



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

SN	Name & Organization	Designation
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10	Smt. Rajani B Special Officer, Karnataka State Higher Education Council	Member Convener

**Model Curriculum
of
BSc
in
Food Technology
V and VI Semesters**

Karnataka State Higher Education Council

Content of Courses for B.Sc. Degree in Food Technology (V and VI Semesters)

Semester	Course Code	Category of Course	Theory/Practicals	Credits	Course/Paper Titles	Marks	
						IA	SA
V		DSC	Theory	4	Spices and Plantation Crop Processing Technology	40	60
			Practical	2		25	25
		DSC	Theory	4	Processing of animal products	40	60
			Practical	2		25	25
		DSC	Theory	4	Extrusion Technology	40	60
		DSE	Theory	3	Functional properties of foods OR Food Chemistry OR Food Adulteration and Food Toxicology	40	60
		VOC	Theory/Practical	3	Engineering Drawing and Graphics I OR Food preservation techniques OR Design and Formulation of Foods	40	60
	Total credits			22	Assessment	250	350

VI		DSC	Theory	4	Food Packaging Technology	40	60
			Practical	2		25	25
		DSC	Theory	4	Nutraceuticals and Functional Foods	40	60
			Practical	2		25	25
		DSC	Theory	4	Food Refrigeration and Cold Storage	40	60
		DSE	Theory	3	Enzymes in Food Industry OR ICT applications in Food industry OR Sensory evaluation of food products	40	60
		VOC	Theory/ Practical	3	Entrepreneurship Development OR Engineering Drawing and Graphics II OR Food Waste Management and Utilization	40	60
	Total credits			22	Assessment	250	350



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Program Name	BSc in Food Technology	Semester	Fifth Semester
Course Title	Spices and Plantation Crop Processing Technology (Theory)		
Course Code:	DSC	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 principles and importance of processing technologies for spices and plantation crops.</p> <p>CO2. Acquire knowledge and skills in pre-processing techniques including cleaning, grading, sorting, and drying of raw materials.</p> <p>CO3. Gain practical experience in processing methods such as grinding, extraction, and distillation for the production of value-added spice and plantation crop products.</p> <p>CO4. Develop competencies in quality assurance, food safety practices, packaging, and marketing strategies for spices and plantation crop products</p>	
Theory Contents	60 Hrs
Unit 1:	14 Hrs
<p>Spices and Plantation Crops: 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</p>	
Unit 2:	16 Hrs
<p>Pre-processing Techniques for Spices and Plantation Crops: Harvesting and transportation methods. Cleaning and grading of raw materials: principles and techniques</p> <p>Sorting, winnowing, and destoning methods. Drying techniques: sun drying, mechanical drying, and other methods. Storage and preservation: principles and practices</p>	
Unit 3:	15 Hrs
<p>Processing Technologies for Spices and Plantation Crops: Curing, grinding and milling operations: principles, equipment, and techniques, Extraction and distillation processes for essential oils and oleoresins. Processing methods for value-added products.</p>	

Unit 4:	14 Hrs
Quality Assurance and Marketing of Spices and Plantation Crop Products: 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, University of California, Division of Agriculture and Natural Resources; 2002
2	Spices and Seasonings: A Food Technology Handbook by Donna R. Tainter and Anthony T. Grenis, John Wiley & Sons; 2001
3	Plantation Crops: Plugs & Stalks by Shashi Singh and Ajit Singh, Daya Publishing House; 2011
4	Spices, Condiments, and Seasonings by Kenneth T. Farrell, Springer; 2016)
5	Spices and Plantation Crops: Recent Advances in Botany, Horticulture, and Pharmacology by Akhilesh Kumar Pandey, Prasanta Kumar Nayak, and Manish Kumar Dubey, Springer; 2018
6	Spice Science and Technology by Kenji Hirasa and Mitsuo Takemasa, CRC Press; 2000
7	Plantation Crops: Biology and Management by S. Rajan, Springer; 2020
8	The Encyclopedia of Herbs and Spices by P. N. Ravindran, CABI Publishing; 2016
9	Processing of Spices and Plantation Crops by P. C. Stephen, Oxford & IBH Publishing Co. Pvt. Ltd.; 2003
10	Plantation Crops and Organic Farming by K. V. Peter, New India Publishing Agency; Publication, 2007

Course Title	Spices and Plantation Crop Processing Technology (Practical)			Practical Credits	2
Course Code	DSC			Contact Hours	60 Hours
Formative Assessment		25 Marks	Summative Assessment		25 Marks
Practical Content					

1: Familiarization with Spice 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: Familiarization with 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

3: Study on characteristics of various plantation crops

4: Chemical analysis of spices:

Moisture, Valuable oil, Specific gravity, Refractive index, Acid value

6: Cleaning and Grading Techniques

Identification and removal of foreign matter and impurities

Cleaning and grading

7: Drying Methods and Techniques

Demonstration and Hands-on experience of different drying methods (traditional and modern methods),

Monitoring and controlling drying parameters

8: 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

9: Extraction of Oils

Extraction techniques for oils and essential oils

Hands-on extraction using steam distillation, solvent extraction, or cold pressing methods - Extraction of virgin coconut oil

Analysis of extracted oils for quality and yield

10: Product Development

Formulation of recipes and standardization of product parameters

Evaluation of sensory attributes, Packaging and Labelling

Preparation of curry powder and Chocolates

11: Quality Assurance

Quality testing of processed products – free fatty acids, pH, peroxide values and Iodine number

12: Market Survey and Marketing Strategies

Conducting a market survey to understand consumer preferences and trends.

Analysing market opportunities and competition

13: Field Visit – to Spice and plantation crop industry

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	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:	15 Hrs
Introduction to meat and meat products: 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. Post-mortem muscle chemistry.	
Unit II:	15 Hrs
Animal meat handling and by-products: Modern abattoirs, Typical layout and features, Antemortem handling and design of handling facilities, Hoisting rail and traveling pulley system, Stunning methods, Steps in slaughtering and dressing, Offal handling and inspection, Inedible by-products, Operational factors affecting meat quality, Effects of processing on meat tenderization, Abattoir equipment and utilities.	
Unit III:	16 Hrs
Poultry meat processing & packaging: Poultry industry in India, Measuring the yields and quality characteristics of poultry products, Microbiology of poultry meat, Spoilage factors, Lay-out and design of poultry processing plants, Plant sanitation, Poultry meat processing operations, Equipment used, Defeathering, Bleeding, Scalding, Packaging of poultry products, Refrigerated storage of poultry meat, By products.	
Unit IV:	14 Hrs

Processing of egg and fish:

Processing of egg: Nutritional value of processed eggs, Effect of processing on nutritional quality of eggs, Eggs and egg products, Whole egg powder, Egg yolk products and their manufacture, packaging and storage. Fish and fish processing: Commercially important marine products from India, Preservation of postharvest fish freshness, Processing of fish, Grading and preservation of shellfish, Pickling and preparation of fish protein concentrate, Fish oil and other by-products. Product export and its sustainability.

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

Course Title	Processing of Animal products (Practical)			Practical Credits	2
Course Code	DSC			Contact Hours	60 Hours
Formative Assessment	25 Marks		Summative Assessment		25 Marks
Practical Content					
1. Determination of pH of meat and meat products					
2. Determination of moisture content of meat					
3. Determination of microbial loads in various animal food products					

4. Preparation of ready-to-eat meat/poultry products.
5. Determination of meat extract volume or WHC
6. Evaluation of Egg quality.
7. Quality Evaluation of fish
8. Development of new product from Meat/Fish /Egg

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	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:	15 Hrs
Food extrusion: 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:	15 Hrs
Screw extruder: 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:	15 Hrs
Extrusion food products: 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:	15 Hrs
Extrusion Process: 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, Springer
2	Technology of Extrusion Cooking by N.D. Frame, Springer
3	Extruders in Food Application by Riaz M.N., CRC Press
4	Extrusion of Foods by J.M. Harper, CRC Press
5	Advances in Food Extrusion Technology by Maskan and Altan, CRC Press



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Model Curriculum

Program Name	BSc in Food Technology	Semester	Fifth Semester
Course Title	Functional Properties of Foods		
Course Code:	DSE	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 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
<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



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Model Curriculum

Program Name	BSc in Food Technology	Semester	Fifth Semester
Course Title	Food Chemistry		
Course Code:	DSE	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
Proteins and Amino acids: Nomenclature, classification, structure, chemistry and properties of amino acids, peptides, proteins. essential and non- essential amino acids. Changes during processing. Food Enzymes: Mechanism of enzyme action, factors affecting enzyme action, browning reactions.	

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



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Model Curriculum

Program Name	BSc in Food Technology	Semester	Fifth Semester
Course Title	Food Adulteration and Food Toxicology		
Course Code:	DSE	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:	15 hrs
Introduction to 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. Methods of Detection of 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:	15 hrs
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. 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:	15 hrs
Food Toxicology: Definition, scope and general principles. 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; 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) 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 by A.Y. Sathe, New Age International (P) Ltd.,1999
2	Food Safety, case studies by Rames 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 by S. N. Jh, Kindle Edition, 2016
5	Food Safety and Standards Act, 2006. Bare ACT, Commercial law publishers, 2020.
6	Food Toxicology by Helferich, W., and Winter, C.K, CRC Press, LLC. Boca Raton, FL. 2007.
7	Introduction to Food Toxicology by Shibamoto, T., and Bjeldanes, L., 2 nd Edition. Elsevier Inc., Burlington, MA. 2009
8	Natural Toxicants in Food by Watson, D.H., CRC Press, LLC. Boca Raton, FL1998.



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Model Curriculum

Program Name	BSc in Food Technology	Semester	Fifth Semester
Course Title	Engineering Drawing and Graphics I		
Course Code:	VOC	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:	15Hrs
Theory of Lettering, Lines Plane, Curves: 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:	15Hrs
Theory of Projection of Solids, Points and Plane Surface: 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:	15Hrs
Theory of Isometric and perspective projections: 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
<i>Formative Assessments are compulsory</i>	

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



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Model Curriculum

Program Name	BSc in Food Technology	Semester	Fifth Semester
Course Title	Food Preservation Techniques		
Course Code:	VOC	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:	14 Hrs
Introduction to Preservation: 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:	15 Hrs
Preservation Techniques: Preservation by Irradiation: technology and application. Preservation by Chemicals – Types, safety of preserved foods. High pressure processing (in brief). Preservation by dehydration and concentration: methods of drying and concentration, types of dryers, Factors affecting drying process	
Unit 3:	16 Hrs
Preservation by Heat and Cold Techniques: Preservation by Heat - Types: Sterilization, Pasteurization, Blanching, Canning, Mechanism of action, methods of application to foods (Equipments), effect on food and micro-organisms. Cold preservation - Types Refrigeration, Freezing, freeze drying, Refrigerated gas storage. Mechanism of action, methods of application to foods (Equipments), 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>	



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Model Curriculum

Program Name	BSc in Food Technology	Semester	Fifth Semester
Course Title	Design and Formulation of Foods (Theory)		
Course Code:	VOC	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-	14 Hrs
Product Development: 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 -	15 Hrs
Consumer Behaviour: Purchasing foods, Factors influencing product acceptance and purchasing trends. Market place changes in processed foods	
Unit 3 –	16 Hrs
Special Food Processing Technologies and Novel Food Ingredients: 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>	



Government of Karnataka

Model Curriculum

Program Name	BSc in Food Technology	Semester	Sixth Semester
Course Title	Food Packaging Technology (Theory + Practical)		
Course Code:	DSC	No. of Credits (Theory)	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 packaging materials CO2. Demonstrate understanding of the role of various techniques in food packaging CO3. Apply and innovate various techniques of food packaging CO4. Design food packaging for applications in food industries	
Theory Contents	60 Hrs
Unit-1	15 Hrs
Packaging Materials: Definition, need for packaging; package requirements and functions; types, Forms of packaging, Packaging materials: Paper –manufacture and types of paper, advantages of corrugated and paper board boxes; Glass–manufacture, advantages, disadvantages; Metal (Aluminium / tin / SS) – manufacture, advantages, disadvantages; Plastic – classification of polymers, properties and uses of plastics	
Unit -2	15 Hrs
Packaging requirement: Packaging requirements and their selection for raw and processed foods; meat, fish, poultry and egg, milk and dairy products, fruits and vegetables, cereal grains and cereal products, baked products, beverages, ready to eat snacks.	
Unit -3	15 Hrs
Characteristics of packaging materials: Permeability: theoretical considerations, permeability of gases and vapours, permeability of multilayer materials, Packaging of specific foods; WVTR, GTR, Mechanical and functional tests on package- bursting strength, tensile strength, tearing strength, drop test, puncture test, impact test, etc.	
Unit - 4	15 Hrs

Packaging machinery and Techniques: 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. Packaging and temperature changes: intelligent packaging; Packaging for microwave heating; Printing techniques; Package labeling: functions and regulations.

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>	

Course Title	Food Packaging Technology (Practical)	Practical Credits	2
Course Code	DSC	Contact Hours	60 Hours
Formative Assessment	25 Marks	Summative Assessment	25 Marks
Practical Content			
1. Classification of various packages based on material and rigidity; 2. Measurement of thickness of different packaging materials 3. Study on Mechanical tests of packaging materials 4. Identification of plastic films 5. Study of different packaging Machineries 6. Determination of chemical resistance of different packaging materials 7. Effect of pre packaging on fruits and vegetables 8. Determination of grease resistance of paper			

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	The Technology of Food Preservation, by Desrosier NW and Desrosier JN., CBS Publication, New Delhi, 2004
2	Handbook of Food Packaging, by Paine FA and Paine HY., Thomson Press India Pvt Ltd, New Delhi, 1992
3	Food Science, by Potter NH, CBS Publication, New Delhi, 1999
4	Innovations in Food Packaging by Bhat, Z. F., & Kumar, S. Elsevier Science, 2015.
5	Iddrisu, M., & Qi, Y. (2018). Smart packaging in food applications: a review of modern technologies. Journal of food science and technology, 55(9), 3571-3582.
6	Moreira, R. G., & Castilhos, T. M. (2018). The role of information technology in food packaging. Trends in Food Science & Technology, 77, 142-152.
7	Sensory Evaluation Techniques by Morten C. Meilgaard, Gail Vance Civille, and B. Thomas Carr, CRC Press, 2016



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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:	DSC	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. 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	60 Hrs
Unit I	15 Hrs
Introduction to nutraceuticals and functional foods: Definition, history and classification. Balanced Diet: Introduction, Basic Five Food Groups, Food Pyramid. Classification of Nutrients. Diseases and disorders related to Excess and deficiency of Carbohydrates, Protein and Fat. Role of nutraceuticals in the prevention and treatment of disease and disorders.	
Unit II	15 Hrs
Prebiotics, probiotics and Synbiotics: Concept of Prebiotics, probiotics and Synbiotics, Sources and health benefits. Sources and health benefits of Natural pigments like chlorophyll, chlorophyllin, carotenoids, lycopene, anthocyanins, glucosinolates, isoflavonoids, phytosterols, phytoestrogens, polyphenols, omega 3 and omega 6 fatty acids, Dietary fiber and antioxidants: Types, sources and health benefits.	
Unit III	15 Hrs
Phyto nutraceutical: Role of medicinal and aromatic plants in nutraceutical industry. Toxicology, bioavailability, bioequivalence; use of animal models and pre-clinical and clinical trials involved. Regulatory issues for nutraceuticals including FSSAI, CODEX, and USFDA, Labelling issues.	

Unit IV	15 Hrs
Functional foods: Cereal and cereal products, Milk and milk products, meat and products, sea foods, nuts and oilseeds, fruits and vegetables, herbs and spices, beverages such as tea and wine. Health benefits and role of fermented foods in disease prevention. Development in processing of functional foods.	

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>	

Course Title	Nutraceuticals and Functional Foods (Practical)		Practical Credits	2
Course Code	DSC		Contact Hours	60 Hours
Formative Assessment	25 Marks	Summative Assessment	25 Marks	
Practical Content				
1. Identification of various nutraceuticals available in the market				
2. Identification of functional foods available in the market				
3. Estimation of chlorophyll content of green vegetable				
4. Estimation of antioxidant content in kokum				
5. Estimation of polyphenols in different tea infusions				
6. Extraction of curcumin from turmeric.				
7. Extraction of lycopene from fruit/vegetable				
8. Estimation of oryzanol from rice bran oil				
9. Extraction of pectin from citrus fruits.				
10. Estimation of anthocyanins in food sample.				
11. Development of a probiotic/prebiotic foods				
12. Isolation of Lactic acid bacteria from curd				

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



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Model Curriculum

Program Name	BSc in Food Technology	Semester	Sixth Semester
Course Title	Food Refrigeration and Cold Storage (Theory)		
Course Code:	DSC	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: 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, Work, Heat, Specific Heat, Sensible heat, Latent heat, First and Second Laws of Thermodynamics, Carnot Refrigeration Systems, Refrigerator and Heat Pump, Coefficient of Performance (COP), Units of refrigeration: Ton of refrigeration, Refrigerants, desirable properties of refrigerants, types of refrigerants characteristics of different refrigeration's, ozone-depletion potentials, green house potential refrigerants, use of non-polluting refrigerants, net refrigerating effect. Refrigeration methods, Refrigeration cycles- Vapour Compression and Vapour Absorption cycles	
Unit II -	15Hrs
Chilling of Foods: Introduction, Chilling equipments, Direct expansion techniques in chilling. Chilled foods transport and display cabinets, Basics of Chilled foods microbiology – Hygienic design considerations for chillers and chilled storages. Chilling injury, cook-chilling systems; cold – shortening; PPP and TTT concepts; Temperature monitoring; -Critical temperatures; Temperature -time indicators (TTI); 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; Transportation regulations; Role of packaging in cold chain- MAS, MAP, CAS, CAP etc; Thaw indicators.	
Unit III -	15 Hrs
Freezing of Foods: Introduction, Freezing rates, Freezing Curve, Freezing types , Freezing of Foods: Freezing equipment (Mechanical Freezers, Cooled air freezers Cooled liquid freezer Cooled surface freezer,	

Cryogenic Freezers, Dehydro-Freezing, Freeze-drying, Individual quick freezing), Freezing practice as applied to different food products. Freezer Storages, Freezer room temperatures, insulation of freezer rooms: Pre-cooling and pre freezing.	
Unit IV -	15 Hrs
Cold Storage Design and Construction: Functional Requirements of cold Storage, Condition of Storage for Perishable Products, Calculation of Cooling Load, Insulation, Properties of insulating materials, Air diffusion equipment, Doors and other openings. Prefabricated systems, walk-in coolers and refrigerated container truck. Cold storage practice, Stacking and handling of material in and around cold rooms, Optimum temperatures of storage for different food materials. Cool storage and their applications. Evaporative cooling and its applications.	

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	Refrigeration, Air Conditioning and Cold Storage by Raymond R. Gunther, Chilton Company, Philadelphia, USA 1957
2	Cold and Chilled Storage Technology by Clive D.J. Dellino, Kluwer Academic Publisher 1997
3	A Course in Refrigeration and Air Conditioning by S. Domkundwar and Subhash Arora, Dhanpat Rai and Sons, Publishers, New Delhi, 1994
4	Refrigeration and Air Conditioning Goodheart by Andrew D Althouse and others, Willcox Company Inc. 1982
5	Cold Storage and Freezer Storage Manual by E.R. Hollowell, AVI Publishing Co. 1980
6	Frozen Food Technology by C.P. Mallet (Ed.) Blackie Academic and Professional, 1993
7	Cooling Technology in the Food Industry by Aurel Gobaneu and Gabriela Lasasha and others, Abacus Press, Tunbridge Wells, U.K, 1976

References	
8	Refrigeration and Air-Conditioning, by Manohar Prasa, Wiley Eastern Publishers, New Delhi, India.
9	Heating, Ventilation and Air-Conditioning, by McQuistion and W. Tauker, Wiley Eastern Publishers, New Delhi, India.
10	Refrigeration and Air-Conditioning, by C. P. Arora, Tata McGraw Hill Book Co. Ltd, New Delhi, India.
11	Principles of Refrigeration, by Roy J. Dossat, Wiley Eastern Publishers, New Delhi, India.



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Model Curriculum

Program Name	BSc in Food Technology	Semester	Sixth Semester
Course Title	Enzymes in Food Industry		
Course Code:	DSE	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 I:	15 hrs
Introduction to Enzymes in the Food Industry: 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 II:	15 hrs
Enzymes in Food Processing and Production: 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 III:	15 hrs
Enzyme Technology and Innovation in the Food Industry: 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, CRC Press, 2017
2	Enzymes in Food Technology by Robert J. Whitehurst and Maarten van Oort, Wiley-Blackwell, 2010
3	Enzymes in Food and Beverage Processing by Alexandre L. Silva, Aline M. Silva, and Juliano Lemos Bicas Apple Academic Press, 2016
4	Food Enzymes: Structure and Mechanism by Alphons G.J. Voragen, Willem M. de Vos, and Gerard Beldman, CRC Press. 2019
5	Industrial Enzymes for Food and Feed Applications by Dietmar Haltrich, Roland Ludwig, and Herwig K. Schottenberger, Springer, 2017
6	Enzymes in Food Biotechnology: Production, Applications, and Future Prospects by Mohamed Essam El-Houri, Nova Science Publishers, 2021
7	Enzymes in Food and Feed Processing by Ramesh C. Ray, 3 rd Ed., CRC Press, 2019

References	
9	Enzymes in Food Technology by R. John Whitaker, Alphons G.J. Voragen, and Dominic W.S. Wong, 2 nd Ed., Wiley-Blackwell, 2002
10	Enzymes in Food Technology by Robert J. Whitehurst, Maarten van Oort, and Robert J. Whitehurst, 3 rd Ed., Wiley-Blackwell, 2019



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Model Curriculum

Program Name	BSc in Food Technology	Semester	Sixth Semester
Course Title	ICT applications in Food Industry		
Course Code:	DSE	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:	15 Hrs
Introduction to ICT and Food Industry: 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 II:	15 rs
ICT in Food Processing and Packaging: 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:	15 Hrs
ICT Tools for Food Safety and Quality Control: Overview of emerging ICT trends in the food industry. The use of artificial intelligence and machine learning in food industry applications. The role of blockchain technology in food supply chain management. ICT-based solutions for reducing food waste and increasing sustainability Traceability Systems in Food Safety. Food Safety Information Systems. Detection and Prevention of Food Fraud using ICT. Detection and Prevention of Food Contamination using ICT. Case studies of emerging ICT trends in the food industry	
Practical	
1. List out products which has intelligent packaging in Foreign and Indian markets and principle behind the packaging material. 2. Make a report on product identification, production and marketing technique using ICT by visiting industry. 3. 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. Foods, 8(10), 476.
2	Sensors in Food and Agriculture by Benitez, J. M., O'Connor, D., & Garcia-Sanchez, A. J. Academic Press, 2018
3	Innovations in Food Packaging by Bhat, Z. F., & Kumar, S. Elsevier Science, 2015
4	Choudhary, A., & Sharma, R. K. (2017). Information and communication technology in food industry: opportunities and challenges. Journal of food science and technology, 54(4), 1015-1026.

References	
5	Diaz-Munoz, S. L., & Manriquez-Alvirde, M. Information and Communication Technologies in Agro-Industry Chains: Applications, Opportunities and Future Trends. IGI Global, 2018
6	Future Foods-Global Trends, Opportunities, and Sustainability Challenge by Rajeev Bhat eBook ISBN: 9780323910026, 2021
7	Iddrisu, M., & Qi, Y. (2018). Smart packaging in food applications: a review of modern technologies. Journal of food science and technology, 55(9), 3571-3582.
8	ICT for Food Safety and Traceability by Li, Y., & Liang, P., Springer, 2019
9	Big Data in Food Industry: Theory, Methods and Applications by Liang, P., Li, X., & Li, D., John Wiley & Sons, 2018
10	Moreira, R. G., & Castilhos, T. M. (2018). The role of information technology in food packaging. Trends in Food Science & Technology, 77, 142-152.
11	Food Safety and Quality Management: Applications and Techniques, Pal, A., & Sanjai, K. Apple Academic Press, 2020
12	Silva, F., & Nascimento, M. (2019). Information and communication technology applications in food safety: A review of the literature. Food Control, 102, 97-107.
13	Šojić-Milosavljević, I., Milijašević-Marčić, S., & Stefanović, A. (2018). The role of information technology in ensuring food safety. Serbian Journal of Management, 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. International Journal of Food Science & Technology, 52(1), 1-10.



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Model Curriculum

Program Name	BSc in Food Technology	Semester	Sixth Semester
Course Title	Sensory Evaluation of Food Products		
Course Code:	DSE	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 I:	15 hrs
Introduction to Sensory Evaluation of Food Products: 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. 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. 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. Sensory Evaluation Experimental Design: Sample preparation and presentation. Randomization and balancing. Control of extraneous variables. Sample size determination.	
Unit II:	15 hrs

Sensory Evaluation Techniques: Sensory Evaluation Panel - Selection and training of panel members. Panel performance evaluation and monitoring. Panelist calibration and consensus building Discrimination Testing - Application of discrimination tests for determining sensory differences. Statistical analysis of discrimination test data. Descriptive Analysis - Training of descriptive analysis panel members. Development of sensory lexicons. Sensory attribute selection and definition. Profiling of food products using descriptive analysis. Hedonic Evaluation - Understanding the concept of hedonic scales and their application. Statistical analysis of hedonic data. Interpretation of hedonic test results.	
Unit III:	15 Hrs
Applications of Sensory Evaluation in Food Industry: 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. 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. 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. 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 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 Hildegard Heymann, Springer, 2010

References	
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 Foegedingm, 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



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Model Curriculum

Program Name	BSc in Food Technology	Semester	Sixth Semester
Course Title	Entrepreneurship Development		
Course Code:	VOC	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 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 -	16 Hrs
Introduction to Entrepreneurship: 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 -	14 Hrs
Business Plan: 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 -	16 Hrs
Women and Rural Entrepreneurship: Women Entrepreneurship- Meaning- Need- Scope- Growth of Women Entrepreneurship- Problems faced. 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. Institutions Supporting Entrepreneurship: 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	Entrepreneurial Development, by Khanna, S. S., S. Chand Publishers, New Delhi.
2	Entrepreneurship by Hisrich D. Robert, Michael P. Peters, Dean A. Sheperd, McGraw-Hill, 6 ed.
3	Essentials of Entrepreneurship and Small Business Management by Zimmerer W. Thomas, Norman M. Scarborough, PHI, 4ed.
4	Entrepreneurship: New Venture Creation, by Holt H. David, Prentice- Hall of India, New Delhi, Latest edition.
5	Entrepreneurship: Theory, Process, Practice by Kuratko, F. Donald, Richard M. Hodgetts, Thomson, 7ed.
6	Dynamics of Entrepreneurship: New Venture Creation by Desai, Vasant, Prentice-Hall of India, New Delhi, Latest edition.
7	The Seven Business Crises and How to Beat Them, by Patel, V. G., Tata McGraw-Hill, New Delhi, 1995.
8	Innovation: Driving Product, Process, and Market Change, by Roberts, Edward B.(ed.), 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	Engineering Drawing and Graphics II		
Course Code:	VOC	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:	16 Hrs
Machine Drawing: 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:	15 Hrs
Theory of Projection of Sectioned Solids and Development of Surface: 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:	14 Hrs
Basics of AutoCAD and its Application: 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, New Age International Publishers, 2014
2	Engineering Drawing, Author: N.D. Bhatt, Charotar Publishing House, 2019
3	Engineering Graphics Essentials with AutoCAD 2020 Instruction, Author: Kirstie Plantenberg, SDC Publications, 2019
4	Engineering Graphics, Author: Frederick E. Giesecke, Alva Mitchell, Henry C. Spencer, Ivan L. Hill, John T. Dygdon, Peachpit Press, 2013
5	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, Peachpit Press, 2017



Government of Karnataka

Model Curriculum

Program Name	BSc in Food Technology	Semester	Sixth Semester
Course Title	Food Waste Management and Utilization		
Course Code:	VOC	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. Analyse and evaluate the causes and consequences of food waste, demonstrating a clear understanding of its environmental, economic, and social impacts.</p> <p>CO2. Develop and implement effective strategies for preventing and reducing food waste, considering factors such as planning, inventory management, consumer behaviour, and sustainable sourcing.</p> <p>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.</p>	
Contents	45 Hrs
Unit I -	15Hrs
<p>Introduction to Food Waste Management: Food By-product/waste and its types. Food loss and waste. Food industry wastes, avoidable and unavoidable waste. Environmental, Economic, and Social Implications of Food Waste, Principles, Methods and Benefits of Waste Management necessity of food waste utilization, environmental best- practice technologies for waste minimization. Characteristics of industrial wastes.</p>	
Unit II -	15Hrs
<p>Prevention and Reduction of Food Waste: Fruit and vegetable processing waste management, Production of pectin, vitamins, ethanol, natural gas, citric acid, activated charcoal, citrus oil, fibre extract from fruit waste. Single cell protein in vegetable waste. Coffee and tea processing waste management. Utilization of tea and coffee waste. Fish waste management, types and methods. By product utilization from Fish processing waste. By product utilization from meat processing waste. Utilization of organs and glands of animal as human food. Poultry waste management and utilization of poultry waste. Characterization and effective utilization of by-products from Cereals, Pulses and Oilseeds Industries. Utilization of waste from non-usable cereals; By product utilization from rice mill waste. By product utilization from dairy industrial</p>	

waste Fermentation products from whey, Condensed & dried, products from whey; Production of lactose and protein from whey. Treatment Methods and Potential Uses of Treated Waste.	
Unit III	15Hrs
Recycling and Resource Recovery: Treatment methods for liquid wastes from Fruit and Vegetable processing industry, Beverage industry, Fish, Meat & Poultry industry, Sugar industry and Dairy industry; Design of Activated Sludge Process, Rotating Biological Contactors, Trickling Filters, UASB, Biogas Plant. Design of Solid Waste Management System such as Landfill Digester, Vermicomposting Pit. Examples of Biofilters and Bioclarifiers, treatment methods- solid phase, liquid phase and gaseous phase, filter media - types, advantages and disadvantages	

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	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 by Charis M. Galanakis (Ed.), 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 by Magnus Bremmer, et al. (Ed.) Springer, 2019.
7	Reducing Food Waste in Urban Food Systems by Roberta Sonnino, Ana Moragues-Faus, & Mike Hodson (Ed.), Routledge, 2017.

References	
8	Food Industry Wastes: Assessment and Recuperation of Commodities by Maria Kosseva & Colin Webb (Ed.), 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.

MODEL QUESTION PAPER
CREDIT BASED SEMESTER B.Sc. DEGREE EXAMINATION – MONTH, YEAR
V/VI Semester B.Sc. Food Technology Theory
(CODE NO): TITLE OF THE COURSE

Time: 2 Hours

Max. Marks: 60

I. Write short notes on any TEN of the following:

2x10=20

1-12

II. Write explanatory notes on any FIVE of the following questions:

4x5=20

1-7

III. Write essays on any TWO of the following:

10x2=20

1-4

Ensure equal distribution from all Units

In each Section I, II and III:

- There shall be questions based on basic conceptual understanding etc.
- There shall be questions based on deeper understanding, analytical, problem-solving skills etc.
- There shall be questions based on critical thinking, higher order thinking skills etc.

MODEL QUESTION PAPER

V/VI Semester B.Sc. Food Technology Degree Practical Examination Month & Year

COURSE CODE AND TITLE

Time:	Max. Marks: 25
I. Major:	10 marks
II. Minor:	5 marks
III Spotters:	2×1.5=3 marks
a.	
b.	
IV. Viva.	2 marks
V. Record.	5 marks