Department of Food Technology
Guru Jambheshwar University of Science and Technology, Hisar, Haryana
Choice Based Credit System Scheme and Syllabi Effective from 2016-2017
B.TECH (FOOD TECHNOLOGY) -Revised

Semester / Discipline	I	II	III	IV	V	VI	VII	VIII	Total
Humanity Sciences (HS)	7	3	3	3					16
Basic Sciences (BS)	13	13							26
Engineering Sciences (ES)	5	9	8						22
Program Core (PC)			14	16	15	15	15		75
Program Elective (PE)				6	6	6	6		24
Open Elective (OE)					4	4	4		12
Industrial Training								25	25
Non Credit Mandatory Courses									0
Total	25	25	25	25	25	25	25	25	200

IMPORTANT NOTES:

1. The minimum credit requirement for B.Tech (Food Technology) is 200. Each semester will be of 25 credits and 30-35 contact hours per week.
2. Each theory examination will be of 3 hours duration and practical examination will be of 4 hours duration. One laboratory hour per week per semester will be assigned half credit. No elective course will be run unless the number of students registered for the elective course is five or more.
3. The student is required to register for one "Open Elective" paper in Semester V, VI and VII of his/her choice from any department other than the parent department.
4. At the end of 6^{th} semester each student will undergo 4-6 week training/ internship in an industry /research institute and it will be evaluated in 7^{th} semester.
5. The student will be required to submit to the department, the offer letter for the full semester industrial training, at-least 15 days before the commencement of 8^{th} semester.

   A student may opt for one semester industrial training in lieu of attending the courses of 8^{th} semester. The credit/marks for industrial training will be equal to the total credits/marks of courses offered in 8^{th} semester study. A student will be allowed to join the industrial training under the conditions stated below. The options shall be according to the following conditions:

   a. If the student gets selected for the job through campus placements and the employer is willing to take the student for the training for a period of full semester.

b. If the student gets offer of pursuing training from reputed Research organization/Govt. sponsored project/ Govt. research institution/ Multinational corporations (MNCs)/ Public sectors for pursuing this training, the student shall require prior approval from Dean of Faculty of Engineering & Technology through the Chairperson of the respective department. To ensure the fruitfulness of this training, a list of companies, beside the Govt. organizations/ Public sectors, will be provided. The student will be allowed to go for training only to the companies/organizations mentioned in the list. The list can be modified (addition/deletion) from time to time subject to approval from Dean of Faculty of Engineering and Technology.

6. The students who do not undertake industrial training will be required to undertake theory papers offered by the department in the 8th semester and should complete a project of 09 credits. The project will be evaluated by a committee of 3 teachers including Chairperson, Senior Teacher & Programme Coordinator.

Department of Food Technology
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Choice Based Credit System Scheme and Syllabi Effective from 2016-2017

B.TECH (FOOD TECHNOLOGY)

Humanity Sciences (HS)	Basic Sciences (BS)	Engineering Sciences (ES)	Program Core (PC)	Program Elective (PE)	Open Elective (OE)	Industrial Training (IT)	Total Credits
16	26	22	75	24	12	25	200

SEMESTER I

Subject Area	Subject Code	Subject Name	Contact Hours / week			Credits /week
			L	T	P	
HS 1	HUM 101 L	Essentials of Communication- I	3	-	-	3.0
HS 2	HUM 103 L	Principles of Economics	3	-	-	3.0
BS 1	PHY 101 L	Physics- I	3	1	-	3.5
BS2	MAT 101 L	Mathematics- I	3	2	-	4.0
BS 3 ES 1	CHY 101 L Or EE 101 L	Chemistry (Group B) Or Basics of Electrical Engineering (Group A)	3	1	-	3.5
ES 2 ES 3	ME 101 L Or ECE 101 L	Workshop Technology (Group A) Or Basics of Electronics Engineering (Group B)	3	-	-	3.0
HS 1	HUM 101 P	Essentials of Communication- I Lab	-	-	2	1.0
BS 1	PHY 101 P	Physics- I Lab	-	-	2	1.0
BS 3 ES 1	CHY 101 P or EE 101 P	Chemistry Lab (Group B) or Basics of Electrical Engineering Lab (Group A)	-	-	2	1.0
ES 2 ES 4	ME 101 P or ME 103 P	Workshop Technology (Group A) Or Engineering Drawing (Group B)	-	-	4	2.0
						Total = 25
MC 1 MC 2	PEY 101 L Or EMV 101 L	Physical Education and Yoga (Group A) Or Professional Ethics for Engineers and Moral Values (Group B)	1 2	- -	2 -	2 Units 2 Units
		SEMESTER II				
HS 3	HUM 101 L	Essentials of Communication- II	2	-	-	2.0
BS 4	PHY 101 L	Physics- II	3	1	-	3.5
BS 5	MAT 101 L	Mathematics- II	3	2	-	4.0
BS 3 ES 1	CHY 101 L Or EE 101 L	Chemistry (Group A) Or Basics of Electrical Engineering (Group B)	3	1	-	3.5
ES 2	ME 101 L Or	Workshop Technology (Group B) Or	3	-	-	3.0

ES 3	ECE 101 L	Basics of Electronics Engineering (Group A)				
ES 5	CSE 101 L	Programming in C	3	-	-	3.0
HS 3	HUM 101 P	Essentials of Communication- II Lab	-	-	2	1.0
ES 5	CSE 101 P	Programming in C Lab	-	-	2	1.0
BS 4	PHY 101 P	Physics- II Lab	-	-	2	1.0
BS 3 Or ES 1	CHY 101 P Or EE 101 P	Chemistry Lab (Group A) Or Basics of Electrical Engineering Lab (Group B)	-	-	2	1.0
ES 2 Or ES 4	ME 101 P Or ME 103 P	Workshop Technology (Group B) Or Engineering Drawing (Group A)	-	-	4	2.0
						Total = 25
MC 1 Or MC 2	PEY 101 L Or EMV 101 L	Physical Education and Yoga (Group A) Or Professional Ethics for Engineers and Moral Values (Group B)	1 2	- -	2 -	2 Units 2 Units
		SEMESTER III				
HS 4	EVS-201-L	Environmental Studies	3	-	-	3.0
PC 1	BFT-201-L	General Microbiology	4	-	--	4.0
PC 2	BFT-203-L	Food Composition and Analysis	4	-	-	4.0
ES 6	BFT-205-L	Engineering Properties of Food	3	1	-	3.5
ES 7	BFT-207-L	Heat and Mass Transfer	4	1	-	4.5
PC 1	BFT-201-P	General Microbiology Lab	-	-	6	3.0
PC 2	BFT-203-P	Food Composition and Analysis Lab	-	-	6	3.0
MC 3	BFT-205-P	Skills and Innovation Lab.	-	-	2	NC
						Total = 25
		SEMESTER IV				
HS 5	HUM-201-L	Fundamentals of Management	3	-	-	3.0
MC 4	PSY-201-L	Personality Development	2	1	-	NC
PC 3	BFT-202-L	Principles and Methods of Food Processing	3	-	-	3.0
PC 4	BFT-204-L	Principles of Food Engineering	2	1	-	2.5
PC 5	BFT-206-L	Food Microbiology	3	-	-	3.0
PC 6	BFT-208-L	Thermodynamics	3	1	-	3.5
PC 3	BFT-202-P	Principles and Methods of Food Processing Lab	-	-	4	2.0
PC 5	BFT-206-P	Food Microbiology Lab	-	-	4	2.0
		Program Elective-I				
		<u>Theory:</u>	4	-	-	
PE 1	BFT-210-L	Technology of Frozen Foods	4	-	-	4.0
PE 2	BFT-212-L	Food Nutrition	4	-	-	4.0
PE 3	BFT-214-L	Technology of Traditional Foods				4.0
		<u>Lab</u>:				
PE 1	BFT-210-P	Technology of Frozen Foods	-	-	4	2.0
PE 2	BFT-212-P	Food Nutrition	-	-	4	2.0
PE 3	BFT-214-P	Technology of Traditional Foods	-	-	4	2.0
						Total = 25
		SEMESTER V				
PC 7	BFT-301-L	Unit Operations in Food Processing	3	-	-	3.0
PC 8	BFT-303-L	Processing of Grains	3	-	-	3.0
PC 9	BFT-305-L	Fruits and Vegetables Processing	3	-	-	3.0
PC 7	BFT-301-P	Unit Operations in Food Processing Lab	-	-	4	2.0
PC 8	BFT-303-P	Processing of Grains Lab	-	-	4	2.0
PC 9	BFT-305-P	Fruits and Vegetables Processing Lab	-	-	4	2.0

		Program Elective – II				
		Theory:				
PE 4	BFT-307-L	Bioprocess Engineering	4	-	-	4.0
PE 5	BFT-309-L	Technology of Fats and Oils	4	-	-	4.0
PE 6	BFT-311-L	Technology of Beverages	4	-	-	4.0
		Lab:				
PE 4	BFT-307-P	Bioprocess Engineering	-	-	4	2.0
PE 5	BFT-309-P	Technology of Fats and Oils	-	-	4	2.0
PE 6	BFT-311-P	Technology of Beverages	-	-	4	2.0
OE 1	Open Elective from other Departments					4.0
						Total = 25
Open Electives (for the students of other teaching departments)						
OE	OEFT-391 L	Food Composition and Analysis	**4**	-	-	4.0
SEMESTER VI						
PC 10	BFT-302-L	Statistical Quality Control for Food Industry	**2**	-	-	2.0
PC 11	BFT-304-L	Meat, Fish and Poultry Processing	**3**	-	-	3.0
PC 12	BFT-306-L	Fermentation Technology	**3**	-	-	3.0
PC 13	BFT-308-L	Technology of Milk and Milk Products	**3**	-	-	3.0
PC 12	BFT-306-P	Fermentation Technology Lab	-	-	4	2.0
PC 13	BFT-308-P	Technology of Milk and Milk Products Lab	-	-	4	2.0
		Program Elective - III				
		Theory:				
PE 7	BFT-310-L	Baking and Confectionary Technology	4	-	-	4.0
PE 8	BFT-312-L	Technology of Pulses and Oilseeds	4	-	-	4.0
PE 9	BFT-314-L	Spices and Herbs	4	-	-	4.0
		Lab:				
PE 7	BFT-310-P	Baking and Confectionary Technology	-	-	4	2.0
PE 8	BFT-312-P	Technology of Pulses and Oilseeds	-	-	4	2.0
PE 9	BFT-314-P	Spices and Herbs	-	-	4	2.0
OE 2	Open Elective from other Departments					4.0
						Total = 25
Open Electives (for the students of other teaching departments)						
OE	OEFT-392L	Baking and Confectionary Technology	4	-	-	4.0
SEMESTER VII						
PC 14	BFT-401-L	Instrumental Analysis of Food	3	-	-	3.0
PC 15	BFT-403-L	Food Safety and Standards	3	-	-	3.0
PC 16	BFT-405-L	Food Packaging	3	-	-	3.0
PC 17	BFT-407-L	Agri Business Management	3	-	-	3.0
PC 16	BFT-403-P	Food Packaging Lab	-	-	4	2.0
PC 18	BFT-409	Seminar on Industrial Training/ Internship	-	-	2	1.0
		Program Elective –IV				
		Theory:	4	-	-	4.0
PE 10	BFT-411-L	Food Additives	4	-	-	4.0
PE 11	BFT-413-L	Waste Management and Effluent Treatment	4	-	-	4.0
PE 12	BFT-415-L	Food Flavours and Colours				
		Lab:				
PE 10	BFT-411-P	Food Additives	-	-	4	2.0
PE 11	BFT-413-P	Waste Management and Effluent Treatment	-	-	4	2.0
PE 12	BFT-415-P	Food Flavours and Colours	-	-	4	2.0
OE 3	Open Elective from other Departments					4.0
						Total = 25

Open Electives (for the students of other teaching departments)						
OE	OEFT-491L	Food Additives	4	-	-	4.0
SEMESTER VIII						
IT	BFT 500	Industrial Training	-	-	50	25
PC 19	BFT-402-L	Food Biotechnology	4	-	-	4.0
PC 20	BFT-404-L	Food Plant Design and Process Modelling	4	-	-	4.0
PC 21	BFT-406-L	Nutraceuticals & Functional Foods	4	-	-	4.0
PC 22	BFT-408-L	Post Harvest Handling of Food Crops	4	-		4.0
PC 23	BFT-410	Project Report			18	9.0
						Total = 25

List of open elective (OE) courses to be selected by students of food technology from following OE offered by other departments:

Semester	Sr No.	Course code	Nomenclature	Department who will offer this subject
5th	1	OE-ME-391-L	Industrial Engineering	Mechanical Engineering
	2	OE-PTG-391-L	Fundamentals of Printing	Printing Department
	3	OE-CSE-39-L	Web development	Com Sci & Engg.
	4	OE-ECE-391-L	Introduction to Communication system	ECE
	5	OE-FT-391-L	Food Composition & Analysis	Food Technology
	6	OE-BME-391- L	Medical Image Processing	BME
6th	1	OE-ME-392- L	Material Science	Mechanical Engineering
	2	OE-PTG-392- L	Graphic Design	Printing Department
	3	OE-CSE-392 –L	Network Admn & Mgmt	Comp Sc.& Engg
	4	OE-ECE-392 -L	Basic measuring Instrument	ECE
	5	OE-FT-392-L	Baking & confectionary Technology	Food Technology
	6	OE-BME-392-L	Medical Devices	BME
7th	1	OE-ME-491-L	Computer Aided Design and Manufacturing	Mechanical Engineering
	2	OE-PTG-491-L	Print Waste Management	Printing Department
	3	OE-CSE-491-L	Advance Computer Architecture	CSE
	4	OE-ECE-491-L	Introduction to Signals and Systems	ECE
	5	OE-FT-491-L	Food Additives	Food Technology
	6	OE-BME-491-L	Medical Image Processing	BME

OE-FT-391-L FOOD COMPOSITION AND ANALYSIS 4 + 0 + 0

OBJECTIVES:

1. To teach about carbohydrates, properties and types.
2. To provide awareness of simple, compound lipids and nutritional value, deterioration of lipids.
3. To impart knowledge of proteins and vitamins.
4. To give different methods of analysis of food components.

UNIT I

Carbohydrates: Introduction, General Properties, Monosaccharides, Oligosaccharides, Polysaccharides, Nutritional Value of Carbohydrates, Commercial Sugar and Sugar Products, Qualitative Analysis and Quantitative Analysis.

UNIT II

Lipids: Introduction, Simple Lipids and their Constituents, Compound Lipids, Derived Lipids, Nutritional Value of Fats amd Fat Products, Commercial Fats and Fat Products, Deterioration of Fats, Analysis.

UNIT III

Protein: Introduction, Amino Acid and the Peptide Bond, Classification Of Proteins, Structure of Proteins, Molecular Weight and Isoelectric Point of Proteins ,Analysis of Proteins; Vitamins: Introduction, Water-Soluble Vitamins, Fat-Soluble Vitamins; Enzymes: Introduction, Nomenclature and Classification, Food Enzymes.

UNIT IV

Weighing Devices, Visible and Ultraviolet Spectrophotometry, Thin-Layer Chromatography, pH, Sampling, Moisture, Crude Fat, Crude Protein, Crude Fiber.

Recommended Readings:

1. **Wang, D. (2012). *Food Chemistry*: Nova Science Publishers.**
2. **Chopra, H. K. & Panesar, P. S. (2010). *Food chemistry*: Alpha Science International Ltd, Oxford, U.K.**
3. **Coultate, T. P. (2009). *Food: The Chemistry of Its Components* (5 ed.): American Chemical Society.**
4. **Newton, D.E. (2009). *Food Chemistry*: Facts On File, Incorporated.**
5. **Damodaran, S., Parkin, K. L., & Fennema, O. R. (2007). *Fennema's Food Chemistry*: CRC Press, Taylor and Francis group**.

OUTCOMES: After the completion of the course, the students will be able to:

1. Know about carbohydrates ,types and nutritional value.
2. Understand structure, types of lipids and deterioration.
3. Appreciate the knowledge of proteins.
4. Learn about vitamins and their nature.

Note for Paper Setters:

Nine questions are to be set by the examiner. Question number one (01) is compulsory and will be based on entire syllabus i.e. all four units. It will contain seven (07) short answer type questions of two (02) marks each. Out of remaining eight questions, a candidate is required to attempt four questions by selecting one from each unit. All questions including compulsory question i.e. question number one shall carry equal marks i.e. fourteen (14) marks each.

Mapping of Course Outcome (CO) and Program Outcome (PO):

OE-FT-391-L: Food Composition and Analysis **(S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak**								
	Program Outcome (PO)							
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
Course Outcome (CO)	**CO 1**	**S**						
	CO 2	**S**						
	CO 3	**S**						
	CO 4	**S**						

OE-FT—392-L BAKING AND CONFECTIONARY TECHNOLOGY 4 + 0 + 0

OBJECTIVES:

1 To make aware a student with knowledge and understanding of the raw material used for preparation of various bakery and confectionary products.
2. To make aware a student with knowledge and understanding in the basic operation and working of various equipments involved in bakery and confectionary technology.
3. To make aware a student with knowledge and understanding in the basic steps and operation in preparation of bread, biscuits, cakes and other bakery products.
4. To make aware a student with knowledge and understanding in the basic steps and operation in preparation of confectionary products.
5. To make aware a student with knowledge food safety rules and regulations for bakery and confectionary products.
6. To make aware a student with knowledge of layout and setting up of bakery plant.

UNIT I

Status of bakery and confectionery industries in India; Raw materials for bakery and confectionery products- essential and optional ingredients; Functionality of bakery ingredients; FSSAI specification of raw materials; Bakery equipments: divider, rounder, proofer, moulder; equipments used in baking, different types of oven, slicer.

UNIT II

Different types of bread and preparation of bread using different methods, quality evaluation of bread, bread faults and remedies, staling of bread; Types, methods of preparation and quality evaluation of biscuits; Types, methods of preparation and quality evaluation of cakes, cake faults and remedies; Preparation of other bakery products: rusks, crackers, buns, muffins and pizza; Pasta products.

UNIT III

Confectionery- Raw materials, types, process and machinery; Types of candies: boiled sweets, hard candy, brittle; chocolates: manufacturing process, quality consideration and parameters; Manufacturing process of toffees, caramels, lozenges, chewing gum, bars; Sugar free confectionary.

UNIT IV

Food safety rules and regulations for bakery and confectionery products; Layout, setting up of units and hygienic conditions required in bakery plant; Operation and maintenance of bakery equipments.

Recommended Readings:

1. Khatkar B. S. (2011) *Baking Science and Technology*, Arihant Publication.

2. Amendola J. & Rees N. (2003) *Understanding Baking: The Art and Science of Baking*, Wiley.

3. Dubey S. C. (2002) *Basic Baking*, The Society of Indian Bakers.

4. Manley D. (2000) *Technology of Biscuits, Crackers & Cookies*. *2nd Edition*, CRC Press.

5. NPCS Board of Food Technologists (2014) *Confectionery Products Handbook (Chocolate, Toffees, Chewing Gum & Sugar Free Confectionery)*, Asia Pacific Business Press Inc.

6. Edwards W.P. (2007) *The Science of bakery products*, RSC Publications.

7. Mohos F. (2010) *Confectionery & chocolate engineering, principles & applications,* Wiley Blackwell Publishing Ltd.

OUTCOMES: After the completion of the course, the students will be able to:

1. Understand various raw materials used for preparation of various bakery and confectionary products.
2. Have knowledge on basic operation and working of various equipments involved in bakery and confectionary technology.
3. Understand the various processes used for the manufacturing of bakery products like bread, biscuits, cakes, muffins and their quality determination.
4. Acquire knowledge of the various processes used for the manufacturing of confectionary products like chocolate, candies, toffees, gums and their quality determination.
5. Acquire knowledge on food safety rules and regulations for bakery and confectionary products.

Note for Paper Setters:

Nine questions are to be set by the examiner. Question number one (01) is compulsory and will be based on entire syllabus i.e. all four units. It will contain seven (07) short answer type questions of two (02) marks each. Out of remaining eight questions, a candidate is required to attempt four questions by selecting one from each unit. All questions including compulsory question i.e. question number one shall carry equal marks i.e. fourteen (14) marks each.

Mapping of Course Outcome (CO) and Program Outcome (PO):

OE-FT—392-L: Technology of Bakery and Confectionery Products **(S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak**								
	Program Outcome (PO)							
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
Course Outcome (CO)	**CO 1**	**S**			**W**			
	CO 2	**S**	**M**		**M**		**S**	**M**
	CO 3	**S**	**M**		**S**	**W**		**M**
	CO 4	**S**	**M**		**S**			**M**
	CO 5			**W**		**S**	**S**	

OE-FT-491-L **FOOD ADDITIVES** **4 + 0 + 0**

OBJECTIVES:

1. To get an insight into additives that are relevant to processed food industry for shelf life extension, processing aids and sensory appeal.
2. To explain about role of food additives in food quality control.
3. To explain the techniques of best use of food additives.
4. To describe the role of food additives in health maintenance and cure of diseases

UNIT - I

Food Additives: definitions, classification and applications, food preservatives- classifications, antimicrobial agents, types and their action, safety concerns, regulatory issues in India, international legal issues; Antioxidants (synthetic and natural, mechanism of oxidation inhibition); Chelating agents: types, uses and mode of action; Coloring agents: color retention agents, applications and natural colorants, sources of natural color, misbranded colors, color extraction techniques, color stabilization.

UNIT - II

Flavoring Agents: flavors (natural and synthetic flavors), flavor enhancers, flavor stabilization, flavor encapsulation; Flour improvers: leavening agents, humectants and sequesterant, hydrocolloids, acidulants, pH control agents buffering salts, anticaking agents.

UNIT - III

Sweeteners: natural and artificial sweeteners, nutritive and non-nutritive sweeteners, properties and uses of saccharin, acesulfame-K, aspartame, corn sweeteners, invert sugar sucrose and sugar alcohols (polyols) as sweeteners in food products; Emulsifiers: types, selection of emulsifiers, emulsion stability, functions and mechanism of action.

UNIT - IV

Nutrient supplements & thickeners: polysaccharides, bulking agents, antifoaming agents, synergists, antagonists; additives food uses and functions in formulations, permitted dosages, indirect food additives; harmful effects/side effects associated with various additives (various diseases).

Recommended Readings:

1. Branen A. L., Davidson P. M., and Salminen S. (2001) *Food Additives*. 2nd Ed. Marcel Dekker.
2. Gerorge A. B., (1996) *Encyclopedia of Food and Color Additives. Vol. III*. CRC Press.
3. Gerorge A. B., (2004) *Fenaroli's Handbook of Flavor Ingredients 5th Ed*. CRC Press.
4. Morton I. D., and Macleod A. J., (1990) *Food Flavours. Part A, B & C*. Elsevier.
5. Stephen A. M., (2006) *Food Polysaccharides and Their Applications*. Marcel Dekker.

OUTCOMES: After the completion of the course, the students will be able to:

1. Understand about the use of food additives in food formulations.
2. Apprehend the suitable application of food ingredients in health foods and convenience food preparation.
3. Grasp the techniques of food additives stability and use level.
4. Understand the role of food additives in health maintenance and cure of diseases

Note for Paper Setters:

Nine questions are to be set by the examiner. Question number one (01) is compulsory and will be based on entire syllabus i.e. all four units. It will contain seven (07) short answer type questions of two (02) marks each. Out of remaining eight questions, a candidate is required to attempt four questions by

selecting one from each unit. All questions including compulsory question i.e. question number one shall carry equal marks i.e. fourteen (14) marks each.

Mapping of Course Outcome (CO) and Program Outcome (PO):

OE-FT-491-L: Introduction to Food Additives (S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak								
	Program Outcome (PO)							
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
Course Outcome (CO)	**CO 1**	**M**	**M**	**M**			**M**	
	CO 2	**M**			**M**		**M**	
	CO 3			**M**			**M**	
	CO 4	**M**		**M**		**M**		