Record of CO-PO Mapping (3rd Semester)

IK Gujral Punjab Technical University Bachelor of Technology Scheme for B.Tech Syllabus 2019

(Semester-3rd)

Course Code	Subject	L-T-P	Credit
EVS 101-18	Environmental Science	2-0-0	0
BTFT 211-19	Introduction to Biology and Microbiology	2-0-0	2
BTFT 213-19	Food Composition and Analysis	3-0-0	3
BTFT 215-19	Nutrition and Health	2-0-0	2
BTEC 216-19	Engineering Properties of Food	3-0-0	3
BTEC 217-19	Thermodynamics	3-1-0	4
BTFT 212-19	Introduction to Biology and Microbiology Lab	0-0-4	2
BTFT 214-19	Food Composition and Analysis Lab	0-0-4	2
BMPD 301-18	Mentoring & professional development	0-0-2	Satisfactory/ Unsatisfactory
Total		**15-1-8**	**18**

Program: B. Tech (Food Technology)	**Semester:** 3rd Semester
Course Name: Environmental Science	**Course Code:** EVS 101-18

Syllabus:

MODULE	DETAILS	HOURS
1	**Natural Resources**: Renewable and non-renewable resources Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies. f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification	8 Hrs
2	**Ecosystems**: Concept of an ecosystem. Structure and function of an ecosystem. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of following ecosystems: a. Forest ecosystem b. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	8 Hrs
3	**Biodiversity and its conservation** • Introduction – Definition : genetic, species and ecosystem diversity. • Biodiversity at global, National and local levels. • Inida as a mega-diversity nation • Hot-sports of biodiversity. • Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts. • Endangered and endemic species of India.	8 Hrs
4	**Social Issues and the Environment** • From Unsustainable to Sustainable development • Resettlement and rahabilitation of people; its problems and concerns. • Environmental ethics : Issues and possible solutions. • Climate change, global warming, acid rain, ozone layer depletion, Nuclear accidents and holocaust. Case Studies. • Public awareness.	8 Hrs

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2	Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net (R)
3	Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
4	Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)

Course Code: EVS101-18.1 (Environmental Science)

	Course Outcomes	BT Level
EVS101-18.1	The students will gain practical knowledge by visiting wildlife areas, environmental institutes and various personalities who have done practical work on various environmental Issues.	1
EVS101-18.2	Students will enable to understand environmental problems at local and national level through literature and general awareness.	2
EVS101-18.3	The students will apply interdisciplinary approach to understand key environmental issues and critically analyze them to explore the possibilities to mitigate these problems.	3
EVS101-18.4	Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.	5
EVS101-18.5	Create, critical thinking, scientific literacy, sustainability, awareness, practical skills, communication, ethics, policy, interdisciplinary.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
EVS101-18.1	1		3	2	2	3	2	3	2	2	3	3	2	1		1
EVS101-18.2	2	2	1			1	3		3	1	1	1	3	1	1	2
EVS101-18.3	1	2	3	3	3	2		3		2	2		2	2	2	3
EVS101-18.4	2	2		2			2		2	1		3	1	1		1
EVS101-18.5	2	1	2	2	2	2	3	3	3		1	2	1			1
AVERAGE	**1.60**	**1.75**	**2.25**	**2.25**	**2.33**	**2.00**	**2.50**	**3.00**	**2.50**	**1.50**	**1.75**	**2.25**	**1.80**	**1.25**	**1.50**	**1.60**

Program: B. Tech (Food Technology)	**Semester:** 3rd Semester
Course Name: Introduction to Biology and Microbiology	**Course Code:** BTFT 211-19

Syllabus:

MODULE	DETAILS	HOURS
1	**Basic Cell Biology**: Introduction: Methods of Science-Living Organisms: Five kingdom classification, Cells and Cell theory, Cell Structure, Function and chemical constituents of living cell and cell division.	12 Hrs
2	**Nutrient Metabolism**: structure and function of protein, carbohydrate (TCA, Pyruvate cycle etc.), fat and enzymes. Mineral nutrition: Essential minerals, macro and micro nutrients and their role, Nitrogen metabolism	13 Hrs
3	The nutritional requirements and types of microorganisms (Carbon, Hydrogen, nitrogen, phosphorus, Oxygen and growth factors); Microbial Growth curve, Measurement of Growth; Factors effecting growth. Microbiology of carbon, nitrogen, phosphorus and sulphur transformations.	12 Hrs
4	Role of microorganisms in organic matter degradation, maintenance of soil fertility and pest control; Microbiology of soil. Microbiology of air. Microbiology of water. Importance of bacteria, yeast, molds in food industry; Overview of Microorganisms associated with different fermented foods; Role of microorganisms in food borne infections and intoxications.	12 Hrs

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	ThyagaRajan S, Selvamurugan N, Rajesh M P, Nazeer R A, Thilagaraj R W, S. Barathi, and M. K. Jaganathan (2012) "Biology for Engineers," Tata McGraw-Hill
2	Weaver R (2012) "Molecular Biology," McGraw-Hill (5th Ed).
3	Stainier R.Y. Ingraham J. L., Wheelis M. L. & Painter P. R. (2003) General Microbiology.
4	Tauro P. Kapoor K. K. & Yadav K. S. (1996) Introduction to Microbiology. New Age International Pvt. Ltd. New Delhi.

Course Code: BTFT 211-19 (Introduction to Biology and Microbiology)

	Course Outcomes	BT Level
BTFT211-19.1	Describe the basic organization of organisms and subsequent building to a living being	1
BTFT211-19.2	Explain the machinery of the cell functions that is ultimately responsible for various daily activities.	2
BTFT211-19.3	Demonstrate the minimum nutritional requirements of microorganisms and the factors affecting their growth.	3
BTFT211-19.4	Differentiate the mechanism of metabolism of various type of nutrients.	4
BTFT211-19.5	Appraise the role of microorganisms in different fields.	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT211-19.1	3	2	1	3	2	2	1		1	1		2	2	3	3	2
BTFT211-19.2	3	3	3	3	2	1	2		1	2	1	2	3	3	3	3
BTFT211-19.3	2	2	2	2	3	2	1			1	1	1	2	2	1	2
BTFT211-19.4	2	2	2	3	2	1	2					1	2	2	2	2
BTFT211-19.5	2	2	2	2	3	2	1			2	1	2	3	3	2	2
AVERAGE	**2.40**	**2.20**	**2.00**	**2.60**	**2.40**	**1.60**	**1.40**		**1.00**	**1.50**	**1.00**	**1.60**	**2.40**	**2.60**	**2.20**	**2.20**

Program: B. Tech (Food Technology)	**Semester:** 3rd Semester
Course Name: Food Composition and Analysis	**Course Code:** BTFT 213-19

Syllabus:

MODULE	DETAILS	HOURS
1	**Carbohydrates:** Introduction, General Properties, Monosaccharides, Oligosaccharides, Polysaccharides, Nutritional Value of Carbohydrates, Commercial Sugar and Sugar Products, Qualitative Analysis and Quantitative Analysis.	10 Hrs
2	**Lipids:** Introduction, Simple Lipids and their Constituents, Compound Lipids, Derived Lipids, Nutritional Value of Fats and Fat Products, Commercial Fats and Fat Products, Deterioration of Fats, Analysis.	12 Hrs
3	**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 and Minerals: Nomenclature, classification and analysis Introduction, Enzymes: Introduction, Nomenclature and Classification, Food Enzymes.	10 Hrs
4	Weighing Devices, Visible and Ultraviolet Spectrophotometry, Thin-Layer Chromatography, pH, Sampling, Moisture, Crude Fat, Crude Protein, Crude Fiber.	10 Hrs

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
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	Damodaran, S., Parkin, K. L., & Fennema, O. R. (2007). Fennema's Food Chemistry: CRC Press, Taylor and Francis group.
5	Newton, D.E. (2009). Food Chemistry: Facts On File, Incorporated.

Course Code: BTFT 213-19 (Food Composition and Analysis)

	Course Outcomes	BT Level
BTFT213-19.1	Draw the chemical structure of carbohydrates, proteins and fats	1
BTFT213-19.2	Explain the properties and functions of food macromolecules and some micronutrients.	2
BTFT213-19.3	Employ different methods for quantitative and quantitative analysis of different food.	3
BTFT213-19.4	Compare various enzymes with respect to their rate of action and site for working.	4
BTFT213-19.5	Select the appropriate method for food analysis by applying food composition knowledge.	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT213-19.1	3	3	3	2	2	1	2		1	1	1	2	2	2	2	3
BTFT213-19.2	3	2	2	2	2	2			1	2		1	3	3	1	1
BTFT213-19.3	3	3	2	3	3	1	1				1		2	2	2	2
BTFT213-19.4	3	2	1	3	3	2	2		1	2	1	1	2	3	1	2
BTFT213-19.5	2	2	2	2	3						1		2	2	2	3
AVERAGE	**2.80**	**2.40**	**2.00**	**2.40**	**2.60**	**1.50**	**1.67**		**1.00**	**1.67**	**1.00**	**1.33**	**2.20**	**2.40**	**1.60**	**2.20**

Program: B. Tech (Food Technology)	**Semester:** 3rd Semester
Course Name: Nutrition and Health	**Course Code:** BTFT 215-19

Syllabus:

MODULE	DETAILS	HOURS
1	Scope, concepts and importance of nutrition; definition of various terms related to nutrition, human digestive system, Malnutrition and its types, epidemiology of under nutrition and over nutrition, nutrition infection and immunity.	10 Hrs
2	**Nutrients:** Classification, functions, sources, requirement and deficiency of proteins, carbohydrates, lipids, vitamins and minerals. Importance of dietary Fiber and water in human health, Energy - definition, units of measurement of energy, basal metabolic rate (BMR), specific dynamic action (SDA) of foods, factors affecting BMR and respiratory quotient (RQ).	12 Hrs
3	Recommended Dietary Allowance (RDA) for reference man and woman, concept of Balanced diets, diets for different age groups, Nutrition - role of nutrition in pregnancy and lactation, infant nutrition, childhood nutrition, geriatric nutrition; Nutrition of special groups: (space & sports).	10 Hrs
4	Importance of Nutrition Education, Role of different national and international organizations in maintaining health and nutritional status, nutritional policies like food for work, mid-day meals, integrated child development services (ICDS) vitamin A and Iron, prophylaxis, measures; Existing food fads and fallacies & how to overcome.	10 Hrs

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	Joshi S. A., (1992) Nutrition and Dietetics Tata Mc Grow- Hill publishing Company Ltd., New Delhi
2	M. Swaminathan, Vol I & II Foods and Nutrition NIN Publications
3	Manay S., and Shadksharawamis N., Food: Facts and Principles, New Age International Pvt. Ltd., New Delhi.
4	Mann J., and Truswell S., (2007) Essentials of Human Nutrition 3rd Ed. Oxford University Press, 2007
5	Khanna (1997) Textbook of Nutrition and Dietitics, Phoenix Publisher House Pvt. Ltd., New Delhi.

Course Code: BTFT 215-19 (Nutrition and Health)

	Course Outcomes	BT Level
BTFT215-19.1	Define the terms and concepts related to food and nutrition.	1
BTFT215-19.2	Explain and classify the requirement and source of nutrients essential for human health.	2
BTFT215-19.3	Discuss the role of nutrition in infections and diseases.	3
BTFT215-19.4	Distinguish the role of nutrition education and different organizations for improving health of the masses nationwide.	4
BTFT215-19.5	Design and formulate balanced diet plans for different vulnerable groups according to RDAs.	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT 215-19.1	3	2	2	2	2	2	2	2	2		1	2	3	2	2	2
BTFT 215-19.2	2	1	3	2		2	3	3	1	2	1	1	2	3	3	2
BTFT 215-19.3	2	2	2		2	2	1	2	2			2	3	2	2	3
BTFT 215-19.4	2	2	1	2	2	1	3	2					2	2	2	2
BTFT 215-19.5	2	2	2	2	2	2	2	1	1	2		1	1	3	2	1
Average	**2.20**	**1.80**	**2.00**	**2.00**	**2.00**	**1.80**	**2.20**	**2.00**	**1.50**	**2.00**	**1.00**	**1.50**	**2.20**	**2.40**	**2.20**	**2.00**

Program: B. Tech (Food Technology)	**Semester:** 3rd Semester
Course Name: Engineering Properties of Food	**Course Code:** BTEC 216-19

Syllabus:

MODULE	DETAILS	HOURS
1	Mass, volume, area related properties of foods and their measurement techniques; Rheological properties of food: stress, strain, Hooke's law, elasticity, Plasticity, ductility; flow behavior: Newtonian and Non Newtonian fluid, Time dependent and independent flow behavior.	10 Hrs
2	**Thermal properties of food:** specific heat capacity, thermal conductivity, enthalpy, thermal diffusivity, experimental approach to measure thermal properties; Thermodynamic properties of food: Thermodynamic food-water system, sorption energy, significance of thermal properties; Psychrometrics: Properties of dry air, composition of air, specific heat of dry air, enthalpy of dry air, properties of water-vapour, properties of air-vapour mixtures, psychometric chart, application of psychometric chart in food processing.	12 Hrs
3	**Dielectric properties of food:** principle, measurement, frequency and temperature dependence, composition dependence of dielectric properties; assessment of food quality by using dielectric properties, effects of processing and storage on dielectric properties of foods.	10 Hrs
4	**Surface properties:** surface tension, fundamental consideration, Gibbs adsorption equation and contact angle measurement techniques; colorimetric properties of food: measurement of colour, colour spectrum etc.	10 Hrs

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	Rao M. A., Rizvi S. S. H., Datta A. K. & Jasim A. (2014) Engineering properties of foods, 4 th edition, CRC Press.
2	Lewis M. J. (1990) Physical Properties of Foods and Food Processing Systems. Woodhead Publishing.
3	Devahastin S. (2011) Physicochemical aspects of food engineering and processing, CRC Publication.
4	Singh R. P. & Heldman D. R. (2009) Introduction to Food Engineering 4th edition, Academic Press

Course Code: BTEC 216-19 (Engineering Properties of Food)

	Course Outcomes	BT Level
BTEC216-19.1	Describe various physical and rheological properties of food and biomaterials.	1
BTEC216-19.2	Describe thermal properties and flow behaviour of foods.	1
BTEC216-19.3	Explain psychrometrics, dielectric, surface and colorimetric properties of foods.	2
BTEC216-19.4	Judge the processing technique to be adopted for various foods according to their properties.	5
BTEC216-19.5	Design the various equipments by considering the various properties of foods.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTEC216-19.1	3	2			3	2	1			1	2	3	3	3	2	2
BTEC216-19.2	2	2			1	1	2	2				3	3	3	3	2
BTEC216-19.3	3	2	2	2		2	1	1	3	3	2	3	3	3	3	2
BTEC216-19.4	3	3		3	2	1	1			2	2	3	3	3	3	3
BTEC216-19.5	3	3	3	3	3	3	2	2		2	2	3	3	3	3	3
AVERAGE	**2.80**	**2.40**	**2.50**	**2.66**	**2.25**	**1.80**	**1.40**	**1.66**	**3.00**	**2.00**	**2.00**	**3.00**	**3.00**	**3.00**	**2.80**	**2.40**

Program: B. Tech (Food Technology)	**Semester:** 3rd Semester
Course Name: Thermodynamics	**Course Code:** BTEC 217-19

Syllabus:

MODULE	DETAILS	HOURS
1	**Basic Concepts:** Macroscopic and microscopic approaches, thermodynamic systems, surrounding and boundary, thermodynamic property – intensive and extensive, thermodynamic equilibrium, state, path, process and cycle, quasi-static, reversible and irreversible processes, working substance; Concept of thermodynamic: work and heat, equality of temperature, zeroth law of thermodynamic and its utility, problems; First Law of thermodynamics: energy and its forms, energy and 1st law of thermodynamics, internal energy and enthalpy, PMMFK, steady flow energy equation, 1st law applied to non- flow process, steady flow process and transient flow process, throttling process and free expansion process, problems.	10 Hrs
2	**Second law of thermodynamics:** limitations of first law, thermal reservoir, heat source and heat sink, heat engine, refrigerator and heat pump, kelvin- planck and clausius statements and their equivalence, PMMSK, Carnot cycle, Carnot heat engine and Carnot heat pump, Carnot theorem and its corollaries; Thermodynamic temperature scale; Entropy, Clausius inequality, principle of entropy increase, temperature entropy plot, entropy change in different processes, problems; Introduction to third Law of thermodynamics. availability and irreversibility: high and low grade energy, availability and unavailable energy, loss of available energy due to heat transfer through a finite temperature difference, dead state of a system, availability of a non-flow or closed system, availability of a steady flow system, Helmholtz and Gibb's Functions, effectiveness and irreversibility, second law efficiencies of processes & cycles, problems.	12 Hrs
3	**Pure Substance:** pure substance and its properties, phase and phase transformation, vaporization, evaporation and boiling, saturated and superheat steam, solid – liquid – vapour equilibrium, T-V, P-V and P-T plots during steam formation, properties of dry, wet and superheated steam, property changes during steam processes, temperature – entropy (T-S) and enthalpy – entropy (H-S) diagrams, throttling and measurement of dryness fraction of steam, problems.	10 Hrs
4	**Ideal and Real Gases:** concept of an ideal gas, basic gas laws, characteristic gas equation, Avogadro's law and universal gas constant, P-V-T surface of an ideal gas; Vander Waal's equation of state, reduced	10 Hrs

	co-ordinates, compressibility factor and law of corresponding states; Mixture of gases, mass, mole and volume fraction, Gibson Dalton's law, gas constant and specific heats, entropy for a mixture of non-reactive gases, problems; Thermodynamic relations: Maxwell relations, Clapyron equation, relations for changes in enthalpy and internal energy & entropy, specific heat capacity relations, Joule Thomson coefficient & inversion curve.	

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	Jones & Dugan (1995) Engineering Thermodynamics, Prentice Hall of India.
2	Radhakrishnan E. (2006) Fundamentals of Engineering Thermodynamics, 2 nd edition, Prentice Hall of India.
3	Rao Y. V. C. (1994) Theory and Problems of Thermodynamics, Wiley Eastern Ltd.
4	Arora C. P. (2001) Thermodynamics, Tata McGraw Hill
5	Nag P. K. (2005) Engineering Thermodynamics, Tata McGraw Hill.

Course Code: BTFT 217-19 (Thermodynamics)

	Course Outcomes	BT Level
BTEC217-19.1	Describe basic concepts of engineering thermodynamics and the practical application of thermodynamic laws.	1
BTEC217-19.2	Illustrate the implementation of 1st law of thermodynamics for different flow processes and apply the basic concepts of heat engine, heat pump and refrigerator used in engineering field.	3
BTEC217-19.3	Use basic concepts of thermodynamics in problem solving.	3
BTEC217-19.4	Evaluate the ideal thermodynamic air standard cycles and mathematical relationships between different thermodynamic properties.	5
BTEC217-19.5	Construct the various thermodynamic models using various properties.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTEC217-19.1	3	2	1	1	1	2	2		2	2	1	3	2	2	3	3
BTEC217-19.2	3	3	2	1	2	3	2	1	2	2	1	3	2	3	3	2
BTEC217-19.3	3	3	2	2	2	3	1	1	2	2		2	1	1	3	3
BTEC217-19.4	2	1	1	1		2			2	1		3	1	2	3	2
BTEC217-19.5	2	2	2	1	1	1			2	1		3	1	1	3	2
AVERAGE	**2.60**	**2.20**	**1.60**	**1.20**	**1.50**	**2.20**	**1.67**	**1.00**	**2.00**	**1.60**	**1.00**	**2.80**	**1.40**	**1.80**	**3.00**	**2.40**

Program: B. Tech (Food Technology)	**Semester:** 3rd Semester
Course Name: Introduction to Biology and Microbiology Lab	**Course Code:** BTFT 212-19

Syllabus:

To learn use of microscope and principles of fixation and staining.

Preparation of Normal, molar and standard solutions, phosphate buffers, serial dilutions.

Use of micropipettes, Separation of amino acids and chloroplast pigments by paper chromatography.

Perform gram staining of bacteria.

Study the cytochemical distribution of nucleic acids and mucopolysac charides in cells/tissues from permanent slides.

Perform quantitative estimation of protein using the Lowry's method and determine the concentration of the unknown sample using the standard curve plotted.

Separate and quantify sugars by thin layer chromatography.

Raise the culture of E. coli and estimate the culture density by turbidity method and draw a growth curve from the available data, Isolation of genomic DNA from E.coli.

Course Code: BTFT 212-19 (Introduction to Biology and Microbiology Lab)

	Course Outcomes	BT Level
BTFT212-19.1	Describe the preparation of standard solutions and buffers	1
BTFT212-19.2	Estimate the various components of cells using different techniques.	2
BTFT212-19.3	Operate simple & micropipettes and microscope.	3
BTFT212-19.4	Examine the cell structure using different instruments.	4
BTFT212-19.5	Evaluate the quantity of microorganisms using different methods.	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT212-19.1	3	2	1	3	2	1	1		1	1		2	2	3	3	2
BTFT212-19.2	3	2	3	3	2	1			1	2	1	1	2	2	3	2
BTFT212-19.3	2	2	2	2	2		1			1	1		2	2	1	1
BTFT212-19.4	2	2	2	2	2	1	1					1	2	2	2	2
BTFT212-19.5	2	2	2	2	3		1			2	1		3	3	2	1
AVERAGE	**2.40**	**2.00**	**2.00**	**2.40**	**2.20**	**1.00**	**1.00**		**1.00**	**1.50**	**1.00**	**1.33**	**2.20**	**2.40**	**2.20**	**1.60**

Program: B. Tech (Food Technology)	**Semester:** 3rd Semester
Course Name: Food Composition and Analysis Lab.	**Course Code:** BTFT 214-19

Syllabus:

Methods of sampling for food analysis. Moisture analysis – oven drying method / moisture meter.

Qualitative test for carbohydrates – Molisch test, Barfoed test, Benedict test.

Determination of total carbohydrates, various types of starches, soluble sugars and reducing sugars.

Methods of protein analysis – Kjeldahl method / Biuret method.

Determination of total fats and oils – solvent extraction method.

Determination of free fatty acids value, saponification value and iodine value in food samples.

Mineral analysis by atomic absorption spectrophotometer and flame photometer.

Chromatographic methods for separations and quantification of various vitamins.

Determination of total phenols and tannins by colorimetric method.

Some important chemical test and analysis for food additives and flavour components.

Course Code: BTFT 214-19 (Food Composition and Analysis Lab.)

	Course Outcomes	BT Level
BTFT214-19.1	Describe the different methods of food sampling.	1
BTFT214-19.2	Explain the different methods used for food analysis.	2
BTFT214-19.3	Apply the qualitative and quantitative methods of food analysis.	3
BTFT214-19.4	Examine the results of food analysis and use it for further data analysis.	4
BTFT214-19.5	Judge the composition of different food materials.	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT214-19.1	3	3	3	2	2	1	1		1	1	1	1	2	2	2	3
BTFT214-19.2	3	2	2	2	2	1			1	2		1	2	3	2	1
BTFT214-19.3	3	3	2	3	3	1	1			1	1		3	2	2	2
BTFT214-19.4	3	2	1	2	3		1		1	2	1	1	2	3	1	2
BTFT214-19.5	2	2	1	1	2	1	1			1	1		2	2	2	3
AVERAGE	**2.80**	**2.40**	**1.80**	**2.00**	**2.40**	**1.00**	**1.00**		**1.00**	**1.40**	**1.00**	**1.00**	**2.20**	**2.40**	**1.80**	**2.20**

Record of CO-PO Mapping (4th Semester)

IK Gujral Punjab Technical University Bachelor of Technology Scheme for B.Tech Syllabus 2019

(Semester-4th)

Course Code	Subject	L-T-P	Credit
BTFT221-19	Food Biochemistry	3-0-0	3
BTFT222-19	Principles and Methods of Food Processing	3-0-0	3
BTFT224-19	Food Engineering	3-1-0	4
BTFT225-19	Food Microbiology	3-0-0	3
BTFT227-19	Heat and Mass Transfer	3-0-0	3
BTFT223-19	Principles and Methods of Food Processing Lab	0-0-4	2
BTFT226-19	Food Microbiology Lab	0-0-4	2
BMPD401-18	Mentoring & professional development	0-0-2	Satisfactory/ Unsatisfactory
Total		**15-1-8**	**20**

Program: B. Tech (Food Technology)	**Semester:** 4th Semester
Course Name: Food Biochemistry	**Course Code:** BTFT221-19

Syllabus:

MODULE	DETAILS	HOURS
1	Importance of food biochemistry, Functions of food; Basic food groups; nutrients supplied by food; Water in foods and its properties, water intake and losses, energy balance and basal metabolism.	8 Hrs
2	Carbohydrate: Sources of food carbohydrates; Physico-chemical and functional properties; chemistry and structure of homo saccharides and hetero saccharide, introduction to carbohydrates metabolism, glycolysis, TCA cycle, Electron transport chain, oxidative and substrate level phosphorylation gluconeogenesis and glycogen metabolism. Functions, sources, digestion, absorption, assimilation, transport of proteins, transamination Deamination and decarboxylation fixation of nitrogen, Introduction to enzyme and characteristics, coenzymes, kinetics and mechanism of enzyme action. Importance of Hormones.	6 Hrs
3	Fats: Sources and physico chemical and functional properties; PUFA [Poly-unsaturated Fatty Acids] hydrogenation and rancidity; Saponification number, iodine value, Reichert-Meissl number, Polenske value; Lipids of biological importance like cholesterol and phospholipids. Introduction to lipid metabolism, β-oxidation of long chain fatty acids, Ketosis, breakdown of phospholipids Biosynthesis of fatty acids, triglycerides, phospholipids, nucleotides and nucleic acids.	11 Hrs
4	Minerals and Vitamins: Sources and structures of minerals & vitamins; Pro vitamins A & D; Vitamins as antioxidants. Minerals: Functions, sources, absorption, deficiency of macrominerals, micro-minerals, and trace minerals. Vitamins: classification, Functions, sources, absorption, deficiency of water soluble and fat-soluble Vitamins. Effect of processing on macro and micronutrients.	11 Hrs

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	Principles of Biochemistry by Lehninger, New York Publication.
2	Donald Voet and Judith G. Voet. 2011. Biochemisry, 4th Ed. John Wiley and Sons, Inc., NY, USA.
3	Lubert stryer, Biochemistry, Freeman & Co, N.Y. 4. Voet & Voet, Fundamentals of Biochemistry, Jonh Willey & Sons.
4	M. Swaminathan, Vol I & II Foods and Nutrition NIN Publications.

Course Code: BTFT221-19 (Food Biochemistry)

	Course Outcomes	BT Level
BTFT221-19.1	Define and describe terminology and basics of biochemistry of food.	1
BTFT221-19.2	Understand the concepts of water and energy balance.	2
BTFT221-19.3	Classify various nutrients according to structures, sources and their functions.	3
BTFT221-19.4	Explain and understand physico-chemical properties of various nutrients.	4
BTFT221-19.5	Illustrate metabolism processes of macro nutrients.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT221-19.1	3	2	1	2	1	2			2	1	1	3	3	3	3	2
BTFT221-19.2	2	3	2	2	1					2		2	2	2	3	1
BTFT221-19.3	2	2	2	3	2	1	3				1	1	2	2	1	
BTFT221-19.4	1	2	2	2	1						1	1	1	3	2	
BTFT221-19.5	3		3	1		2						2	2	1		3
AVERAGE	**2.20**	**2.25**	**2.00**	**2.00**	**1.25**	**1.67**	**3.00**		**2.00**	**1.50**	**1.00**	**1.80**	**2.00**	**2.20**	**2.25**	**2.00**

Program: B. Tech (Food Technology)	**Semester:** 4th Semester
Course Name: Principles and Methods of Food Processing	**Course Code:** BTFT222-19

Syllabus:

MODULE	DETAILS	HOURS
1	**Introduction to food processing:** basic principles, importance of food processing and preservation; techniques of preservation; Use of preservatives: Sugar and salt preservation, use of chemical preservatives in food, smoking, sulphur fumigation and pickling, purposes and advantages, classification of foods, types of food spoilage, viz. microbiological, enzymatic, chemical, physical and their effects on food quality	8 Hrs
2	**High temperature processing:** principles of thermal processing, pasteurization and sterilization, microbial destruction in batch and continuous sterilization; methods of heat transfer, heat resistance in microorganisms, factors affecting heat resistance in micro-organisms, Thermal Death Time (TDT) curve; ultra-heat treatment UHT processing; Industrial applications of canning and bottling: commercial canning operation, spoilage of canned food and its quality evaluation; food irradiation (commercial applications, quality/technological aspects); application of ultra violet (UV) rays in food, microwave heating, its mechanism, effects and applications in food preservation.	10 Hrs
3	**Low temperature processing:** low temperature requirement for different foods, refrigeration, components of refrigerators, chilling and freezing of food, freezing principles, low and fast freezing, freezing process, determining freezing load, refrigeration systems, freezing rate, estimation of freezing time of foods, types of freezers, thawing of frozen food, advantages of cold preservation.	8 Hrs
4	**Processing by moisture removal:** evaporation, concentration, and dehydration, drying equipments, types of dryers, their advantages and disadvantages, evaporation and functions, continuous, multiple effect, falling and rising film evaporators, water activity (aW) in foods: role of water activity in food preservation, control of aW by addition of solutes and moisture removal, moisture sorption isotherm, measurements of water activity; intermediate moisture food (IMF), principles.	8 Hrs

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	Norman N. P., and Joseph H. H., (1997) Food Science 5th edition, CBS Publication, New Delhi.
2	Frazier W. C., and Westhoff D. C., (1996) Food Microbiology 4th Ed, Tata McGraw Hill Pvt. Ltd., New Delhi.
3	Fellows P. J., (2002) Food Processing Technology: Principles and Practice 2nd Ed, Woohead Pub. Ltd.
4	Sivasankar B., (2002) Food Processing & Preservation, Prentice Hall of India.
5	Khetarpaul N., (2005) Food Processing and Preservation, Daya Publications.
6	Norman W. Desrosier; (2018) The Technology of food preservation, Medtech, New Jersey.

Course Code: BTFT222-19 (Principles and Methods of Food Processing)

	Course Outcomes	BT Level
BTFT222-19.1	Describe actions taken to maintain foods with the desired properties or nature for long as needed	1
BTFT222-19.2	Identify quality loss mechanisms as biological, chemical and physical.	2
BTFT222-19.3	Employ preservation methods that make use of heat/cold, drying, acid, added chemicals, controlled air, pressure and high energy radiation.	3
BTFT222-19.4	Judge the best method of food preservation on the basis of various properties.	5
BTFT222-19.5	Develop food handling practices that reduce the potential for food borne illness.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT222-19.1	3	3	2	2	2	2			1	1	1	3	2	3	3	2
BTFT222-19.2	2	3	2	2	1					1			3	3	3	1
BTFT222-19.3	2	1	1	1	2	1	3						2	2	1	
BTFT222-19.4	3	3	2	2	2				1		1	1	2	2		2
BTFT222-19.5	3	2	3	1		2					1	1		2		3
AVERAGE	**2.60**	**2.40**	**2.00**	**1.60**	**1.75**	**1.67**	**3.00**		**1.00**	**1.00**	**1.00**	**1.67**	**2.25**	**2.40**	**2.33**	**2.00**

Program: B. Tech (Food Technology)	**Semester:** 4th Semester
Course Name: Food Engineering	**Course Code:** BTFT224-19

Syllabus:

MODULE	DETAILS	HOURS
1	**Introduction to Food Engineering**: units and dimensions; Material and energy balance: basic principles, process flow diagrams, total mass balance, component mass balance, problems related to material balance, heat balance and energy balance.	8 Hrs
2	**Fluid Flow Principles**: fluid statics and fluid dynamics, Bernoulli equation; Newtonian and non Newtonian fluids, streamline and turbulent flow, fluid flow applications, measurement of pressure and velocity; Liquid transport system, pipelines and pumps for food processing plants, types of pipelines, positive displacement pumps, air-lift pumps, propeller pumps, centrifugal pumps and jet pumps, pump selection.	10 Hrs
3	**Thermal Process Calculations:** commercially sterile concept, concept of D, F and Z values, reference F value, effect of temperature on thermal inactivation of microorganisms, thermal process calculation for canned foods, calculation of processing time in continuous flow systems.	8 Hrs
4	**Refrigeration:** introduction, refrigeration cycle, components of refrigeration systems: compressor, condenser, and expansion valve, mechanical refrigeration system, Freezing time calculations; Boiler design, working; Steam properties.	8 Hrs

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	Batty J. C. & Folkman S. L. (1983) Food Engineering Fundamentals, John Wiley and Sons.
2	Singh R. P. & Heldman D. R. (2014) Introduction to Food Engineering, Academic Press.
3	Loncin M. & Merson R. L. (1979) Food Engineering Principles and Selected Applications, Academic Press.
4	Toledo R. T. (2007) Fundamentals of Food Process Engineering, 3rd edition, Springer.
5	Ibarz A. & Gustavo Barbosa-Cánovas V. (2003) Unit Operations in Food Engineering, CRC Press.

Course Code: BTFT224-19 (Food Engineering)

	Course Outcomes	BT Level
BTFT224-19.1	Describe the construction and operating principles of food and beverage processing, handling and packaging systems using engineering terminology.	1
BTFT224-19.2	Explain Newtonian and non-Newtonian behaviour of fluids and their relevance to food rheology principles and related food processing methods.	2
BTFT224-19.3	Apply the principles of mass and energy balance to food processing systems.	3
BTFT224-19.4	Evaluate heat loads and heat losses in heating and cooling food process systems.	5
BTFT224-19.5	Design a general food plant layout and improve on existing plant layout.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT224-19.1	3	2			3	2	1			1	2	3	3	3	2	2
BTFT224-19.2	2	2			1	1	2	2		2		3	3	3	3	2
BTFT224-19.3	3	2	2	2		2	1	1	3	3	2	3	2	3	2	2
BTFT224-19.4	3	3		3	2	1	1			2	2	3	3	3	3	3
BTFT224-19.5	3	3	3	3	3	3	2	3	2		2	2	3	3	3	3
AVERAGE	**2.80**	**2.40**	**2.50**	**2.66**	**2.25**	**1.80**	**1.40**	**2.00**	**2.50**	**2.00**	**2.00**	**2.80**	**2.80**	**3.00**	**2.60**	**2.40**

Program: B. Tech (Food Technology)	**Semester:** 4th Semester
Course Name: Food Microbiology	**Course Code:** BTFT225-19

Syllabus:

MODULE	DETAILS	HOURS
1	Introduction, history and scope of food microbiology; Source and types of microorganism associated with food; Factors governing interaction between food and microorganisms; Importance of microorganism in food industry.	8 Hrs
2	Fermented foods from cereal, meat, fish, fruits, vegetables and milk; Single cell protein; Fermented beverages - beer, vinegar and wine; Oriental foods.	10 Hrs
3	Foods microbiology and public health - Types of food poisonings, important features and control; Overview of algal, fungal and viral food borne illnesses.	10 Hrs
4	Microbial spoilage of milk, meats, fish and various plant products. Microbiology of spices. Control of Microorganisms & Food Preservation methods, HACCP &Hurdle Technology and its applications.	8 Hrs

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	James M. J. (2000) Modern Food Microbiology, 5th Edition, CBS Publishers
2	Barnart G. J. (1997) Basic Food Microbiology, CBS Publishers.
3	Fundamentals of Computer Algorithms – E. Horowitz, Sartaj Saini, Galgota Publications.
4	Adam M. R. & Moss M. O. (1995) Food Microbiology, New Age International Pvt. Ltd. Publishers.
5	Bibek Ray (1996) Fundamental Food Microbiology, CRC Press.

Course Code: BTFT225-19 (Food Microbiology)

	Course Outcomes	BT Level
BTFT225-19.1	Describe the microbiology of various food products.	1
BTFT225-19.2	Identify the important pathogens and spoilage microorganisms in foods.	2
BTFT225-19.3	Demonstrate understanding of how microorganisms enter and grow in food or can be used to make food and processes to identify and control foodborne disease and food spoilage and understand of the basis of food safety regulations that governing these processes.	3
BTFT225-19.4	Compare the role and significance of microbial inactivation, adaptation and environmental factors (i.e., aw, pH, temperature) on growth and response of microorganisms in various environments.	4
BTFT225-19.5	Formulate different microorganisms for different industrial applications.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT225-19.1	2	1	2	2	1	2			1	1	1	3	1	2	3	2
BTFT225-19.2	2	3		2	1						1	2	2	1	3	2
BTFT225-19.3	2		2		2	1	3		2		1	1	3	3	1	
BTFT225-19.4	2	2		2						1	1	1	2	3	2	1
BTFT225-19.5	3		3		3	2				1		2	2	2		3
AVERAGE	**2.20**	**2.00**	**2.33**	**2.00**	**1.75**	**1.67**	**3.00**		**1.50**	**1.00**	**1.00**	**1.80**	**2.00**	**2.20**	**2.25**	**2.00**

Program: B. Tech (Food Technology)	**Semester:** 4th Semester
Course Name: Heat and Mass Transfer	**Course Code:** BTFT227-19

Syllabus:

MODULE	DETAILS	HOURS
1	Heat transfer in food processing operations, mean temperature difference; Concept of heat conduction, Fourier's law of heat conduction, one dimensional steady state heat conduction equation for flat plate, hollow cylinder, hollow sphere; Thermal conductivity measurement, effect of temperature on thermal conductivity, conduction through liquids.	5 Hrs
2	**Convection and Radiation**: concept of heat transfer by convection, natural and forced convection, application of dimensional analysis for convection, equations for forced convection under laminar, transition and turbulent conditions, equations for natural convection; Concept of thermal radiations, black body concept, Stefan Boltsman's law, concept of grey body, radiation between surfaces.	3 Hrs
3	**Heat Exchangers:** parallel and counter flow heat exchangers, log mean temperature difference, single pass and multipass heat exchangers, plate heat exchangers, number of transfer unit; Diffusion and mass transfer coefficients: molecular and eddy diffusion in gases and liquids, steady state diffusion under stagnant and laminar flow conditions, diffusion in solids, concept of mass transfer coefficients.	18 Hrs
4	**Absorption and Distillation:** equilibrium and operating line concept in absorption calculations, types of contactors, methods of distillation, extractive and azeotropic, low pressure distillation, steam distillation; Extraction and leaching: equilibrium in ternary systems; Differential contact extraction equipment - spray, packed and mechanically agitated contactors, pulsed extractors, centrifugal extractors, solid-liquid equilibria, leaching equipment-batch and continuous types.	

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	Binay K. Dutta (2001) Heat Transfer Principles and Applications, Prentice Hall of India.
2	Nag P. K. (2015) Heat and mass transfer, 3 rd edition, McGraw Hill Publishers.
3	Barhr H. & Stephan K. (2011) Heat and mass transfer, 3 rd edition, Springer Publication.
4	Kamaraj G. &Raveendiran P. (2008) Heat and mass transfer, Scitech Publications.

Course Code: BTFT227-19 (Heat and Mass Transfer)

	Course Outcomes	BT Level
BTFT227-19.1	Describe the concept of various modes of heat transfer during processing of food.	1
BTFT227-19.2	Explain the concept of mass transfer during processing operations.	2
BTFT227-19.3	Use various analytical techniques for distillation and extraction for foods.	3
BTFT227-19.4	Judge the processing technique to be adopted for various foods according to their heat and mass transfer properties.	5
BTFT227-19.5	Design equipment's for food processing using heat and mass transfer equations.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT227-19.1	3	2	2	2		3	2	1		2		3	3	3	2	3
BTFT227-19.2	3	2	2	2		3	2	1		2		3	3	3	2	2
BTFT227-19.3	3	3	2	3		1	1		1	2		3	2	1	2	2
BTFT227-19.4	3	3	2	3			1		1	2		3	2	2	2	1
BTFT227-19.5	3	2	3	2		2			1	2		3	1	2	2	2
AVERAGE	**3.00**	**2.40**	**2.20**	**2.40**		**2.25**	**1.50**	**1.00**	**1.00**	**2.00**		**3.00**	**2.20**	**2.20**	**2.00**	**2.00**

Program: B. Tech (Food Technology)	**Semester:** 4th Semester
Course Name: Principles and Methods of Food Processing Lab	**Course Code:** BTFT223-19

Syllabus:

Demonstration of various food processing equipment.

Assessment of adequacy of blanching of food sample.

Measurement of specific gravity of liquid sample.

Identification of different food grains.

Measurement of cooking quality of rice grains.

Preparation of the sugar syrup of different degree brix.

Preservation of vegetable with the help of fermentation technique (Sauerkraut).

Studies on the effect of boiling time on egg quality.

Effects of various types of drying on food quality.

Effect of edible coating processing on food quality.

Adequacy tests for pasteurization and sterilization for different foods.

Course Code: BTFT223-19 (Principles and Methods of Food Processing Lab)

	Course Outcomes	BT Level
BTFT223-19.1	Describe the basic principles of equipments used during food processing.	1
BTFT223-19.2	Understand the use of different processing techniques.	2
BTFT223-19.3	Test the adequacy of different processing treatments.	4
BTFT223-19.4	Evaluate the effects of preservation techniques on food quality.	5
BTFT223-19.5	Develop different processing parameters on the basis of food properties.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT223-19.1	3	3	2	2	3	2	1		2	2	1	3	2	3	3	2
BTFT223-19.2	2	3	2	2	3					1			3	3	3	1
BTFT223-19.3	2	1	2	3	2	1	2						2	2	1	
BTFT223-19.4	3	3	2	2	2				1		1	1	2	3		2
BTFT223-19.5	3	2	2	1	3	2					1	1	1	2	2	3
AVERAGE	**2.60**	**2.40**	**2.00**	**2.00**	**2.60**	**1.67**	**1.50**		**1.50**	**1.50**	**1.00**	**1.67**	**2.00**	**2.60**	**2.25**	**2.00**

Program: B. Tech (Food Technology)	**Semester:** 4th Semester
Course Name: Food Microbiology Lab	**Course Code:** BTFT226-19

Syllabus: List of Experiments

Study of a compound microscope.

Gram Staining and Study of morphology of bacterial cells.

Study of autoclave, Preparation and sterilization of nutrient broth and agar.

Sub culturing of a bacterial strain in liquid and solid medium.

Study of growth of E. coli by a spectrophotometer.

Study of microbiological quality of milk by MBRT test.

Preparation of synthetic medium for yeast and mould and inoculation with standard strains of yeasts and moulds.

Isolation of starchhydrolyzing organism from soil.

Dilution and Plating by spread – plate and pour – plate techniques.

Isolation of pure culture.

Estimation of microbial count of air.

Course Code: BTFT226-19 (Food Microbiology Lab)

	Course Outcomes	BT Level
BTFT226-19.1	Describe different culturing techniques for microorganisms.	1
BTFT226-19.2	Identify bacteria through staining and biochemical testing.	2
BTFT226-19.3	Demonstrate the use of microscope in identifying various bacterial, protozoa, and fungal species.	3
BTFT226-19.4	Examine the effectiveness of various antiseptics, disinfectants, and antibiotics in preventing bacterial growth.	4
BTFT226-19.5	Evaluate the numbers of bacteria present in culture.	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT226-19.1	2	1	2	2	2	2			1	1	1	3	2	2	3	2
BTFT226-19.2	2	3	3	2	1				1		1	2	2	2	3	1
BTFT226-19.3	2		2		2	1	3		1		1	1	3	3	1	
BTFT226-19.4	2	2		1						1	1	1	2	3	2	1
BTFT226-19.5	3		3		3	2			1	1		2	2	2		3
AVERAGE	**2.20**	**2.00**	**2.50**	**1.67**	**2.00**	**1.67**	**3.00**		**1.00**	**1.00**	**1.00**	**1.80**	**2.20**	**2.40**	**2.25**	**1.75**

Record of CO-PO Mapping (5th Semester)

IK Gujral Punjab Technical University Bachelor of Technology Scheme for B. Tech Syllabus 2019

(Semester-5th)

Course Code	Subject	L-T-P	Credit
HSMC301-19	Economics for Engineers	2-0-0	2
BTFT 311-19	Processing of Grains	3-0-0	3
BTFT 313-19	Fruits and Vegetables Processing	3-0-0	3
BTFT 315-19	Food Safety, Quality and Regulations	3-0-0	3
BTFT 316-19	Food Refrigeration and Cold Storage	3-0-0	3
OEE-104-18	Renewable Energy Resources	3-0-0	3
BTFT 312-19	Processing of Grains Lab	0-0-4	2
BTFT 314-19	Fruits and Vegetables Processing Lab	0-0-4	2
BTFT 317-19	In Plant Training Seminar (4-6 weeks)	0-0-4	2
BTMC102-18	Essence of Indian Traditional Knowledge	3-0-0	Satisfactory / Un-Satisfactory
BMPD501-18	Mentoring & professional development	0-0-2	Satisfactory / Un-Satisfactory

Program: B. Tech (Food Technology)	**Semester:** 5th Semester
Course Name: Economics for Engineers	**Course Code:** HSMC301-19

Syllabus:

MODULE	DETAILS	HOURS
1	Basic Principles and Methodology of Economics. Demand/Supply – elasticity – Government Policies and Application. Theory of the Firm and Market Structure. Basic Macro-economic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes	
2	Public Sector Economics –Welfare, Externalities, Labour Market. Components of Monetary and Financial System, Central Bank – Monetary Aggregates; Commercial Banks & their functions; Capital and Debt Markets. Monetary and Fiscal Policy Tools & their impact on the economy – Inflation and Phillips Curve.	
3	Elements of Business/Managerial Economics and forms of organizations. Cost & Cost Control – Techniques, Types of Costs, Lifecycle costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation, Time value of money (present and future worth of cash flows). Business Forecasting – Elementary techniques. Statements – Cash flow, Financial. Case Study Method.	
4	Indian economy - Brief overview of post-independence period – plans. Post reform Growth, Structure of productive activity. Issues of Inclusion – Sectors, States/Regions, Groups of people (M/F), Urbanization. Employment–Informal, Organized, Unorganized, Public, Private. Challenges and Policy Debates in Monetary, Fiscal, Social, External sectors.	

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	Mankiw Gregory N. (2002), Principles of Economics, Thompson Asia
2	V. Mote, S. Paul, G. Gupta (2004), Managerial Economics, Tata McGraw Hill
3	Misra, S.K. and Puri (2009), Indian Economy, Himalaya
4	Pareek Saroj (2003), Textbook of Business Economics, Sunrise Publishers

Course Code: HSMC301-19 (Economics for Engineers)

	Course Outcomes	BT Level
HSMC301-19.1	Understand an idea of Economics in general, Economics of India particularly for public sector agencies and private sector businesses.	2
HSMC301-19.2	Be able to relate and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives.	3
HSMC301-19.3	Be able to solve out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives.	3
HSMC301-19.4	Analyze economic principles and their application to engineering decision-making.	4
HSMC301-19.5	Evaluate cost-benefit scenarios to optimize engineering project efficiency and sustainability.	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
HSMC301-19.1	2	1	2			2	2	2	2	2	1	2	2	2	2	1
HSMC301-19.2	1	1				2	3	3	1	3	1	2	2	2	2	1
HSMC301-19.3	1	1	1			2	3	2	1	2		2	3	2	1	1
HSMC301-19.4	2	2				3	3	2	1	2		2	2	2	1	2
HSMC301-19.5	2	1				2	3	2	1	2		2	1	3	1	1
Average	**1.60**	**1.20**	**1.50**			**2.20**	**2.80**	**2.20**	**1.20**	**2.20**	**1.00**	**2.00**	**2.00**	**2.20**	**1.40**	**1.20**

Program: B. Tech (Food Technology)	**Semester:** 5th Semester
Course Name: Processing of Grains	**Course Code:** BTFT311-19

Syllabus:

MODULE	DETAILS	HOURS
1	Present status and future prospects of major cereals and millets in India and world, Morphology, composition, nutritive value and properties of various food grains including cereals, pseudocereals, millets and other coarse grains.	7 Hrs
2	**Wheat**- varieties and quality characteristics, milling process- conditioning and tempering, equipments in wheat milling- disc mill, hammer mill, roller mill, Functionality of wheat flour components- composition and classification of proteins, lipids and starch functionality in bakery products, Extruded wheat products, pasta products.	10 Hrs
3	**Paddy**- threshing, drying and storage, parboiling processes- drying, milling operations, precleaners, shellers and hullers, separators, polishers, rice mill yields and losses at different stages of milling, processed rice products	3 Hrs
4	**Corn**- types and dry and wet milling, manufacture of value-added products, Barley- structure, composition, nutritive value and quality characteristics, malting process and industrial applications of barley malt, Oats- structure, composition, nutritive value, milling and food uses, Sorghumstructure, composition, nutritive value, threshing, de-hulling and milling, sorghum based products, Millets- structure, composition, nutritive value and types of millet, importance of millets.	6 Hrs

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	Matz, S.A. (1970) "Cereal Technology", AVI Publishing Co.
2	Kulp K. (2000) Handbook of Cereal Science and Technology, Second Edition. CRC Press.
3	Dendy D. A. V. & Dobraszczyk B. J., (2001) Cereal and Cereal Products. Aspen
4	Wheat, rice, corn, oat, barley and sorghum processing handbook, Asia pacific business press, New Delhi.

5	Pomeranz Y. (1988) Wheat: chemistry and technology, American Association of cereal chemists, Minnesota
6	Tanley A. Watson and Paul E. Ramstad: Corn Chemistry and Technology, ADCC, USA. Julliano, B.O., Rice Chemistry and Technology, AACC, USA.

Course Code: BTFT311-19 (Processing of Grains)

	Course Outcomes	BT Level
BTFT311-19.1	Describe the morphology, composition, nutritive value and properties of cereals, millets and their processed products and by-products.	1
BTFT311-19.2	Understand the importance, working and problems associated with the processing of grains like dehulling/threshing, milling etc. for improving their utilization.	2
BTFT311-19.3	Apply theoretical knowledge of grains at the industrial level to broaden applications.	3
BTFT311-19.4	Evaluate the changes resulted from various treatments and select the best suitable condition to minimize loss and improve quality.	5
BTFT311-19.5	Create problem solving strategies according to the current and future prospects of grain processing sector.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT311-19.1	3	2	2	2	1	2	2	1	1	1	1	2	2	3	2	3
BTFT311-19.2	3	2	2	1	2	2	1	2	2	2		2	2	3	3	3
BTFT311-19.3	2	3	3	3	3	2	1	2	2	2		1	3	3	2	3
BTFT311-19.4	2	3	3	3	3	2	2	2	2	2	1	2	3	3	3	2
BTFT311-19.5	2	3	3	3	2	2	2	2	2	2		2	3	3	3	3
Average	**2.40**	**2.60**	**2.60**	**2.40**	**2.20**	**2.00**	**1.60**	**1.80**	**1.80**	**1.80**	**1.00**	**1.80**	**2.60**	**3.00**	**2.60**	**2.80**

Program: B. Tech (Food Technology)	**Semester:** 5th Semester
Course Name: Fruits and Vegetables Processing	**Course Code:** BTFT 313-19

Syllabus:

MODULE	DETAILS	HOURS
1	Scope of fruit and vegetable processing industry in India- present status, constraints and prospects. Fruits and vegetables- classification, types, structure and composition of fruits and vegetables chemical composition and nutritive value and importance in our diet, Post harvest technology and its significance, pre-harvest factors affecting post-harvest quality of fruits and vegetables.	12 Hrs
2	Physiological development – fruit ripening, respiration, role of ethylene, fruit maturity- definition, methods of maturity determination, maturity indices for selected fruits and vegetables, chemical changes during maturation. Methods of storage- controlled atmospheric storage (CAS), modified atmospheric storage (MAS) and hypobaric.	9 Hrs
3	Pre-processing treatment and operations: equipments, cleaning methods, sorting, grading, peeling and blanching, methods of pre-cooling, minimal processing of fruits and vegetables, packaging of fruits and vegetables.	12 Hrs
4	Processing technology of jam, jelly and marmalades, fruit preserves and candied fruits, chutneys, pickles, pickling with vinegar and fermentation- sauerkraut, sauces and ketchups, Processing technology of fruit products- unit operations involved in preparation of fruit beverage, types of beverages, juice, ready to serve (RTS), nectar, cordial, squash, crush, processing of syrups, fruit juice concentrate, fruit juice powder, carbonated beverages, fruit cheese, fruit leather, FPO specifications, Machineries involved in fruit processing.	4 Hrs

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	Giridharlal, Siddappa and Tandon., Preservation of fruits and vegetables. ICAR, New Delhi.
2	Srivastava. P., R., and Sanjeev Kumar. Fruit and vegetable preservation - 3rd Edition.
3	Thompson, A.K., (2003). Fruits and vegetables; Harvesting, handling and storage. Blackwell Publishing
4	Norman. N. Potter Food Science.CBS publishers and distributors, New Delhi.
5	Arthey, David, Arhurst, Philip, R., (2005). Fruit processing- Nutrition, products and quality management, 2nd edition. Springer

Course Code: BTFT 313-19 (Fruits and Vegetables Processing)

	Course Outcomes	BT Level
BTFT313-19.1	Define the harvesting factors, structure, composition, nutritive value and storage conditions of fruits and vegetables and specifications related to their processed products.	1
BTFT313-19.2	Select best suitable maturity and operating conditions for attaining quality products.	2
BTFT313-19.3	Apply theoretical knowledge of fruits and vegetables at the industrial level to broaden applications by producing value added products.	3
BTFT313-19.4	Evaluate the changes resulted from various processing techniques.	5
BTFT313-19.5	Create problem solving strategies and methods in accordance with the current and future prospects of fruits and vegetables.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT313-19.1	3	3	2	3	2	3	1	1	1	1	1		3	3	3	2
BTFT313-19.2	2	2	2	2	3				1				1	1	2	3
BTFT313-19.3	3	2	2	1	2				2	1	1	1	2		2	2
BTFT313-19.4	2	2	2	2	1				1	2	2	2	1	1	1	1
BTFT313-19.5	3	3	3	1	2				2		3	2	3	3	3	3
Average	**2.60**	**2.40**	**2.20**	**1.80**	**2.00**	**3.00**	**1.00**	**1.00**	**1.40**	**1.33**	**1.75**	**1.67**	**2.00**	**2.00**	**2.20**	**2.20**

Program: B. Tech (Food Technology)	**Semester:** 5th Semester
Course Name: Food Safety, Quality and Regulations	**Course Code:** BTFT315-19

Syllabus:

MODULE	DETAILS	HOURS
1	Introduction, concept of food safety and standards, food safety strategies; Food hazards and contaminations- biological (bacteria, viruses and parasites), chemical (toxic constituents/ hazardous materials from pesticide residues/environmental pollution/chemicals) and physical factors, Food borne disease causing agents, Water borne diseases, sources of contaminations and their effects.	10 Hrs
2	Food safety inspection services (FSIS) and their applications, Food safety aspects of novel methods of food processing such as pulsed electric field (PEF), high pressure processing (HPP), irradiation and other thermal and non-thermal processing, Environmental protection agency (EPA) and its role in food safety system.	8 Hrs
3	Fundamentals of quality management principles, FSMS, QMS, TQM, systems and requirements, Guidelines of performance improvements; GMP, GAP, GHP; ISO: Fundamental, requirement and guidelines.	10 Hrs
4	BIS (Bureau of Indian standards), Food Safety and Standard act 2006, Food Authority of India and scientific panels, Codex Alimentarius Commission, HACCP system of food protection- Principles and its applications, HACCP system for food safety, Food and drug administration (FDA).	8 Hrs

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	Singh, S. P. (2009). Food Safety, Quality Assurance and Global Trade: Concerns and Strategies: International Book Distributing Co. Lucknow.
2	Alli, I. (2004). Food Quality Assurance: Principles and Practices: CRC Press.
3	Julie, Miller & Jones (1998) Food safety, Association of official analytical chemist USA.
4	Rekha, S. & Pushpa, R. (1997). Handbook of Indian Food Quality and authenticity: Woodhead Publishing Ltd., London.

Course Code: BTFT315-19 (Food Safety, Quality and Regulations)

	Course Outcomes	BT Level
BTFT315-19.1	Remember the concepts of all laws, standards and systems related to food quality and safety.	1
BTFT315-19.2	Differentiate and compare various food safety management systems and laws according to their applications in various food sectors.	2
BTFT315-19.3	Deploy the specifications of food quality and safety improvement laws in the manufacturing and storage sector.	3
BTFT315-19.4	Evaluate and control various factors that affect food quality and safety for obtaining good quality and safe foods.	5
BTFT315-19.5	Formulate new laws and specifications required by dynamic food sector.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT315-19.1	2	2	2	3	2	1	1	2	1	1			2	2	2	2
BTFT315-19.2	3	2	2	2	2	1		2	2		1	1	2	2	2	3
BTFT315-19.3	3	2	1	2	1	2	2	1		2			1	2	3	2
BTFT315-19.4	2	3	2	1	2	1		2	2		1	1	3	3	1	
BTFT315-19.5	2	2	2	2	1	2						2	2		2	3
Average	**2.40**	**2.20**	**1.80**	**2.00**	**1.60**	**1.40**	**1.50**	**1.75**	**1.67**	**1.50**	**1.00**	**1.33**	**2.00**	**2.25**	**2.00**	**2.50**

Program: B. Tech (Food Technology)	**Semester:** 5th Semester
Course Name: Food Refrigeration and Cold Storage	**Course Code:** BTFT316-19

Syllabus:

MODULE	DETAILS	HOURS
1	Principles of Refrigeration Refrigeration cycles, Vapour Compression and Vapour Absorption cycles, Refrigerants, characteristics of different refrigerants, 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, Energy considerations.	7 Hrs
2	Cold Storage Design and Construction Small and large commercial storages, Insulation, properties of insulating materials, air diffusion equipment, Doors and other openings. Cold load estimation; prefabricated systems, walk-in-coolers, and Refrigerated container trucks: 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-meat and poultry products, marine products, fruits and vegetables, spices and food grains.	8 Hrs
3	Operation and maintenance - Controlled atmosphere and modified atmosphere storages Controlled atmosphere and Modified atmosphere storages Principles and basics of their construction, 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, Packaging of Chilled foods - Hygienic design considerations for chillers and chilled Storages. Cool storages and their applications. Evaporative cooling and its applications	5 Hrs
4	Freezing of foods Freezing equipment, Freezing rates, growth rate of ice crystals, crystal size and its effect of texture and quality of foods, Freezer types, Individual quick freezing. Cryogenic Freezing, Freezing practice as applied to marine foods, meat and poultry, fruits and vegetables.	3 Hrs

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	Raymond R.Gunther: Refrigeration, Air conditioning and Cold Storage Chilten Company, Philadelphia, USA 1957.
2	Clive D.J.Dellino: Cold and Chilled Storage Technology Publisher: Kluwer Academic Publishers (1997).
3	S. Domkundwar and Subhash Arora: A Course in refrigeration and Air Conditioning: Dhanpat Rai and sons, Publishers, New Delhi (1994).
4	Andrew D Althouse and others: Refrigeration and air Conditioning Goodheart – Willcox Company Inc. 1982.
5	Ed. C.P.Mallet: Frozen Food Technology Balckie Academic and Professional, (1993).
6	Colin Dennis and Michael Stringer: Chilled Foods – A Comprehensive Guide Ellis Horwood Publishing, New york (1992).
7	D.K.Tressler and C.F.Evers: The Freezing Preservation of Foods (Vol.1&2) AVI Publishing Company Inc. USA (1965).

Course Code: BTFT316-19 (Food Refrigeration and Cold Storage)

	Course Outcomes	BT Level
BTFT316-19.1	Familiarize with the terminology associated with refrigeration system and cold storage design	1
BTFT316-19.2	Understand basic refrigeration systems and identify methods for performance improvement.	2
BTFT316-19.3	Apply the knowledge of different refrigeration technique for different food.	3
BTFT316-19.4	Evaluate the quality of frozen food preserved using refrigeration technique.	5
BTFT316-19.5	Design the cold storage structure as per different commodity requirement.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT316-19.1	3	2	2	2	2	3	2	1		2		3	3	3	2	2
BTFT316-19.2	3	2	2	2	1	3	2	1		2		3	3	3	2	3
BTFT316-19.3	3	3	2	3	2	1	1		1	2		3	2	1	2	2
BTFT316-19.4	3	3	2	3			1		1	2		3	2	1	2	1
BTFT316-19.5	3	2	3	2		2			1	2		3	1	1	2	2
Average	**3.00**	**2.40**	**2.20**	**2.40**	**1.67**	**2.25**	**1.50**	**1.00**	**1.00**	**2.00**		**3.00**	**2.20**	**1.80**	**2.00**	**2.00**

Program: B. Tech (Food Technology)	**Semester:** 5th Semester
Course Name: Renewable Energy Resources	**Course Code:** OEE-104-18

Syllabus:

MODULE	DETAILS	HOURS
1	**Solar Radiation and Solar Energy Collection** Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data. Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.	12
2	**Wind Energy** Energy availability of wind, wind resources, principle of wind energy conservation. Wind turbine site and its site selection, classification of wind turbine, characteristics of wind turbine.	8
3	**Bio-Mass** Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking.	8
4	**Geothermal Energy** Resources, types of wells, methods of harnessing the energy, potential in India.	6
5	**Ocean Energy** OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.	8

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	Non-Conventional Energy Sources /G.D. Rai, Khanna Publishers
2	Renewable Energy Resources – Twidell &Wier, CRC Press (Taylor & Francis)
3	Renewable energy resources/ Tiwari and Ghosal/ Narosa.
4	D. P. Kothari, K. C. Singhal, Renewable energy sources and emerging technologies, P.H.I.

Course Code: OEE-104-18 (Renewable Energy Resources)

	Course Outcomes	BT Level
OEE-104-18.1	Knowledge of the basic properties of different renewable sources of energy and technologies.	1
OEE-104-18.2	Understand the main elements of technical systems designed for utilization of renewable sources of energy.	2
OEE-104-18.3	Compare the advantages and disadvantages of different renewable sources of energy.	2
OEE-104-18.4	Analyze the energy potential of renewable sources of energy.	4
OEE-104-18.5	Evaluate and judge the effectiveness of various renewable energy technologies in terms of their environmental impact, economic feasibility, and scalability for different geographical regions.	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
OEE104-18.1	3	3	2	2	2	1	2		2		1	2	2	3	3	2
OEE104-18.2	2	2	2	2	2	2					1	1	2	3	3	2
OEE104-18.3	3	2	1	2	2	1	1		1	1		2	3	2	3	1
OEE104-18.4	2	2	2	3	1					1		1	3	2	2	
OEE104-18.5	2	1	2	2	2	2			1	1	1	2	2	2	1	3
Average	**2.40**	**2.00**	**1.80**	**2.20**	**1.80**	**1.50**	**1.50**		**1.33**	**1.00**	**1.00**	**1.60**	**2.40**	**2.40**	**2.40**	**2.00**

Program: B. Tech (Food Technology)	**Semester:** 5th Semester
Course Name: Processing of Grains Lab	**Course Code:** BTFT312-19

Syllabus:

Orientation to different grain processing equipments, their functions and uses.

Determination of adulterants in wheat and wheat flour.

Study the morphological and physical properties of different grains.

Experimental milling of wheat and paddy.

Proximate analysis of grains and grain products.

Estimation of dry and wet gluten of wheat flour.

Parboiling and cooking properties of different varieties of rice.

Determination of sedimentation value of the whole/refined wheat flour.

Estimation of alcoholic acidity of wheat flour

Determination of water absorption capacity of wheat flour.

Storage studies of various grains having different moisture levels.

Preparation of expanded & puffed rice from raw and parboiled materials and assessment of quality of products including expansion in volume.

Determination of foaming and dough raising capacities of flour.

Determination of diastatic activity and maltose value.

Preparation of bread, cake and cookie and analyzing their quality parameters.

Visit to a rice mill, flour mill and FCI godown.

Course Code: BTFT312-19 (Processing of Grains Lab)

	Course Outcomes	BT Level
BTFT312-19.1	Define principles and procedures of grain processing and qualitative and quantitative analysis of grains and their products.	1
BTFT312-19.2	Understand the importance of formulating and analyzing processed products of cereals and other grains.	2
BTFT312-19.3	Operate and maintain various equipments of grain processing and analysis.	3
BTFT312-19.4	Evaluate the problems related to grain processing and analysis.	5
BTFT312-19.5	Design cereal based new products having good nutrition and safety for human health.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT312-19.1	2	1	3	2	2	3	2	1			1		3	3	3	2
BTFT312-19.2	1	2	2	2	3	2				2			3	3	3	3
BTFT312-19.3	3	2	3	1	2	3	1				1	1	3	3	3	3
BTFT312-19.4	2	2	2	2	1	1	1			2	2	2	3	3	3	3
BTFT312-19.5	3	3	3	1	2	3	2		1	2	3	2	3	3	3	3
Average	**2.20**	**2.00**	**2.60**	**1.60**	**2.00**	**2.40**	**1.50**	**1.00**	**1.00**	**2.00**	**1.75**	**1.67**	**3.00**	**3.00**	**3.00**	**2.80**

Program: B. Tech (Food Technology)	**Semester:** 5th Semester
Course Name: Fruits and Vegetables Processing Lab	**Course Code:** BTFT314-19

Syllabus:

Orientation to different fruit processing equipments, their functions and uses.

Determination of pectin, moisture, total solids, vitamin C, lycopene, titratable acidity.

TSS of fruit and vegetable products, preparation of fruit juices, squashes and cordial.

Enzymatic classification of fruit pulp, preservation and processing of certain vegetables by drying.

Preparation of tomato ketchup, puree and paste and their preservation.

Preparation of pickles and chutneys, preparation of jam, jelly and marmalade and their storage study.

Blanching of the given sample and assessment of its adequacy.

Enzymatic browning of fruits and vegetables and its control.

Preparation of preserve and dried fruit products (papad, bars, candy).

Freezing of fruits and vegetables, determination of reducing and total sugars.

Visit to local fruit and vegetables processing industries.

Course Code: BTFT314-19 (Fruits and Vegetables Processing Lab)

	Course Outcomes	BT Level
BTFT314-19.1	Remember principles and procedures of processing and qualitative and quantitative analysis of fruits and vegetables.	1
BTFT314-19.2	Understand importance of preparation and analysis of processed products of fruits and vegetables.	2
BTFT314-19.3	Operate and maintain various equipments of processing and analysis in fruits and vegetables sector.	3
BTFT314-19.4	Evaluate the changes and problems related to the processing of fruits and vegetables.	5
BTFT314-19.5	Create new products and methods for value addition.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT314-19.1	2	2	2	2		3	1	1	1	1	1		3	3	3	2
BTFT314-19.2	2	2	2					2	1	2			1	1	2	3
BTFT314-19.3	2		1	2	1	2		1	2	2	1	1	2	2	2	2
BTFT314-19.4	2	1	2	2	2	1		2	2	1	2	2	1	1	1	1
BTFT314-19.5	3	2	1	1				3			3	2	3	3	3	3
Average	**2.20**	**1.75**	**1.60**	**1.75**	**1.50**	**2.00**	**1.00**	**1.80**	**1.50**	**1.50**	**1.75**	**1.67**	**2.00**	**2.00**	**2.20**	**2.20**

Program: B. Tech (Food Technology)	**Semester:** 5th Semester
Course Name: In Plant Training Seminar (4-6 weeks)	**Course Code:** BTFT317-19

Evaluation:

At the end of the training (during summer vacations following 4th Semester) the seminar on training will be done in the 5th Semester

Course Code: BTFT317-19 (In Plant Training Seminar (4-6 weeks))

	Course Outcomes	BT Level
BTFT317-19.1	Outline the historical background of modern industry and the production function.	1
BTFT317-19.2	Understand the influence of various environmental factors on Food Industries and business operations.	2
BTFT317-19.3	Analyze the process of starting a new venture and create their business plan.	4
BTFT317-19.4	Judge the process of entrepreneurship and the institutional facilities available to an entrepreneur in India.	5
BTFT317-19.5	Develop the knowledge on legal aspects and government policy relating to entrepreneurship.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT317-19.1	3	3	2	3	3	2	1	2	2	2	2	1	3	2	3	2
BTFT317-19.2	3	2	2	3	2	1	1	3	2	1	2	1	3	2	3	2
BTFT317-19.3	3	3	2	2	2	1	1	2	2	1	2	1	2	2	2	3
BTFT317-19.4	3	2	2	2	2	1	1	2	2	1	2	1	2	2	3	2
BTFT317-19.5	3	2	2	3	2	1	1	3	2	1	2	1	2	2	3	3
Average	**3.00**	**2.40**	**2.00**	**2.60**	**2.20**	**1.20**	**1.00**	**2.40**	**2.00**	**1.20**	**2.00**	**1.00**	**2.40**	**2.00**	**2.80**	**2.40**

Program: B. Tech (Food Technology)	**Semester:** 5th Semester
Course Name: Essence of Indian Knowledge Tradition	**Course Code:** BTMC102-18

Syllabus:

MODULE	DETAILS	HOURS
1	Basic structure of Indian Knowledge System: अ’ादशिवEा -४वेद, ४उपवेद (आयुवőद, धनुवőद, गंधवाɲवेद, ‘थापrआिद) ६वेदांग (िशɨा, कB, िनŝb, fŋाकरण, Ǖोितष, छं द) ६उपाङ्ग (धमाɲशा, िममांसा, पुराणतकाɲशा) ● Modern Science and Indian Knowledge System ● Yoga and Holistic Health care ● Case studies	7 Hrs
2	Philosophical Tradition (सवाɲदशाɲन)- Qाय, वैशोिपक, संþा, योग, िममांसा, वेदांतचावाɲक, जैन, बौŋ, ● Indian Linguistic Tradition (Phonology, morphology, syntax and semantics) ● Indian Artistic Tradition - िचũकला, मूितɲकला, वा·ुकला‘थापr, संगीत, नृrएवंसािहr ● Case studies	8 Hrs

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014.
2	Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan.
3	Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan.
4	Fritzof Capra, Tao of Physics.
5	Fritzof Capra, The Wave of life.

Course Code: BTMC102-18 (Essence of Indian Knowledge Tradition)

	Course Outcomes	BT Level
BTMC102-18.1	Recognize key historical events, figures, and texts from Indian knowledge traditions.	1
BTMC102-18.2	Interpret the fundamental concepts of Indian philosophy, literature, and science.	2
BTMC102-18.3	Apply principles from Indian knowledge systems to contemporary issues and practices.	3
BTMC102-18.4	Analyze the influence of Indian cultural, social, and religious traditions on modern society.	4
BTMC102-18.5	Integrate insights from various Indian traditions to propose new interpretations or applications in modern contexts.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTMC102-18.1	1	1	1	2	1	2	1	1	1		1	1	1	2	2	
BTMC102-18.2	2	2	2	1	2	1	3	1	2	3	1	3		2	3	1
BTMC102-18.3	2	2	1	1		3	1	2	1	2	3	1	2	1	1	3
BTMC102-18.4	1		2	2	2	3	2	3	3	3	3	1	3	2	2	1
BTMC102-18.5	2	1	2	1	2	2	2	3	3	1	1	2	3	3		1
Average	**1.60**	**1.50**	**1.60**	**1.40**	**1.75**	**2.20**	**1.80**	**2.00**	**2.00**	**2.25**	**1.80**	**1.60**	**2.25**	**2.00**	**2.00**	**1.50**

Record of CO-PO Mapping (6th Semester)

(Semester-6th)

Course Code	Subject	L-T-P	Credit
HSMC302-19	Fundamentals of Management for Engineers	2-0-0	2
BTFT 320-19	Statistics for Food Technologists	2-1-0	3
BTFT 321-19	Technology of Milk and Milk Product	3-0-0	3
BTFT 323-19	Fermentation Technology	3-0-0	3
BTFT325.2-19	Technology of Beverages	3-0-0	3
BTFT326.2-19	Technology of Spices and Herbs	3-0-0	3
BTME615-18	Non- Conventional Energy Resources	3-0-0	3
BTFT 322-19	Technology of Milk and Milk Products Lab	0-0-4	2
BTFT 324-19	Fermentation Technology Lab.	0-0-2	1
BMPD 601-18	Mentoring & professional development	0-0-2	Satisfactory/ Unsatisfactory
Total		**19-1-8**	**23**

Program: B. Tech (Food Technology)	**Semester:** 6th Semester
Course Name: Fundamentals of Management for Engineers	**Course Code:** HSMC302-19

Syllabus:

MODULE	DETAILS	HOURS
1	Introduction to Management: Definition, Nature and Scope, Functions of Management, Managerial Roles, Levels of Management, Managerial Skills, Challenges of Management.	
2	Introduction to Operations Management, Types of Plant Layout, Introduction to Total Quality Management (TQM), Total Quality Management Models, Benefits of TQM, Basics of Six Sigma and Lean Manufacturing.	
3	Introduction to Marketing, Functions of Marketing, Types of Marketing, Marketing vs. Selling, Marketing Mix, Product Life Cycle, Market Segmentation, Supply Chain Management (SCM).	
4	Introduction to Work Analysis, Definition, need and scope of work analysis, Method Study: Objectives, Step-by-step procedure, Charts and diagrams for recording data, Principles of Motion economy, Therbligs, Work Measurement: Definition, Various techniques of work measurement such as Work Sampling, Stop Watch Time Study, Analytical Estimating, Predetermined Motion Time System, Need for operator rating, Methods of rating, Allowances and their types, Standard time.	
5	Introduction to Productivity: Definition, Reasons for low productivity, methods to improve productivity, Value Engineering: Definition, Types of values, concept, phases and applications of value engineering.	
6	Introduction to Personnel Management, aims and objectives of personnel management, Principles of a good personnel policy, Recruitment and selection of employees, Education and training of employees, Safety engineering.	

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	Industrial Engineering and Management/ O. P. Khanna/ Dhanpat Rai and Sons.
2	Fundamentals of Management/ Stephen P. Robbins/ Pearson
3	A Text Book of Industrial Management/ A. P. Verma and N. Mohan/ Katson.
4	Industrial Management/ I. K. Chopde and A. M. Sheikh/ S. Chand.

Course Code: HSMC302-19 (Fundamentals of Management for Engineers)

	Course Outcomes	BT Level
HSMC302-19.1	Identify and recall fundamental management principles and practices relevant to engineering.	1
HSMC302-19.2	Explain key management concepts such as planning, organizing, leading, and controlling within an engineering context.	2
HSMC302-19.3	Apply management techniques to solve engineering project management problems effectively	3
HSMC302-19.4	Analyze the impact of different management styles on engineering team performance and project outcomes.	4
HSMC302-19.5	Develop integrated management strategies for enhancing efficiency and productivity in engineering projects.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
HSMC302-19.1	1	2	2	2	2	3	3	3	2	2	2	3	1	2	2	2
HSMC302-19.2	1	1	2	1	1	2	3	3	2	3	1	3	2	2	1	2
HSMC302-19.3	1	2	1	1	2	2	3	2	2	3	1	2	3	2	1	2
HSMC302-19.4	1	1	1	2	2	1	3	2	2	3	2	2	2	2	1	1
HSMC302-19.5	1	1	2	1	2	2	3	3	2	2	1	1	2	2	1	2
Average	**1.00**	**1.40**	**1.60**	**1.40**	**1.80**	**2.00**	**3.00**	**2.60**	**2.00**	**2.60**	**1.40**	**2.20**	**2.00**	**2.00**	**1.20**	**1.80**

Program: B. Tech (Food Technology)	**Semester:** 6th Semester
Course Name: Statistics for Food Technologists	**Course Code:** BTFT320-19

Syllabus:

MODULE	DETAILS	HOURS
1	Statistical terms and notations, frequency distribution, frequency curve, measures of central tendency and dispersion, Binomial and poission distribution; Introduction to sampling.	6 Hrs
2	Statistical Methods: normal distribution, test of significance, null hypothesis, types of error, level of significance and degree of freedom, steps involved in testing of hypothesis, z-test, t-test for testing sample mean and difference between two means, paired t- test, chi-square test for testing goodness of fit and independence of attributes in 2×2 contigency table, yates correction, F-test.	7 Hrs
3	Statistical quality control: Introduction, advantages and limitations; Techniques of statistical quality control, control charts for variations, $\bar{x}$ and R chart, control chart for attribution, c chart, p chart, np chart; consumer risk, producer risk; Acceptance quality level (AQL); Lot tolerance percentage quality level (LTPD), process average fraction defective. Operative characteristic curve, simple and double sampling plans for prepackaged foods.	7 Hrs
4	Correlation and regression, Analysis of variance, How to use excel; Overview of Computer aided statistical tools.	7 Hrs

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	Chesson. A. "Industrial Statistic", Duncan. D.B.Taraporevate Sons & Co. Bombay
2	Nath, Pran "Statistics and Reliability for Engineering", Tara Printing works Varanasi.
3	Hald A., "Statistical theory with Engineering applications" John and Sons. Inc.
4	Hubbard M. R. (2005) Statistical quality control for food industry, Springer Publishers.
5	Gupta S. P. (2006) Statistical Methods
6	Gupta S. C. & Kapoor V. K. Fundamentals of Applied Statistics.

Course Code: BTFT320-19 (Statistics for Food Technologists)

	Course Outcomes	BT Level
BTFT320-19.1	Define basic concept and ideas of Statistical quality control and different Statistical methods.	1
BTFT320-19.2	Understand basics of control chart for variables and for attributes with its application, concept of Process Capability Analysis (PCA).	2
BTFT320-19.3	Solve the problems regarding measures of central tendency and measures of dispersion and problems related to chi square test, analysis of variance, regression analysis.	3
BTFT320-19.4	Evaluate different concept of sampling, sampling distribution and its application.	5
BTFT320-19.5	Design different types of statistical methods for fast and easy calculations.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT320-19.1	3	2	3	2	2	2	1		2	2	1	2	3	2	1	2
BTFT320-19.2	2	3	2	2	3	1			1				2	3		2
BTFT320-19.3	2	2	3	3	2		2						2	1	3	1
BTFT320-19.4	3	1	2	3	2					1			1	3	2	2
BTFT320-19.5	2	2	3	2	1	1						1	2	2	3	2
Average	**2.40**	**2.00**	**2.60**	**2.40**	**2.00**	**1.33**	**1.50**		**1.50**	**1.50**	**1.00**	**1.50**	**2.00**	**2.20**	**2.25**	**1.80**

Program: B. Tech (Food Technology)	**Semester:** 6th Semester
Course Name: Technology of Milk and Milk Product	**Course Code:** BTFT321-19

Syllabus:

MODULE	DETAILS	HOURS
1	**Current status of Indian dairy sector:** production, utilization and per capita consumption of milk; Milk: definition, types of milk, composition, nutritive value of milk and milk products; Milk properties: physical, chemical and thermal properties like density, acidity, redox potential, specific gravity, thermal conductivity etc.; Milk processing: reception, pasteurization (LTLT, HTST), homogenization, sterilization, aseptic packaging	7 Hrs
2	**Cream separation and related equipments; Butter:** definition, butter-making process, overrun, defects in cream & butter; Technology of ice-cream: composition of ice-cream, methods of preparation; Evaporated and concentrated milks: water and solid balance, boiling point elevation; Dried milks: dried whole milk, dried non-fat milk/SMP; milk drying system (film, roller, drum, spray, foam spray drying).	7 Hrs
3	**Cultured milk and milk products:** Types and manufacturing process; Cheese: technology of different varieties of cheese manufacturing (cheddar & mozarella), changes during ripening; manufacture of processed cheese, defects in cheese; Introduction to traditional dairy products: rabri, kulfi, srikhand, mawa, channa, paneer, ghee.	7 Hrs
4	**Value addition and by-products utilization**: Fortified milk and milk products such as minerals and vitamins fortified milk; Low fat, low lactose and low cholesterol milk products; Utilization of whey, caseinates etc; Cleaning and disinfections in a dairy industry: terms, definitions, cleaning and disinfection agents and processes; Cleaning in Place (CIP) and Cleaning out of Place (COP).	7 Hrs

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	Ahmed, Tufail (1997) "Dairy Plant Engineering and Management", Kitab Mahal, Allahabad
2	Kessler, H.G. (1981) "Food Engineering and Dairy Technology", V.A. Kessler, Frcising., Germany
3	Vaclavik V. A. & Christian E. W. (2003) Essentials of food science. 2nd edition, Springer International.
4	Hohnson M. & Alford (1987) Fundamentals of dairy chemistry. 2 nd edition, CBS Publishers
5	Rajagopal, Roy, S.K. (2014) Milk & milk products technology, BS Publishers.
6	Smit G. (2003) Dairy processing - improving quality, Woodhead Publishing.

Course Code: BTFT321-19 (Technology of Milk and Milk Product)

	Course Outcomes	BT Level
BTFT321-19.1	Define all concepts related to the composition, properties, processing and utilization of various types of milk and milk products.	1
BTFT321-19.2	Understand the current scenario and future prospective of dairy sector for broadening applications.	2
BTFT321-19.3	Employ and interpret the technology of processing treatments for value addition in milk sector.	3
BTFT321-19.4	Judge the quality characteristics of various dairy products.	5
BTFT321-19.5	Design the various technologies related to dairy sector.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT321-19.1	3	3	2	2	2	1		2		1	3	2	1	2	3	2
BTFT321-19.2	2	3	3	3	2	1	3						2	1		3
BTFT321-19.3	3	2	2	3	3		3	3	3	2			3	3	1	
BTFT321-19.4	2	2	2	3	2								2	1	2	
BTFT321-19.5	2	3	1	2	2							3	3	2	1	2
Average	**2.40**	**2.60**	**2.00**	**2.60**	**2.20**	**1.00**	**3.00**	**2.50**	**3.00**	**1.50**	**3.00**	**2.50**	**2.20**	**1.80**	**1.75**	**2.33**

Program: B. Tech (Food Technology)	**Semester:** 6th Semester
Course Name: Fermentation Technology	**Course Code:** BTFT323-19

Syllabus:

MODULE	DETAILS	HOURS
1	Introduction, history, scope and principle components of fermentation; Types of fermentation. Growth kinetics during fermentation; Isolation & screening of microorganisms used in fermentation; Media for industrial fermentation, criteria used in media formulation, sterilization, raw materials.	5 Hrs
2	**Fermenter Design:** Bioreactor configuration, design features, criteria in Fermenter design, requirement for aeration and mixing, energy transfer; Other fermenter designs- tube reactors, packed bed reactors, fluidized bed reactors, cyclone reactors, trickle flow reactors; Measurement and control of fermentation parameters.	5 Hrs
3	**Fermentation Systems:** Batch and Continuous system, Fed batch culture, solid substrate fermentation; Production and recovery of primary and secondary metabolites: industrial alcohol, citric acid, acetic acid, lactic acid, acetone- butanol fermentation, amino acids- lysine & glutamic acid production, enzymes, antibiotics (penicillin and tetracycline); oriental fermented foods.	12 Hrs
4	Methods of separation, purification and formulation of metabolites; Principle of over-production of primary and secondary metabolites with relevant examples; Application of fermentations for value-addition; Waste product types and utilization for production of useful products; Waste treatment systems, aerobic and anaerobic systems for wastes from industry.	6 Hrs

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	Godfrey T., and West S., (1996) Industrial enzymology, Stockholon Press, New York.
2	Cruger W., and Kruger (2002), Biotechnology –A Textbook of Industrial Microbiology, 2ndEdition, Panima Publishing Corporation, New Delhi.
3	Ward O. P., (1999), Fermentation Biotechnology – Principles, Process and Products. Prentice Hall Publishing, New Jersey.
4	Pandey A., (1994) Solid state fermentation, New Age, Publishers. New Delhi.

Course Code: BTFT323-19 (Fermentation Technology)

	Course Outcomes	BT Level
BTFT323-19.1	Define the scope of fermentation technology in food industry.	1
BTFT323-19.2	Understand about parts, design and working of fermenters.	2
BTFT323-19.3	Use of cultivation techniques of industrial microorganisms.	3
BTFT323-19.4	Judge production of primary and secondary metabolites.	5
BTFT323-19.5	Create problem solving methods according to current and future prospects of fermented foods.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT323-19.1	3	2	2	2	2	1	1	2	1	2		2	2	3	3	2
BTFT323-19.2	2	3	2	2	1							1	3		2	
BTFT323-19.3	3	1	1	3	2	2	2			1	2	1	2	2	2	2
BTFT323-19.4	3	2	1	3	2	2		1	1			1	2	2		
BTFT323-19.5	2	2	2	2	2			2	2			2	2	2	1	1
AVERAGE	**2.60**	**2.00**	**1.60**	**2.40**	**1.80**	**1.67**	**1.50**	**1.67**	**1.33**	**1.50**	**2.00**	**1.40**	**2.20**	**2.25**	**2.00**	**1.67**

Program: B. Tech (Food Technology)	**Semester:** 6th Semester
Course Name: Technology of Beverages	**Course Code:** BTFT 325.2-19

Syllabus:

MODULE	DETAILS	HOURS
1	Beverages- classification and scope of beverage industries in India and world; Water for beverage industry, Technology of alcoholic and non-alcoholic beverages and their manufacturing; Important aspects of unit operations, Changes during malting, brewing, hopping, fermentation, ageing, maturation & packaging.	
2	Technology of alcoholic beverages; wine and its classification, processing of grape wine, perry, cider, toddy. Distilled alcoholic beverages; whisky, rum, vodka etc.	
3	Fruit beverages and soft drinks; Various ingredients and additives, Technology of fruit beverages like fruit juice, squash, cordial, crush, syrup, nectar, carbonated beverages, RTS (Ready to serve), mocktails and cocktails.	
4	Coffee: production practices and structure of coffee/cherry, Coffee processing- roasting, grinding, brewing extraction, dehydration, instant coffee; Tea: tea leaf processing, black, green, red, yellow, oolong, instant tea; Effective applications of quality controls- sanitation and hygiene in beverage industry, Technology of cocoa beverage, Technology of dairy beverages; whey, flavored milk.	

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	Ashurst P. R. (2005) Chemistry and technology of Soft drink and fruit juices, 2nd edition, Blackwell Publishing Ltd
2	Steen D. P. & Ashurst P. R. (2000) Carbonated soft drinks – Formulation and manufacture, Blackwell Publishing Ltd.
3	Manay S. N. & Shadakdharaswamy M (2000) Foods – Facts and Principles, 3rd edition New, Age International Pvt. Ltd.
4	Bamforth C. W. (2005) Food, fermentation and microorganisms, Blackwell Science Publishing Ltd.
5	Hui Y. H. (2012) Handbook of Plant Based fermented technology & Beverages, Taylor & Francis Group.

Course Code: BTFT 325.2-19 (Technology of Beverages)

	Course Outcomes	BT Level
BTFT 325.2-19.1	Define the technology, manufacturing, quality control and specifications of beverages.	1
BTFT 325.2-19.2	Select the best favorable additives, processing methods, equipments and other conditions for attaining good quality beverages.	2
BTFT 325.2-19.3	Apply theoretical and practical skills of various beverages and their raw materials at the industrial level by producing value added products.	3
BTFT 325.2-19.4	Evaluate the changes resulted from various processing techniques.	5
BTFT 325.2-19.5	Create problem solving methods and treatments according to the current and future prospects of beverage industries in India and world.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT325.2-19.1	3	3	2	2	3	2	1		1	1	2		2	2	2	3
BTFT325.2-19.2	2	3	1	1	2		2		2	2			2	1	2	2
BTFT325.2-19.3	3	2	2	2	2	1	2						2	2	3	3
BTFT325.2-19.4	3	2	2	2	1		2				2		1	2	1	1
BTFT325.2-19.5	2	2	1	2	2	1	1				1	1	1	3	3	2
AVERAGE	**2.60**	**2.40**	**1.60**	**1.80**	**2.00**	**1.33**	**1.60**		**1.50**	**1.50**	**1.67**	**1.00**	**1.60**	**2.00**	**2.20**	**2.20**

Program: B. Tech (Food Technology)	**Semester:** 6th Semester
Course Name: Technology of Spices and Herbs	**Course Code:** BTFT 326.2-19

Syllabus:

MODULE	DETAILS	HOURS
1	**Introduction:** Importance and role of spices and herbs in food processing, classification and properties of spices, scope of spice and herb processing in India and world.	
2	**Spices and culinary herbs:** Types, spice qualities and specifications, uses and physiological effects, components, antimicrobial and antioxidant properties of spices and herbs, important spices and medicinal herbs added in food products and their processing.	
3	**Spice processing:** Processing and manufacturing of major Indian spices and herbs: Pepper, cinnamon, cardamom, nutmeg, saffron, turmeric and ginger; Minor spices- cloves, leafy spices, bay oregano, seed spices; Common herbs- brahmi, tulsi, mint, thyme, curry leaves, lemon grass their composition , processed products.	
4	Medicinal values of herbs; Condiments and spice products, Spice blends and extractives, their types, manufacturing steps, essential and encapsulated oils, salad dressings and seasonings, oleoresins, uses in processed foods, spice processing machineries; Packaging of spices and herbs: handling, packaging machineries, uses and limitations.	

Course Code: BTFT 326.2-19 (Technology of Spices and Herbs)

	Course Outcomes	BT Level
BTFT326.2-19.1	Describe the role, classification, properties, quality, specifications and processing of spices and herbs.	1
BTFT326.2-19.2	Illustrate importance, working and problem associated with processing of spices and herbs.	2
BTFT326.2-19.3	Operate and maintain various processing machines used for value addition.	3
BTFT326.2-19.4	Judge effects of spices and herbs on the food products and human health and thereby selecting best blends of spices and herbs.	5
BTFT326.2-19.5	Develop improved procedures for use of spices and herbs and their processing knowing the current and future prospects in national and international markets.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT326.2-19.1	3	2	2	1	2			1	1	1	1	1	2	3	3	2
BTFT326.2-19.2	2	3	2	2					2			1	3		2	3
BTFT326.2-19.3	3	2	3	1	2		1		1			2	2	3	2	2
BTFT326.2-19.4	3	3	2	2	2				2	1		1	2	2		2
BTFT326.2-19.5	3	2	2	2	1	2				1		2	2	2	1	1
AVERAGE	**2.80**	**2.40**	**2.20**	**1.60**	**1.75**	**2.00**	**1.00**	**1.00**	**1.50**	**1.00**	**1.00**	**1.40**	**2.20**	**2.50**	**2.00**	**2.00**

Program: B. Tech (Food Technology)	**Semester:** 6th Semester
Course Name: Non- Conventional Energy Resources	**Course Code:** BTME615-18

Syllabus:

MODULE	DETAILS	HOURS
1	An introduction to energy sources, Environmental Aspects of Power Generation. Heat Transfer from Solar Energy, Physical principles of conversion of solar radiation into heat utilization, Flat Plate Collectors (FPC), Thermal losses and efficiency of FPC, Practical considerations for flat plate collectors, Applications of FPC – Water heating and drying, Focusing Type Collectors: orientation and sun tracking systems, Types of concentrating collectors – cylindrical parabolic collector, compound parabolic collector, Thermal performance of focusing collectors.	
2	Solar energy storage system, Application of solar energy: solar water heating, space heating and cooling, solar photovoltaic, solar cooking, solar distillation & desalination , Solar industrial process heating, Solar power generation. Solar Green Houses, Solar thermo mechanical power, solar refrigeration & air conditioning, Solar ponds.	
3	Energy from Biomass: Type of biomass sources, Energy plantation, Methods for obtaining energy from biomass, Biomass conversion technologies-wet and dry processes, Biodigestion, Community/Industrial biogas plants, Factors affecting biodigestion, Design of a biogas plant, Classification, advantages and disadvantages of biogas plants, Problems related to biogas plants, Utilization of biogas. Thermal gasification of biomass, Gasifier- classification, chemistry, advantages, disadvantages and application. Alcohol fuels from biomass: overview, feedstock, methods for alcohol production, Ethanol as an alternative liquid fuel; engine performance with alcohol fuels, biodiesel from biomass.	
4	Wind Energy: Basic principles of wind energy conversion: power in the wind, maximum power, forces on the blades, lift and drag, Components of wind energy conversion systems (WEC), Classification, advantages and disadvantages of WEC systems, Types of wind machines, Performance of wind machines, Design considerations, Energy storage, Application of wind energy, Environmental aspect. Tidal Energy. Components of tidal power plants, Single and double basin arrangements, Estimation of energy and power, Advantages and limitations of tidal power. Wave energy- its advantages and disadvantages, energy and power from wave energy.	
5	Chemical Energy Sources: Fuel cells: Design, principle, classification,	

	types, advantages and disadvantages, Work output and EMF of fuel cells, Application of fuel cells, Hydrogen energy, Properties of hydrogen, Methods of hydrogen production, Storage and transportation of hydrogen, Advantages and application.	

Course Code: BTME615-18 (Non- Conventional Energy Resources)

	Course Outcomes	BT Level
BTME615-18.1	Define smart energy and green infrastructure.	1
BTME615-18.2	Understand models that simulate sustainable and renewable green technology systems.	2
BTME615-18.3	Summarize the history, global, environmental and economical impacts of green technology.	2
BTME615-18.4	Analyze nonrenewable energy challenges.	4
BTME615-18.5	Evaluate non-conventional energy resources to propose innovative solutions for sustainable energy production and consumption in diverse socio-economic contexts.	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTME615-18.1	3	2	3	2	3	1	2	1	1		1	1	2	3	3	2
BTME615-18.2	2	3	2	2	3	2				1		1	3	2	2	2
BTME615-18.3	3	2	3	3	2		1	2		1	2	1	2	3	2	1
BTME615-18.4	3	2	2	2	2	2						1	2	2	1	3
BTME615-18.5	2	1	2	2	3							2	2	1	1	3
AVERAGE	**2.60**	**2.00**	**2.40**	**2.20**	**2.60**	**1.67**	**1.50**	**1.50**	**1.00**	**1.00**	**1.50**	**1.20**	**2.20**	**2.20**	**1.80**	**2.20**

Program: B. Tech (Food Technology)	**Semester:** 6th Semester
Course Name: Technology of Milk and Milk Products Lab	**Course Code:** BTFT 322-19

Syllabus: List of Experiments

Orientation to different milk processing equipments, their functions and uses.

Sampling of milk and milk products, platform tests of milk.

Determination of proximate composition.

Adequacy of pasteurization of milk.

Separation of cream using cream separator.

Standardization of milk, detection of common adulterants in milk, bulk properties of dairy powders.

Estimation of salt in butter, preparation of reconstituted milk/rehydrated milk, khoa, channa, paneer, ice-cream, curd/yoghurt, butter, ghee and flavored dairy products.

Visit to a dairy plant.

Course Code: BTFT 322-19 (Technology of Milk and Milk Products Lab)

	Course Outcomes	BT Level
BTFT322-19.1	Describe all procedures and their mechanism related to dairy sector.	1
BTFT322-19.2	Understand the use of different manufacturing and analytical techniques for value addition.	2
BTFT322-19.3	Judge the adequacy of different processing treatments.	5
BTFT322-19.4	Evaluate the effects of preservation techniques on nutritional and quality parameter of milk and milk products.	5
BTFT322-19.5	Develop new methods for proper utilization under hygienic conditions.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT322-19.1	2	2	2	2	2	1		2		1	1	2	3	2	1	2
BTFT322-19.2	2	1	2	1	2		1						2	3	2	1
BTFT322-19.3	1	3	3	3	1	1	1	2	2				1	1	2	
BTFT322-19.4	3	2	1	1	2	2							2	3	2	3
BTFT322-19.5	2	1	3	2	2	1						1	1	2	3	2
AVERAGE	**2.00**	**1.80**	**2.20**	**1.80**	**1.80**	**1.25**	**1.00**	**2.00**	**2.00**	**1.00**	**1.00**	**1.50**	**1.80**	**2.20**	**2.00**	**2.00**

Program: B. Tech (Food Technology)	**Semester:** 6th Semester
Course Name: Fermentation Technology Lab.	**Course Code:** BTFT 324-19

Syllabus: List of Experiments

Inoculation, Isolation & screening of culture, Production, recovery and control tests for the following fermented products such as Alcohol, Baker's yeast, Citric acid , Amylases, Pectinase, Yoghurt, Wine, Cider, Sauerkraut etc., production of polysaccharides, production of traditional fermented foods such as rabri, bhatura, dahi, dhokla, kanji etc.

Course Code: BTFT 324-19 (Fermentation Technology Lab.)

	Course Outcomes	BT Level
BTFT324-19.1	Define the scope of fermentation technology in food industry.	1
BTFT324-19.2	Understand about parts, design and working of fermenters.	2
BTFT324-19.3	Use of cultivation techniques of industrial microorganisms.	3
BTFT324-19.4	Judge production of primary and secondary metabolites.	5
BTFT324-19.5	Create problem solving methods according to current and future prospects of fermented foods.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT324-19.1	3	2	2	2	2	1	1	1	1	1	2	2		2		2
BTFT324-19.2	2	3	3	2	1							3	2	3	1	3
BTFT324-19.3	3	3	2	3	2	2	2			2	1	2		2		2
BTFT324-19.4	3	2	1	3	2	2			1			2	3		3	1
BTFT324-19.5	2	2	2	2	2				2		1	3	3	3	2	3
AVERAGE	**2.60**	**2.40**	**2.00**	**2.40**	**1.80**	**1.67**	**1.50**	**1.00**	**1.33**	**1.50**	**1.33**	**2.40**	**2.67**	**2.50**	**2.00**	**2.20**

Record of CO-PO Mapping (7th Semester)

IK Gujral Punjab Technical University Bachelor of Technology Scheme for B. Tech Syllabus 2019

(Semetser-7th)

Course Code	Subject	L-T-P	Credit
HSMC401- 19	Personality Development	3-0-0	3
BTFT411-19	Instrumental Analysis of Foods	2-0-0	2
BTFT413-19	Waste Management and Effluent Treatment	2-0-0	2
BTFT415.3-19	Food Flavours and Colours	3-0-0	3
BTFT416.2-19	Meat, Fish and Poultry Processing	3-0-0	3
BTFT417-19	In Plant Training Seminar (4-6 weeks)	0-0-6	4
PRFT-1	Project-1	0-0-2	1
OECE701-18	Metro Systems and Engineering	3-0-0	3
BTFT412-19	Instrumental Analysis of Foods Lab	0-0-2	1
BTFT414-19	Waste Management and Effluent Treatment Lab.	0-0-2	1
BMPD701-18	Mentoring & professional development	0-0-2	Satisfactory/ Unsatisfactory
Total		16-0-14	23

Program: B. Tech (Food Technology)	**Semester:** 7th Semester
Course Name: Personality Development	**Course Code:** HSMC401- 19

Syllabus:

MODULE	DETAILS	HOURS
1	**Introduction To Personality Development:** The concept personality- Dimensions of theories of Freud & Erickson-personality – significant of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles - Factors responsible for success – What is failure Causes of failure. SWOT analyses.	
2	**Attitude & Motivation:** Attitude - Concept - Significance - Factors affecting attitudes - Positive attitude - Advantages –Negative attitude - Disadvantages - Ways to develop positive attitude - Difference between personalities having positive and negative attitude. Concept of motivation - Significance - Internal and external motives - Importance of self-motivation- Factors leading to de-motivation.	
3	**Self-Esteem:** Term self-esteem - Symptoms - Advantages - Do's and Don'ts to develop positive self-esteem – Low selfesteem - Symptoms - Personality having low self-esteem - Positive and negative self-esteem. Interpersonal Relationships – Defining the difference between aggressive, submissive and assertive behaviours - Lateral thinking.	
4	**Other Aspects Of Personality Development:** Body language - Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader - Character-building -Team-work - Time management - Work ethics – Good manners and etiquette. **Employability Quotient:** Resume building- The art of participating in Group Discussion – Acing the Personal (HR & Technical) Interview -Frequently Asked Questions - Psychometric Analysis - Mock Interview Sessions.	

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	Three Basic Managerial Skills For All – Hall Of India Pvt Ltd New Delhi
2	Social Psychology: By Robert S Feldman. (Tata McGraw Hill Publishing)
3	Wehtlel David A and Kin S Kemerron – Developing Managerial Skills – Pearson Education New Delhi.
4	Understanding Psychology: By Robert S Feldman (Tata McGraw Hill Publishing)
5	Essentials of Business Communication - Rajendra Pal and J. S. Korlhalli - Sultan Chand & Sons, New Delhi.

Course Code: HSMC401- 19 (Personality Development)

	Course Outcomes	BT Level
HSMC401-19.1	Recall fundamental personality traits and development theories in engineering contexts.	1
HSMC401-19.2	Explain the role of personality in professional engineering environments.	2
HSMC401-19.3	Apply communication and teamwork strategies to engineering projects effectively	3
HSMC401-19.4	Analyze the influence of personality traits on leadership and project outcomes.	4
HSMC401-19.5	Develop a comprehensive plan for personal and professional growth in engineering.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
HSMC401-19.1	2	1	3	2	2				2	2	3	3	2	2		1
HSMC401-19.2		2	1	3									3	3	2	2
HSMC401-19.3			2	1	3										1	2
HSMC401-19.4	2	1	3	2	2				2	2	3	3		3	2	2
HSMC401-19.5	1	2		3	3						2	1	3	2	1	
AVERAGE	**1.67**	**1.50**	**2.25**	**2.20**	**2.50**				**2.00**	**2.00**	**2.66**	**2.33**	**2.66**	**2.50**	**1.50**	**1.75**

Program: B. Tech (Food Technology)	**Semester:** 7th Semester
Course Name: Instrumental Analysis of Foods	**Course Code:** BTFT 411- 19

Syllabus:

MODULE	DETAILS	HOURS
1	Methods of analysis, introduction and scope of various analytical methods for food samples such as food colour, pH value and turbidity; Importance, methods and types of sampling; Uses and roles of various grinding instruments/ machines for preparation of samples for analysis; Expression of results; Methods of moisture analysis in food – drying methods; Near infrared (NIR) techniques, isothermic technique; Analysis of principal food constituents such as carbohydrates, proteins, fat, vitamins and minerals by various methods.	5 Hrs
2	Methods for separation, identification and quantification of various food components; Separation methods – filtration, centrifugation, sedimentation; Electrophoresis: gel electrophoresis, paper electrophoresis, high voltage electrophoresis, starch gel electrophoresis; Basic principles of spectroscopy: UV, visible and fluorescence spectroscopy.	6 Hrs
3	Refractometric techniques (refractive index) and instruments for various food components including flavour component and food additives; Methods for measuring textural properties of foods– Instron food tester, penetrometer, texture analyser; Methods for measuring rheological properties of foods – viscoamylograph, extensograph, alveograph, farinograph and mixograph etc.	8 Hrs
4	High performance liquid chromatography (HPLC)– types of column and their applications, high pressure pumps, various types of detectors for HPLC; Gas chromatograph (GC) and gas liquid chromatography (GLC); mass spectrophotometer and their applications in food.	8 Hrs

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	Nielson S. S. (2003) Food analysis, Kluwer Academic Press
2	Pomeranz Y. J. (2000) Food Analysis, Springer Publications.
3	Srivastava (2000) Instrumental Approach to chemical analysis, S. Chand Publishers.
4	Winton A. L. (1999) Techniques of food analysis, Allied Science, Official methods of analysis, Association of official analytical chemist USA.
5	Das H. (2005) Food processing operations analysis, Asian Books private ltd
6	Winton, AL (1999). Techniques of food analysis, Allied Science Publication, New Delhi.
7	Song, DWS (1996) Mechanism and theory in food chemistry Champasian and Hall Inc. New York.

Course Code: BTFT 411- 19 (Instrumental Analysis of Foods)

	Course Outcomes	BT Level
BTFT411-19.1	Remember and define all concept related to qualitative and quantitative estimation of foods using various instruments.	1
BTFT411-19.2	Illustrate the principle and working of instrument related to physical, chemical and microbiological analysis.	2
BTFT411-19.3	Operate and maintain favorable conditions during analysis for achieving preciseness.	3
BTFT411-19.4	Examine advantages and disadvantages of one method of food analysis versus another.	4
BTFT411-19.5	Develop the appropriate instrumental procedure and course of action for a food analysis problem.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT411-19.1	3	3	2	3	3		2	1	2	2			3	2	3	3
BTFT411-19.2	2	3	2	2	2				2				3	2	3	3
BTFT411-19.3	3	3	3	3	2			2		2				3	3	
BTFT411-19.4		3	2		1							2	3	3	3	
BTFT411-19.5	3	1	3	2	2				1			1	3		3	3
AVERAGE	**2.75**	**2.60**	**2.40**	**2.50**	**2.00**		**2.00**	**1.50**	**1.67**	**2.00**		**1.50**	**3.00**	**2.50**	**3.00**	**3.00**

Program: B. Tech (Food Technology)	**Semester:** 7th Semester
Course Name: Waste Management and Effluent Treatment	**Course Code:** BTFT 413- 19

Syllabus:

MODULE	DETAILS	HOURS
1	Waste generation in food processing industries; concept, scope, health and environmental concern in waste management and effluent treatment; Physicochemical quality of wastewater from different food processing industries- temperature, pH, dissolved oxygen, biological oxygen demand, chemical oxygen demand; Grease content, metal content, forms of phosphorus and sulphur in waste waters and other ingredients like insecticide, herbicides and fungicides residues.	7 Hrs
2	Physicochemical unit operations- screening, grit chamber, equalization, sedimentation, floatation, coagulation, flocculation, filtration, disinfection; Adsorption and ion exchange; Aeration and gas transfer; Membrane separation processes.	8 Hrs
3	Biological treatment/Secondary treatment: aerobic and anaerobic biological treatment processes, combined aerobic and anaerobic treatment processes; Suspended growth and attached growth biological treatment; Oxidation ditches; Activated sludge process; Biological oxidation- trickling filters; Bio- towers; Rotating biological contractors, aerated lagoons; Anaerobic sludge blanket processes.	8 Hrs
4	Tertiary treatments: advanced wastewater treatment process- sand, coal and activated carbon filters, phosphorus, sulphur, nitrogen and heavy metals removal; Disinfection processes- theory, characteristics of disinfectants, mechanism and factors influencing disinfection; Environmental protection act and specifications for effluent of different food industries, treatment, reuse and disposal of solids and biosolids.	10 Hrs

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	Metcalf & Eddy (2013) Wastewater Engineering treatment and Resource recovery, 5th edition, McGraw Hill.
2	Marriott N. G. (2006) Principles of Food Sanitation, 5th edition, CBS Publication.
3	Lawrence K. W., Howard H. Y. & Yapijakis C. (2005) Waste Treatment in the Food Processing Industry, CRC Press.
4	Wang & Lo H. (2006) Waste treatment in the food processing industry, CRC Press, Taylor & Francis Group.
5	Loannis & Arvanitoyannis S. (2008) Waste management for the food industries, Elsevier publishers.

Course Code : BTFT 413- 19 (Waste Management and Effluent Treatment)

	Course Outcomes	BT Level
BTFT413- 19.1	Define waste management and effluent treatment	1
BTFT413- 19.2	Classify and describe content of the waste and its application in food industry.	2
BTFT413- 19.3	Using various methods employed for the treatment of industrial wastes.	3
BTFT413- 19.4	Examine the different waste produced in the industries.	4
BTFT413- 19.5	Evaluate and judge the effect of waste and disposal on environment produced from food industries.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT413-19.1	3	2	2	3	2	3	3	2		1	1	3	2	1	3	2
BTFT413-19.2	2	2	1	1	2							3	2	2	1	
BTFT413-19.3	3	3	3	2	2	2					2	3	1	1	2	
BTFT413-19.4	2	2	2	1		2	1				2	3	1		2	3
BTFT413-19.5	2	2	2	2							2	3	2	2	3	3
AVERAGE	**2.40**	**2.20**	**2.00**	**1.80**	**2.00**	**2.33**	**2.00**	**2.00**		**1.00**	**1.75**	**3.00**	**1.60**	**1.50**	**2.20**	**2.67**

Program: B. Tech (Food Technology)	**Semester:** 7th Semester
Course Name: Food Flavors and Colours	**Course Code:** BTFT 415.3-19

Syllabus:

MODULE	DETAILS	HOURS
1	Introduction to food flavours: Definition, classification and types, volatile and non-volatile flavouring compounds and their sensory characteristics; Natural food flavouring: Fruit, vegetables, spices, beverage, meat, fat, cooked flavours, uses in foods and importance of natural flavours.	
2	Flavours in processed foods: Development of flavours in processed foods, role of microbes, thermal reactions, off flavours in foods; Synthetic flavourings: Flavouring materials, terminology, flavour extraction and production methods, compounding of flavours, flavour encapsulation, functional uses and applications in food products, flavour enhancers, functions and stability in foods.	
3	Food colorants: Natural pigments from plant and microbial sources, colour stability, need of colour addition, colour loss during thermal processing, applications of natural colorants, types of colours, uses of synthetic colorants. Colour analyzing technique and equipment.	
4	Certified colours: Colorants subject to certification, colour effects in certified foods, certified F, D and C colorants, Primary certified food colours, blending of colours, lakes and dyes, properties and uses of certified dyes and their regulatory aspects; Microbial colours: Methods of production, advantages and disadvantages, maximum permissible limits of food colours, standards for use in processed foods.	

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	Fennema O. R. (1996) Food Chemistry 3rd edition, Marcel Dekker Inc.
2	Fisher C. & Scott T. R. (1997) Food flavours- Biology and Chemistry, The Royal Society of Chemistry.
3	Branen A. L., Davidson P. M. & Salminen S. (1980) Food Additives 2nd edition, Marcel Dekker Inc.
4	A.O.A.C. (1997) Official methods of analysis. 16th edition, Vol. II. AOAC International Publication.

Course Code : BTFT 415.3-19 (Food Flavors and Colours)

	Course Outcomes	BT Level
BTFT415.3-19.1	Define various food flavours, their types and characteristics.	1
BTFT415.3-19.2	Understand different methods of production and extraction of food flavours & colors.	2
BTFT415.3-19.3	Use flavor, colour extract and natural pigments in different kind of food products.	3
BTFT415.3-19.4	Compare various physicochemical properties of colours and flavous for their best use.	4
BTFT415.3-19.5	Select best lakes and dyes with their maximum permissible limits in food processing industries.	5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT415.3-19.1	3	2	3	3	3	1	3		2	1	2	2	2	3	2	2
BTFT415.3-19.2	2	2	2	3	3	1	1		2	2	1	2	3	2	1	
BTFT415.3-19.3	3	3	2	3	2	1	2		1	1	2	1	2	2	2	2
BTFT415.3-19.4	3	3	1	2	2	1	2		2	2	1	1	2	2	1	2
BTFT415.3-19.5	3	2	3	3	3	1	1			1	2		2	1	3	1
AVERAGE	**2.80**	**2.40**	**2.20**	**2.80**	**2.60**	**1.00**	**1.80**		**1.75**	**1.40**	**1.60**	**1.50**	**2.20**	**2.00**	**1.80**	**1.75**

Program: B. Tech (Food Technology)	**Semester:** 7th Semester
Course Name: Meat, Fish and Poultry Processing	**Course Code:** BTFT 416.2-19

Syllabus:

MODULE	DETAILS	HOURS
1	Status and scope of meat and poultry industry in India; Muscle-structure, chemical composition and physico-chemical properties of meat muscle, nutritive value, conversion of muscle into meat; Slaughtering of animals and poultry, post-mortem inspection and grading of meat; Factors affecting post-mortem changes, properties and shelf life of meat; Meat tenderization - natural and artificial methods.	
2	Processing and preservation of meat - mechanical deboning, aging or chilling, freezing, pickling, curing, cooking and smoking of meat; Thermal processing- canning of meat, retort pouch, dehydration and irradiation; Meat Products - uncooked comminuted and restructured meat products, sausages, meat emulsions, dried meats, intermediate moisture meats and meat extracts, ready to eat (RTE) meat products. Meat plant sanitation and waste disposal.	
3	Poultry products: types, chemical and nutritive value of poultry meat; Poultry handling and dressing: inspection of birds, poultry slaughter and dressing, factors affecting quality of poultry; Egg: structure, composition and nutritive value of eggs, changes in egg due to aging; Quality evaluation of eggs, candling, albumen index, haugh unit, yolk index; Egg preservation: grading of eggs, whole egg preservation, pasteurization, dehydration, freezing; Egg products: egg powder, value added egg products (Meringues and Foams etc.), packaging of egg and egg products.	
4	Fish products - production of fish meal, fish protein concentrate, fish liver oil, fish paste and fish sauce and other important by products; Quality control of processed fish; Fish processing; Byproduct utilization: By-products and wastes from meat and poultry industry; HACCP in meat industry.	

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	Govindan, T.K. (1985) "Fish Processing Technology". Oxford and IBH.
2	Wheaton, F.W. and Lawson, T.R (1985) "Processing of Aquatic Food Products". John Wiley and Sons.
3	Hall, G.M. "Fish Processing Technology"(1992). London Blackie Academic and Professional Publication.
4	Gerasimov, G.V. and Antonova, MT. (1979) "Techno-Chemical Control of fish Processing Industry". Amerind Publishing Co. Pvt. Ltd.
5	Borgess, G.H.O., Cutting, C.L., Lovern, J.A. and Waterman, U. (1967) "Fish Handling and Processing". Chemical Publishing Co.
6	Sahoo J. & Chatli M. K. (2016) Textbook on Meat, Poultry and Fish Technology, Daya Publishing House.

Course Code : BTFT 416.2-19 (Meat, Fish and Poultry Processing)

	Course Outcomes	BT Level
BTFT416.2-19.1	Describe the composition, structure and properties of muscle meats.	1
BTFT416.2-19.2	Explain the various preservation techniques of meat, poultry and fish products.	2
BTFT416.2-19.3	Evaluate the need and means of utilization meat, fish and poultry industry by products.	3
BTFT416.2-19.4	Examine safety and quality aspects of meat, fish and poultry products.	4
BTFT416.2-19.5	Maintain and develop hygienic condition with maximum utilization within the meat industry.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT416.2-19.1	3	2	2		1	1	1					1	3	3	3	3
BTFT416.2-19.2	2	3	2	2	1		1			2	2	2	3	2	3	3
BTFT416.2-19.3	2	2	2	2			2					3	2	3	2	
BTFT416.2-19.4	3	2	1		2		3			1	1	1	2	3		3
BTFT416.2-19.5	3	2	2	2						2	1			2	3	3
AVERAGE	**2.60**	**2.20**	**1.80**	**2.00**	**1.33**	**1.00**	**1.75**			**1.67**	**1.33**	**1.75**	**2.50**	**2.60**	**2.75**	**3.00**

Program: B. Tech (Food Technology)	**Semester:** 7th Semester
Course Name: In Plant Training Seminar (4-6 weeks)	**Course Code:** BTFT417-19

Course Code: BTFT417-19 (In Plant Training Seminar (4-6 weeks))

	Course Outcomes	BT Level
BTFT417-19.1	Outline the historical background of modern industry and the production function.	1
BTFT417-19.2	Understand the influence of various environmental factors on Food Industries and business operations	2
BTFT417-19.3	Analyze the process of starting a new venture and create their business plan.	4
BTFT417-19.4	Judge the process of entrepreneurship and the institutional facilities available to an entrepreneur in India.	5
BTFT417-19.5	Develop the knowledge on legal aspects and government policy relating to entrepreneurship.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT417-19.1	2	1	3	2	2	1	1	2	2	2	3	3	3	2	3	3
BTFT417-19.2	2	3	1		3	2	2	2	1	1	1	2	1	3		3
BTFT417-19.3	3	2	2	3	2	2		3	2	2	1	2	3	1	3	2
BTFT417-19.4	3	1					3	2	3	2		1		3	1	2
BTFT417-19.5	1	2		3	2			2	1		2	1	2	3	3	3
AVERAGE	**2.20**	**1.80**	**2.00**	**2.67**	**2.25**	**1.67**	**2.00**	**2.20**	**1.80**	**1.75**	**1.75**	**1.80**	**2.25**	**2.40**	**2.50**	**2.60**

Program: B. Tech (Food Technology)	**Semester:** 7th Semester
Course Name: Project-1	**Course Code:** PRFT-1

Course Code: PRFT-1 (Project-1)

	Course Outcomes	**BT Level**
PRFT-1.1	Define project objectives, background information, and relevant theories/concepts related to food technology.	1
PRFT-1.2	Interpret and explain the project scope, methodologies, and expected outcomes in the context of food technology principles.	2
PRFT-1.3	Apply theoretical knowledge and practical skills to design and execute experiments or solutions relevant to food processing or product development.	3
PRFT-1.4	Analyze experimental data, results, and findings critically to draw conclusions and make recommendations for further development or improvement.	4
PRFT-1.5	Evaluate the effectiveness of the project implementation, identify limitations or constraints encountered, and propose strategies for overcoming challenges in future projects.	5

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
PRFT-1.1	3	1	3	2	2	2	1	2	2	2	3	3	3	2	3	
PRFT-1.2	2	2	1	3		2	2	1					3	2	3	2
PRFT-1.3	3	2	2	1	3	1	2	2					2	3	2	3
PRFT-1.4	2	1	3	2	2	2		1	2	2	3	3	3	2	3	2
PRFT-1.5	3	2	2	3	2			1			2	1	2	3	3	3
AVERAGE	**2.60**	**1.60**	**2.20**	**2.20**	**2.25**	**1.75**	**1.67**	**1.40**	**2.00**	**2.00**	**2.67**	**2.33**	**2.60**	**2.40**	**2.80**	**2.50**

Program: B. Tech (Food Technology)	**Semester:** 7th Semester
Course Name: Metro Systems and Engineering	**Course Code:** OECE-701-18

Syllabus:

MODULE	DETAILS	HOURS
1	**Introduction to Metro systems** Overview of Metro Systems; Need for Metros; Routing studies; Basic Planning and Financials.	
2	**Planning and Development** Overview and construction methods for: Elevated and underground Stations; Viaduct spans and bridges; Under ground tunnels; Depots; Commercial and Service buildings. Initial Surveys& investigations;	
3	**Traffic Management Systems** Basics of Construction Planning &Management, Construction Quality& Safety Systems. Traffic integration, multimodal transfers and pedestrian facilities; Environmental and social safeguards; Track systems-permanent way.Facilities Management Module	
4	**Signalling Systems** Introduction to Signalling systems; Automatic fare collection; Operation Control Centre (OCCand BCC);SCADA and other control systems; Platform Screen Doors.	
5	**Electrical Systems** OHE, Traction Power; Substations-TSS and ASS;Power SCADA; Standbyand Back-upsystems; Green buildings, Carbon credits and clear air mechanics.	
6	**Mechanical Systems** Ventilation systems; Air conditioning for stations and buildings; Fire control systems; Lifts and Escalators	

TEXT/REFERENCE BOOKS:

S. No	BOOK TITLE/AUTHORS/PUBLICATION
1	"Metropolitan Railways: Rapid Transit in America (Railroads Past and Present)",Middleton, Indiana UniversityPress2013.
2	"ElectricTractionforRailwayTrains:ABookforStudents,ElectricalandMechanicalEngineers, Superintendents of Motive Power and Others" Edward Parris Burch Palala Press2018
3	"World Metro Systems", Garbutt, Capital Transport Publishing; 2nd Revised edition1997.

Course Code: OECE-701-18 (Metro Systems and Engineering)

	Course Outcomes	BT Level
OECE701-18.1	Identify and recall fundamental concepts of metro systems, including components, design principles, and operational strategies.	1
OECE701-18.2	Explain the working mechanisms of various metro system technologies and their applications in urban transportation.	1
OECE701-18.3	Apply engineering principles and techniques to solve practical problems related to the design, construction, and maintenance of metro systems.	3
OECE701-18.4	Analyze engineering principles and methods to address practical issues in the design.	4
OECE701-18.5	Create the socio-economic and environmental impacts of metro systems, proposing improvements and sustainable practices for urban transit solutions.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
OECE701-18.1	3	3	2	2	2	1	2	1	1	1	1	2	2	2	3	3
OECE701-18.2	2	2	2	2	1				2	1			2	2	2	3
OECE701-18.3	2	2	3	3	2	2				1	2	1	2	3	2	2
OECE701-18.4	2	3	1	1	1				1	2		2	3	3	2	2
OECE701-18.5	3	1	1	2	2				2				3	3	2	3
AVERAGE	**2.40**	**2.20**	**1.80**	**2.00**	**1.60**	**1.50**	**2.00**	**1.00**	**1.50**	**1.25**	**1.50**	**1.67**	**2.40**	**2.60**	**2.20**	**2.60**

Program: B. Tech (Food Technology)	**Semester:** 7th Semester
Course Name: Instrumental Analysis of Foods Lab.	**Course Code:** BTFT 412-19

Syllabus: List of Experiments

Sampling plan; Sample collection and preparation for analysis;

Qualitative and quantitative evaluation of food materials;

pH, turbidity, viscosity, texture, colour, etc.

Spectrophotometric analysis of foods.

Study of germination in various grains, millets, pulses and other pseudocerals using seed germinator.

Quality of milk using ultrasonic milk analyzer.

Dehydration of foods of different categories like fruits, vegetables, herbs etc.

Working/demonstration of HPLC, GC, DSC, farinograph, viscoamylograph,

FTIR, bomb calorimeter and NIR.

Course Code: BTFT 412-19 (Instrumental Analysis of Foods Lab.)

	Course Outcomes	BT Level
BTFT412-19.1	Remember and define all procedures related to qualitative and quantitative estimation of foods.	1
BTFT412-19.2	Illustrate the principle and working of instruments related to food analysis.	2
BTFT412-19.3	Operate and maintain analytical instruments for their maximum efficiency with good preciseness.	3
BTFT412-19.4	Select best convenient method of food analysis according to the available conditions and instruments in food industries.	4
BTFT412-19.5	Improve and develop the existing and new innovative instrumental methods.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT412-19.1	3	3	3		3	3		1	2	2		1	3	3	3	3
BTFT412-19.2		2	2	3				2	2				2	2	1	3
BTFT412-19.3	2	2	3	2	1			2	2		2	2	2		2	2
BTFT412-19.4		3	2		2			1					3		2	3
BTFT412-19.5		2	3	2			2		1				3	3	2	3
AVERAGE	**2.50**	**2.40**	**2.60**	**2.33**	**2.00**	**3.00**	**2.00**	**1.50**	**1.75**	**2.00**	**2.00**	**1.50**	**2.60**	**2.67**	**2.00**	**2.80**

Program: B. Tech (Food Technology)	**Semester:** 7th Semester
Course Name: Waste Management and Effluent Treatment Lab.	**Course Code:** BTFT 414-19

Syllabus: List of Experiments

Demonstration of different sewage, water and effluent treatment plant in various industries.

Determination of pH of different samples by pH meter. (Electrometric Method),

Determination of total solids in waste sample.

Determination of total dissolved solids in waste water sample by Gravimetric Method.

Determination of total suspended solids in waste water sample.

Determination of fixed & volatile solids in waste water sample.

Determination of total organic matter in a given waste water,

To evaluate effectiveness of coagulants & flocculants foe water treatment using jar test method.

Determination of BOD of waste water sample.

Determination of COD of waste water sample.

Determination of Total Organic Carbon of waste water sample.

Course Code: BTFT 414-19 (Waste Management and Effluent Treatment Lab.)

	Course Outcomes	BT Level
BTFT414-19.1	Outline waste management and effluent treatment.	1
BTFT414-19.2	Classify and describe content of the waste and its application in food industry.	2
BTFT414-19.3	Apply and use various methods employed for the treatment of industrial wastes.	3
BTFT414-19.4	Compare and examine the different waste produced in the industries.	4
BTFT414-19.5	Develop and improve the existing and new innovative methods of waste and disposal on environment produced from food industries.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT414-19.1	3	1	2	1	2	3	3	2		1	1	3	2	1	3	2
BTFT414-19.2	2	2	3	1	2							3	2	3		2
BTFT414-19.3	2	2	2		2	2					2	3		2	2	
BTFT414-19.4	2	1	1	1		2	1				2	3				3
BTFT414-19.5	2	2	2								2	3	2	2	3	3
AVERAGE	**2.20**	**1.60**	**2.00**	**1.00**	**2.00**	**2.33**	**2.00**	**2.00**		**1.00**	**1.75**	**3.00**	**2.00**	**2.00**	**2.67**	**2.50**

Record of CO-PO Mapping (8th Semester)

IK Gujral Punjab Technical University Bachelor of Technology Scheme for B. Tech Syllabus 2019

(Semester-8th)

Course Code	Subject	L-T-P	Credit
BTFT426-19	In Plant Training Seminar+ Report+ Viva	0-0-20	10
PRFT- 2	Project 2	0-0-12	6
Total		0-0-32	16

Program: B. Tech (Food Technology)	**Semester:** 8th Semester
Course Name: In Plant Training Seminar+ Report+ Viva	**Course Code:** BTFT426-19

Course Code: BTFT426-19 (In Plant Training Seminar+ Report+ Viva)

	Course Outcomes	BT Level
BTFT426-19.1	Describe the nature, scope and structure of modern industry and the Production function.	1
BTFT426-19.2	Summarize the significance and knowledge of employee relations and legislation related to employees in modern Food Industries and business.	2
BTFT426-19.3	Connect the process of starting a new venture.	4
BTFT426-19.4	Judge the process of entrepreneurship and the institutional facilities available to an entrepreneur in India	5
BTFT426-19.5	Develop the knowledge on legal aspects and government policy relating to entrepreneurship.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTFT426-19.1	3	2	3	2	2	1	1	2	2	2	3	3	3	2	3	3
BTFT426-19.2	2	3	1	2	3	2	1	3	1	1	1	2	1	3		3
BTFT426-19.3	2	1	2	3	2	2	2	2	2	2	1	2	3	1	3	2
BTFT426-19.4	3	1	2			2	1	2	3	2		1		3	1	2
BTFT426-19.5	2	2		3	2	1		3	1		2	1	2	3	3	3
AVERAGE	**2.40**	**1.80**	**2.00**	**2.50**	**2.25**	**1.60**	**1.25**	**2.40**	**1.80**	**1.75**	**1.75**	**1.80**	**2.25**	**2.40**	**2.50**	**2.60**

Program: B. Tech (Food Technology)	**Semester:** 8th Semester
Course Name: Project 2	**Course Code:** PRFT 2

Course Code: PRFT 2 (Project 2)

	Course Outcomes	BT Level
PRFT 2.1	Explain and indicate about new ideas on current issues in food sector.	1
PRFT 2.2	Compare and expand their knowledge base with literature review on the current topic	2
PRFT 2.3	Apply the Research methodology and Research plan in practice to resolve the problem.	3
PRFT 2.4	Relate the whole process to compare with the trending ideas and gain exposure while doing NPD practices.	4
PRFT 2.5	Design new research and study on various problems pertaining to research area.	6

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PRFT 2.1	3	1	3	2	2	2	1	2	2	2	3	3	3	2	3	
PRFT 2.2	2	2	1	3		2	2	1					3	2	3	2
PRFT 2.3	3	2	2	1	3	1	2	2					2	3	2	3
PRFT 2.4	2	1	3	2	2	2		1	2	2	3	3	3	2	3	2
PRFT 2.5	3	2	2	3	2			1			2	1	2	3	3	3
AVERAGE	**2.60**	**1.60**	**2.20**	**2.20**	**2.25**	**1.75**	**1.67**	**1.40**	**2.00**	**2.00**	**2.67**	**2.33**	**2.60**	**2.40**	**2.80**	**2.50**