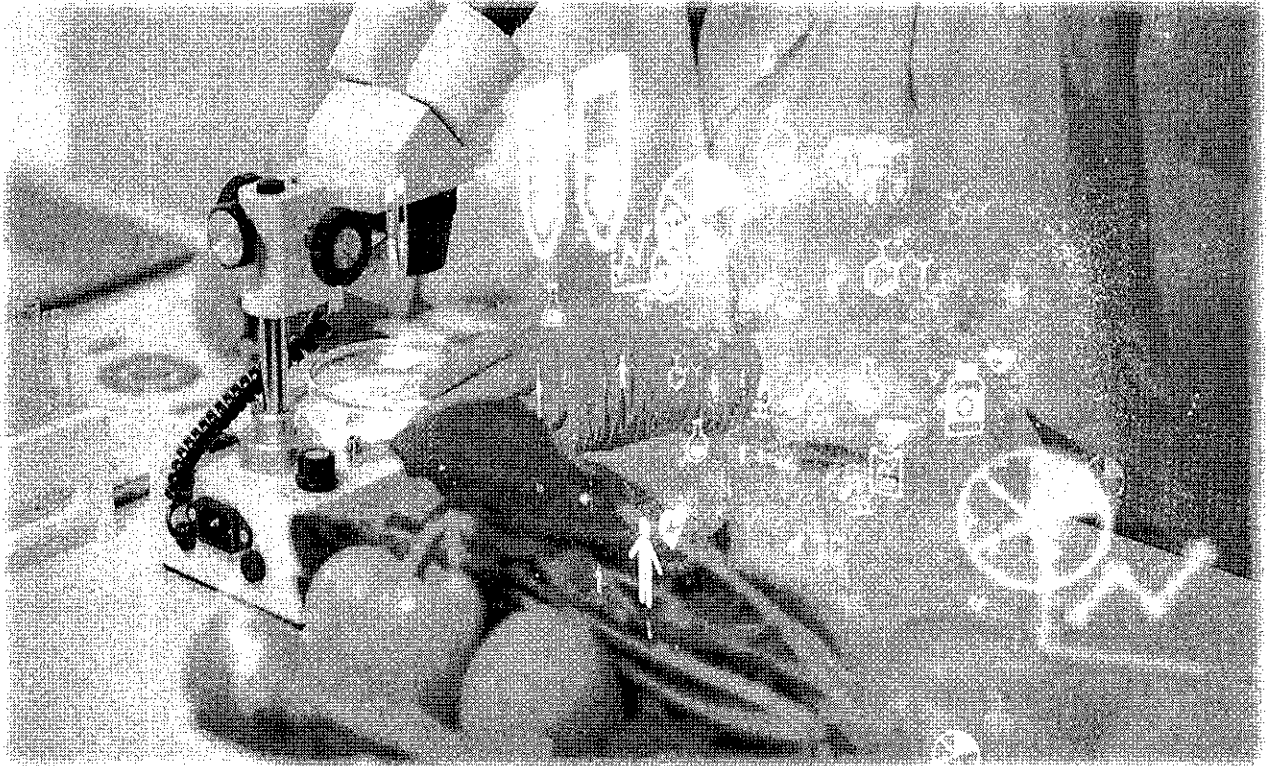


DAVANGERE UNIVERSITY

Department of Studies in Food Technology
Shivangotri, Davanagere-577007

**Curriculum Framework for Undergraduate Programme in Colleges
under Davangere University**




**5th and 6th Semester Model Syllabus
for
BSc in
Food Technology**

**Department of Studies in Food Technology
Shivangotri, Davanagere University, Davanagere-577007**

Board of Studies in Food Technology Committee Members

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6	Dr. Veeresh S J Assistant Professor, Davanagere University, Davanagere	Member

Model Curriculum
of
BSc
in
Food Technology
5th Semester


Dr. RAMALINGAPPA
Professor and Dean,
Faculty of Science & Technology
Davangere University Shivangangothri
DAVANGERE - 577 007


Registrar
Davangere University
Shivangangothri, Davangere.

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Course Code	DSC FT-C22	Contact Hours	60 Hours
Formative Assessment	25 Marks	Summative Assessment	25 Marks
Practical Content			
1: Familiarization with Spice and Plantation Crop Processing Equipment			
Introduction to various processing equipment			
Demonstration of cleaning, grading, sorting, and drying equipment			
Hands-on practice in operating and maintaining processing equipment			
2: Cleaning and Grading Techniques			
Identification and removal of foreign matter and impurities			
Cleaning and grading			
3: Drying Methods and Techniques			
Demonstration and Hands-on experience of different drying methods (traditional and modern methods),			
Monitoring and controlling drying parameters			
4: Grinding and Milling Operations			
Demonstration and Hands-on experience of different grinding and milling methods (traditional and modern methods),			
Introduction to grinding and milling equipment			
Hands-on practice in grinding and milling of spices and plantation crops			
Evaluation of particle size distribution and quality of ground materials			
5: Extraction of Oils			
Extraction techniques for oils and essential oils			
Hands-on extraction using steam distillation, solvent extraction, or cold pressing methods			
Analysis of extracted oils for quality and yield			
6: Product Development			
Formulation of recipes and standardization of product parameters			
Evaluation of sensory attributes, Packaging and Labelling			
7: Quality Assurance			
Quality testing of processed products – free fatty acids, pH, peroxide values and Iodine number			

8: Market Survey and Marketing Strategies

Conducting a market survey to understand consumer preferences and trends.

Analysing market opportunities and competition

9: Field Visit

Visit to processing units to observe industrial-scale processing techniques.

Interaction with industry professionals to understand real-world challenges and practices.

Documentation and reporting of the field visit observations and insights

Pedagogy:

Formative Assessment for Practical	
Assessment Occasion/ type	Marks
Test 1	05
Test 2	05
Practical Record	10
Participation and Involvement	05
Total	25 Marks
<i>Formative Assessments are compulsory</i>	

Model Curriculum

Program Name	BSc in Food Technology	Semester	Fifth Semester
Course Title	Processing of Animal products (Theory)		
Course Code:	DSC FT-C23	No. of Credits	4
Contact hours	60 Hours	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

<p>Course Outcomes (COs): After the successful completion of the course, the student will be able to:</p> <p>CO1. Understanding basic theoretical knowledge and practical skills of meat science,</p> <p>CO2. Acquire knowledge of the chemical composition and physico-chemical properties of meat of different species,</p> <p>CO3. Gain knowledge of equipment and various technological procedures of meat processing,</p> <p>CO4. Get the latest knowledge of meat science.</p>	
Theory Contents	60 Hrs
Unit I: IMPORTANCE OF MEAT PRODUCTS	15 Hrs
Introduction & Importance of meat products in India, Chemical Composition, Nutritional value & microscopic structure of meat, Pre-slaughter inspection of animal, Transportation, feeding of animal before slaughtering.	
Unit II: STUNNING & SLAUGHTER OPERATIONS	15 Hrs
Slaughtering of animal, Bones & cuts of Carcass, Quality and grading of meat, Post-mortem inspections Meat tenderization, aging curing & rigour mortis, preservation of meat & Poultry products.	
Unit III: MEAT, EGG PROCESSING & PACKAGING	16 Hrs
Organic meat food products, Modern processing technologies of meat and meat products. Packaging of meat and meat products. Meat processing facilities design, Nutritive value, preservation, packaging of egg and egg products.	
Unit IV: REGULATIONS OF MEAT	14 Hrs
Laws governing national/international trade in meat and meat products, Quality criteria, Meat processing operations and hygiene of meat production and processing (GHP, GMP and CCP), Meat plant sanitation & safety.	

Pedagogy:

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	40 Marks
<i>Formative Assessments are compulsory</i>	

References	
1	"Food Processing Technology: Principles and Practice" by P.J. Fellows, Publisher: Woodhead Publishing, Year: 2016.
2	"Food Processing: Principles and Applications" by Stephanie Clark and Stephanie Jung, Publisher: Wiley-Blackwell, Year: 2014.
3	"Food Processing Handbook" by James G. Brennan, Publisher: Wiley-VCH, Year: 2011.
4	"Food Processing Technology: Principles and Practice" by Richard Jowitt, Publisher: CRC Press, Year: 2018
5	"Food Processing: Principles and Applications" by Hosahalli S. Ramaswamy and others, Publisher: CRC Press, Year: 2014.

Course Title	Processing of Animal products (Practical)		Practical Credits	2
Course Code	DSC FT-C24	Contact Hours	60 Hours	
Formative Assessment	25 Marks	Summative Assessment	25 Marks	
Practical Content				
<ol style="list-style-type: none"> 1. Chilling/freezing of meat, meat products. 2. Determination of pH of meat and meat products 3. Slaughtering of meat 4. Identification of meat cuts. 5. Identification of physical characteristics of meat 6. Determination of MSC of meat 7. Ageing of meat preservation and packaging of meat food and their products. 				

8. Determination of microbial loads in various animal food products
9. Estimation of deteriorative changes in meat and meat products.
10. Preparation of ready-to-eat meat/poultry products.
11. Evaluation of Egg quality.

Pedagogy:

Formative Assessment for Practical	
Assessment Occasion/ type	Marks
Test 1	05
Test 2	05
Practical Record	10
Participation and Involvement	05
Total	25 Marks
<i>Formative Assessments are compulsory</i>	

Model Curriculum

Program Name	BSc in Food Technology	Semester	Fifth Semester
Course Title	Extrusion Technology (Theory)		
Course Code:	DSC FT-C25	No. of Credits	4
Contact hours	60 Hours	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

<p>Course Outcomes (COs): After the successful completion of the course, the student will be able to:</p> <p>CO1. Understanding fundamentals, design considerations, processing of different extruded products and selection of food extrusion equipments.</p> <p>CO2. Understanding suitability of raw materials, preconditioning, process variables and extruder types for extrusion and its impact on extrusion process, rheological behaviour, and product quality.</p> <p>CO3. Understanding chemical and nutritional changes occurring in extrusion process and packaging requirement of extruded products.</p> <p>CO4. . Knowing recent trends and future aspects of food extrusion.</p>	
Theory Contents	60 Hrs
Unit I - FOOD EXTRUSION	15 Hrs
<p>Definition, introduction to extruders, principles and types, Uses of extruders in the food industry, Pre-conditioning of raw materials used in extrusion process, Extruder Selection, Design, and Operation for Different Food Applications</p> <p>Recent Advances in extrusion technology: Carbon dioxide or Nitrogen assisted extrusion technology, Extrusion in confectionary technology, Non-thermal Extrusion of Protein Products</p>	
Unit II - SCREW EXTRUDER	15 Hrs
<p>Single screw extruder: working Principle, Net Flow, Operations, manufacturing of pasta, Macaroni, Spaghetti and vermicelli.</p> <p>Twin screw extruder: Counter rotating and co-rotating twin screw extruder, Process characteristics of the twin screw extruder, Rheological Properties of Materials During the Extrusion Process, advantages and disadvantages of Twin Screw Extruder</p>	

Unit III - EXTRUSION FOOD PRODUCTS	15 Hrs
Effect of extrusion on food products: Chemical and nutritional changes in food during extrusion, factors affecting extrusion, Net Flow, Packaging materials for extruded product	
Breakfast cereals by extrusion technology: Classification of Breakfast cereals: Raw materials, process and quality testing for Ready to eat breakfast cereals.	
Unit IV - EXTRUSION PROCESS	15 Hrs
Material characteristics and selection criteria, Types of Extrusion process: Dry and Wet, Melting process, Equation of output, Process variables.	
Start-up and Shut-down of extruder, Post extrusion techniques, Trouble shooting of Manufacturing Process, Applications – Products of Extrusions.	

Pedagogy:

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	40 Marks
<i>Formative Assessments are compulsory</i>	

References	
1	Extruded foods by S. Matza Publisher Springer
2	Technology of Extrusion Cooking by N.D. Frame Publisher Springer
3	Extruders in Food Application by Riaz M.N. Publisher CRC Press
4	Extrusion of Foods by J.M. Harper Publisher CRC Press
5	Advances in Food Extrusion Technology by Maskan and Altan Publisher CRC Press

Model Curriculum

Program Name	BSc in Food Technology	Semester	Fifth Semester
Course Title	Functional Properties of Foods (Theory)		
Course Code:	DSE FT-E1.1	No. of Credits	3
Contact hours	45Hours	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

<p>Course Outcomes (COs): After the successful completion of the course, the student will be able to:</p> <p>CO1. To know the functional aspects of food components & their role in food processing</p> <p>CO2. To understand the Physico-chemical properties of food and to familiarize the students with changes occurring in various foodstuffs as a result of processing.</p> <p>CO3. Discuss major chemical reactions that occur during food preparation and storage and to identify and apply food principles to food and nutrition systems in end use quality</p>	
Theory Contents	45 Hrs
Unit 1:	15 hrs
<p>Physico-chemical properties of foods- Organic food components, colloids, osmotic pressure, food dispersions (sols, gels, emulsion, foam), pH</p> <p>Role of water in foods, free and bound water, functional properties, water activity and intermediate moisture foods</p>	
Unit 2:	15 hrs
<p>Carbohydrates: Starch, cellulose, hemicelluloses, hydrocolloids and gums: occurrence, functions in food systems, rheological properties, gelatinization, retrogradation and modified starches</p> <p>Browning in foods: Enzymatic and non-enzymatic- mechanism, methods of prevention and health effects in brief</p>	
Unit 3:	15 hrs
<p>Functional properties of proteins, modified proteins, application in product formulation</p> <p>Functional Properties of Lipids (Fats and Oil)</p>	

Pedagogy:

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	40 Marks
<i>Formative Assessments are compulsory</i>	

References	
1	"Functional Foods: Concept to Product" by G. Mazza and M. D. Oomah (CRC Press, 2000)
2	"Food Processing Handbook" by J. G. Brennan (Wiley-VCH, 2006)
3	"Functional Foods: Biochemical and Processing Aspects" by J. Shi and D. W. T. Griffiths (CRC Press, 2002)
4	"Functional Foods: The Connection Between Nutrition, Health, and Food Science" by I. G. Tucker and M. J. Eskin (Springer, 2014)
5	"Functional Foods and Nutraceuticals" by I. Goldberg (Academic Press, 2012)
6	"Functional Food Ingredients and Nutraceuticals: Processing Technologies" by J. Shi (CRC Press, 2007)
7	"Handbook of Food Science, Technology, and Engineering" by Y. H. Hui et al. (CRC Press, 2005)
8	"Functional Food Ingredients and Nutraceuticals: Processing Technologies" by J. Shi (CRC Press, 2007)
9	"Functional Foods: Principles and Technology" by C. M. D. Man (Woodhead Publishing, 2009)
10	"Functional Foods and Biotechnology" by M. Saarela (CRC Press, 2018)
11	"Functional Foods, Nutraceuticals, and Natural Products: Concepts and Applications" by D. R. Prakash and G. J. Martin (Wiley, 2018)
12	"Functional Foods, Nutraceuticals, and Natural Products: Research Perspectives" by Y. C. Hung and F. Shetty (Wiley, 2017)

Model Curriculum

Program Name	BSc in Food Technology	Semester	Fifth Semester
Course Title	Food Chemistry (Theory)		
Course Code:	DSE FT-E1.2	No. of Credits	3
Contact hours	45 Hours	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

- CO1. Understand the fundamental biochemical principles, structure/function of biomolecules, metabolic pathways and the regulation of biochemical processes.
- CO2. Identification of cell compartments and macromolecules in foods as well as their roles in biochemical process

Theory Contents

45 Hrs

Unit:1-:

15 Hrs

Introduction to Food Chemistry: Structure of Water, Water binding and chemical reactions mediated by water, Determination of moisture in food, weak acids & weak base, pH & buffers. Polarity and hydrogen bond, Noncovalent interactions in biomolecule, Functional groups in biomolecule, Building blocks of biomolecule.

Vitamins & Minerals: Types, chemistry and source.

Pigments: Structure and properties of chlorophyll, anthocyanins, tannin, myoglobin and carotenoids, chemical changes during processing

Unit:2-

15 Hrs

Carbohydrates: Nomenclature and classification, structure, physical and chemical properties of carbohydrates – monosaccharide, disaccharides and polysaccharides (homo and hetero polysaccharides); dietary fiber, changes in carbohydrates during processing, Maillard reactions.

Fats and Lipids:

Structure, classification, physical and chemical properties of fatty acids and glycerides, rancidity, Auto-oxidation, photo oxidation and flavor reversion, Changes in fats & oils during processing.

Unit:3-	15 Hrs
<p>Proteins and Amino acids: Nomenclature, classification, structure, chemistry and properties of amino acids, peptides, proteins. essential and non- essential amino acids. Changes during processing.</p> <p>Food Enzymes: Mechanism of enzyme action, factors affecting enzyme action, browning reactions.</p>	

Pedagogy:

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	40 Marks
<i>Formative Assessments are compulsory</i>	

References	
1	AL Lehninger," Principle of Biochemistry, 7th Edition, W H Freeman & Co. 2017
2	Lubert Stryen, Biochemistry, 6th Edition, W H Freeman & Co. 2006
3	Shubhangini A. Joshi' Nutrition and Dietetics 2nd Edition Tata Mc GrawHill publishing Company Ltd. 2002
4	JH Weil, " General Biochemistry, 6th Edition, New Age International Private Limited 1990
5	Aurand, L. W. and Wood, A. E. (1973). Food Chemistry. The AVI Publishing Co., Connecticut.
7	Belitz, H. D., Grosch, W. and Schieberler, P. (2004). Food Chemistry. Springer, Berlin.
8	DeMan, J. M. (1999). Principles of Food Chemistry. A Chapman and Hall Food Science Book, Aspen Publ., Inc., Gaithersburg, Maryland.
9	Fennema, O. R. (ed). (1996). Food Chemistry. Marcel Dekker, Inc., New York.
10	Gopalan, C., Rama Sastri, B.V., and Balasubramaniam, S.C. (1991). Nutritive value of Indian Foods. National Institute of Nutrition (NIN), Indian Council of Medical Research (ICMR), Hyderabad.
11	Meyer, L. H. (1976). Food Chemistry. Reinhold Publ. Corporation, New York.
12	Potter, N. M. (1995). Food Science. The AVI Publishing Co., Connecticut.

Model Curriculum

Program Name	BSc in Food Technology	Semester	Fifth Semester
Course Title	Food Adulteration and Food Toxicology (Theory)		
Course Code:	DSE FT-E1.3	No. of Credits	3
Contact hours	45 Hours	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

<p>Course Outcomes (COs): After the successful completion of the course, the student will be able to:</p> <p>CO1. Understand the adulteration of common foods and their adverse impact on health</p> <p>CO2. Comprehend certain skills of detecting adulteration of common foods.</p> <p>CO3. Able to extend their knowledge to other kinds of adulteration, detection and remedies.</p> <p>CO4. Know the basic laws and procedures regarding food adulteration and consumer protection.</p> <p>CO5. Understand the concept of food toxicology and toxicants in foods.</p>	
Theory Contents	45 Hrs
Unit 1: Introduction to Food Adulteration	15 hrs
<p>Food adulteration – Introduction of Food adulteration, definition. New adulterants in foods. Common Foods subjected to Adulteration - Adulteration – Definition – Types; Poisonous substances, Foreign matter, Cheap substitutes, Spoiled parts. Adulteration through Food Additives – Intentional and incidental. General Impact on Human Health. Means of Adulteration, Methods of Detection Adulterants in the following Foods; Milk, Oil, Grain, Sugar, Spices and condiments, Processed food, Fruits and vegetables. Additives and Sweetening agents (at least three methods of detection for each food item).</p>	
Unit 2: Laws and Procedures on Adulteration	15 hrs
<p>Highlights of Food Safety and Standards Act 2006 (FSSA) –Food Safety and Standards Authority of India–Rules and Procedures of Local Authorities. Role of voluntary agencies such as, Agmark, I.S.I. Quality control laboratories of companies, Private testing laboratories, Quality control laboratories of consumer co-operatives. Consumer education, Consumer’s problems rights and responsibilities, COPRA 2019 – Offenses and Penalties – Procedures to Complain – Compensation to Victims</p>	

Unit 3: Food Toxicology

15 hrs

Definition, scope and general principles of food toxicology. Classification, Importance of toxicology, naturally occurring toxins in various foods, residual chemical utilized in food production and processing: Pesticides, Heavy metals. dose, the Dose-Response Curve, determination of toxins in food; characteristics of exposure; spectrum of undesirable effects; interaction and tolerance; biotransformation and mechanisms of toxicity; Natural toxins in food: natural toxins of importance in food-toxins of plant and animal origin; microbial toxins (e.g., bacterial toxins, fungal toxins and Algal toxins), natural occurrence, toxicity and significance, determination of toxicants in foods and their management. Toxicological evaluation of food additives; common dietary supplements; relevance of the dose, possible toxic effects; Safety of children consumables; Radioactive contamination of food.

Pedagogy:**Formative Assessment for Theory**

Assessment Occasion/ type	Marks
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	40 Marks
<i>Formative Assessments are compulsory</i>	

References

1	A first course in Food Analysis – A. Y. Sathe, New Age International (P) Ltd., 1999
2	Food Safety, case studies – Ramesh. V. Bhat, NIN, 1992
3	DART- Detect adulteration with rapid test. FASSAI, Imprinting Trust, assuring safe and nutritious food, Ministry of Health and Family Welfare, Government of India.
4	Rapid detection of food adulterants and contaminants Theory and Practice, S. N. Jh, 2016, Kindle Edition
5	Food Safety and Standards Act, 2006. Bare ACT, November 2020, Commercial law publishers.
6	Helferich, W., and Winter, C.K “Food Toxicology”,. CRC Press, LLC. Boca Raton, FL. 2007.
7	Shibamoto, T., and Bjeldanes, L. “Introduction to Food Toxicology”, 2009, 2nd Edition. Elsevier Inc., Burlington, MA.
8	Watson, D.H. “Natural Toxicants in Food”, CRC Press, LLC. Boca Raton, FL 1998.

Model Curriculum

Program Name	BSc in Food Technology	Semester	Fifth Semester
Course Title	Engineering Drawing and Graphics I		
Course Code:	FT-Voc1.1	No. of Credits	3
Contact hours	45 Hours	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

<p>Course Outcomes (COs): After the successful completion of the course, the student will be able to:</p> <p>CO1. Develop clear concept and perception of Lettering, Lines Plane Curves</p> <p>CO2. Develop the skill of expressing Projection of Solids, Points and Plane Surface</p> <p>CO3. Develop clear concept and perception of Isometric and perspective projections.</p>	
Theory Contents	45 Hrs
Unit 1: Theory of Lettering, Lines Plane, Curves	15Hrs
<p>Essentials of lettering, Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola, and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Introduction to orthographic projection - principles-Principal Planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes – Drawing of tangents and normal to the above curves.</p>	
Unit 2: Theory of Projection of Solids, Points and Plane Surface	15Hrs
<p>Introduction to the concepts and description of methods of drawing projections of simple solids like prisms, pyramids, cylinder, cone, and truncated solids when the axis is inclined to one of the principal planes by rotating object method. Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.</p>	
Unit 3: Theory of Isometric and perspective projections	15Hrs
<p>Principles of isometric projection – Introduction to the concepts and description of isometric scale – Isometric projections of simple solids and truncated solids – Prisms, pyramids, cylinders, cones, combination of two solid objects in simple vertical positions – Perspective projection of simple solids, Prisms, pyramids and cylinders by visual ray method.</p>	

Pedagogy:

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	40 Marks
<i>Formative Assessments are compulsory</i>	

References	
1	Engineering Drawing and Graphics Author: K. Venugopal, Publisher: New Age International Publishers, Publication Year: 2014
2	Title: Engineering Drawing, Author: N.D. Bhatt, Publisher: Charotar Publishing House, Publication Year: 2019
3	Title: Engineering Graphics Essentials with AutoCAD 2020 Instruction, Author: Kirstie Plantenberg, Publisher: SDC Publications, Publication Year: 2019
4	Title: Engineering Graphics, Author: Frederick E. Giesecke, Alva Mitchell, Henry C. Spencer, Ivan L. Hill, John T. Dygdon, Publisher: Peachpit Press, Publication Year: 2013
5	Title: Technical Drawing with Engineering Graphics, Author: Frederick E. Giesecke, Alva Mitchell, Henry C. Spencer, Ivan L. Hill, John T. Dygdon, James E. Novak, R. O. Loving, Publisher: Peachpit Press, Publication Year: 2017

Model Curriculum

Program Name	BSc in Food Technology	Semester	Fifth Semester
Course Title	Food Preservation Techniques		
Course Code:	FT-Voc1.2	No. of Credits	3
Contact hours	45 Hours	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

<p>Course Outcomes (COs): After the successful completion of the course, the student will be able to:</p> <p>CO1. To know the importance and need of food preservation.</p> <p>CO2. To familiarize with various type of food preservation techniques, principle behind those techniques and its practical application</p> <p>CO3. To learn about advanced methods which are being used in food processing sector.</p>	
Theory Contents	45 Hrs
Unit 1: Introduction to Preservation	14 Hrs
<p>Classification of food in relation to shelf life: Spoilage in food and its control: spoilage caused by microorganism (bacteria, fungi and virus), enzymes, pests and rodents</p>	
Unit 2: Preservation Technique	15 Hrs
<p>Preservation by</p> <p>Irradiation: technology and application</p> <p>Preservation by Chemicals – Types, safety of preserved foods</p> <p>High pressure processing (in brief)</p> <p>Preservation by dehydration and concentration</p> <ol style="list-style-type: none"> a. methods of drying and concentration b. types of dryers c. Factors affecting drying process 	
Unit 3: Preservation by Heat and Cold Techniques	16 Hrs
<p>Preservation by Heat</p> <ol style="list-style-type: none"> a. Types: Sterilization, Pasteurization, Blanching, Canning b. Mechanism of action 	

- c. methods of application to foods (Equipments)
- d. effect on food and micro-organisms

Cold preservation

- e. Types Refrigeration, Freezing, freeze drying, Refrigerated gas storage
- f. Mechanism of action
- g. methods of application to foods (Equipments)
- h. effect on food and micro-organisms

Pedagogy:

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	40 Marks
<i>Formative Assessments are compulsory</i>	

Model Curriculum

Program Name	BSc in Food Technology	Semester	Fifth Semester
Course Title	Design and Formulation of Foods (Theory)		
Course Code:	FT-Voc1.3	No. of Credits	3
Contact hours	45 Hours	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Pre-requisite(s): Diploma with minimum 45%	
Course Outcomes (COs): After the successful completion of the course, the student will be able to: CO 1. To attain knowledge on different aspects of product development CO 2. To understand the significance of processing technology and consumer behaviour.	
Theory Contents	45 Hrs
Unit 1- Product Development	14 Hrs
<ul style="list-style-type: none"> a. Designing new product – types and drawing forces b. Need for product development c. Stages of product development d. Success in product development e. Consumer research f. Role of sensory evaluation in consumer product acceptance 	
Unit 2 - Consumer Behaviour	15 Hrs
Purchasing foods, Factors influencing product acceptance and purchasing trends. Market place changes in processed foods	
Unit 3 – Special Food Processing Technologies and Novel Food Ingredients	16 Hrs
Membrane technology (reverse osmosis and ultra filtration), agglomeration, agitation, air classification, extrusion, automation in food industries	

Pedagogy:

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Attendance	10
Seminar	10
Debates and Quiz	10
Test	10
Total	40 Marks
<i>Formative Assessments are compulsory</i>	

Model Curriculum
of
BSc
in
Food Technology
6th Semester

Karnataka State Higher Education Council



Government of Karnataka

Model Curriculum

Program Name	BSc in Food Technology	Semester	Sixth Semester
Course Title	Food Processing Equipment Design (Theory)		
Course Code:	DSC FT-C26	No. of Credits (Theory + Practical)	4
Contact hours	60 Hours	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO1. Demonstrate comprehension of principles and design of food processing equipment

CO2. Demonstrate understanding of the role of various techniques in food processing.

CO3. Apply and innovate various techniques of food processing and packaging.

CO4. Design new food processing equipments for applications in food industries

Theory Contents

60 Hrs

Unit-1

15 Hrs

Introduction

Goals and applications of food processing. Food processing equipment. Unit operations in food processing.

Preparation equipment – Wet cleaning, dry cleaning. Equipment for Grading, Sorting and Peeling.

Mechanical processing – Size reduction and enlargement, Homogenization, Mixing - Different types and applications of grinders and mixers used in food industry

Heat processing – Sterilization, roasting, frying, baking, dehydration, evaporation, blanching equipments

Unit -2

15 Hrs

Preservation Equipment

Irradiation – Isotope and electron accelerators

Cooling – mechanical refrigerators, chillers, freezers – still air sharp freezer, blast freezer, fluidized freezer, plate freezer, spiral freezer, cryogenics - Construction of cold storages, types of cold storages, requirement of cold storages, machineries and utensils in cold storages

Concentration – evaporators, condensers, drying – convective dryers – air convection dryer, tray dryer, tunnel dryer, continuous belt dryer, fluidized bed dryer, spray dryer, drum dryer, vacuum dryers, freeze drying, foam mat drying. Dehydration systems, Dehydration system Design.

Unit -3	15 Hrs
Design of food processing plant	
Function, form, hygienic design, sizing, construction requirements, operational characteristics, cost. Design considerations of food plants, Types of layout. Material handling equipment – equipment design and functioning of belt conveyor, screw conveyor, bucket elevator and pneumatic conveyor. Installation of cold storage, evaporators, dryers, freezers, Seaming machine; Sterilizers & other accessories used in canning industries; Design aspects of pasteurizer; homogenizer, evaporators and concentrators.	
Unit - 4	15 Hrs
Packaging	
Packaging Material: Origin, types, chemistry, morphology and physical characteristics, advantages, defects and risks. Forms of packaging-wooden boxes, crates, plywood, wire bound boxes, corrugated and fibre board boxes, bottle, tetra, reportable, flexible and laminated pouches, shrink, vacuum, gas, CAP, MAP, wrappers, textile bags, aseptic etc.	
Packaging machinery: Bottling, canned former, form fill and sealed machine, bags- their manufacturing and closing, vacuum pack units, shrink pack units, tetra pack units, temper evident and child resistant packaging and box coding.	

Pedagogy:

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Attendance	10
Seminar	10
Debates and Quiz	10
Test	10
Total	40 Marks
<i>Formative Assessments are compulsory</i>	

References	
1	Desrosier NW and Desrosier JN. The Technology of Food Preservation, CBS Publication, New Delhi, 2004
2	Paine FA and Paine HY. Handbook of Food Packaging, Thomson Press India Pvt Ltd, New Delhi, 1992
3	Potter NH. Food Science, CBS Publication, New Delhi, 1999
4	Ramaswamy H and Marcott M. Food Processing Principles and Applications, CRC Press, 2006

References	
5	Rao PG. Fundamentals of Food Engineering, PHI Learning Pvt Ltd, New Delhi, 2010
6	Toledo Romeo T. Fundamentals of Food Process Engineering, Aspen Publishers, 2007
7	Rao DG. Fundamentals of food engineering. PHI learning Pvt. Ltd., 2010.
8	Singh RP and Heldman DR. Introduction to food engineering, Academic press 4th Ed., 2009.
9	Rao CG. Essentials of food process engineering, B S publications 2006
10	Fellows P. Food processing technology, 2022

Course Title	Food Processing Equipment Design (Practical)	Practical Credits	2
Course Code	DSC FT-C27	Contact Hours	60 Hours
Formative Assessment	25 Marks	Summative Assessment	25 Marks
Practical Content			
<ol style="list-style-type: none"> 1. Preservation of food by freezing 2. Estimation of drip loss during frozen storage. 3. Comparison of conventional and microwave processing of food 4. Moisture changes during artificial/sun drying of vegetables. 5. Drying of food using Tray/other dryers 6. Minimal processing 7. Testing of packaging material 8. Types of packaging materials and their uses 9. Plant layout design 			

Pedagogy:

Formative Assessment for Practical	
Assessment Occasion/ type	Marks
Record	05
Test	10
Attendance	05
Performance	05
Total	25 Marks
<i>Formative Assessments are compulsory</i>	

Model Curriculum

Program Name	BSc in Food Technology	Semester	Sixth Semester
Course Title	Food Refrigeration and Cold Storage (Theory)		
Course Code:	DSC FT-C28	No. of Credits	4
Contact hours	60 Hours	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Pre-requisite(s):	
<p>Course Outcomes (COs): After the successful completion of the course, the student will be able to:</p> <p>Upon completion of this course, the students will be able to demonstrate the operations in different Refrigeration and cold storage systems and also able to design Refrigeration and cold storage systems.</p>	
Theory Contents	60 Hrs
Unit – 1	15Hrs
<p>Terminology & laws of thermodynamics applied to refrigeration, Principles of refrigeration, Units of refrigeration, Types of refrigeration systems Refrigeration cycles, Vapour compression and vapour absorption cycles, refrigerants, characteristics of different refrigeration's, ozone-depletion potentials, green house potential refrigerants, use of non-polluting refrigerants, net refrigerating effect, ton of refrigeration - Components of a Refrigeration system: compressor, condenser, Evaporator, Expansion valves piping and different controls. Atmospheric air and its properties, Psychometrics. Thermodynamic Cycles- Carnot Cycle for Refrigeration, Reverse Carnot Cycle, Conclusion from Carnot Cycle, Refrigerator and Heat Pump, Coefficient of Performance (COP)</p>	
Unit II -	15Hrs
<p>Cold Storage Design and Construction, Functional Requirements of cold Storage, Condition of Storage for Perishable Products, Calculation of Cooling Load .Small and large commercial storages, Cold Room temperatures, Insulation, Properties of insulating materials, Air diffusion equipment, Doors and other openings. Cold load estimation; prefabricated systems, walk-in coolers and refrigerated container truck: Freezer Storages, Freezer room temperatures, insulation of freezer rooms: Pre-cooling and pre freezing. Cold storage practice, Stacking and handling of material in and around cold rooms, Optimum temperatures of storage for different food materials</p>	

Unit III -	15 Hrs
<p>Controlled atmosphere and modified atmosphere storages: Principles and basics of their construction, Operation and maintenance, cleanliness, defrosting practices, preventive maintenance and safety measures. Cold Chain-What is cold chain? Need for the chain for chilled / frozen food item, various links of the chain; importance of shelf- life; just – in-time deliveries; Temperature limits;-in various countries-Europe, US, Australia etc; Chilling and freezing;- Chilling injury, cook-chilling systems; cold – shortening; PPP and TTT concepts; Temperature monitoring; -Critical temperatures; Temperature -time indicators(TTI); Time - temperature -correlation-the kinetic approach, effective temperature; Transportation regulations; Role of packaging in cold chain- MAS, MAP, CAS, CAP etc; Thaw indicators.</p>	
Unit IV	15 Hrs
<p>Chilling of Foods: Chilling equipment for liquid foods. Secondary refrigerants and direct expansion techniques in chilling. Chilled foods transport and display cabinets – Basics of Chilled foods microbiology – Hygienic design considerations for chillers and chilled storages. Cool storage and their applications. Evaporative cooling and its applications. Freezing of Foods: Freezing equipment, Freezing rates, growth rate of ice crystals size and its effect of texture and quality of foods, Freezer types (blast freezers, contact plate freezers, conveyORIZED quick freezers, Individual quick freezing), Freezing practice as applied to different food products.</p>	

Pedagogy:

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	40 Marks
<i>Formative Assessments are compulsory</i>	

References	
1	Raymond R. Gunther: Refrigeration, Air Conditioning and Cold Storage Chiltan Company, Philadelphia, USA 1957 2. Clive D.J. Dellino: Cold and Chilled Storage Technology Publisher: Kluwer Academic Publisher (1997)
2	S. Domkundwar and Subhash Arora: A Course in Refrigeration and Air Conditioning: Dhanpat Rai and Sons, Publishers, New Delhi (1994)

References	
3	Andrew D Althouse and others: Refrigeration and Air Conditioning Goodheart – Willcox Company Inc. 1982
4	E.R. Hollowell: Cold Storage and Freezer Storage Manual AVI Publishing Co. (1980)
5	Ed. C.P. Mallet: Frozen Food Technology Balckie Academic and Professional, (1993)
6	Aurel Gobaneu and Gabriela Lasesha and others (1976) Cooling Technology in the Food Industry: Abacus Press, Tunbridge Wells, U.K

Course Title	Food Refrigeration and Cold Storage (Practical)	Practical Credits	2
Course Code	DSC FT-C29	Contact Hours	60 Hours
Formative Assessment	25 Marks	Summative Assessment	25 Marks

Practical Content

1. Studies on Parallel Flow and Counter Flow Heat Exchangers
2. Performance Evaluation of Reciprocating Air-Compressor
3. Study on Components and Processes of Vapour Compression and Vapour Absorption Type Refrigeration System
4. Determination of Coefficient of Performance of Vapour Compression and Vapour Absorption Type Refrigeration System
5. Experimentation on Refrigeration Tutor, Humidifier and Heat Pump to Determine Coefficient of Performance and Efficiency
6. Calculation of Cooling Loads
7. Determination of Heat Transfer Coefficient inside a Cold Storage and Refrigerator.
8. Determination of Pull-Down Characteristics of a Cold Storage.
9. Study cold storage for fruit and vegetables, Freezing load and time calculations for food materials, Determination of refrigeration parameters (COP) using refrigeration tutor , Determination of refrigeration parameters (COP) using Air conditioning tutor
10. Estimation of refrigeration requirements in dairy & food plant; Visit to chilling or ice making and cold storage plants.

Pedagogy:

Formative Assessment for Practical	
Assessment Occasion/ type	Marks
Record	05
Test	10
Attendance	05
Performance	05
Total	25 Marks
<i>Formative Assessments are compulsory</i>	

References	
1	C. P. Arora, "Refrigeration and Air-Conditioning", Tata McGraw Hill Book Co. Ltd, New Delhi, India.
2	Manohar Prasa, "Refrigeration and Air-Conditioning", Wiley Eastern Publishers, New Delhi, India.
3	Roy J. Dossat, "Principles of Refrigeration",. Wiley Eastern Publishers, New Delhi, India.
4	McQuiston and W. Tauker, "Heating, Ventilation and Air-Conditioning",Wiley Eastern Publishers, New Delhi, India.

Model Curriculum

Program Name	BSc in Food Technology	Semester	Sixth Semester
Course Title	Entrepreneurship Development (Theory)		
Course Code:	DSC FT-C30	No. of Credits	4
Contact hours	60 Hours	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

<p>Course Outcomes (COs): After the successful completion of the course, the student will be able to:</p> <p>CO1. Understand the concept of Entrepreneurship, its applications and scope.</p> <p>CO2. Know various types of financial institutions that help the business at Central, State and Local Level- Understand Central and State Government policies, Aware of various tax incentives, concessions.</p> <p>CO3. Applies the knowledge for generating a broad idea for a starting an enterprise/start up.</p> <p>CO4. Understand the content for preparing a Project Report for a startup and differentiate between financial, technical analysis and business feasibility.</p>	
Theory Contents	60 Hrs
Unit I - Introduction to Entrepreneurship	16 Hrs
Introduction, Concept of Entrepreneur, Entrepreneurship and Enterprise, Definition of Entrepreneurship, Objectives of Entrepreneurship Development, Phases of Entrepreneurship Development, Role of Entrepreneurship, The Entrepreneurial Mindset, Characteristics of Entrepreneurship, Traits of Entrepreneurship, Introduction to Entrepreneurship Skills	
Unit II - Business Plan	14 Hrs
Definition, importance- Preparing Business Plan - Financial aspects of the Business Plan -Marketing aspects of the Business Plan - Human Resource aspects of the Business Plan - Technical aspects of the Business Plan - Social aspects of the Business Plan - Problems and prospects of Business Plan	
Unit III - Women and Rural Entrepreneurship	16 Hrs
Women Entrepreneurship- Meaning- Need- Scope- Growth of Women Entrepreneurship- Problems faced by Women Entrepreneurs- Special Scheme for Women Entrepreneurs, Role of SHG IN Women Entrepreneurship Development. Rural Entrepreneurship- Meaning- Need- Scope- Problems faced by Rural Entrepreneurs- Entrepreneurship development in rural area- Special Schemes for Rural Entrepreneurs	

Unit IV - Institutions Supporting Entrepreneurship	14 Hrs
A brief overview of financial institutions in India- Central level and state level institutions- SIDBI- NABARD- IDBI- SIDCO- Indian Institute of Entrepreneurship- DIC- Single Window- Latest Industrial Policy of Government of India	

Pedagogy:

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	40 Marks
<i>Formative Assessments are compulsory</i>	

References	
1	Khanna, S. S., Entrepreneurial Development, S. Chand, New Delhi.
2	Hisrich D. Robert, Michael P. Peters, Dean A. Sheperd, Entrepreneurship, McGraw-Hill,6 ed.
3	Zimmerer W. Thomas, Norman M. Scarborough, Essentials of Entrepreneurship and Small Business Management, PHI, 4ed.
4	Holt H. David, Entrepreneurship: New Venture Creation, Prentice- Hall of India, New Delhi, Latest edition.
5	Kuratko, F. Donald, Richard M. Hodgetts, Entrepreneurship: Theory, Process, Practice, Thomson,7ed.
6	Desai, Vasant, Dynamics of Entrepreneurship: New Venture Creation, Prentice-Hall of India, New Delhi, Latest edition.
7	Patel, V. G., The Seven Business Crises and How to Beat Them, Tata McGraw-Hill, New Delhi, 1995.
8	Roberts, Edward B.(ed.), Innovation: Driving Product, Process, and Market Change, San Francisco: Jossey Bass,2002.
9	SIDBI Report on Small Scale Industries Sector, the latest edition.

Model Curriculum

Program Name	BSc in Food Technology	Semester	Sixth Semester
Course Title	Nutraceuticals and Functional Foods (Theory + Practical)		
Course Code:	DSE FT-E2.1	No. of Credits	2+1
Contact hours	45 Hours	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Outcomes (COs): After the successful completion of the course, the student will be able to:	
CO1. Upon completion of this course, the students will be aware about nutraceutical composition, relationship between nutraceutical compounds and health, their health benefits and the development of functional foods	
Theory Contents	45 Hrs
Unit I	15 Hrs
Introduction to nutraceuticals and functional foods. Definition, history and classification. Basis of claims for a compound as a nutraceutical. Regulatory issues for nutraceuticals including FSSAI, CODEX, and USFDA, Labelling issues. Development of functional foods	
Unit II	15 Hrs
Probiotics, prebiotics and Synbiotic-Sources and health benefits Sources and health benefits–Natural pigments like chlorophyll, chlorophyllin, carotenoids, lycopene, anthocyanins, glucosinolates, isoflavonoids, phytosterols, phytoestrogens, polyphenols, omega 3 and omega 6 fatty acids, Conjugated Linoleic Acid, Dietary fiber, antioxidants.	
Unit III	15 Hrs
The role of nutraceuticals and functional foods in disease prevention: Beneficial nutraceuticals and their mechanism of action in Cardio vascular diseases, diabetes, cancer, cholesterol management, obesity, immune enhancement, age related macular degeneration, endurance performance, peri-menopausal syndrome, Parkinson’s disease and Alzheimer’s disease Contra indications and toxicity of nutraceuticals.	
Practical:	
<ol style="list-style-type: none"> 1. Estimation of antioxidant content in kokum 2. Estimation of polyphenols in different tea infusions 3. Extraction of curcumin from turmeric. 	

4. Extraction of lycopene from tomato
5. Estimation of oryzanol from rice bran oil
6. Development of a probiotic yoghurt
7. Development of prebiotic food products.
8. 8) Survey of intake of functional foods by patients suffering from non-communicable diseases

Pedagogy:

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	40 Marks
<i>Formative Assessments are compulsory</i>	

References

1	Robert EC. 2006. Hand book of Nutraceuticals and Functional Foods. 2nd Ed. Wildman.
2	Shi J. (2006). Functional food ingredients and nutraceuticals: Processing technologies. CRC Press
3	Gibson GR & William CM. 2000. Functional Foods – Concept to Products.
4	Goldberg I. (1994). Functional Foods: Designer Foods, Pharma Foods.
5	Losso JN. 2007. Anti-angiogenic functional and medicinal Foods. CRC Press
6	Neeser JR & German BJ. (2004). Bioprocesses and Biotechnology for Nutraceuticals. Chapman & Hall.

Model Curriculum

Program Name	BSc in Food Technology	Semester	Sixth Semester
Course Title	ICT applications in Food Industry (Theory)		
Course Code:	DSE FT-E2.2	No. of Credits	2+1
Contact hours	45 Hours	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

<p>Course Outcomes (COs): After the successful completion of the course, the student will be able to:</p> <p>CO1. Upon completion of this course, the students will be able to apply ICT in Food Processing, Packaging, Marketing and Ensure Food Quality Control</p>	
Theory Contents	45 Hrs
Unit 1: Unit 1: Introduction to ICT and Food Industry	15 Hrs
<p>Definition of Information and Communications Technology</p> <p>Relationship between ICT and food industry – i.e., production, processing, storage, distribution and marketing</p> <p>Components of information and communication technologies- Collection of data, Wireless sensors in data collection, Data processing technologies</p> <p>Significance and current role of ICT in food industry</p> <p>Challenges and Opportunities of ICT in Food Industries</p>	
UNIT 2 - ICT in Food Processing and Packaging	15 Hrs
<p>Computational Modelling of Food Processing Operations</p> <ul style="list-style-type: none"> • Data Warehousing and Data Mining • Analytics in Food Industries • Decision Making using Analytics. • Quality Control using Analytics. • Customer Satisfaction using Analytics. <p>Monitoring and surveillance of food manufacturing process</p> <p>Data Management Techniques in Food Industries</p>	

ICT tools in food industry - RFID tag, bar codes and QR code	
Smart and Intelligent packaging -- (time temperature indicator, oxygen indicator, carbon di oxide indicator, pathogen indicator etc)	
Unit III: ICT Tools for Food Safety and Quality Control	15 Hrs
<p>Overview of emerging ICT trends in the food industry</p> <p>The use of artificial intelligence and machine learning in food industry applications</p> <p>The role of blockchain technology in food supply chain management</p> <p>ICT-based solutions for reducing food waste and increasing sustainability Traceability Systems in Food Safety</p> <p>Food Safety Information Systems</p> <p>Detection and Prevention of Food Fraud using ICT.</p> <p>Detection and Prevention of Food Contamination using ICT.</p> <p>Case studies of emerging ICT trends in the food industry</p>	
Practical	
<ol style="list-style-type: none"> List out products which has intelligent packaging in Foreign and Indian markets and principle behind the packaging material. Make a report on product identification, production and marketing technique using ICT by visiting industry. Make a report on food technology related app and how it processes data. 	

Pedagogy:

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	40 Marks
<i>Formative Assessments are compulsory</i>	

References	
1	Aggelogiannopoulos, D., & Koukouvinos, C. (2019). Information and Communication Technologies in the Food Industry: Recent Advances and Prospects. <i>Foods</i> , 8(10), 476.
References	
2	Benitez, J. M., O'Connor, D., & Garcia-Sanchez, A. J. (2018). <i>Sensors in Food and Agriculture</i> . Academic Press.
3	Bhat, Z. F., & Kumar, S. (2015). <i>Innovations in Food Packaging</i> . Elsevier Science.
4	Choudhary, A., & Sharma, R. K. (2017). Information and communication technology in food industry: opportunities and challenges. <i>Journal of food science and technology</i> , 54(4), 1015-1026.
5	Diaz-Munoz, S. L., & Manriquez-Alvirde, M. (2018). <i>Information and Communication Technologies in Agro-Industry Chains: Applications, Opportunities and Future Trends</i> . IGI Global.
6	Future Foods-Global Trends, Opportunities, and Sustainability Challenge, 1st Edition - December 4, 2021, Editor: Rajeev Bhat eBook ISBN: 9780323910026
7	Iddrisu, M., & Qi, Y. (2018). Smart packaging in food applications: a review of modern technologies. <i>Journal of food science and technology</i> , 55(9), 3571-3582.
8	Li, Y., & Liang, P. (2019). <i>ICT for Food Safety and Traceability</i> . Springer.
9	Liang, P., Li, X., & Li, D. (2018). <i>Big Data in Food Industry: Theory, Methods and Applications</i> . John Wiley & Sons.
10	Moreira, R. G., & Castilhos, T. M. (2018). The role of information technology in food packaging. <i>Trends in Food Science & Technology</i> , 77, 142-152.
11	Pal, A., & Sanjai, K. (2020). <i>Food Safety and Quality Management: Applications and Techniques</i> . Apple Academic Press.
12	Silva, F., & Nascimento, M. (2019). Information and communication technology applications in food safety: A review of the literature. <i>Food Control</i> , 102, 97-107.
13	Šojić-Milosavljević, I., Milijašević-Marčić, S., & Stefanović, A. (2018). The role of information technology in ensuring food safety. <i>Serbian Journal of Management</i> , 13(2), 211-221.
14	Wani, S. A., Gani, A., & Masoodi, F. A. (2017). ICT-based food safety management systems: a review of the literature. <i>International Journal of Food Science & Technology</i> , 52(1), 1-10.

Model Curriculum

Program Name	BSc in Food Technology	Semester	Sixth Semester
Course Title	Enzymes in Food Industry (Theory)		
Course Code:	DSE FT-E2.3	No. of Credits	3
Contact hours	45 Hours	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO1. Demonstrate a comprehensive understanding of the practical applications of enzymes in food processing and production.

CO2. Understand the specific enzymes used in different food sectors and their respective functions.

CO3. Identify and analyse enzyme-related challenges in the food industry.

CO4. Engage in group discussions, case studies, and projects related to enzyme technology and student will effectively communicate their ideas and solutions related to enzyme technology in the food industry

Theory Contents

45 Hrs

Unit 1: Introduction to Enzymes in the Food Industry

15 hrs

Overview of enzymes: definition, characteristics, and functions

Enzymes as catalysts: their role in food processing and production

Sources of enzymes: microbial, animal, and plant-derived enzymes

Enzyme classification and nomenclature

Enzyme kinetics: understanding enzyme-substrate interactions and reaction rates

Factors influencing enzyme activity: pH, temperature, substrate concentration, and inhibitors

Safety considerations and regulations for enzyme use in the food industry

Unit 2: Enzymes in Food Processing and Production

15 hrs

Enzymes in baking: amylases, proteases, and lipases for dough fermentation, gluten modification, and flavor development

Enzymes in brewing and distilling: amylases, cellulases, and glucanases for starch and cellulose degradation

Enzymes in dairy processing: lactases, lipases, and proteases for lactose hydrolysis, flavor enhancement, and cheese ripening

Enzymes in fruit and vegetable processing: pectinases, cellulases, and invertases for juice clarification, texture modification, and preservation

Enzymes in meat processing: proteases and transglutaminases for tenderization, flavor development, and binding

Enzymes in beverage production: carbohydrases and proteases for flavor modification, clarification, and stability enhancement

Unit 3: Enzyme Technology and Innovation in the Food Industry

15 hrs

Enzyme immobilization techniques: advantages, methods, and applications in food processing

Enzyme engineering and modification: directed evolution, protein engineering, and genetic modification for improved enzyme properties.

Enzyme production and purification: fermentation processes, downstream processing, and quality control

Enzyme formulation and application: considerations for enzyme stability, dosage, and delivery in food systems

Emerging trends in enzyme technology: nanobiotechnology, enzymatic biosensors, and biocatalysis for sustainable food production

Enzymes in functional foods and nutraceuticals: application of enzymes in the production of health-promoting ingredients and supplements

Pedagogy:

Formative Assessment	
Assessment Occasion/ type	Marks
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	40 Marks
<i>Formative Assessments are compulsory</i>	

References

1	"Enzymes in Food Processing" by Gulzar Singh Sangha and D.N. Gandhi, Publisher: CRC Press, Year of Publication: 2017
2	"Enzymes in Food Technology" by Robert J. Whitehurst and Maarten van Oort, Publisher: Wiley-Blackwell, Year of Publication: 2010

References

3	"Enzymes in Food and Beverage Processing" by Alexandre L. Silva, Aline M. Silva, and Juliano Lemos Bicas Publisher: Apple Academic Press, Year of Publication: 2016
4	"Food Enzymes: Structure and Mechanism" by Alphons G.J. Voragen, Willem M. de Vos, and Gerard Beldman, Publisher: CRC Press. Year of Publication: 2019
5	"Industrial Enzymes for Food and Feed Applications" by Dietmar Haltrich, Roland Ludwig, and Herwig K. Schottenberger, Publisher: Springer, Year of Publication: 2017
6	"Enzymes in Food Biotechnology: Production, Applications, and Future Prospects" by Mohamed Essam El-Houri, Publisher: Nova Science Publishers, Year of Publication: 2021
7	"Enzymes in Food and Feed Processing: Third Edition" by Ramesh C. Ray, Publisher: CRC Press
8	Year of Publication: 2019
9	"Enzymes in Food Technology: Second Edition" by R. John Whitaker, Alphons G.J. Voragen, and Dominic W.S. Wong, Publisher: Wiley-Blackwell, Year of Publication: 2002
10	"Enzymes in Food Technology: Third Edition" by Robert J. Whitehurst, Maarten van Oort, and Robert J. Whitehurst, Publisher: Wiley-Blackwell, Year of Publication: 2019

Model Curriculum

Program Name	BSc in Food Technology	Semester	Sixth Semester
Course Title	Engineering Drawing and Graphics 2		
Course Code:	FT Voc2.1	No. of Credits	3
Contact hours	45 Hours	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

- CO1. Develop clear concept and perception of Machine Drawing.
- CO2. Develop the skill of expressing Sectioned Solids and Development of Surface.
- CO3. Acquire speed and accuracy in use of drawing instruments.
- CO4. AutoCAD basis and Applications

Theory Contents	45 Hrs
Unit I: Machine Drawing	16 Hrs
Sectional drawing of simple machine parts, Orthographic projection of simple machine blocks, Isometric Projection - Construction of isometric scale showing main divisions of 10 mm and smaller divisions of 1 mm each. Isometric projection (drawn to isometric scale) of regular plane figures - triangle, square, pentagon, hexagon, circle and semi-circle with their surface parallel to HP or VP (keeping one side either parallel or perpendicular to HP/VP). Drawing of missing views.	
Unit II: Theory of Projection of Sectioned Solids and Development of Surface	15 Hrs
Introduction to the concepts and description of sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinders and cones.	
Unit III: Basics of AutoCAD and its Application	14 Hrs
Introduction to AutoCAD, Basics of AutoCAD: applicability and capability, DRAW tools, MODIFY tools, TEXT, DIMENSION, PROPERTIES. Application of computers for design, definition of CAD, benefits of CAD, CAD system components; Computer hardware for CAD.	

Pedagogy:

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	40 Marks
<i>Formative Assessments are compulsory</i>	

References	
1	Engineering Drawing and Graphics Author: K. Venugopal, Publisher: New Age International Publishers, Publication Year: 2014
2	Title: Engineering Drawing, Author: N.D. Bhatt, Publisher: Charotar Publishing House, Publication Year: 2019
3	Title: Engineering Graphics Essentials with AutoCAD 2020 Instruction, Author: Kirstie Plantenberg, Publisher: SDC Publications, Publication Year: 2019
4	Title: Engineering Graphics, Author: Frederick E. Giesecke, Alva Mitchell, Henry C. Spencer, Ivan L. Hill, John T. Dygdon, Publisher: Peachpit Press, Publication Year: 2013
5	Title: Technical Drawing with Engineering Graphics, Author: Frederick E. Giesecke, Alva Mitchell, Henry C. Spencer, Ivan L. Hill, John T. Dygdon, James E. Novak, R. O. Loving, Publisher: Peachpit Press, Publication Year: 2017

Model Curriculum

Program Name	BSc in Food Technology	Semester	Sixth Semester
Course Title	Sensory Evaluation of Food Products		
Course Code:	FT Voc2.2	No. of Credits	3
Contact hours	45 Hours	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Outcomes (COs):

- CO1. Upon completion of the course, students will be able to explain the importance of sensory evaluation in the food industry and its role in product development and quality control.
- CO2. Students will demonstrate an understanding of human sensory perception, including the functioning of sensory organs, the concept of thresholds, and sensory adaptation.
- CO3. Students will be able to apply different sensory evaluation techniques, such as discrimination tests, descriptive analysis, hedonic evaluation, and consumer tests, to assess and analyse food products.
- CO4. Students will gain practical skills in designing and conducting sensory evaluation experiments, including sample preparation, panel selection and training, experimental design, and statistical analysis of sensory data. They will be able to interpret and communicate the results effectively.

Theory Contents

45 Hrs

Unit 1: Introduction to Sensory Evaluation of Food Products

15 hrs

1.1 Definition and Importance of Sensory Evaluation:

Understanding the role of sensory evaluation in food product development and quality control. Exploring the significance of sensory attributes in consumer acceptance.

1.2 Human Sensory Perception:

Sensory organs and their functions. Sensory receptors and their response to different stimuli. Basic principles of sensory perception, including thresholds and adaptation.

1.3 Sensory Evaluation Methods:

Discrimination tests: paired comparison, triangle test, duo-trio test. Descriptive analysis: profiling sensory attributes using trained panels. Hedonic evaluation: determining consumer preference and liking. Consumer tests: focus groups, surveys, and preference mapping.

1.4 Sensory Evaluation Experimental Design:

Sample preparation and presentation. Randomization and balancing. Control of extraneous variables.
Sample size determination.

Unit 2: Sensory Evaluation Techniques

15 hrs

2.1 Sensory Evaluation Panel:

Selection and training of panel members. Panel performance evaluation and monitoring. Panelist calibration and consensus building.

2.2 Discrimination Testing:

Application of discrimination tests for determining sensory differences. Statistical analysis of discrimination test data.

2.3 Descriptive Analysis:

Training of descriptive analysis panel members. Development of sensory lexicons. Sensory attribute selection and definition. Profiling of food products using descriptive analysis.

2.4 Hedonic Evaluation:

Understanding the concept of hedonic scales and their application. Statistical analysis of hedonic data. Interpretation of hedonic test results.

Unit 3: Applications of Sensory Evaluation in Food Industry

15 Hrs

3.1 Quality Control and Product Development:

Sensory evaluation in quality assurance programs. Monitoring product consistency and identifying sensory defects. Using sensory data for product reformulation and improvement.

3.2 Shelf-Life Studies:

Sensory evaluation techniques for determining product stability over time. Sensory attributes affected by storage conditions. Sensory testing protocols for shelf-life determination.

3.3 Consumer Acceptance and Preference:

Understanding consumer preferences and drivers of product acceptance. Application of consumer tests and preference mapping. Consumer research techniques and data analysis.

3.4 Sensory Evaluation in Marketing:

Sensory branding and product positioning. Sensory claims substantiation.

Pedagogy:

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	40 Marks
<i>Formative Assessments are compulsory</i>	

References	
1	Sensory aspects of packaging and labeling. "Sensory Evaluation Techniques" by Morten C. Meilgaard, Gail Vance Civille, and B. Thomas Carr (CRC Press, 2016)
2	"Sensory Evaluation of Food: Principles and Practices" by Harry T. Lawless and Hildegarde Heymann (Springer, 2010)
3	"Sensory Evaluation of Food: Statistical Methods and Procedures" by Michael O'Mahony (CRC Press, 2000)
4	"Sensory Evaluation in Quality Control" by P. Brent Murray and E. Allen Foegeding (Springer, 2003)
5	"Sensory Evaluation Practices" by Herbert Stone and Joel L. Sidel (Academic Press, 2004)
6	"Sensory Evaluation of Food: Principles and Techniques" by Stephanie Clark, Anne F. Brewer, and Bernard Valeur (Wiley-Blackwell, 2016)
7	"Sensory Evaluation of Food: Principles and Practices" by Michael D. Reed (Chapman & Hall, 2004)
8	"Sensory Evaluation of Food: Statistical Methods and Procedures" by Michael C. Qian (Taylor & Francis, 2003)
9	"Sensory Evaluation of Food: Principles and Applications" by Harry T. Lawless and Emily L. Keller (Springer, 2017)
10	"Sensory Evaluation of Food: Principles and Practices" by Michael O'Mahony and Ulla Kidmose (Woodhead Publishing, 2018)

Model Curriculum

Program Name	BSc in Food Technology	Semester	Sixth Semester
Course Title	Food Waste Management		
Course Code:	FT Voc2.3	No. of Credits	3
Contact hours	45 Hours	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

- CO1. Analyse and evaluate the causes and consequences of food waste, demonstrating a clear understanding of its environmental, economic, and social impacts.
- CO2. Develop and implement effective strategies for preventing and reducing food waste, considering factors such as planning, inventory management, consumer behaviour, and sustainable sourcing.
- CO3. Assess and apply various recycling and resource recovery options for food waste, including composting, anaerobic digestion, waste-to-energy conversion, and the production of valuable byproducts.

Contents	45 Hrs
Unit I - Introduction to Food Waste Management	15Hrs
<ul style="list-style-type: none"> ❖ Definition and scope of food waste management ❖ Causes and consequences of food waste ❖ Global and local food waste statistics ❖ Environmental, economic, and social impacts of food waste ❖ Regulatory frameworks and policies related to food waste management 	
Unit II - Prevention and Reduction of Food Waste	15Hrs
<ul style="list-style-type: none"> ❖ Food waste prevention strategies ❖ Planning and forecasting ❖ Inventory management ❖ Purchasing and sourcing practices ❖ Food labeling and expiration date management 	

- ❖ Consumer education and behavior change
- ❖ Food waste reduction techniques
- ❖ Proper storage and handling
- ❖ Portion control and menu engineering
- ❖ Donation and redistribution programs
- ❖ Food processing and preservation techniques
- ❖ Composting and anaerobic digestion

Unit III - Recycling and Resource Recovery

15Hrs

- ❖ Recycling and recovery options for food waste
- ❖ Composting: methods, benefits, and applications
- ❖ Anaerobic digestion: process, biogas production, and utilization
- ❖ Animal feed and livestock utilization
- ❖ Bioenergy production from food waste
- ❖ Waste-to-value technologies
- ❖ Nutrient recovery and fertilizer production
- ❖ Waste-to-energy conversion processes
- ❖ Bioplastics and biomaterials from food waste
- ❖ Case studies and best practices in food waste recycling and resource recovery
- ❖ Economic and environmental considerations in food waste recycling

Pedagogy:

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	40 Marks
<i>Formative Assessments are compulsory</i>	

References

References	
1	"Waste: Uncovering the Global Food Scandal" by Tristram Stuart (Penguin Books, 2009).
2	"Food Waste to Animal Feed" by Amitava Chatterjee (CRC Press, 2019).
3	"Food Waste Recovery: Processing Technologies and Industrial Techniques" edited by Charis M. Galanakis (Academic Press, 2015).
4	"Waste Management in the Food Processing Industry" by Carlos A. da Silva, Maria L. Martins, & Simona M.C. Morais (CRC Press, 2013).
5	"Food Waste: Home Consumption, Material Culture and Everyday Life" by David Evans (Bloomsbury Academic, 2014).
6	"Food Waste and Sustainable Food Waste Management in the Baltic Sea Region" edited by Magnus Bremmer, et al. (Springer, 2019).
7	"Reducing Food Waste in Urban Food Systems" edited by Roberta Sonnino, Ana Moragues-Faus, & Mike Hodson (Routledge, 2017).
8	"Food Industry Wastes: Assessment and Recuperation of Commodities" edited by Maria Kosseva & Colin Webb (Woodhead Publishing, 2013).
9	"Food Waste Management: Solving the Wicked Problem" by Maria M. Campos (Academic Press, 2020).
10	"The Zero Waste Solution: Untrashing the Planet One Community at a Time" by Paul Connett (Chelsea Green Publishing, 2013).

Question Paper Pattern

Paper Code:		Paper Title:	
Duration of Exam	2 Hours	Max Marks	60
Instruction:	Answer all the sections		

Section-A

1. Answer any Five of the Following	5x3=15
a. b. c. d. e. f. g.	

Section-B

Answer any Five of the Following	5x5=25
2. 3. 4. 5. 6. 7. 8. 9.	

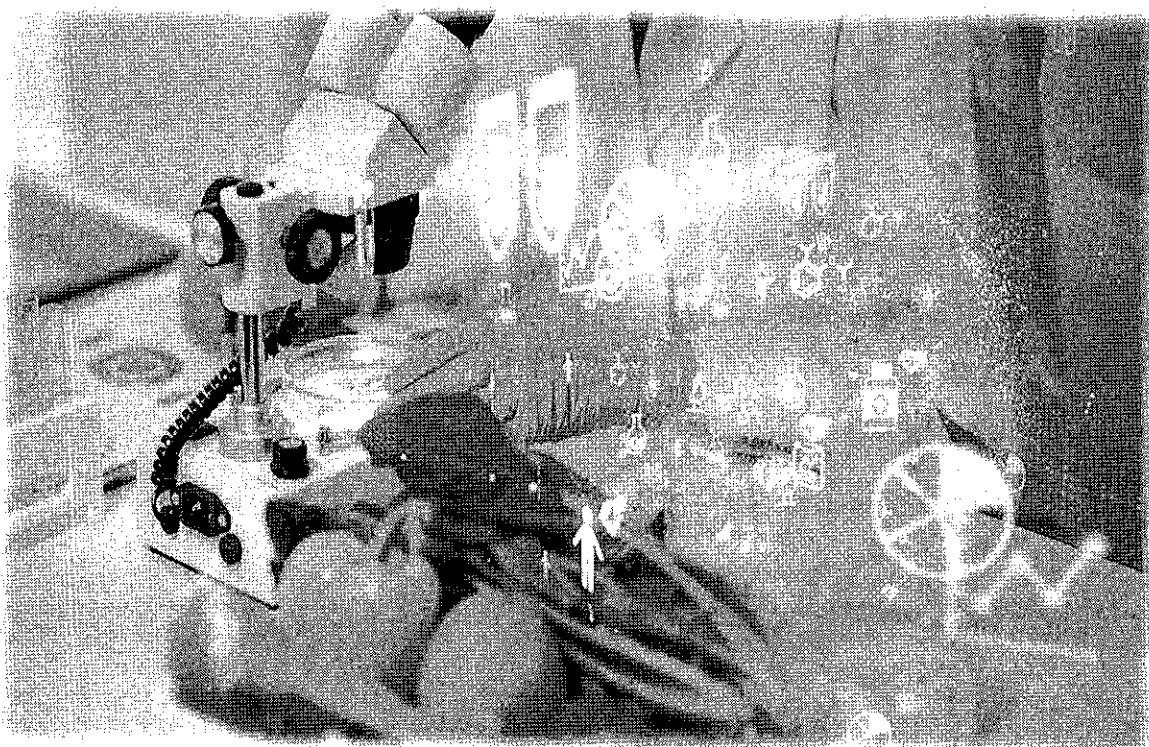
Section-C

Answer any Two of the Following	2x10=20
10. 11. 12. 13.	

DAVANGERE UNIVERSITY

Department of Studies in Food Technology
Shivagangotri, Davanagere-577007

**Curriculum Framework for Four-Year Undergraduate
Multidisciplinary Programme (Honours) & Master Programme in
Colleges and Universities of Karnataka State Under NEP 2020.**



**1st and 2nd Semesters Model Syllabus
for
BSc. in
Food Technology**

**Department of Studies in Food Technology
Shivagangothri, Davanagere University, Davanagere-577007**

Composition of Subject Expert Committee Members

SN	Name & Organization	Designation
1	Dr. Ravikumar Patil H. S., Professor, Davanagere University, Davanagere	Chairman
2	Dr. Giridhar P Chief Scientist Plant cell Biotechnology CSIR-CFTRI Mysuru	External Member
3	Dr. Shyam Kumar V Professor Department of Microbiology and Biotechnology Karnataka University Dharwad.	External Member
4	Dr. Shankar J Associate Professor, Davanagere University, Davanagere	Member
5	Dr. Paramesha M Associate Professor, Davanagere University, Davanagere	Member
6	Dr. Veeresh S J Assistant Professor, Davanagere University, Davanagere	Member

Contents of Courses for B.Sc. Honours in Food Technology (Model)

Semester	Course Category	Theory / Practical	Credits	Paper Title	Marks	
					S. A	I. A
1	DSC- 1.1	Theory	3	Food Biochemistry	60	40
		Practical	2	Food Biochemistry	25	25
	DSC- 1.2	Theory	3	Principles of Food Science	60	40
		Practical	2	Principles of Food Science	25	25
	DSC- 1.3	Theory	3	Applied Mathematics	60	40
	OE- 1.1	Theory	3	Food and Nutrition	60	40
2	DSC- 2.1	Theory	3	Cereals and Millets Processing Technology	60	40
		Practical	2	Cereals and Millets Processing Technology	25	25
	DSC- 2.2	Theory	3	Food Microbiology	60	40
		Practical	2	Food Microbiology	25	25
	DSC- 2.3	Theory	3	Food Additives and Preservatives	60	40
	OE- 2.1	Theory	3	Food Safety	60	40
<p>Exit option with Undergraduate Certificate with completion of courses equivalent to a minimum of 48 credits followed by 10 - 12 credit bridge course(s) for 2 months, including at least 6 credit jobs specific internship / apprenticeship to acquire job ready competencies required to enter a job</p>						

OE Papers to be offered for the students other than Food technology.

**Model Curriculum
of
BSc Honours
in
Food Technology
1st and 2nd Semesters**

**Department of Studies in Food Technology
Shivagangothri, Davangere University, Davanagere-577007**

Model Curriculum

Program Name	B Sc Food Technology	Semester	First Semester
Course Title	Principles of Food Science (Theory + Practical)		
Course Code:	DSC-1.2	No. of Theory +Practical Credits	3+2 = 5
Contact hours	42-45 hrs	Duration of ESA/Exam	2 Hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Pre-requisite(s): PUC with PCMB (KCET Appeared has first preference)	
Course Objectives (COs):	
CO1. Learn about food groups, properties, nutrient composition,	
CO2. Learn about factors affecting the cooking quality	
Theory Content	45 Hrs
Unit-1	15
<p>Introduction: Meaning and scope of Food Science</p> <ul style="list-style-type: none"> a. Properties of Food: Melting and Freezing Point, pH Value, Osmosis and Osmotic Pressure, Bound and Free Water, Colloids, Sols, Gels, Emulsion, Foams b. Sensory Evaluation of Foods: Subjective and Objective Methods <p>Cereals, Millets, and their products</p> <ul style="list-style-type: none"> a. Structure And Nutrient Composition of Rice and Wheat b. Gelatinization, Dextrinization, Parboiling, Malting c. Formation Of Gluten, Amylase Rich Foods d. Millets and their uses <p>Legumes/ Pluses:</p> <ul style="list-style-type: none"> a. Structure and Nutrient Composition of Pulses and Legumes b. Toxic Constituents and Cooking of Pulses c. Factors Affecting the Cooking Quality of Legumes d. Soaking, Germination, Fermentation, Extrusion and Puffing 	
Unit -2	15
<p>Fruits and vegetables:</p> <ul style="list-style-type: none"> a. Composition, Pigment and Flavouring Constituents, Changes During Coking b. Enzymatic Browning, Loss of Nutrients During Cooking 	

Milk and Milk products:

- a. Nutritional Composition of Milk and Milk Products (Butter, Ghee, Cheese, Curd)
- b. Processing of Milk, Types of Processed Foods
- c. Pasteurization, Homogenization, Coagulation of Milk

Egg, Meat, Fish and Poultry:

- a. Egg: Structure, Composition, Grading, Factors Affecting the Quality in Egg Cookery

Meat, Poultry and Fish:

- a. Structure of Meat and Meat Quality
- b. Post-mortem Changes
- c. Factors To Be Considered in Selection and Preparation of Meat, Poultry and Fish

Unit -3

15

Fats and oils

- a. Composition and Types, Changes during heating (smoking point), Hydrogenated fats, Rancidity

Sweetening Agents:

- a. Composition of sugar, jaggery and honey
- b. Behaviour of sugar syrups at different temperatures and its application in food preparation
- c. Crystallization of sugar
- d. Artificial sweetening agents: Composition and Uses

Fermented foods

- a. Mechanism of fermentation and changes occurring during fermentation
- b. Indian fermented foods (Idli, dosa, dhokla, bread, batura)
- c. Beverages:
 - ✓ Types: Alcoholic and non- alcoholic

Learning Outcomes:

1. Students will acquire knowledge on classification and properties of food
2. Students will acquire knowledge of food processing methods

Formative Assessment:

Assessment Occasion/ type	Weightage in Marks
Test 1	10
Test 2	10
Assignment	05
Seminar	05

Formative Assessment:

Assessment Occasion/ type	Weightage in Marks
Project	10
Total	40 Marks

Formative Assessment as per NEP guidelines are compulsory

Summative Assessment (60 marks) + Formative Assessment (40 marks) = Total 100 marks

Course Title	Principles of Food Science (Practical)	Practical Credits	2
Course Code	DSC (P)-1.2	Contact Hours	54 hrs
Formative Assessment Marks	25 marks	Summative Assessment Marks	25 marks

Content of Practical

1	Sensory evaluation of foods
2	Starch cookery <ol style="list-style-type: none"> a. Microscopic examination of starch molecules b. Gelatinization of starch and dextrinization c. Wheat preparation- gluten formation, effect of kneading
3	Pulse cookery <ol style="list-style-type: none"> a. Whole grams: effect of soaking and germination b. Dhals: effect of acid and alkali on cooking time
4	Vegetables and fruits cookery <ol style="list-style-type: none"> a. Effects of methods of cooking and added substances on pigments in vegetables b. Enzymatic browning in foods and its prevention
5	Milk cookery <ol style="list-style-type: none"> a. Coagulation and curdling of milk b. Preparation of paneer and khova
6	Egg cookery <ol style="list-style-type: none"> a. Grading of eggs for quality b. Ferrous sulphide formation and prevention c. Effect of beating egg white on stiffness of foam and its uses (custard and omelettes)

7	Sugar and jaggery cookery: a. Determination of stages of crystallization and its uses b. Preparation of groundnut toffee
8	Fats and oils cookery: a. Smoking point of different oil and fats b. Shallow frying- cutlet c. Deep frying- papad
9	Market survey of processed food products
10	Visit to food processing and packaging industry research laboratory
11	Submission of class records and projects

References	
1	Food and Nutrition- Dr. M. Swaminathan
2	Food Facts and Principles- S. Manay & Shadakshara Swamy
3	Food Science- Sumathi Mudambi
4	Fundamentals of Food and Nutrition- Mudami & Rajgopal 4th edition 2001
5	Principles of Food Science by Borgstrom and Macmillon
6	Food Science by Potter & Hotchkiss Judith E. Brown, Nutrition Now, 3 rd edition, Wads Worth, Thomas learning, 10 Davis Drive Belmont CA 94002-3098 USA, 2002
7	Barbara A. Bowmaw and Robert M. Russell, Nutrition, 8 th Edition, IISI press, Washington, DC, 2001.
8	C. Gopalan, B.V. Ramasastri and S.G. Balasubramaniam, Nutritive value of Indian foods, NIN, ICMR
9	Mehatab S. Bamji, N. Prahalad Rao, Vinod Reddy, Textbook of Human Nutrition, Oxford IBH publishing Co. Pvt. Ltd. New Delhi

Model Curriculum

Program Name	B Sc Food Technology	Semester	First Semester
Course Title	Applied Mathematics (Theory)		
Course Code:	DSC-1.3	No. of Credits	3
Contact hours	45 hrs	Duration of ESA/Exam	2 Hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Pre-requisite(s): PUC with PCMB (KCET Appeared has first preference)

Course Objectives (COs):

- CO1. To understand basic theoretical engineering mathematics
- CO2. To learn mathematical functions required for designing industrial plants of food industry

Theory Content

45 Hrs

Unit-1

17

- Taylor's and Mac laurin's expansions, indeterminate form
- Curvature, asymptotes, tracing of curves
- Function of two or more independent variables, partial differentiation, homogeneous functions and Euler's theorem, composite functions, total derivatives, derivative of an implicit function, change of variables, Jacobians, error evaluation, maxima and minima
- Reduction formulae, Gamma and Beta functions
- Rectification of standard curves, volumes, and surfaces of revolution of curves
- Double and triple integrals, change of order of integration, application of double and triple integrals to find area and volume

Unit -2

15

- Exact and Bernoulli's differential equations, equations reducible to exact
- Form by integrating factors, equations of first order and higher degree, Clairaut's equation,
- Differential equations of higher orders, methods of finding complementary functions and particular integrals, Method of variation of parameters
- Simultaneous linear differential equations with constant coefficients
- Cauchy's and Legendre's linear equations
- Bessel's and Legendre's differential equations
- Series solution techniques

- Differentiation of vectors, scalar and vector point functions, vector Differential operator.
- Gradient of a scalar point function, Divergence and Curl of a vector point function and their physical interpretations,
- Identities involving Del, second order differential operator
- Line, Surface and volume integrals, Stoke's, divergence and Green's theorems.

Learning Outcomes: Student will acquire the knowledge on

1. Differential and integral equation, Scalar and Vector quantities and their operations
2. Mathematical applications and functions required in designing plant layout

Formative Assessment:	
Assessment Occasion/ type	Weightage in Marks
Test 1	10
Test 2	10
Assignment	05
Seminar	05
Project	10
Total	40 Marks
<i>Formative Assessment as per NEP guidelines are compulsory</i>	
<i>Summative Assessment (60 marks) + Formative Assessment (40 marks) = Total 100 marks</i>	

*Note – Course to be taught by the Department of Mathematics

References	
1	B.S. Grewal. 2004. Higher Engineering Mathematics. Khanna Publishers Delhi. Shanti Narayan. 2004.
2	Differential Calculus. S. Chand and Co. Ltd., New Delhi. Shanti Narayan. 2004.
3	Integral Calculus. S. Chand and Co. Ltd. New Delhi.
4	Shanti Narayan. 2004. A Textbook of Vector Calculus. S. Chand and Co. Ltd. New Delhi

Model Curriculum

Program Name	B Sc Food Technology	Semester	First Semester
Course Title	Food and Nutrition (Theory)		
Course Code:	OE-1.1	No. of Credits	3
Contact hours	45 hrs	Duration of ESA/Exam	2 Hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Pre-requisite(s): PUC with PCMB (KCET Appeared has first preference)

Course Objectives (COs):

- CO1. Students will learn basic of nutrients benefits to human.
- CO2. Classification of Food groups, energy, and their functions

Theory Content

45 Hrs

Unit-1: Introduction to Food and Nutrition

15

- Understanding relationship between food, nutrition, and health.
- Functions of food-physiological, psychological, and social. Concept of balanced diet.
- Lipids - Classification, Composition function – essential fatty acids, deficiency, food sources of EFA, Function of TGL, Characteristics of animal and vegetable fats, sterols - cholesterol - function, food sources, phospholipids - function, ketone bodies – fat requirements - food sources, dietary lipids and their relation to CVD.

Unit -2: Carbohydrates and Proteins:

15

- Proteins - Composition - structure and classification, function of protein, Amino acids Indispensable and dispensable amino acids -special function of amino acids - protein deficiency - Protein Energy Malnutrition - KWASHIORKOR and MARASMUMS - etiology, clinical features, treatment, and prevention
- Evaluation of protein quality PER, BV, NPU and NPR, chemical score mutual and amino acid supplementation of proteins.

- Energy units - Kilocalories, Megajoules, determination of energy value of foods, using Bomb calorimeter, diagram of Bomb Calorimeter – gross calorific values, Physiological energy, value of foods, relation between oxygen used and calorific value.
- Determination of energy requirements, direct calorimetry. Relation between Respiratory quotient and energy output - Specific dynamic action of food (Thermogenic food in REE) definition, determination of BMR by different methods.
- Factors affecting BMR - determination of energy metabolism, during work - energy requirements for various types of activities, PAL, RDA for different age and gender.
- Reference man and reference woman - FAO committee and ICMR committee percent calories supplied by carbohydrates, fats and proteins in average Indian diets - Energy requirements for different age groups.

Learning Outcomes:

1. Student will acquire the knowledge on nutrients and their functions.
2. Student will acquire the knowledge on sources of nutrients.

Formative Assessment:

Assessment Occasion/ type	Weightage in Marks
Test 1	10
Test 2	10
Assignment	05
Seminar	05
Project	10
Total	40 Marks

Formative Assessment as per NEP guidelines are compulsory

Summative Assessment (60 marks) + Formative Assessment (40 marks) = Total 100 marks

References

1	B. Srilakshmi, Food Science, New Age International Publishers (India), 2003.
2	NIN, ICMR (1990). Nutritive Value of Indian Foods.

References

3	Raina U, Kashyap S, Narula V, Thomas S, Suvira, Vir S, Chopra S (2010). Basics Food Preparation: A Complete Manual, Fourth Edition. Orient Black Swan Ltd.
4	Seth V, Singh K (2005). Diet planning through the Life Cycle: Part 1. Normal Nutrition. A Practical Manual, Fourth edition, Elite Publishing House Pvt. Ltd.
5	Guthrie H.A. - Introductory Nutrition C.V. Mosby Co. St. Louis, 2006.

Model Curriculum

Program Name	B Sc Food Technology	Semester	Second Semester
Course Title	Cereal and Millets Processing Technology (Theory + Practical)		
Course Code:	DSC-2.1	No. of Theory +Practical Credits	3+2 = 5
Contact hours	42-45 hrs	Duration of ESA/Exam	2 Hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Pre-requisite(s): PUC with PCMB (KCET Appeared has first preference)

Course Objectives (COs):

CO1. Classifications of cereals and nutrition composition

CO2. Processing and development of product.

Theory Content

45 Hrs

Unit-1

10

Introduction to Cereals and Millets

- Importance and uses, composition, nutritive value and structure of cereal grain (Paddy, Wheat, Barley and Maize). Present status and Production of cereals and millets.
- Physio-chemical properties of cereals, major and minor millets. Toxins, Malting, Changes during cooking, Changes during germination.

Unit -2

20

A) Processing of Cereals

- Paddy/Rice, Wheat, Oats, Maize/ corn, Sorghum, Finger millet: Properties, types, milling, treatments before and after milling, Products and by-products of cereals, Rice Parboiling.
- Storage of cereals- basic types, moisture management, drying of cereals, aeration, grain respiration, functional changes, deterioration, microflora and macro flora, pests and other infestations.

B) Breakfast cereals

- Uncooked breakfast cereals and Ready to eat cereal- advantages and disadvantages
- Types of cereal flours fermented and non-fermented cereal products, macaroni products.
- Breakfast cereal foods: Flaked, puffed, expanded, extruded, and shredded.

Cereal cookery

- Cereal protein- Gluten formation, Factors affecting gluten formation, types of cereal dough, problems encountered in cereal cookery.
- Cereal Starch- various types of starch-modified and unmodified starches, gelatinization, factors affecting gelatinization, Effects of cooking on starch, factors affecting the properties of starch as a thickening agent.
- Gelatin- concentration, heating, stirring, effects of added ingredients, aging of gel, retrogradation.
- Effect of dry heat- dextrinization, effect of cooking on nutritive value.

Learning Outcomes:

- Student will acquire the knowledge on chemical composition and sources of cereals
- Student will acquire the knowledge on techniques and skills developing novel products

Formative Assessment:

Assessment Occasion/ type	Weightage in Marks
Test 1	10
Test 2	10
Assignment	05
Seminar	05
Project	10
Total	40 Marks

Formative Assessment as per NEP guidelines are compulsory

Summative Assessment (60 marks) + Formative Assessment (40 marks) = Total 100 marks

Course Title	Cereal and Millets Processing Technology (Practical)	Practical Credits	2
Course Code	DSC (P)-2.1	Contact Hours	54 hrs
Formative Assessment Marks	25 marks	Summative Assessment Marks	25 marks

Practical Contents	
1	Physical and Frictional Characteristics of cereals
2	Determination of Moisture Content of Cereals
3	Identification of different millets, products at markets
4	Processing of cereals: Germination, Soaking, Size reduction, Fermentation
5	Cooking quality of rice
6	Parboiling and milling methods
7	Processing of value-added products from millets
8	Conditioning and milling of wheat
9	Production of popcorns
10	Production of flaked rice and puffed rice
11	Preparation of sorghum malt
12	Quality evaluation – physical, chemical, and biological (insects, pests, and microbes)
13	Visit to Cereal processing unit.

References	
1	Chakraverty A. Post Harvest Technology of Cereals, Pulses and Oil seeds. Oxford and IBH Publishing Co. Ltd., Calcutta.
2	Chakraverty A, Majumdar A.S, Vijaya Raghavan G.S and Ramaswamy H.S. Handbook of Post-Harvest Technology. Marcel Dekker Inc., New York. Basel.
3	Dendy DAV and Dobraszczyk BJ. 2001. Cereal and Cereal Products. Aspen.
4	Development in Milling & Baking Technology by AFST (I), CFTRI, Mysore, India
5	Kent NL. 1983. Technology of Cereals. Fourth Edition. Pergamon Press..
6	Lorenz KL.1991. Handbook of Cereal Science and Technology. Marcel Dekker
7	Matz SA. 1969. Cereal Science. AVI Publ.
8	Samuel A.Matz. Cereals Technology , CBS Publications.

References

9	Sahay K.M and Singh K.K. Unit operations of Agricultural Processing. Vikas Publishing House Pvt. Ltd.
10	Srilakshmi. Food Science, 7thEdition. New Age International (P) Ltd, 2018. New Delhi

Model Curriculum

Program Name	B Sc Food Technology	Semester	Second Semester
Course Title	Food Microbiology (Theory + Practical)		
Course Code:	DSC-2.2	No. of Theory +Practical Credits	3+2 = 5
Contact hours	42-45 hrs	Duration of ESA/Exam	2 Hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Pre-requisite(s): PUC with PCMB (KCET Appeared has first preference)	
Course Objectives (COs): CO1. To learn characteristics of different microorganisms CO2. To learn about food spoilage and food borne diseases	
Theory Content	45 Hrs
Unit-1	10
<p>Microbiology: Introduction, historical developments in food microbiology; prokaryotes and eukaryotes; classification of microorganisms - a brief account (Yeast, Mold and Bacteria);</p> <p>Microbiological Techniques - Sterilization, Cultivation of Microorganisms, culture media and types of culture media, Nutritional requirements of microorganisms, Growth curve, Measurement of growth; Isolation of microorganisms - serial dilutions, streak plate, pour plate & spread plate methods; Staining Techniques - Simple and differential, fluorescent, negative, Structural staining - capsule, spore, cell wall and reserved food material, Preservation of cultures</p>	
Unit -2	20
<p>Food spoilage: Determination of microorganisms and their products in food; sample preparation for analysis; Culture dependent methods- Direct microscopic observation, culture, enumeration and isolation methods; Chemical and Physical methods - Chemical, immunological and nucleic acid based methods.</p> <p>Methods to assess microbial diversity, Merits and demerits of culture dependent and culture independent methods; Molecular analysis of bacterial community - Culture independent techniques - Denaturing Gradient Gel Electrophoresis (DGGE), Terminal Restriction Fragment Length Polymorphism (T-RFLP), Analytical methods for microbial metabolites- microbial toxins and metabolites.</p>	

Food borne diseases: Bacterial food borne diseases - Staphylococcal in toxification, Botulism, Salmonellosis, Shigellosis, Enteropathogenic Escherichia coli Diarrhea, Clostridium perfringens gastroenteritis, Bacillus cereus Gastroenteritics; Food Borne Viral Pathogens - Norwalk virus, Norovirus, Reovirus, Rotavirus, Astrovirus, Adenovirus, Parvovirus, Hepatitis A Virus.

Food Borne Animal Parasites - Protozoa - Giardiasis, Amebiasis, Toxoplasmosis, Cysticercosis/Taeniasis; Roundworm - Trichinosis, Anisakiasis; Mycotoxins- Aflatoxicosis, Deoxynivalenol Mycotoxicosis, Ergotism.

Indicators microorganisms; Quality assurance: Microbiological quality standards.

Learning Outcomes: Student will acquire the knowledge on

- Be able to understand and identify the specific processing technologies used for pulses and oil seeds and the various products derived from these materials.
- Understand the application of scientific principles in the processing technologies specific to the materials.
- Grasp the changes in the composition of foods with respect to the type of processing technology used.

Formative Assessment:	
Assessment Occasion/ type	Weightage in Marks
Test 1	10
Test 2	10
Assignment	05
Seminar	05
Project	10
Total	40 Marks
<i>Formative Assessment as per NEP guidelines are compulsory</i>	
<i>Summative Assessment (60 marks) + Formative Assessment (40 marks) = Total 100 marks</i>	

Course Title	Food Microbiology (Practical)	Practical Credits	2
Course Code	DSC (P)-2.2	Contact Hours	54 hrs
Formative Assessment Marks	25 marks	Summative Assessment Marks	25 marks

Practical Contents

1	Good Microbiology laboratory practices: Laboratory safety (Dos and Don'ts), hazard from chemicals, handling of cultures and chemicals, disposal of chemicals and cultures.
2	Introduction to different Glass wares used in Microbiology Laboratory and handling of different instruments and Equipment's used for culture and Sterilization.
3	Preparation of basic liquid (Nutrient broth) and basic solid media (Nutrient Agar and Potato Dextrose Agar), selective, differential media and enriched media (MacConkey Agar and Blood Agar). for cultivation of bacteria and fungi.
4	Pure culture techniques used for isolation and purification of microorganisms - Streak plate method / Pour plate method / Spread plate method.
5	Different staining methods to study morphological and structural characteristics of bacteria and fungi. - Gram Staining / Fungal staining (Lacto-phenol cotton blue) / Sporestaining / Flagella staining / Capsule staining / Negative staining.
6	Culture preservation techniques (Agar slants, stabs and glycerol stocks).
7	Study the effect of salt, pH and temperature on microbial growth.
8	Determination of bacterial growth by turbidity measurements and to plot bacterial growth curve.
9	Detection and enumeration of pathogenic and indicator organisms in food; MPN of coliforms;
10	Evaluation of microbiological quality of commonly consumed street foods.
11	Extraction and detection of alfa toxin for infected foods.
12	Preservation of potato/onion by UV radiation

References

1	Food Microbiology, Fundamentals and Frontiers, Doyle, P., Bonehat, L.R. and Mantville, T.J (2010): ASM Press, Washington DC.
2	Bacterial Pathogenesis A Molecular Approach. 2 nd Edition. 2001 by Abigail A. Salyers and Dixie D. Whitt. ASM Publications.
3	Basic Food Microbiology, Banwart, G.J. (1997). CBS Publishers.

References

4	Fundamental Food Microbiology, Bibek Ray (1996). CRC Press.
5	Microbiology; Pelczar, Chan and Krieg; Tata McGraw Hill, Delhi
6	Modern Food Microbiology, James M. Jay (2000). 5th Edition, CBS Publishers.

Model Curriculum

Program Name	B Sc Food Technology	Semester	Second Semester
Course Title	Food Additives and Preservatives (Theory)		
Course Code:	DSC-2.3	No. of Credits	3
Contact hours	45 hrs	Duration of ESA/Exam	2 Hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Pre-requisite(s): PUC with PCMB (KCET Appeared has first preference)

Theory Content	45 Hrs
Unit-1	10
<p>Food additives: Definitions, classification, and function. Role of Food Additives in food preparation and uses in processed food products. Chemical, technological, and toxicological aspects of food additives, pH controllers, salts and chelating/sequestering agents, leavening agents, antioxidants, emulsifying and stabilizing agents, anti-caking agents, thickeners, firming agents, Proteins, starches and lipids as functional ingredient; isolation, modification, specifications, functional properties and applications in foods.</p>	
Unit -2	20
<p>Health and safety aspects of food additives: Present status of various food additives. Controversial food additives Saccharin, history, function, aspartame, nitrite and nitrate compounds, nitrosamines. Additives to improve acceptability, permitted food colors, natural and artificial sweeteners composition, uses, emulsifiers, enzymes, fat replacers, gelling agents, leavening agents, stabilizers, surfactants, tenderizers, texturizers, thickeners, vitamins, nutraceuticals, essential oils and oleoresins viscosity modifiers, whipping agents.</p>	
Unit -3	15
<p>Food Flavors and Food adulteration: Types of flavours, flavoring constituents, stability of flavours during food processing, analysis of flavours, extraction techniques of flavours, flavours emulsions; flavours Spices and flavors in food industries. Food adulteration, definition, reasons for food adulteration, methods of adulteration, and methods of detection. Normal food adulterants in coffee, tea leaves, edible oil, milk, cereals, spice powders. Adverse effects of food adulterants.</p>	

Learning Outcomes:

- Students will understand the chemical and technological properties of relevant food additives used as food improvement.
- Students learnt the knowledge of the food additives, the reasons of their use in foods and toxicological evaluation.
- Students will acquire competence in the proper use of additives in safe food production.
- Students identify the importance of data collection & its role in determining scope of Bio-statistics. Interpret statistical results correctly and effectively.

Formative Assessment:	
Assessment Occasion/ type	Weightage in Marks
Test 1	10
Test 2	10
Assignment	05
Seminar	05
Project	10
Total	40 Marks

Formative Assessment as per NEP guidelines are compulsory

Summative Assessment (60 marks) + Formative Assessment (40 marks) = Total 100 marks

References	
1	Branen, A.L., Davidson PM & Salminen S. 2001. Food Additives. 2nd Ed. Marcel Dekker.
2	Gerorge, A.B. 1996. Encyclopedia of Food and Color Additives. Vol. III. CRC Press.
3	Gerorge, A.B. 2004. Fenaroli's Handbook of Flavor Ingredients. 5th Ed. CRC Press.
4	Madhavi, D.L., Deshpande, S.S & Salunkhe, D.K. 1996. Food Antioxidants: Technological, toxicological and Health Perspective. Marcel Dekker
5	Mahindru, S N (2000) Food Additives- Characteristics Detection and Estimation. Tata Mc Graw Hill Publishing Co. Ltd.

Model Curriculum

Program Name	B Sc Food Technology	Semester	Second Semester
Course Title	Food Safety (Theory)		
Course Code:	OE-2.1	No. of Theory Credits	3
Contact hours	45hrs	Duration of ESA/Exam	2 Hrs
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Pre-requisite(s): PUC with PCMB (KCET Appeared has first preference)

Course Objectives (COs):

CO1. To develop the knowledge of students on food safety, its management tools and the laws & standards related to food.

Content of Theory

45 Hrs

Unit-1

Introduction to Food Safety

- A. Definition, types of hazards, biological, chemical, physical hazards
- B. Factors affecting Food Safety
- C. Importance of Safe Foods

Unit -2

Food Safety Management Tools

- A. Basic concept - Prerequisites- GHPs, GMPs,
- B. HACCP, ISO series, TQM - concept and need for quality
- C. Risk Analysis
- D. Accreditation and Auditing

Unit -3

Food Laws and Standards

- A. Indian Food Regulatory Regime
- B. Global Scenario
- C. Other laws and standards related to food

Learning Outcomes: After the successful completion of the course, the student will be able to:

- To study the types of hazards associated with food
- To gain knowledge on food regulations (national as well as international)
- To understand the design and implementation of food safety management systems such as ISO series, HACCP and its prerequisites such as GMP, GHP etc.

Formative Assessment:	
Assessment Occasion/ type	Weightage in Marks
Test 1	10
Test 2	10
Assignment	05
Seminar	05
Project	10
Total	40 Marks
<i>Formative Assessment as per NEP guidelines are compulsory</i>	
<i>Summative Assessment (60 marks) + Formative Assessment (40 marks) = Total 100 marks</i>	

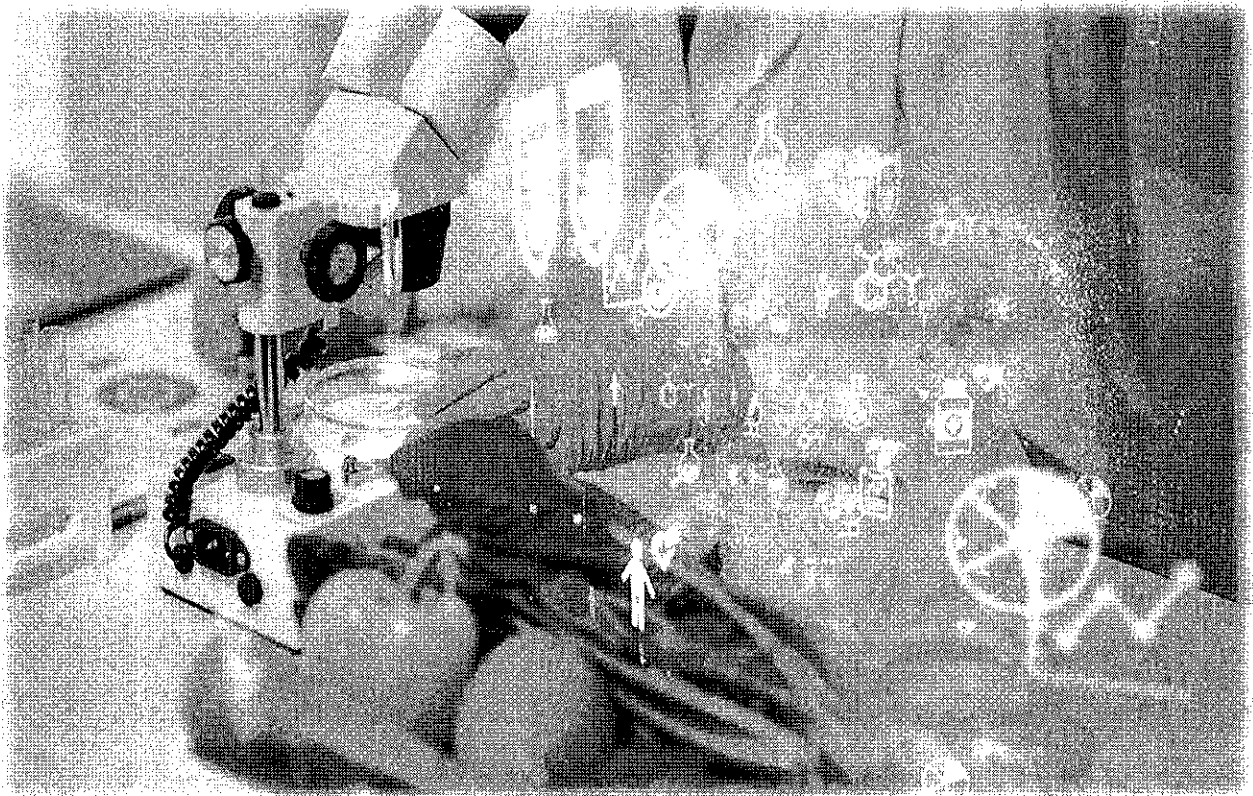
References	
1	Lawley, R., Curtis L. and Davis, J. The Food Safety Hazard Guidebook, RSC publishing, 2004
2	De Vries. Food Safety and Toxicity, CRC, New York, 1997
3	Marriott, Norman G. Principles of Food Sanitation, AVI, New York, 1985
4	Forsythe, S J. Microbiology of Safe Food, Blackwell Science, Oxford, 2000 41
5	Forsythe, S. J. The Microbiology of Safe Food, second edition, Wiley Blackwell, U.K.,2010
6	Mortimore S. and Wallace C. HACCP, A practical approach, Chapman and Hill, London,1995
7	Blackburn CDW and Mc Clure P.J. Food borne pathogens. Hazards, risk analysis & control. CRC Press, Washington, U.S.A, 2005

DAVANGERE UNIVERSITY



**Department of Studies in Food Technology
Shivagangotri, Davanagere-577007**

**Curriculum Framework for Four-Year Undergraduate
Multidisciplinary Programme (Honours) & Master Programme in
Colleges and Universities of Karnataka State Under NEP 2020.**



**3rd and 4th Semesters Model Syllabus
for
BSc. in
Food Technology**

**Department of Studies in Food Technology
Shivagangothri, Davanagere University, Davanagere-577007**

Composition of Subject Expert Committee Members

SN	Name & Organization	Designation
1	Dr. Ravikumar Patil H. S., Professor, Davanagere University, Davanagere	Chairman
2	Dr. Giridhar P Chief Scientist Plant cell Biotechnology CSIR-CFTRI Mysuru	External Member
3	Dr. Shyam Kumar V Professor Department of Microbiology and Biotechnology Karnataka University Dharwad.	External Member
4	Dr. Shankar J Associate Professor, Davanagere University, Davanagere	Member
5	Dr. Paramesha M Associate Professor, Davanagere University, Davanagere	Member
6	Dr. Veeresh S J Assistant Professor, Davanagere University, Davanagere	Member

Contents of Courses for B.Sc. Honours in Food Technology (Model)

Semester	Course Category	Theory / Practical	Credits	Paper Title	Marks	
					S. A	IA
3	DSC-3.1	Theory	3	Legumes and Oil Seeds Technology	60	40
		Practical	2	Legumes and Oil Seeds Technology	25	25
	DSC-3.2	Theory	3	Fruits and Vegetable Technology	60	40
		Practical	2	Fruits and Vegetable Technology	25	25
	DSC-3.3	Theory	3	Operations in Food Processing	60	40
	OE- 3.1	Theory	3	Food Adulteration	60	40
4	DSC-4.1	Theory	3	Dairy Technology	60	40
		Practical	2	Dairy Technology	25	25
	DSC-4.2	Theory	3	Baking and Confectionary Technology	60	40
		Practical	2	Baking and Confectionary Technology	25	25
	DSC-4.3	Theory	3	Food laws and Food Safety	60	40
<p>Exit option with Undergraduate Diploma with completion of courses equivalent to a minimum of 96 credits followed by 10 - 12 credit bridge course(s) for 2 months, including at least 6 credit jobs specific internship / apprenticeship to acquire job ready competencies required to enter a job</p>						

OE Papers to be offered for the students other than Food technology

**Model Curriculum
of
BSc Honours
in
Food Technology
3rd and 4th Semesters**

Karnataka State Higher Education Council

Model Curriculum

Program Name	B Sc Food Technology	Semester	Third Semester
Course Title	Fruit and Vegetable Technology (Theory + Practical)		
Course Code:	DSC-3.2	No. of Theory +Practical Credits	3+2 = 5
Contact hours	45 hrs	Duration of ESA/Exam	2 Hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Pre-requisite(s): Certificate on completion of First Year BSc Food Technology

Course Objectives:

1. To learn about the various process of plant products undertaken in an industrial level
2. To gain the knowledge about the post-harvest technology and the novel technologies in the processing of the products

Course Outcomes (COs): After successful completion of the course, students will be able to

- CO 1. Interpret the history and need of preservation along with the best-known canning and bottling process for all the related vegetable and fruit products.
- CO 2. Classify the science behind the processing and drying techniques of fruits and vegetables which leads to a final product with enhanced characteristics and shelf life.
- CO 3. Formulate and familiarize the reactions and changes taking place in fruits and vegetables, beverages, and spices during the overall processing.
- CO 4. Apply the technological ideas and methodologies to preserve the harvest and turn it into multiple uses.

Theory Content

45 Hrs

Unit-1

15

Introduction: Importance of fruits and vegetables. History and need of preservation, reasons of spoilage, method of preservation.

Canning and bottling of Fruits and vegetable: Selection of fruits and vegetables, process of canning, factors affecting the process- time and temperature, containers of packing, lacquering, syrups and brines for canning, spoilage in canned foods, Process of bottling, factors affecting the sterilization, factors affecting the quality of the bottles foods.

Fruits juices and tomato pulps: Selection of fruits, Processing of fruit juices, preservation of fruit juices. Selection of tomatoes, pulping& processing of tomato juice, tomato puree, paste, ketchup, sauce and soup.

Unit -2	15
<p>Fruit squashes, Jams, Jellies, Marmalades and candies: Selection of fruits, Processing, essential constituents, types, technology and defects in Fruit squashes, Jams, Jellies, Marmalades and candies</p> <p>Pickles, Chutneys and Sauces: Processing of pickles, chutneys and squashes, Types of pickles, chutneys and squashes, Causes of spoilage in pickling.</p> <p>Drying of Foods and Vegetables:</p> <p>Sun drying and mechanical drying of Food and Vegetables, process variation for fruits and vegetables, packing and storage.</p>	
Unit -3	15
<p>Spices: Processing and properties of major and minor spices, essential oils & oleoresins, adulteration.</p> <p>Tea, Coffee and Cocoa: Processing of Tea, Coffee and Cocoa, Variety Tea, Coffee and Cocoa and its products.</p> <p>Browning: Enzyme activity enzymic browning Non enzymic browning, its prevention.</p>	

Formative Assessment:	
Assessment Occasion/ type	Weightage in Marks
Test 1	10
Test 2	10
Assignment	05
Seminar	05
Project	10
Total	40 Marks
<i>Formative Assessment as per NEP guidelines are compulsory</i>	
<i>Summative Assessment (60 marks) + Formative Assessment (40 marks) = Total 100 marks</i>	

Course Title	Fruit and Vegetable Technology (Practical)	Practical Credits	2
Course Code	DSC (P)-3.2	Contact Hours	54 hrs
Formative Assessment Marks	25 marks	Summative Assessment Marks	25 marks

Content of Practical

1	Estimation of total soluble solids (TSS).
2	Estimation of brix: acidity ratio
3	Estimation of ascorbic acid and effect of heat treatment on it.
4	To study the steps of artificial drying of vegetables.
5	Adulteration of spices.
6	Dehydration of fruits and vegetables.
7	Rehydration of fruits and vegetables.
8	Salting of vegetables.
9	Brining of vegetables.
10	Organoleptic changes during dehydration of vegetables and fruits.

Formative Assessment:

Assessment Occasion/ type	Weightage in Marks
Test 1	05
Test 2	05
Practical Record	10
Participation and Involvement	05
Total	25 Marks

Formative Assessment as per NEP guidelines are compulsory

References

1	Girdharilal, Siddappaa, G.S and Tandon, G.L.1998. Preservation of fruits & Vegetables, ICAR, New Delhi
2	Crusess W B.2004. Commercial Unit and Vegetable Products, W.V. Special Indian Edition, Pub: Agrobios India

References

- | | |
|---|---|
| 3 | Manay, S. & Shadaksharaswami, M.2004. Foods: Facts and Principles, New Age Publishers |
| 4 | Ranganna S.1986. Handbook of analysis and quality control for fruits and vegetable products, Tata Mc Graw-Hill publishing company limited, 2 nd edition. |
| 5 | Srivastava, R.P. and Kumar, S. 2006. Fruits and Vegetables Preservation- Principles and Practices. 3 rd Ed. International Book Distributing Co. |
| 6 | Manay, S. and Sharaswamy, M. 1987. Food Facts and Principles. Wiley Eastern Limited |

Model Curriculum

Program Name	B Sc Food Technology	Semester	Third Semester
Course Title	Operations in Food Processing (Theory)		
Course Code:	DSC-3.3	No. of Credits	3
Contact hours	45 hrs	Duration of ESA/Exam	2 Hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Pre-requisite(s): Certificate on completion of First Year BSc Food Technology.	
Course Objectives:	
1. To learn about the principles, techniques and processes required for unit operations.	
Course Outcomes (COs): After successful completion of the course, students will acquire knowledge on	
CO 1. Gain know-how regarding principles of unit operations.	
CO 2. Understand the principles underlying various types of food processing	
CO 3. Familiarize with unit operations and techniques in food processing	
CO 4. Apply the knowledge of unit operations in food industry	
Theory Content	45 Hrs
Unit-1	15
Theory Size reduction: Benefits, classification, sieve/screen analysis, principle and mechanisms of comminution of food, Rittinger's, Kick's and Bond's equations, work index, energy utilization; Size reduction equipment: Principal types, hammer mills and impactors, attrition mills, buhr mill, tumbling mills, tumbling mills, colloid mill, cutting machines (slicing, dicing, shredding, pulping);	
Unit -2	15
Mixing: Theory of solids mixing, criteria of mixer effectiveness and mixing indices, rate of mixing, Theory of liquid mixing, power requirement for liquids mixing; Mixing equipment: Mixers for low- or medium-viscosity liquids (paddle agitators, impeller agitators, powder-liquid contacting devices, other mixers), Mixers for high viscosity liquids and pastes, mixers for dry powders and particulate solids;	

Mechanical Separations: Theory, centrifugation, liquid-liquid centrifugation, liquid-solid centrifugation, clarifiers, desludging machines; Filtration: Theory of filtration, rate of filtration, pressure drop during filtration, applications Filtration equipment; plate and frame filter press, rotary filters, centrifugal filters and air filters, filter aids; Membrane separation: General considerations, materials for membrane construction, Ultra-filtration, processing variables, membrane fouling, Applications of ultra-filtration in food processing, reverse osmosis, mode of operation, and applications, Membrane separation methods, gel filtration, ion exchange, per-evaporation and micro filtration.

Formative Assessment:

Assessment Occasion/ type	Weightage in Marks
Test 1	10
Test 2	10
Assignment	05
Seminar	05
Project	10
Total	40 Marks

Formative Assessment as per NEP guidelines are compulsory

Summative Assessment (60 marks) + Formative Assessment (40 marks) = Total 100 marks

References

1	Unit Operations of Chemical Engineering Warren LM, Julian Smith, Peter Harriott 7 th Ed. McGraw-Hill, Inc., NY, USA. 2004
2	Transport Processes and Separation Process Principles Christie John Geankoplis 4 th Ed. Prentice-Hall, NY, USA. 2003
3	Handbook of Food Processing Equipment Saravacos GD and Athanasios EK Springer Science+Business Media, New York, USA. 2002

Model Curriculum

Program Name	B Sc Food Technology	Semester	Third Semester
Course Title	Food Adulteration (Theory)		
Course Code:	OE-3.1	No. of Credits	3
Contact hours	45 hrs	Duration of ESA/Exam	2 Hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Pre-requisite(s): Certificate on completion of First year BSc Food Technology

Course Objectives:

1. To educate about common food adulterants and their detection.
2. To impart knowledge in the legislative aspects of adulteration.
3. To educate about standards and composition of foods and role of consumer.

Course Outcomes (COs): After successful completion of the course, students will be able to:

- CO 1. Get basic knowledge on various foods and about adulteration.
- CO 2. Understand the adulteration of common foods and their adverse impact on health
- CO 3. Comprehend certain skills of detecting adulteration of common foods.
- CO 4. Be able to extend their knowledge to other kinds of adulteration, detection and remedies.
- CO 5. Know the basic laws and procedures regarding food adulteration and consumer protection.

Theory Content

45 Hrs

Unit-1: Adulteration – Introduction

14

- Definition – Types;
- Common Foods subjected to Adulteration - Poisonous substances, Foreign matter, Cheap substitutes, Spoiled parts. New adulterants in foods
- Adulteration through Food Additives – Intentional and incidental.
- General Impact on Human Health

Unit -2:

15

- Adulteration of Common Foods and Methods of Detection
- Means of Adulteration

- Methods of Detection Adulterants in the following Foods: Milk, Oil, Grain, Sugar, Spices and condiments, processed food, Fruits and vegetables.
- Historical Food legislation in India; Central food laboratory, Municipal laboratories,

Unit -3: Energy

16

- Present Laws and Procedures on Adulteration: Highlights of Food Safety and Standards Act 2006 (FSSA)
- Food Safety and Standards Authority of India–Rules and Procedures of Local Authorities.
- Consumer protection: Role of voluntary agencies such as, Ag mark, I.S.I. Quality control laboratories of companies, Private testing laboratories,
- Quality control laboratories of consumer co-operatives.
- Consumer education, Consumer’s problems rights and responsibilities, COPRA 2019 - Offenses and Penalties – Procedures to Complain – Compensation to Victims.

Formative Assessment:

Assessment Occasion/ type	Weightage in Marks
Test 1	10
Test 2	10
Assignment	05
Seminar	05
Project	10
Total	40 Marks

Formative Assessment as per NEP guidelines are compulsory

Summative Assessment (60 marks) + Formative Assessment (40 marks) = Total 100 marks

References

1	A first course in Food Analysis – A.Y. Sathe, New Age International (P)Ltd.,1999
2	Food Safety, case studies--Ramesh. V. Bhat, NIN,1992
3	https://old.fssai.gov.in/Portals/0/Pdf/Draft_Manuals/Beverages and confectionary.pdf
4	https://cbseportal.com/project/Download-CBSE-XII-Chemistry-Project-FoodAdulteration#gsc.tab=0 (Downloadable e material on food adulteration)
5	https://www.fssai.gov.in/

References

6	https://indianlegalsolution.com/laws-on-food-adulteration/
7	https://fssai.gov.in/dart/
8	https://byjus.com/biology/food-adulteration/

Model Curriculum

Program Name	B Sc Food Technology	Semester	Fourth Semester
Course Title	Dairy Technology (Theory + Practical)		
Course Code:	DSC-4.1	No. of Theory +Practical Credits	3+2 = 5
Contact hours	45 hrs	Duration of ESA/Exam	2 Hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Pre-requisite(s): Certificate on completion of First Year BSc Food Technology

Course Objectives:

1. To learn about the varied processing of dairy products undertaken in an industrial level
2. To gain the knowledge about the post-harvest technology and the novel technologies in the processing of the products

Course Outcomes (Cos): After successful completion of the course, students will be able to:

- CO 1. Acquire the basic knowledge of developments in dairy industries.
- CO 2. Comprehend the recent advances in processing of dairy products.
- CO 3. Acquire the knowledge in manufacturing of different dairy products.
- CO 4. Understand about types of dairy plants and working principles of dairy instruments.
- CO 5. Gain knowledge regarding hygiene and sanitation practices in the milk and milk products industry

Theory Content

45 Hrs

Unit-1

15

Dairy industry: Review of dairy development in India. Dairy industry in India and abroad. Co-operative dairying, Market survey; milk production & consumption pattern, national and global markets. Clean milk production & hygienic handling of raw milk. Milk collection/procurement and pricing.

Recent developments in dairy sector: Dehydration, UHT processing, types of UHT plants, aseptic fillers, heat stability and deposit formation aspects, retort processing, use of bio-protective factors for preservation of raw milk and their effects on physicochemical, microbial, and nutritional properties of milk and milk products. Packaging of dairy products.

Unit -2	15
<p>Dairy products: Fluid milk: Full cream, standardized, toned & double toned milk, reconstituted, rehydrated, and recombined milk, flavoured milk.</p> <p>Traditional dairy products, Fat-rich dairy products, Heat and acid coagulated milk products, Cheese (types and manufacture process), value added dairy products, ice-cream and frozen desserts, imitation dairy products, By-products Technology (Processing and utilization of whey, ghee residue, casein – classification and applications).</p>	
Unit -3	15
<p>Dairy Plant Management: Principles of dairy plant design, classification of dairy plants, Instrumentation and process control, microbial quality and safety in dairy industry, HACCP, GMP/GHP practices in dairy processing. Waste Disposal and Pollution Abatement, Current trends in cleaning and sanitization of dairy equipment.</p>	

Formative Assessment:	
Assessment Occasion/ type	Weightage in Marks
Test 1	10
Test 2	10
Assignment	05
Seminar	05
Project	10
Total	40 Marks
<i>Formative Assessment as per NEP guidelines are compulsory</i>	
<i>Summative Assessment (60 marks) + Formative Assessment (40 marks) = Total 100 marks</i>	

Course Title	Dairy Technology (Practical)		Practical Credits	2
Course Code	DSC (P)-4.1	Contact Hours	54 hrs	
Formative Assessment Marks	25 marks	Summative Assessment Marks	25 marks	

Practical Contents	
1	Rapid tests for evaluation of milk quality- Clot on boiling test, alcohol test, alizarin alcohol test, phosphatase, acidity, turbidity
2	Chemical analysis of milk and determination of its components like fat, SNF, protein and TSS.
3	Preparation and quality evaluation of milk products: Heat desiccated/ Heat – acid
4	coagulated milk products, Cultured milk products, Fat rich products, Puddings / desserts
5	By product utilization experiments (Whey and ghee residue)
6	Visit to dairy plant.

Formative Assessment:	
Assessment Occasion/ type	Weightage in Marks
Test 1	05
Test 2	05
Practical Record	10
Participation and Involvement	05
Total	25 Marks

Formative Assessment as per NEP guidelines are compulsory

References	
1	Products. Dairy India Yearbook Publications, New Delhi. 2002.
2	Gupta P. R., Dairy India, 5 th Ed., New Delhi. 1997.
3	Robinson R. K., Modern dairy Technology, 2nd Ed., Chapman and Hall, New York. 1994.
4	Subbulaksmi G and Shobha A. Udipi, Food processing and preservation, New age international, 2008.
5	<u>D.B. Puranik</u> , Dairy plant management, New India Publishing Agency. 2014
6	De Sukumar, Outlines of dairy: Technology, 1st edition, Oxford, 2001.

Model Curriculum

Program Name	B Sc Food Technology	Semester	Fourth Semester
Course Title	Bakery and Confectionery Technology (Theory + Practical)		
Course Code:	DSC-4.2	No. of Theory +Practical Credits	3+2 = 5
Contact hours	45 hrs	Duration of ESA/Exam	2 Hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Pre-requisite(s): Certificate on completion of First Year BSc Food Technology	
Course Objectives:	
<ol style="list-style-type: none"> 1. To familiarize the students about the bakery and confectionary industry. 2. To understand and examine the technologies used in different industries. 	
Course Outcomes (COs): After successful completion of the course, students will be able to:	
CO 1. To understand and identify methods and products used in bakery industry.	
CO 2. Apply the knowledge of the various technologies in bakery industries.	
CO 3. Define and describe the manufacturing methods and general technical aspects of confectionary industry.	
CO 4. Identify and explain about the extruded food product industry	
Theory Content	45 Hrs
Unit-1	15
<p>Baking Industry: Global status of Baking industry, Introduction to baking, Bakery ingredients and their functions, traditional bakery products; Modern bakery product.</p> <p>Baking methods: Various methods of production and effect of ingredients, formulations and process parameters on quality, machinery used in baking industry.</p> <p>Bakery Products: Bread, bread rolls, sweet yeast dough products, biscuits, wafer, cookies and crackers, Multi grain bread and gluten free products</p>	
Unit -2	15
<p>Bakery Product Quality: Rheological testing of dough- Farinograph, mixograph, extensograph, amylograph/ rapid visco analyzer, Falling number; Microbiological aspects of different bakery products – prevention of bacterial rope and mold infection</p>	

Bakery plants sanitation: Bakery hygiene and sanitation including control of rodents and pests. Bread faults – causes and remedies; Bread staling – theory, manifestation, retardation measures

Cakes: Cake flour specifications; ingredients, manufacturing process and quality evaluation; Basic methods of cake preparations, variety cakes and doughnuts, rusks, crackers, buns, muffins, pizza; Icings, glazers, creams, fondants, frostings; Cake recipe balancing, faults and remedies; Preparation of basic custards, pudding; Mousse.

Unit -3

15

Confectionery industry: Global status of confectionery industry; Raw materials, quality parameters; production, types, applications.

Confectionery manufacture: Raw materials and processing; cocoa, sugar, special fats, dried milk products, emulsifiers; chocolate processing- compound coatings, candy bars, tempering, enrobing technology, chocolate shells.

Sugar confectionery: General technical aspects, manufacture of boiled sweets, lollipops, lozenges, gums and jellies, chewing gums, caramel, toffee, fudge. Indian Confectionery – Types, role of sugar in preparation, other ingredients and their role in preparation

Formative Assessment:

Assessment Occasion/ type	Weightage in Marks
Test 1	10
Test 2	10
Assignment	05
Seminar	05
Project	10
Total	40 Marks

Formative Assessment as per NEP guidelines are compulsory

Summative Assessment (60 marks) + Formative Assessment (40 marks) = Total 100 marks

Course Title	Bakery and Confectionery Technology (Practical)	Practical Credits	2
Course Code	DSC (P)-4.2	Contact Hours	54 hrs
Formative Assessment Marks	25 marks	Summative Assessment Marks	25 marks

Practical Contents	
1	Introduction to bakery equipments
2	Determination of ash content of the given sample of white wheat flour
3	Estimation of water absorption power and gluten content of the given flour.
4	Determination of alcoholic acidity of the given sample of wheat flour.
5	Determination of sedimentation value of white wheat flour
6	Determination of yeast quality by its dough rising capacity
7	Preparation of plain biscuit in laboratory
8	Preparation of egg less cake.
9	Preparation of bread by straight dough method.
10	Microbial flora of aging bakery items.
11	Sensory characteristics of the baked products.
12	Objective characteristics of biscuits.

Formative Assessment:	
Assessment Occasion/ type	Weightage in Marks
Test 1	05
Test 2	05
Practical Record	10
Participation and Involvement	05
Total	25 Marks
<i>Formative Assessment as per NEP guidelines are compulsory</i>	

References	
1	Matz, Samuel A, Bakery Technology and Engineering, 3 rd Ed, CBS Publishers, 2008.
2	Stanley Cauvain and Linda Young, Baked Products- Science, Technology and practice, Blackwell

References

	Publishing, 2006.
3	Amendola, Joseph and Nicole Rees, The Baker's Manual, 5 th Ed, Wiley, 2003.
4	Hamed Faridi and Jon M. Faubion, Dough Rheology and Baked Product Texture, CBS Publishers, 1997.
5	Duncan, Manley. Biscuit, Cookie and Cracker Manufacturing Manuals. Vol.1-6. Woodhead Publishing Harper JM. Extrusion of Food, Vol 2, CRC Press1981.
6	Matz SA. Bakery Technology & Engineering. AVI Pub. 1960.
7	Fance WJ and Wrogg BH. Up to-date Bread Making; Maclasen & Sons Ltd. 1968,
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Model Curriculum

Program Name	B Sc Food Technology	Semester	Fourth Semester
Course Title	Food Safety and Food Laws (Theory)		
Course Code:	DSC-4.3	No. of Credits	3
Contact hours	45 hrs	Duration of ESA/Exam	2 Hours
Formative Assessment Marks	40	Summative Assessment Marks	60

Course Pre-requisite(s): Certificate on completion of First Year BSc Food Technology.

Course Objectives:

1. To learn the principles and importance of food safety
2. To familiarize with the existing food laws and regulations

Course Outcomes (COs): After successful completion of the course, students will be able to:

- CO 1. Understand the principles and importance of food safety.
- CO 2. Implement analytical techniques to assess food quality
- CO 3. Have the knowledge of and follow food laws and regulations at both national and international levels

Theory Content

45 Hrs

Unit-1

15

Principles of Food Safety: Food Sanitation and safety: Factors contributing to physical, chemical and biological contamination in food chain, prevention and control of food borne hazards, definition and regulation of food sanitation, sources of contamination, personal hygiene-food handlers, cleaning compounds, sanitation methods, waste disposal strategy (solid and liquid waste) and pest control. Food adulteration: common adulterants, simple tests for detection of adulteration. Food additives classification, functional role and safety issues.

Unit -2

15

Analytical Techniques for Food Quality Analytical method used for quality determination: chemical and physical, microbiological, biochemical and sensory analysis. Analytical methods of determination of basic food components: protein, saccharides, lipids, vitamins, water, minerals and trace elements, sensory active compounds, anti-nutritive and natural toxic compounds, food additives and food contaminants. Basic principles of chromatography. Paper Chromatography. Spectrophotometric techniques:

Spectrophotometry introduction and principles.

Unit -3

15

Food Laws and Regulations Food Safety Systems: Quality systems standards including ISO; Auditing; Good Manufacturing Practice and HACCP. Food Laws & Implementing Agencies-National: FSSAI. International Scenario in Food Regulation USFDA, EFSA, UK, Canada, A & NZ, Japan, Malaysia, Singapore; Consumer Movements; Intellectual Property Rights and Trade Marks: Protection of investment and efforts in research and development by patenting; Criteria of patentability; National and international patent; Terms of patents; Copyright. International Agencies in Food Regulation: Food Codex Alimentarius: Various aspects and relation with domestic laws; FAO, WHO, WTO.

Formative Assessment:

Assessment Occasion/ type	Weightage in Marks
Test 1	10
Test 2	10
Assignment	05
Seminar	05
Project	10
Total	40 Marks

Formative Assessment as per NEP guidelines are compulsory

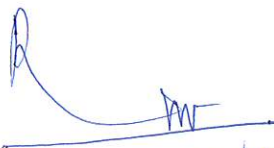
Summative Assessment (60 marks) + Formative Assessment (40 marks) = Total 100 marks

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