B. Tech. Food Technology

B. Tech. Food Technology	
Programme outcomes	This program enables the students to acquire comprehensive knowledge for identification, quantification, and characterization of appropriate food raw materials, processes, and products critical for sustaining life processes and also for industrial applications. They will get the ability to unravel basic principles and methods related to human food nutrition leading to individual and social well-being in a sustainable environment safety and ethics. Students will develop management and communication skills through teamwork and self-learning for healthy and sustainable food systems.
Programme specific outcomes	The student will be able to apply knowledge of food technology and allied disciplines which enable them to understand the emerging techniques and advanced food engineering concepts. Students will get the ability for solving engineering problems related to the modern food industry, food spoilage, and adulteration along with the focus on the importance of food safety and hygiene of nutritious processed foods. By the end of this course, students will be able to work in the domain of food processing, quality assurance, and quality control in private or government organizations and research laboratories to design or process food products as per the needs and specifications, or can also emerge as an entrepreneur.

Course Outcomes

B. Tech. 1st semester	
Courses	**Outcomes**
Professional communication skills (ENG-101)	CO 1: To stimulate intellectual exercises and to develop communicative skills among students. CO 2: To guide them in becoming socially responsible citizens and balanced human beings. CO 3: To train learners in the art of communication through language exercises of both general and technical varieties.
General Microbiology (MIC-101)	CO 1: Illustration of the evolution and scope of microbiology; and history of microbiology.

	CO 2: Introduction to bacteria, fungi, algae, and protozoa, and viruses. CO 3: To understand microbial genetics, bacterial recombination, bacterial conjugation, transduction, and bacterial transformation. CO 4: To learn the different types of mutations, mutagenesis, mutation rate, and repair of mutations.
Basic Mathematics-I (MATH-111)	CO 1: To illustrate the different aspects of mensuration. CO 2: To acquaint with algebra and solution of the quadratic equation. CO 3: To illustrate the different aspects of co-ordinate geometry.
Engineering Drawing and Graphics (EE-101)	CO 1: To know the first and third angle methods of projection, and preparation of working drawing from models. CO 2: To know the different methods of dimensioning and the concept of sectioning. CO 3: To understand the types of rivet heads and riveted joints. CO 4: To understand the different types of lock nuts, studs, machine screws, cap screws, and wood screws
Basics of Electronics Engineering (ETE-101)	CO 1: Introduction to a semiconductor diode, ideal diode, CO 2: Understanding of bipolar junction transistor, construction, transistor operations, and BJT characteristics CO 4: Understanding of small-signal amplifiers and feedback amplifiers.
Workshop Technology (EE-102)	CO 1: Introduction to basic materials such as ferrous and non-ferrous materials and important engineering materials CO 2: To learn the different aspects of measuring and gauging, welding, carpentry, machinery, and sheet metal
Fundamentals of Food Processing (FT-101)	CO 1: Causes and types of food spoilage, scope, and benefit of food preservation and methods of food preservation. CO 2: Preservation by heat treatment, drying, concentration, irradiation, and fermentation. CO 3: Illustration of advanced processing techniques such as pulsed electric field ultrasound, dielectric heating, ohmic and infrared heating, high-pressure processing, microwave processing.
Environmental Sciences & Disaster Management (ENV-101)	CO 1: Introduction to environmental, ecology, and ecosystem. CO 2: Description of renewable and non-renewable resources and forest resources. CO 3: Description of eenvironmental pollution – water, air, land, and noise pollution.

Physical Education (PHE-101)	CO 1: Description of physical training and health; test and measurement in physical education. CO 2: To learn the different aspects of circuit training, interval training, far trek training, pressure training, and resistance training.
B. Tech. 2nd semester	
Food Chemistry of Macronutrients (FC-101)	CO 1: Nature, scope, and development of food chemistry. CO 2: Develop an understanding of dispersed systems of foods, physicochemical aspects of food dispersion system (Sol, gel, foam, emulations). CO 3: Learning of chemistry of carbohydrates, proteins, and lipids. CO 4: Oil processing operations such as refining, hydrogenations, and inter esterification.
Food Microbiology (FT-102)	CO 1: Importance and significance of microbes in food science. CO 2: Learning of Intrinsic and extrinsic factors affecting the growth of microorganisms. CO 3: Sources of contamination in food and their prevention. CO 4: Microbiology of poultry, eggs, and canned foods and food-borne intoxications and infections.
Food Thermodynamics (FT-103)	CO 1: Learning of laws of thermodynamics CO 2: Learning of thermodynamic properties of pure substances in solid, liquid, and vapor phases, and psychometry: CO 3: Description of three stages of water, phase diagram for water, vapor pressure-temperature curve for water. CO 4: Description of properties of steam: wet, dry saturated, superheated steam, use of steam tables.
Fluid Mechanics (EE-103)	CO 1: Learning of flow behavior of viscous foods, compressible and non-compressible fluids and pressure measuring devices. CO 2: Introduction to reciprocating pumps and working of reciprocating pump. CO 3: Description of fluid flow: Classification, steady, uniform and non-uniform, laminar and turbulent, continuity equation. CO 4: Description of dimensional analysis: Buckingham's theorem, application to fluid flow phenomena, Froude number, Reynolds number, Weber number, and hydraulic similitude.

Basics of Electrical Engineering (ETE-102)	CO 1: Learning of Circuit Analysis: Ohm's Law, KCL, KVL Mesh and Nodal Analysis. CO 2: Description of A.C. Circuits, Measuring Instruments, Transformers, AND Three Phase Circuits
Basic Mathematics-II ()	CO 1: Description of trigonometry, elementary calculus, differentiation of simple algebraic trigonometry, theorems on differentiation of the sum. CO 2: Description of Integration of the standard forms as the inverse of differentiation.
Post-Harvest Engineering (FT-104)	CO 1: Learning of post-harvest handling operations; cleaning, separation, drying, shelling, milling. CO 2: Description of materials handling: Introduction to different conveying equipment used for handling of grains, fruits, and vegetables. CO 3: Learning of conveyers, belt conveyor, chain conveyors, screw conveyors, pneumatic conveyers.
Statistics (STAT-102)	CO 1: Definition of statistics and its use and limitations, frequency distribution, and frequency curves. CO 2: Introduction to sampling: random sampling; the concept of standard error; tests of significance- types of errors, the null hypothesis. CO 3: Description of Small sample test for means, student's t-test for a single sample, two samples, and paired t-test. F test; Chi-Square test and Linear regression.
NCC/NSS (PHE-102)	CO 1: Orientation of students towards national problems. CO 3: Study of the philosophy of N.S.S., fundamental rights, directive principles of state policy, the socio-economic structure of Indian society.
B. Tech. 3rd semester	
Crop Production Technology (FT-201)	CO 1: Classification of crops, crop production technology for major cereal crops viz., paddy, wheat, maize, pearl millet, sorghum. CO 2: Description of crop production technology for major pulse crops viz., mango, banana, sapota, amla, pomegranate, guava pigeon pea, cowpea, gram, green gram, black gram. CO 3: Description of crop production technology for major fruits and vegetable crops viz., potato, onion, tomato, chili, and other green and leafy vegetables.
Processing Technology of Liquid Milk (FT-202)	CO 1: Historical development of dairy in India; production and utilization of milk

	CO 2: Learning of production technology for cream, fermented milk products, CO 3: Description of adulterations in milk and its detection CO 4: Description of milk reception equipment, milk tanks/silos, pasteurizers, sterilizers, centrifuges, clarifiers, filtration units, homogenizers, packaging, and filling machines
Processing Technology of Cereals (FT-203)	CO 1: Present status and prospects of cereals and millets. CO 2: Description of paddy processing and rice milling, parboiling, and milling of wheat milling, corn, Barley, oat, sorghum. CO 3: Description of by-products processing of cereals and millets and processing of infant foods from cereals and millets.
Industrial Microbiology (FT-204)	CO 1: History of industrial microbiology; primary and secondary metabolites produced by the microorganisms. CO 2: Description of fermenter, components, and types of the fermenter. CO 3: Description of probiotics, importance, role in fermented foods, organisms involved beneficial effects. CO 4: Description of cell disruption methods: mechanical disruption methods and non-mechanical disruption methods.
Food Chemistry of Micronutrients (FT-205)	CO 1: Learning of Chemistry of food flavor, sensory assessment of flavor, technology for flavor retention. CO 2: Description of Pigments in animal and plants kingdoms, vitamins and minerals. CO 3: Description of chemistry of anti-nutritional factors. Enzymes in the food industry.
Heat and Mass Transfer in Food Processing (FT-206)	CO 1: Description of Basic heat transfer processes, heat transfer coefficients, properties related to heat transfer. CO 2: Description of One-dimensional steady-state heat conduction with heat generation. CO 3: Introduction to unsteady-state heat conduction, system with negligible internal resistance and in various geometries. CO 4: Learning of heat transfer to flowing fluids, application of different types of heat exchangers in dairy and food industry.
Unit Operations in Food Processing-I (FT-207)	CO 1: Size reduction equipment, attrition mills, buhr mill, tumbling mills, tumbling mills, ultra-fine grinders. CO 2: Description of mixers for low- or medium-viscosity liquids, paddle agitators, impeller agitators, powder-liquid contacting devices, other mixers.

	CO 3: Description of mechanical separations, filtration, and membrane separation.
Computer Programming and Data Structures (CSE-221)	CO 1: Review of computer technology; processor, memory, secondary storage, display devices, and other peripheral devices. CO 2: Description of algorithms and flow-charts, role of the compiler and the integrated development environment, and control structures. CO 3: Use of function prototypes, structures, unions, and user-defined types. CO 4: Description of primary data types and user-defined data types, variables, typecasting, operators, building and evaluating expressions.
B. Tech. 4th semester	
Processing Technology of Dairy Products (FT-209)	CO 1: Processing technology of butter, ghee, ice cream, and frozen desserts. CO 2: Description of processing technology of condensed and dried milk, traditional dairy products. CO 3: Description of by-products of the dairy industry and their utilization.
Processing Technology of Legumes and Oilseeds (FT-210)	CO 1: Classification and types of legumes and oilseeds; CO 2: Description of chemical composition, nutritional value, and anti-nutritional compounds in legumes and oilseeds CO 3: Description of nutritional changes during soaking and sprouting of pulses CO 4: Learning of oilseed milling: Ghani's, hydraulic presses, expellers, solvent extraction methods, refining and hydrogenation of oils
Food Biochemistry and Nutrition (FT-211)	CO 1: Learning of biochemistry of carbohydrates, lipids, proteins, vitamins, and minerals. CO 2: Formulation of diets, classification of a balanced diet, preparation of balanced diet for various groups, recommended dietary allowances. CO 3: Description of mechanism of enzyme action, metabolism of lipids, proteins, minerals.
Unit Operations in Food Processing-II (FT-212)	CO 1: Principles of evaporation, mass and energy balance, factors affecting rate of evaporation, thermodynamics of evaporation.

	CO 2: Description of food freezing, freezing point curve for food and water, common food materials. CO 3: Principles of food freezing, freezing time calculation by using Plank's equation. CO 4: Description of expression, extraction, sterilization, and roasting.
Food Biotechnology (FT-213)	CO 1: Chemical nature, properties, and functions of the genetic material. CO 2: Organization of the genetic material in bacteria, eukaryotes, and viruses. CO 3: Description of Transcription and translation, recombinant DNA technology, Ethical issues concerning GM foods. CO 4: Classification of biosensors, application of biosensors, application of biotechnology in food.
Food Refrigeration and Cold Chain (FT-214)	CO 1: Principles of refrigeration, vapor refrigeration, and vapor-absorption refrigeration system. CO 2: Description of cold store, design of cold storage for different categories of food resources. CO 3: Meaning of air-conditioning and factors affecting comfort air-conditioning, classification, sensible heat factor, industrial air-conditioning.
Processing of Spices and Plantation Crops (FT-215)	CO 1: Production and processing scenario of spice, flavor, and plantation crops. CO 2: Description of minor spices: herbs, leaves, and Spartan seasonings and their processing and utilization. CO 3: Learning of post-harvest technology for Tea, coffee, cocoa; Vanilla, and annatto processing. CO 4: Learning of post-harvest technology and processing of areca nut, cashew nut, oil palm
Business Management and Economics (BM-201)	CO 1: Learning of management principles, scientific principles, and administrative principles. CO 2: Description of human resource management, objectives of manpower planning, process, sources of recruitment, the process of selection. CO 3: Learning of finance management: definition, scope, objective; different systems of accounting, Financial accounting, cost accounting, management accounting.
B. Tech. 5th semester	

Processing Technology of Fruits and Vegetables (FT-301)	CO 1: Production and processing scenario of fruits and vegetables in India and the world. CO 2: Description of canning, processing steps, and equipment, quality assurance, and defects in canned products. CO 3: Description of FSSAI specifications and preparation and preservation of juices, squashes, syrups, sherbets, nectars, cordials. CO 4: Learning of commercial processing technology of selected fruits and vegetables for production of various value-added processed products.
Processing of Meat and Poultry Products (FT-302)	CO 1: Sources and importance of meat and poultry; Status of Meat and poultry industry in India. CO 2: Description of preservation of meat by chilling, freezing, pickling, curing, cooking, and smoking. CO 3: Learning of preparation, packaging, and equipment for the manufacture of dehydrated meat products and their quality evaluation CO 4: Description of structure, composition, quality characteristics, processing, preservation of eggs.
Instrumental Techniques in Food Analysis (FT-303)	CO 1: Concepts of food analysis; rules and regulations of food analysis; principles and methodology involved in the analysis of foods. CO 2: Description of chromatography: adsorption, column, partition, gel-filtration, affinity, ion-exchange, size-exclusion method, gas-liquid, high-performance liquid chromatography. CO 3: Learning of Instrumentation and sensors for the food industry, rapid microbiological methods, and chemically sensitive semiconductor devices.
ICT Applications in Food Industry (FT-304)	CO 1: Importance of computerization in the food industry, operating environments, and information systems for various types of food industries. CO 2: Introduction to MATLAB, Basic commands, computing with MATLAB. CO 3: Learning of automation in the Food industry, mechanization, and automation, classification of automation systems. CO 4: Introduction to computational fluid dynamics (CFD), governing equations of fluid dynamics, models of flow.

Food Process Equipment Design (FT-305)	CO 1: Description of marterials for fabrication, mechanical properties, ductility, hardness, corrosion, protective coatings, corrosion prevention linings equipment. CO 2: Description of Design of pressure and storage vessels, agitators and separators, dryers, and extruders.
Food Storage Engineering (FT-306)	CO 1: Importance of scientific storage systems, post-harvest physiology of semi-perishables and perishables, climacteric and non-climacteric fruits. CO 2: Description of traditional storage structures, improved storage structures, modern storage structures. CO 3: Description of aaeration and stored grain management, storage of perishables, functional and structural design of grain storage structures.
Bakery, Confectionery and Snack Products (FT-307)	CO 1: Types, specifications, compositions, ingredients, formulations, processing, equipment for bakery products. CO 2: Types, specifications, compositions, ingredients, formulations, processing, equipment, packaging, storage, and quality testing of confectionery and chocolate products. CO 3: Description of snack foods and breakfast cereals, macaroni products, and malts, types, specifications, compositions, ingredients, formulations, processing.
Marketing Management and International Trade (BM-301)	CO 1: Concept, functions, scope, and marketing management Market measurement, market forecasting, market segmentation, targeting, and positioning. CO 2: Learning of aadvertising, objectives, budget, and advertising message, media planning, personal selling, and publicity. CO 3: Description of direct exports, indirect exports, licensing, joint ventures, direct investment, and internationalization process, distribution channels.
B. Tech. 6th semester	
Processing Technology of Beverages (FT-308)	CO 1: History and importance of beverages and status of the beverage industry CO 2: Description of Low-calorie and dry beverages, isotonic and sports drinks, dairy-based beverages CO 3: Description of FSSAI specifications for beverages, Sweeteners, colorants, acidulates, clouding and clarifying and flavoring agents for beverages.

Food Plant Sanitation (FT-309)	CO 1: Good manufacturing practices, current good manufacturing practices; standard operating procedures, good laboratory practices, sanitation. CO 2: Learning of personal hygiene and sanitary food handling and pest control. CO 3: Learning of dairy processing plant sanitation, seafood plant sanitation, and beverage plant sanitation.
Food Packaging Technology and Equipment (FT-310)	CO 1: Need of packaging, package requirements, and package functions. CO 2: Description of package materials and their classification. CO 3: Description of lamination, molding-injection, blow, extrusion, and coating on paper and films. CO 4: Learning of permeability of gases and vapors; Permeability of multilayer materials; Permeability in relation to packaging requirement of foods.
Processing of Fish and Marine Products (FT-311)	CO 1: Types of fish and other marine products, classification of fish (fresh water and marine). CO 2: Principles of canning, the effect of heat processing on fish, storage of canned fish. CO 3: Description of fish protein concentrates (FPC), fish protein extracts (FPE). CO 4: Description of oxygen absorbents and CO2 generators, ethanol vapor generation, hurdle barrier concept.
Sensory Evaluation of Food Products (FT-312)	CO 1: Introduction, definition, and importance of sensory evaluation in relation to consumer acceptability and economic aspects. CO 2: Learning of basic principles, senses and sensory perception, physiology of sensory organs, classification of tastes and odors. CO 3: Description of panel selection, screening, and training of judges, requirements of sensory evaluation. CO 4: Learning of Interrelationship between sensory properties of food products and various instrumental and physicochemical tests.
Food Additives and Preservatives (FT-313)	CO 1: Intentional and unintentional food additives, their toxicology and safety evaluation. CO 2: Regulatory aspects of dyes, food color (natural and artificial), pigments, and their importance.

	CO 3: Description of Humectants/polyhydric alcohol, anticaking agent, firming agent, flour bleaching and maturing agents, antioxidants, nutritional and non-nutritional sweeteners.
Food Quality, Safety Standards, and Certification (FT-314)	CO 1: Food quality its definition and its role in the food industry. CO 2: Description of pathological and entomological defects. CO 2: Description of laboratory quality measurement, consumer measurement, and limitations of the consumer survey.
Instrumentation and Process Control in Food Industry (FT-315)	CO 1: Learning of the static and dynamic characteristics, temperature and temperature scales, various types of thermometers, thermocouples, resistance thermometers, and pyrometers. CO 2: Learning of kinds of flow, rate of flow, total flow differential pressure meters, variable area meters, food flow metering. CO 3: Description of transmission, transducer, computer-based monitoring, and control.
Project Preparation and Management (BM-302)	CO 1: Functions and viewpoints of management, the evolution of project management, forms and environment of project management. CO 1: Learning of project identification and screening, project appraisal, project charter and project proposal. CO 1: Description of project planning and scheduling, project cost estimation, project implementation, monitoring and control, and project completion and future directions.
B. Tech. 7th semester	
Communication Skills and Personality Development (ENL-401)	CO 1: Description of structural and functional grammar. CO 2: Description of communication, verbal and nonverbal communication. CO 3: Learning of Oral presentation skills, public speaking; group discussion sentence patterns in English.
Entrepreneurship Development (BM-403)	CO 1: Importance and growth, characteristics and qualities of an entrepreneur, the role of entrepreneurship. CO 1: Concept of entrepreneurship, entrepreneurial and managerial characteristics, managing an enterprise. CO 1: Learning of corporate entrepreneurship; role, mobility of entrepreneur; entrepreneurial motivation.

	CO 1: Description of Government schemes and incentives for promotion of entrepreneurship.
Student READY - Experiential Learning Program - I (EXPL-401)	CO 1: Experiential Learning is intended to build practical skills and entrepreneurship attributes among the students to deal with work situations and for better employability and self-employment. CO 2: To develop the detailed Project Report on setting up of an enterprise in the selected areas of product manufacture and evaluation of the module.
Student READY - Research Project (RP-401)	CO 1: To investigate selected problems of special interests in Food Processing Technology to the individual student. CO 2: The work includes library work, field or laboratory research, recording data, analyzing data and writing of report.
Student READY - Seminar 1 (FT-500)	CO 1: To develop presentation skills among students CO 1: Presentation and discussion by each student on current topics/interests in Food Processing Technology
B. Tech. 8th semester	
Student READY - Industrial Tour (INDT-401)	CO 1: Educational tour of two three weeks to various industries within and outside the state of the university CO 2: To develop Writing skills among students and submission reports on Industrial tour.
Student READY - Internship/In-Plant Training (INDT-402)	CO 1: In-plant Training is intended to expose the students to an environment in which they are expected to be associated in their future careers. CO 2: The students will gain hands-on experience in one or more commercial establishments.