Visit to industry (Dairy / Biscuit/ Confectionary/ Beverage Industry) 30 days in-plant training.**

Annexure 1

List of equipment in Department of Food Technology

S.No.	Name of equipment
1	Fruit/ vegetable Blancher
2	Exhaust Box
3	Retort system
4	Kettle (steam jacketed)
5	Steam generator
6	Fruit/vegetable peelers
7	Homogenizer
8	Mixers
9	Fruit cutting/ slicing machine
10	Spice mixing machine
11	Dough Mixer
12	Dough divider
13	Table Sheeter
14	Dough moulds
15	Baking oven
16	Bread slicer
17	Pasta making machine
18	Laboratory ovens
19	Cooling chamber
20	Pouch sealing machine
21	Lab Tray dryer
22	Lab Cabinet dryer
23	Grain dryer
24	High precision digital balance
25	Munshell colour chart
26	Hunter colour lab meter
27	Disc colour meter
28	Viscometer
29	Shrink wrap packaging machine
30	Heat sealing machine
31	Fruit/ vegetable sorter
32	Fruit/ vegetable Grader
33	Vernier callipers of different sizes
34	Colour dictionary chart for grain
35	Hardness tester
36	Soxhlet apparatus
37	Kjeldhal apparatus
38	Muffle furnace
39	pH meter
40	Refractometers for different ranges
41	Incubator
42	Laboratory modern rice mill
43	Laboratory modern dhal mill
44	Lab oil expeller

45	Sieve analysis set up
46	Modem wheat milling machine
47	Extruder
48	Conching unit
49	Cocoa roaster
50	Chocolate moulder
51	Rolling machine
52	S.S. utensils (pan/ fry pan/Kadhai/ spoon plates/ knife etc.)
53	Basket press
54	Screw type juice extractor
55	Centrifugal Juice extractor
56	Hydraulic press
57	Fruit Pulper/ Crusher
58	Juice dispensing machine
59	Bottle filling machine
60	Bottle washing machine
61	Crown corking machine
62	Texture analyzer
63	Milk Analyzer
64	Gerber butyrometer
65	Cream separator
66	Density meter
67	TDS meter
68	Water baths
69	Autoclave
70	BOD incubators
71	Puncture resistance tester
72	Bursting strength tester
73	Tearing strength tester
74	Tensile testing machine
75	Moisture meters
76	pH meter
77	Protein digestion unit
78	Protein distillation unit
79	Soxhlet unit
80	Desiccators
81	Digital moisture meter
82	Digital pH meter
83	Muffle Furnace