



Government of Karnataka

**Curriculum Framework for Undergraduate Programme in Colleges and
Universities of Karnataka**



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

**Submitted to
Vice Chairman**

Karnataka State Higher Education Council
30, Prasanna Kumar Block, Bengaluru City University Campus,
Bengaluru, Karnataka – 560009

Composition of Subject Expert Committee Members

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2	Dr. Renuka Meti, Assoc. Professor, KSAW University, Vijayapura	Member
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10	Smt. Rajani B Special Officer, Karnataka State Higher Education Council	Member Convener

Model Curriculum
of
BSc
in
Food Technology
5th Semester

Karnataka State Higher Education Council



Government of Karnataka

Model Curriculum

Program Name	BSc in Food Technology	Semester	Fifth Semester
Course Title	Spices and Plantation Crop Processing Technology (Theory)		
Course Code:	DSC FT-C21	No. of Credits	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. Understand the principles and importance of processing technologies for spices and plantation crops.
- CO2. Acquire knowledge and skills in pre-processing techniques including cleaning, grading, sorting, and drying of raw materials.
- CO3. Gain practical experience in processing methods such as grinding, extraction, and distillation for the production of value-added spice and plantation crop products.
- CO4. Develop competencies in quality assurance, food safety practices, packaging, and marketing strategies for spices and plantation crop products

Theory Contents	60 Hrs
Unit 1: Spices and Plantation Crops	14 Hrs
Introduction, definition, classification, importance, and historical significance Major spices and plantation crops: characteristics and cultivation practices Post-harvest handling and quality control and an overview of processing technologies	
Unit 2: Pre-processing Techniques for Spices and Plantation Crops	16 Hrs
Harvesting and transportation methods Cleaning and grading of raw materials: principles and techniques Sorting, winnowing, and destoning methods. Drying techniques: sun drying, mechanical drying, and other methods. Storage and preservation: principles and practices	
Unit 3: Processing Technologies for Spices and Plantation Crops	15 Hrs
Curing, grinding and milling operations: principles, equipment, and techniques Extraction and distillation processes for essential oils and oleoresins Processing methods for value-added products.	
Unit 4: Quality Assurance and Marketing of Spices and Plantation Crop Products	14 Hrs

Quality evaluation and control of process, Food safety and hygiene practices, Marketing strategies and channels, Packaging technologies, labelling requirements, regulations and certifications.

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	"Postharvest Technology of Horticultural Crops" by Adel A. Kader (Publisher: University of California, Division of Agriculture and Natural Resources; Publication Year: 2002)
2	"Spices and Seasonings: A Food Technology Handbook" by Donna R. Tainter and Anthony T. Grenis (Publisher: John Wiley & Sons; Publication Year: 2001)
3	"Plantation Crops: Plugs & Stalks" by Shashi Singh and Ajit Singh (Publisher: Daya Publishing House; Publication Year: 2011)
4	"Spices, Condiments, and Seasonings" by Kenneth T. Farrell (Publisher: Springer; Publication Year: 2016)
5	"Spices and Plantation Crops: Recent Advances in Botany, Horticulture, and Pharmacology" by Akhilesh Kumar Pandey, Prasanta Kumar Nayak, and Manish Kumar Dubey (Publisher: Springer; Publication Year: 2018)
6	"Spice Science and Technology" by Kenji Hirasa and Mitsuo Takemasa (Publisher: CRC Press; Publication Year: 2000)
7	"Plantation Crops: Biology and Management" by S. Rajan (Publisher: Springer; Publication Year: 2020)
8	"The Encyclopedia of Herbs and Spices" by P. N. Ravindran (Publisher: CABI Publishing; Publication Year: 2016)
9	"Processing of Spices and Plantation Crops" by P. C. Stephen (Publisher: Oxford & IBH Publishing Co. Pvt. Ltd.; Publication Year: 2003)
10	"Plantation Crops and Organic Farming" by K. V. Peter (Publisher: New India Publishing Agency; Publication Year: 2007)

Course Title	Spices and Plantation Crop Processing Technology (Practical)	Practical Credits	2
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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>	



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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

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

- CO1. Understanding basic theoretical knowledge and practical skills of meat science,
- CO2. Acquire knowledge of the chemical composition and physico-chemical properties of meat of different species,
- CO3. Gain knowledge of equipment and various technological procedures of meat processing,
- CO4. Get the latest knowledge of meat science.

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				
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>	



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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

Course Outcomes (COs): After the successful completion of the course, the student will be able to:	
CO1. Understanding fundamentals, design considerations, processing of different extruded products and selection of food extrusion equipments.	
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.	
CO3. Understanding chemical and nutritional changes occurring in extrusion process and packaging requirement of extruded products.	
CO4. . Knowing recent trends and future aspects of food extrusion.	
Theory Contents	60 Hrs
Unit I - FOOD EXTRUSION	15 Hrs
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	
Recent Advances in extrusion technology: Carbon dioxide or Nitrogen assisted extrusion technology, Extrusion in confectionary technology, Non-thermal Extrusion of Protein Products	
Unit II - SCREW EXTRUDER	15 Hrs
Single screw extruder: working Principle, Net Flow, Operations, manufacturing of pasta, Macaroni, Spaghetti and vermicelli.	
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	

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



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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

Course Outcomes (COs): After the successful completion of the course, the student will be able to:	
CO1. To know the functional aspects of food components & their role in food processing	
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.	
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	
Theory Contents	45 Hrs
Unit 1:	15 hrs
Physico-chemical properties of foods- Organic food components, colloids, osmotic pressure, food dispersions (sols, gels, emulsion, foam), pH Role of water in foods, free and bound water, functional properties, water activity and intermediate moisture foods	
Unit 2:	15 hrs
Carbohydrates: Starch, cellulose, hemicelluloses, hydrocolloids and gums: occurrence, functions in food systems, rheological properties, gelatinization, retrogradation and modified starches Browning in foods: Enzymatic and non-enzymatic- mechanism, methods of prevention and health effects in brief	
Unit 3:	15 hrs
Functional properties of proteins, modified proteins, application in product formulation Functional Properties of Lipids (Fats and Oil)	

Pedagogy:

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	40 Marks

Formative Assessments are compulsory

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)



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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	Fennama, 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.



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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

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

- CO1. Understand the adulteration of common foods and their adverse impact on health
- CO2. Comprehend certain skills of detecting adulteration of common foods.
- CO3. Able to extend their knowledge to other kinds of adulteration, detection and remedies.
- CO4. Know the basic laws and procedures regarding food adulteration and consumer protection.
- CO5. Understand the concept of food toxicology and toxicants in foods.

Theory Contents	45 Hrs
Unit 1: Introduction to Food Adulteration	15 hrs
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).	
Unit 2: Laws and Procedures on Adulteration	15 hrs
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	

Unit 3: Food Toxicology	15 hrs
<p>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.</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	A firstcourseinFoodAnalysis–A. Y. Sathe, NewAgeInternational(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, 2ndEdition. Elsevier Inc., Burlington, MA.
8	Watson, D.H. “Natural Toxicants in Food”, CRC Press, LLC. Boca Raton, FL 1998.



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Model Curriculum

Program Name	BSc in Food Technology	Semester	Fifth Semester
Course Title	Engineering Drawing and Graphics 1		
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

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

- CO1. Develop clear concept and perception of Lettering, Lines Plane Curves
- CO2. Develop the skill of expressing Projection of Solids, Points and Plane Surface
- CO3. Develop clear concept and perception of Isometric and perspective projections.

Theory Contents

45 Hrs

Unit 1: Theory of Lettering, Lines Plane, Curves

15Hrs

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.

Unit 2: Theory of Projection of Solids, Points and Plane Surface

15Hrs

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.

Unit 3: Theory of Isometric and perspective projections

15Hrs

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.

Pedagogy:

Formative Assessment for Theory	
Assessment Occasion/ type	Marks
Test 1	10
Test 2	10
Assignment / Seminar	5+5
Project	10
Total	40 Marks

Formative Assessments are compulsory

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



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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

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

CO1. To know the importance and need of food preservation.

CO2. To familiarize with various type of food preservation techniques, principle behind those techniques and its practical application

CO3. To learn about advanced methods which are being used in food processing sector.

Theory Contents

45 Hrs

Unit 1: Introduction to Preservation

14 Hrs

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

Unit 2: Preservation Technique

15 Hrs

Preservation by

Irradiation: technology and application

Preservation by Chemicals – Types, safety of preserved foods

High pressure processing (in brief)

Preservation by dehydration and concentration

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

Preservation by Heat

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>	



Government of Karnataka

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

- Designing new product – types and drawing forces
- Need for product development
- Stages of product development
- Success in product development
- Consumer research
- 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>	



Government of Karnataka

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):

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

Theory Contents **60 Hrs**

Unit – 1 15Hrs

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)

Unit II - 15Hrs

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

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.



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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

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

CO1. Understand the concept of Entrepreneurship, its applications and scope.

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.

CO3. Applies the knowledge for generating a broad idea for a starting an enterprise/start up.

CO4. Understand the content for preparing a Project Report for a startup and differentiate between financial, technical analysis and business feasibility.

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.



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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	50	Summative Assessment Marks	50

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:

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	Neiser JR & German BJ. (2004). Bioprocesses and Biotechnology for Nutraceuticals. Chapman & Hall.



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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

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 able to apply ICT in Food Processing, Packaging, Marketing and Ensure Food Quality Control

Theory Contents

45 Hrs

Unit 1: Unit 1: Introduction to ICT and Food Industry

15 Hrs

Definition of Information and Communications Technology

Relationship between ICT and food industry – i.e., production, processing, storage, distribution and marketing

Components of information and communication technologies- Collection of data, Wireless sensors in data collection, Data processing technologies

Significance and current role of ICT in food industry

Challenges and Opportunities of ICT in Food Industries

UNIT 2 - ICT in Food Processing and Packaging

15 Hrs

Computational Modelling of Food Processing Operations

- Data Warehousing and Data Mining
- Analytics in Food Industries
- Decision Making using Analytics.
- Quality Control using Analytics.
- Customer Satisfaction using Analytics.

Monitoring and surveillance of food manufacturing process

Data Management Techniques in Food Industries

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

References	
	in the Food Industry: Recent Advances and Prospects. <i>Foods</i> , 8(10), 476.
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.



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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
<p>Overview of enzymes: definition, characteristics, and functions</p> <p>Enzymes as catalysts: their role in food processing and production</p> <p>Sources of enzymes: microbial, animal, and plant-derived enzymes</p> <p>Enzyme classification and nomenclature</p> <p>Enzyme kinetics: understanding enzyme-substrate interactions and reaction rates</p> <p>Factors influencing enzyme activity: pH, temperature, substrate concentration, and inhibitors</p> <p>Safety considerations and regulations for enzyme use in the food industry</p>	
Unit 2: Enzymes in Food Processing and Production	15 hrs
<p>Enzymes in baking: amylases, proteases, and lipases for dough fermentation, gluten modification, and flavor development</p> <p>Enzymes in brewing and distilling: amylases, cellulases, and glucanases for starch and cellulose degradation</p> <p>Enzymes in dairy processing: lactases, lipases, and proteases for lactose hydrolysis, flavor enhancement, and cheese ripening</p>	

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



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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



Government of Karnataka

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

Formative Assessments are compulsory

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)



Government of Karnataka

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
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- ❖ 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

.....	Marks

Section-B

.....	Marks

Section-C

.....	Marks