2019-20

COURSE	Course outcomes
SEMESTER-I	**SEMESTER-I**
MATHEMATICS –I	CO1: To test the behavior of infinite series. Operate vectors and convert line integral to surface integral to volume integral. CO2: Analyze functions of several variables and their applications. CO3: Evaluate multiple integrals and apply them to practical problems. CO4: To study cylinders and cones and understand applying cylindrical and polar coordinates. Formulate and solve linear differential equations.
CHEMISTRY (ORGANIC)	CO1: Understand and explain the different nature and behaviour of organic compounds CO2: Understand the concept of stereochemistry CO3: Learn and identify organic reaction intermediate and explain the mechanism including the free radical substitution , electrophilic addition, electrophilic aromatic substitution and nucleophilic reactions. CO4: Identify important organic reactions and their application for syntheses.
ELECTRICAL & ELECTRONICS ENGINEERING	CO1: The student will understand how various loads are connected in circuits and difference between single and three phase system. CO2: The students will know the principles and working of different types of electrical machines used in industry CO3: The students will have the basic knowledge of digitalization and conversion of physical quantity to digital quantity.
MATERIAL & ENERGY BALANCE	CO1: To review of Stoichiometric and composition relationship gas law, conversions etc. CO2: To study the dimensional consistency of the equations and review of basic concepts of fluid flow, vapour pressure and gaseous mixture. CO3: To study and application of material and energy balance of non-reacting and reacting systems for recycle, by pass and purge streams. CO4: To study combustion calculation s and use steam tables and psychometric charts.
COMPUTER PROGRAMMING FOR PROBLEM SOLVING	CO1: The student will demonstrate proficiency in C++ programming language. CO2: The student will be able to solve basic engineering computation problems using C++
ELECTRICAL & ELECTRONICS ENGINEERING LAB.	CO1: The student will understand how various loads are connected in circuits and difference between single and three phase system. CO2: The students will know the principles and working of different types of electrical machines used in industry. CO3: The students will have the basic knowledge of digitalization and conversion of physical quantity to digital quantity.
CHEMISTRY (ORGANIC) LAB.	CO1: Practise analytical skills and recognize various aspects of lab safety. CO2: Learn and apply basic technique used in the organic laboratory for preparation ,purification, and identification of oganic compound. CO3: Outline the synthesis of Benzamide and Asprin, and carry out the purification and percentage yield of compound. CO4: Identify important functional groups by a study of their properties and reaction.
COMPUTER LAB.	CO1: The students will be able to demonstrate proficiency in C++ CO2: The student will become confident in solving any computation problem using his programming skills.
SEMESTER-II	**SEMESTER-II**
PHYSICS	CO1: Understand Bragg's law and introduced to the principles of lasers, types of lasers and applications. CO2: Various terms related to properties of materials such as permeability, polarization etc. CO3: Basic knowledge of structural properties, crystal structure and X ray

COURSE	Course outcomes
	diffraction analysis. CO4: Basic knowledge of magnetic, superconducting, dielectric properties of materials. CO5: Knowledge of nanomaterials, nanotechnology and its application.
CHEMISTRY (INORGANIC)	CO1: Understanding the basics of wave mechanics and chemical bonding in inorganic chemistry. CO2: Understanding the relation between structure and reactions of various complex compounds. CO3: Understanding the mechanism of various reaction and the ways to control them. CO4: Identifying the elements hazardous to nature and means to control them.
MATHEMATICS –II	CO1: Expand functions in terms of Fourier series and introduction of harmonic analysis. CO2: Formulate and solve various partial differential equations. Solve partial differential equations of engineering interest by the method of separation of variables. CO3: Find Laplace transforms, inverse transforms and apply these to solve various differential equations. CO4: Evaluate complex integrals and apply these to various problems.
COMMUNICATION SKILLS	CO1: Gain proficiency in English language as medium for communication in both professional and personal life CO2: Increase in employment prospective of students by developing technical aspects of communication. CO3: Personality development of students by thorough knowledge of effective and enhanced communication skills
ENGINEERING GRAPHICS	CO1: Understand the use of different drawing tools, types of lines, dimensioning rotation of planes and types of projections. CO2: Projection of points, lines and planes. Visualization of solid objects through projection of solids and assembly drawing. CO3: Understand the importance of development of surfaces, isometric projection and computer graphics.
ENGINEERING WORKSHOP	CO1: Identify basic prototypes in the carpentry trade such as Lap joint, Lap Tee joint, Dove tail join, Bridle joint, and Mitre joint. CO2: Recognize and differentiate between the use of arc welding and gas welding in making different types of welding joints such as Lap joint, Lap Tee joint, Edge joint, Butt joint and Corner joint. CO3: Describe the various fabrication processes in Machine shop, use of machine tools and materials, introduction to working of lathe, shapper, milling and drilling machines, power hacksaw, shearing machine and grinding wheel. CO4: Recognize the wiring techniques in link clip and casting and causing wiring of lights with switches in parallels, series and with 2 ways switches, Connecting energy meter, main switch and distribution board, testing a wiring installation for insulation resistance.
PHYSICS LAB.	CO1: Proficiency in technical aspects of performing the experiments. CO2: State various laws which they have studied through experiments. CO3: Experimental data observations and analysis. CO4 Proficiency in designing scientific projects and reporting
CHEMISTRY (INORGANIC) LAB.	CO1: getting hands on training in handling various equipment. CO2: understanding practically all theoretical concepts CO3: working with discipline and as a team with co-operation.
COMMUNICATION SKILLS LAB.	CO1: English Speaking skills of students will be enhanced. CO2: Students will become self confident in handling both professional and personal meetings/discussions. CO3: Students will be able to demonstrate improved technical writing skills. CO4: Overall personality of students as well as their communication skills will be developed.
SEMESTER-III	**SEMESTER-III**

COURSE	Course outcomes
ELEMENT OF BIO & FOOD SCIENCE	CO1: Understand the basic principles of cells and the metabolic processes of cells in terms of cellular organelles, membranes, and biological molecules. Along with that various methods used for the isolation, identification and maintenance of microbial cultures. CO2: Understand the molecular basis of genetic information and the flow of genetic information from DNA to RNA to protein and the concept of mutations. CO3: Knowledge of various food regulatory bodies in food processing and packaging as well as differentiating between different materials used in food packaging like metals, glass, plastics and papers and their methods of production. CO4: Understanding techniques employed by food industries to preserve the raw material and finished products and to increase its shelf life by tackling various physical, chemical and biological constraints
ELEMENTS OF BIO & FOOD SCIENCE (PRACTICAL)	CO1 Understand working principle of microscopes and sterilization techniques. CO2 Use aseptic technique to properly handle microorganisms to avoid contamination. CO3 Identify the microorganisms using staining techniques. CO4 Understand and apply the knowledge to handle microscopes to observe stained microorganisms. CO5 Isolate the pure culture from mixed population found in contaminated foods.
FLUID FLOW	CO1: Understand and solve hydrostatic problems related to forces on submerged bodies and pressure measurement. CO2: Derive & apply basic equations of fluid flow; understand fluid flow phenomena. CO3: Understand the flow of incompressible fluids, examine energy losses in pipe transitions and evaluate pressure drop in pipe flow using Hagen-Poiseulli equation. CO4: Apply the concepts of dimensional analysis to various fluid flow problems. CO5: Understand compressible flow and flow measurement devices. CO6: Understand fluid machineries including pumps, blowers and compressors.
FLUID FLOW (PRACTICAL)	CO1: Verify Bernoulli's theorem. CO2: Evaluate discharge coefficient for various flow measurement devices and understand their industrial applications. CO3: Identify various types of flow, valves and fittings and evaluate the frictional losses associated with them. CO4: Calibrate a given flow meter. CO5: Understand the characteristics of pumps. CO6: Verify $f=16/Re$ for laminar flow through a straight tube.
BIOCHEMISTRY & NUTRITION	CO1 Introduce students to basis of biological catalysts and their function in metabolic pathways. CO2 Provides information about energy produced from lipids and proteins. CO3 Provides information regarding biotechnological concepts and their applications. CO4 Understanding the knowledge about the role of nutrition in maintaining good health.
BIOCHEMISTRY & NUTRITION (PRACTICAL)	CO1 Describe various separation and quantification techniques frequently used for food analysis. CO2 Demonstrate the presence of protein, lipid, carbohydrate and water in food using chemical methods. CO3 Apply their knowledge in food biochemistry and nutrition in designing new range of products with improved nutritional characteristics CO4 Evaluate proper selection and application of appropriate methods of analysis.
PROCESS PLANT	Capability:

COURSE	Course outcomes
MATERIAL AND ENERGY BALANCE	CO1: To convert units and dimensions and modify equations from one system to another, CO2: To integrate the data and formulate the material and energy balance problems, CO3: To apply material and energy balance in different chemical processes (with and without reactions), including problems involving recycle, bypass and purge streams, CO4: To use steam tables and psychrometric charts.
ORGANIC CHEMISTRY	CO1: Understand and explain the different nature and behaviour of organic compounds CO2: Understand the concept of stereochemistry CO3: Learn and identify organic reaction intermediate and explain the mechanism including the free radical substitution , electrophilic addition, electrophilic aromatic substitution and nucleophilic reactions. CO4: Identify important organic reactions and their application for syntheses.
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SEMESTER-IV	**SEMESTER-IV**
CHEMICAL ENGINEERING THERMODYNAMICS	CO1: Understand the First and Second Laws of Thermodynamics apply it to open and closed systems, steady and unsteady state processes, isothermal and adiabatic processes and solve related engineering problems. CO2: Estimate the thermodynamic properties of pure substances, especially fluids. Knowledge of various PVT equations of state including Principle of corresponding states and heat capacities to evaluate thermodynamic properties of fluids. CO3: Explain the underline principles of phase equilibrium and evaluate the thermodynamic properties in two-component and multi-component systems CO4: To develop and ability to envisage intermolecular potential and excess property behaviour of multi-component systems CO5: Impart ability to apply the concepts of phase equilibrium to vapour liquid equilibrium (VLE), separation processes and chemical reaction equilibrium
FOOD CHEMISTRY	CO1 The students will gain knowledge about various components of foods, their importance and deficiency, effect of processing condition on nutrition value of foods. CO2 The Students will be able to apply that knowledge during process condition optimization of different food product manufacturing and quality mentainance. CO3 The Students will be able to apply the knowledge during processing so that loss of vitamins and nutrient loss will be minimum. CO4 The students will be able to be able to implement the knowledge during fibre rich product development and food gel development.
FOOD CHEMISTRY (PRACTICAL)	CO1: Student will be able to implement the practical knowledge of food analysis in industrial scale analysis of food material. CO2: Students will be able to detect adulterants in food products. CO3: Students will be able to maintain the quality of fresh food products. CO4: Students will be able to maintain quality of food products during storage at different atmospheric conditions.
FOOD MICROBIOLOGY	CO1 Identify different types of microorganisms present in the environment responsible for spoilage of food and evaluate the measures required to

COURSE	Course outcomes
	control undesired microorganisms in food. CO2 Interpret the effects and causes of various food borne diseases and steps involved in investigating an outbreak. CO3 Understand the technology and microbiology behind various fermented products along with their health benefits and various microbiological methods used for analysis of micro-organisms in food. CO4 Understand the importance of maintaining safety and hygiene in food industry and various approaches used for sanitation of plants and equipments.
FOOD MICROBIOLOGY (PRACTICAL)	CO1 Explain various methods of isolation, characterization and screening of bacteria, fungi and other related organisms. CO2 Apply different preservation techniques relative to food safety and spoilage. CO3 Enumerate the microorganisms to check the quality characteristics of food. CO4 Illustrate the growth requirements of common food borne pathogens and spoilage microorganisms. CO5 Identify which organisms would be likely to grow in a specific food product.
MECHANICAL OPERATIONS	CO1: Understand and determine various properties of solids, specific surface area, average particle sizes of particles in mixtures, sphericity and laws of crushing. Classification of SR equipments, power consumption of various machines, description and working of Size reduction equipments and their applications CO2: Understand various screening techniques and equipments, capacity and effectiveness of screens, standard screens CO3: Understand and apply knowledge of Filtration Processes , constant pressure and constant volume filtration and various filtration equipments, their types and applications CO4: Understanding and applying concepts of Flow around a single particle, drag force and drag coefficient, settling velocity of particles in a fluid, hindered and free settling of particles, thickening and gravity separation, types of settling devices. CO5: analyzing flow through a bed of particles, applications of fluidization & fluidized bed, conditions for fluidization, minimum fluidization velocity, types and applications of fluidization. CO6: Understand and applying concepts of Handling, Storage and Transportation of Solids, Agitation of liquids, axial flow impellers, radial flow impellers, design of agitators, velocity and power consumption of agitated vessels, blending & mixing.
MECHANICAL OPERATIONS (PRACTICAL)	CO1: Understand the grinding operation and evaluate critical speed of a ball mill. CO2: Analyze particle size distribution and evaluate screen effectiveness. CO3: Understand pressure drop behavior for the flow of Newtonian fluid flowing though fixed and fluidized beds. CO4: Understand the process of filtration and apply the basic equations of filtration. CO5: Understand settling rate and behavior of particles falling in quiescent liquid.
STRENGTH OF MATERIALS	CO1: Identify various types of Stressers and Strains, define Hooke's law, modulus of dlasticity and modulus of rigidity, calculate stresses under impact loads and sudden applied loads under varying conditions. CO2: Apply the theory to solve numerical problems based on Shearing force, bending moment, types of load on beams, types of supports, Concentrated loads and uniformly distributed loads. CO3: Define different types of Struts and Columns, Explain Euler theory and its limitations, describe Rankine-Gordon formula and its applications to numerical problems. CO4: Describe Stresses and Strains in Thin Shells and in springs, Strain

COURSE	Course outcomes
	Energy and Theories of Elastic Failure and numerical problems.
PROCESS EQUIPMENT DESIGN	CO1: Understand general design consideration, codes and specifications for pressure vessels. CO2: Design of thin-walled vessels under internal as well as external pressure. CO3: Design of foundation, supports and various joints.
COMPREHENSIVE VIVA	CO1: Demonstrate technical knowledge of theory and practical subjects taught during first to fourth semesters. CO2: Demonstration of professional aptitude, learning ability and communication skills.
SEMESTER-V	**SEMESTER-V**
HEAT TRANSFER	CO1: To understand conduction, convection and radiation modes of heat transfer and to estimate heat transfer rates, CO2: To understand boiling and condensation phenomena CO3: To carryout thermal analysis of heat exchanger using LMTD and effectiveness method, CO4: To estimate steam economy, capacity of single and multiple-effect evaporators. CO5: To apply engineering judgment including an appreciation of cost and safety.
HEAT TRANSFER (PRACTICAL)	CO1: Determination of heat transfer coefficient for different types of heat transfer equipment and Unsteady state heat transfer in jacketed vessels. CO2: Correlation of instantaneous heat transfer coefficients with time study deposition of scale on a heating surface & heat losses for insulated pipes. Study of double pipe heat exchanger and 1, 2 - shell and tube heat exchanger. CO3: Study and operation of long tube, forced circulation and multiple effect evaporators, Duhring plot for solutions involving nonvolatile solutes
MASS TRANSFER – I	CO1: Classify mass transfer operations and laws of mass transfer. CO2: Evaluation of molecular diffusion in gases, liquids and solids. CO3: Discuss diffusion coefficient/Mass transfer coefficient, interphase mass transfer and estimation of number of stages. CO4: Evaluation of humidification operations, design of cooling tower and working of gas-liquid contacting equipments. CO5: Analysis of drying and discuss the working of different types of dryers.
PROCESSING OF CEREALS & PULSES	CO1 The students will be able to gain knowledge about the basic composition and structural parts of food grains. They will become aware about paddy processing and rice milling equipments. CO2 They will know about wheat processing and basic rheology of wheat dough which will help them for developing entrepreneurial skills and apply the knowledge to process food grains into value added products. CO3 Study the processing and milling of maize which will promote gainful employment. They will also gain knowledge about the various products made from processing of maize. CO4 They will develop skills needed in the milling of pulses. Students will also become familiar with hygienic and safe handling of Cereal Products.
CEREALS & PULSES PROCESSING LAB. (PRACTICAL)	CO1 Student will be able to apply their knowledge in the cereal processing industry. CO2 Students will be able to optimize new cereal product development or fortification of different additives maintaining its quality and nutritional values. CO3 Study the processing and milling of wheat, rice maize which will promote gainful employment.. CO4 Students will also become familiar with hygienic and safe handling of Cereal Products.
PROCESSING OF FRUITS & VEGETABLES	CO1: The students will gain knowledge about various techniques employed by food industries to preserve the raw material. CO2: The students will gain knowledge about how to increase its shelf life by

COURSE	Course outcomes
	tackling various physical, chemical and biological constraints. CO3: The students will gain knowledge about various techniques employed by food industries to preserve the finished constraints. CO4: Students will get familiar with by-product utilization process of fruits and vegetable industry.
FRUITS & VEGETABLES PROCESSING LAB (PRACTICAL)	CO1. The students will gain knowledge about the manufacturing technology of Fruits and vegetable products. CO2. Understand the importance of various ingredients required for preparation of products and calculate the quantity requirement of each constituent. CO3. Prepare fruit and vegetable products of desired specification. CO4. Enumerate the processing and preservation of fruits and vegetables by heat treatment and understand the dehydration methods used for drying fruit and vegetables.
BEVERAGE TECHNOLOGY	CO1 Recognize the types of beverages in market and understanding the processingtechniques and safety aspects of drinking water. CO2 Understand the technology of non-alcoholic beverages along with the importance and effect of quality of raw materials on the final products. CO3 Understand the principle behind the production of various alcoholic beverages and importance of every step for a safe and effective production. CO4 Learn the process and machinery involved in production of beverages that will be help in designing and creating newer processes and products that are better economically, nutritionally or technologically.
CONFECTIONARY TECHNOLOGY	CO1: Students will be able to implement their knowledge in diverse confectionary manufacturing processes. CO2: Students will be able to select suitable raw material, optimize proess conditions and maintain the quality of the product. CO3: Students will be able to choose suitable packaging material and also will be able to optimize the storage conditions for confectionary products.
PROCESS PLANT DESIGN –I	CO1: Design and specifications of pipes, pumps, fans and blowers. CO2: Design and specifications Dor thickeners, dust chambers, cyclone separators and centrifuges. CO3: Design of agitated vessels, impellers and Conveyor system for solids.
SEMESTER-VI	**SEMESTER-VI**
NUMERICAL METHODS IN CHEMICAL ENGINEERING	CO1: Learn evaluating error in calculations, use of numerical methods for solving algebraic and transcendental equations and using various methods to carry out numerical differentiation and numerical integration. CO2: Understanding the concept of Finite Differences and Learn to use this for Interpolation and Inverse Interpolation with equispaced and unequispaced data. Learn to use Least Square Curve Fitting Procedure. CO3: Solve numerically ordinary differential equations of First and Higher order/Simultaneous differential equations using different methods. CO4: To Find the solution of linear system of equations by Direct and Iterative methods. Learn to solve partial differential equations using Finite difference approximation method.
MASS TRANSFER-II	At the end of the course, the students will be able to: CO1: To understand the concepts of mass transfer equilibria for vapour-liquid and to generate operating line for various mass transfer systems like absorption, distillation, liquid-liquid extraction. Leaching, adsorption and principles of crystallization. CO2: The students are able to comprehend the concepts of co current & counter current processes, cascades and concept of Ideal stage and stage efficiencies, continuous contact equipments, number of transfer units and height of a transfer unit (NTU & HTU) concepts, packed column for absorption, equipment for gas absorption CO3: The students will get acquaintance about McCabe–Thiele methods &

COURSE	Course outcomes
	Ponchon Savarit method to calculate the number of stages for distillation column and able to design the column. CO4: The students will be able to understand the working of different equipments used for various mass transfer operations such as leaching, crystallization, etc.
MASS TRANSFER-II	CO1: To understand the concepts of mass transfer equilibria for vapour-liquid and to generate operating line for various mass transfer systems like absorption, distillation, liquid-liquid extraction. Leaching, adsorption and principles of crystallization. CO2: The students are able to comprehend the concepts of co current & counter current processes, cascades and concept of Ideal stage and stage efficiencies, continuous contact equipments, number of transfer units and height of a transfer unit (NTU & HTU) concepts, packed column for absorption, equipment for gas absorption CO3: The students will get acquaintance about McCabe–Thiele methods & Ponchon Savarit method to calculate the number of stages for distillation column and able to design the column.
MASS TRANSFER II LAB.	CO1: Application of different mass transfer equipments, Determination of mass transfer coefficients for naphthalene-air system. To determine drying rate curves for different wet solids in a batch drier. CO2: Verification of Rayleigh's equation for differential distillation, Determination of flooding velocities in packed columns. CO3: Determination of HETP for packed distillation columns, flooding velocities in packed columns. CO4: Practice operation of a pilot sized distillation column under total reflux, Fractional approach to equilibrium for liquid-liquid extraction from single drop.
CHEMICAL REACTION ENGINEERING–I	CO1: To understand the mechanism of chemical kinetics for different types of reactions. CO2: To design batch and flow reactors for single homogeneous reactions. CO3: To understand the factors affecting the conversion, yield and selectivity in multiple reactions. CO4: To understand the concepts of non-ideal reaction.
CHEMICAL REACTION ENGINEERING–I LAB.	CO1: Describe the kinetics of a batch and semi batch and adiabatic batch reactor CO2: To understand and demonstrate kinetics of CSTR and PFR CO3: Perform RTD studies in a CSTR
PROCESSING OF OIL SEEDS, OILS AND FATS	CO1: Students will be able to implement their knowledge in choosing proper extraction process and CO2: Students will be able to optimization of process parameter of oil from diverse oil bearing material. CO3: Will also be able to optimize refining and storage conditions of oils and fats without rancidity development. CO4: Students will also be able to optimize by product utilization and manufacturing of valuable products out of that.
PROCESSING OF OIL SEEDS, OILS AND FATS (PRACTICAL)	CO1: Students will be able to implement the practical knowledge of extraction of oils and fat content in food products. CO2: Students will be able to implement the practical knowledge of characterization of oils and fat content in food products. CO3: Students will be able to implement the practical knowledge of optimization of oils and fat content in food products. CO4: Students will be able to detect adulterants in oils/fats.
PROCESSING OF MILK AND MILK PRODUCTS	CO1: Students will be able to implement their knowledge in milk procurement, processing and packaging. CO2: Students will be able to implement their knowledge in optimization of development of milk products. CO3: Students will be able to detect adulterant present in the milk and milk products. CO4: Students will be able to implement their knowledge in dairy equipment

COURSE	Course outcomes
	design and optimization of process variable of milk processing.
PROCESSING OF MILK AND MILK PRODUCTS (PRACTICAL)	CO1: Students will be able to implement their knowledge in milk Industry during processing, packaging and optimization of pasteurization conditions, CO2: Students will be able to implement the knowledge in making milk concentrate, milk powder and icecream. CO3: Student will be able to implement their knowledge in dairy equipment design and optimization of process variables of milk processing. CO4: Students also will be able to apply their knowledge in detecting adulterant present in the milk and milk products.
CHEMICAL ENGINEERING COMPUTATION LAB. (PRACTICAL)	CO1: Determination of solution of linear and non-linear algebraic and transcendental equations using computer programs or MATLAB. CO2: To carryout Numerical differentiation & integration using computer programs. CO3: To find solution of Ordinary and partial differential equations using computer programs. CO4: Carryout Interpolation and least squares approximation using computer programs.
PROCESS PLANT DESIGN-II	CO1: Design and specifications of double pipe heat exchanger, shell and tube heat exchanger, plate type heat exchanger, condenser and reboiler. CO2: Design of distillation column, calculation of number of plates, height and design of fractionator internals- sieve tray. CO3: Design aspects of fixed bed reactors and fluidized bed reactors.
SEMESTER-VII	**SEMESTER-VII**
PROCESS DYNAMICS & CONTROL	CO1 Describe need of chemical process control & design aspects of a process control system. Laplace transform and transfer functions. Difference between lumped and distributed parameter system. CO2 Define dynamic behaviour of first and higher order systems. Different modes of control actions and their basic characteristics, controllers and their characteristics, control valves CO3 Describe closed loop transfer functions, transient response of simple control systems, Routh stability criterion, Root locus. Introduction to frequency response CO4 Describe and apply advanced control techniques such as cascade control, feed forward control, ratio control, inferential control
PROCESS DYNAMICS & CONTROL LAB.	CO1: To plot the response curve for a given input to a U-tube manometer and to determine the transfer function from the response CO2: To study the dynamics of the given thermometer and compare the theoretical value of its time constant with the experimental value. CO3: Determine Experimentally characteristics of of control valves and liquid level measurement systems. CO4: Experimental studies on temperature and pressure control systems.
PROCESS ENGINEERING ECONOMICS	On successful completion of the course students will be able to: CO1: Formulate and apply interest factors to real life engineering problems CO2: Perform economic analysis for process to calculate equipment cost CO3: Develop and apply mathematical models describing real life cash flows and time value of money CO4: Evaluate engineering alternatives and profitability for process CO5: Perform breakeven analysis and optimum and plant design of a process.
LITERATURE SURVEY, REPORT WRITING & SEMINAR	CO1: Survey of scientific, technical and commercial literature in engineering/technology and defining problem statement. CO2: Critical analysis and evaluation of literature CO3: Demonstrate effective public speaking and impromptu discussions CO4: Write technical report in a coherent and concise manner.
SEMESTER-VIII	**SEMESTER-VIII**
ENVIRONMENTAL ENGINEERING	CO1: Describe principal air pollutants, their sources and effects. CO2: Discuss atmospheric dispersion of air pollutants and estimate

COURSE	Course outcomes
	concentration of air pollutants. CO3: Demonstrate the construction, working and theory of equipments used for the control of air pollution. CO4: Classify water pollutants, their sources and effects and calculation of water quality parameters. CO5: Application and design of physical/ chemical/ biological treatment methods for small communities/municipal sewage/industrial water/ waste water treatment. CO6: Classify solid wastes, their sources, effects and methods of disposal of solid wastes.
ENVIRONMENTAL ENGINEERING LAB.	CO1: Calculate BOD, COD, TSS & TDS of wastewater samples. CO2: Determination of chromium separation, phenol content of water sample & To find the biodegradation constant (K) and the effect of timing on it CO3: Practice and apply electro dialysis apparatus and reverse osmosis set up for waste water analysis. CO4: To use stack monitoring kit to find: Efficiency of a cyclone & Dust sampling.
PROJECT WORK	CO1: Apply the knowledge of Food Technology and basic sciences to design or fabricate a system/unit/plant. CO2: Apply knowledge to solve energy and material balance in Food Technology and design efficient process. CO3: Analyze the process components and perform the cost analysis and efficiency of the process.
PROCESS MODELLING & SIMULATION	CO1: Describe fundamentals of modelling and simulation, formulate mathematical models and perform degree of freedom analysis. CO2: Derive the mathematical models for chemical engineering systems and solve them using any one of the softwares Polymath/C/C++/Matlab. CO3: Apply simulation to get the output for the models of heat exchangers, distillation columns, reactor and process equipment.
COMPREHENSIVE VIVA	CO1: Demonstrate technical knowledge of theory and practical subjects taught during whole degree course. CO2: Demonstration of professional aptitude, learning ability and communication skills, originality and capacity for application of this profession to service of mankind. CO3: Strive for lifelong learning, exhibiting professionalism and ethical behaviour and service of the nation, discipline and society.
DEPARTMENTAL ELECTIVE	**DEPARTMENTAL ELECTIVE**
MEAT, FISH & POULTRY TECHNOLOGY	CO1 Know the status of meat industry in India and study about structure of meat, nutritive value and shelf life of meat. CO2 Provide an understanding of the technology for handling, processing, preservation and byproduct utilization of meat industry. CO3 understanding the composition, structure of fish and poultry eggs and various techniques used for the preservation of eggs and fish. CO4 understanding the concept of utilization of meat by-products and importance of hygiene and sanitation in meat industry.
PROCESSING OF MEAT, FISH & POULTRY (PRACTICAL)	CO1: Students will be able to apply their knowledge in fish processing industry to optimize several fish preservation processes CO2: Students will be able to implement their knowledge poultry processing industry to optimize several poultry preservation processes CO3: Students will be able to apply their knowledge egg processing industry to optimize several egg preservation processes CO4: Students will be able to implement their knowledge to maintain quality of meat, fish, poultry based processed product during storage.
PACKAGING TECHNOLOGY	CO1: Students will be able to implement their knowledge in design of different packaging material. CO2: Students will be able to implement their knowledge in size of pack and combination of different packaging material to make laminated pack.

COURSE	Course outcomes
	CO3: Students will be able to implement their knowledge in labelling, printing of different packaged foods also able to design packaging machines.
BIOCHEMICAL ENGINEERING	CO1 Gaining knowledge about metabolic pathways and cell growth. CO2 Understanding the concept of enzyme kinetics and their applications. CO3 Designing and creating new processes and fermented products that are better economically and technologically. CO4 Understanding the basic calculations for heat and mass transfer and yield of product.
FOOD BIOTECHNOLOGY	CO1 Learning fundamentals of food biotechnology and application of recombinant DNA technology in food processing industry. CO2 Knowledge of various fermentation techniques for the production of food and medicines. CO3 Learning production methods of organic acids, alcoholic beverages and glycerol and basic knowledge on genetic engineering and genetically modified crop CO4 Developing new products with improved quality and application of biotechnology for treatment of food industry wastes.
FUNCTIONAL FOOD	CO1 Gaining knowledge about concept of nutraceutical and functional foods,their sources and role in prevention of chronic disorders. CO2 Learning methods for identification nutraceutically significant molecules. CO3 Understand the extraction procedures and formulation of functional food along with their stability and analytical issues. CO4 Knowledge of the adverse effects and toxicity issues of nutraceuticals.
INDUSTRIAL SAFETY & HAZARDS	CO1: Identify the various types of hazards in work-place environment, protective and preventive measures in hazard control, Toxic Chemicals, maximum allowable concentrations and other standards. Biological threshold limit values. CO2: Recognize Mechanical and Electrical hazards, Explosives and inflammable substances, radioactive hazards CO3: Select appropriate Personal protective equipments and effective control strategies for Fire prevention. Good housekeeping in industrial environment. CO4: Understand Standard safety procedures and disaster control, OSHAS, OHSMS and OSHA. Current amendments in Indian Legislation on safety and prevention of hazards and safety code: ISO 14000, ISO9000. CO5: Describe Environmental impact assessment. Case studies of typical hazardous industries. CO6: Select proper control strategies for hazardous wastes.
PLANT UTILITIES	CO1: Understand the selection of different utilities to run process plant. CO2: Analyze the use of compressed air through air compressore and vacuum pumps. CO3: Analyse of use of steam and or boiler. CO4: To analyse the power generation through IC engines and turbines. CO5: Understand the importance refrigeration and water resources.
OPEN ELECTIVES	**Open Electives**
PROCESS INSTRUMENTATION	Upon successful completion of the course, the students will be able to: CO1: Classify elements and types of instruments, static and dynamic characteristics of instruments. CO2: Illustrate the different methods for the measurement of temperature and their useful applications. CO3: Elucidate the construction and working of various industrial devices used to measure pressure and vacuum. CO4: Explicate the construction and working of various industrial devices used to measure level. CO5: Discuss methods for measurement of viscosity, conductivity, humidity,

COURSE	Course outcomes
	density, weight and pH. CO6: Describe recording/indicating/signalling instruments and Control Centre. CO7: Construct Instrumentation diagrams.
FOOD REGULATION & QUALITY CONTROL	CO1 Understand the concept of quality and various quality attributes, their measurement and evaluation as well as the quality assessment of food materials on the basis of sensory evaluation. CO2 Learn various methods and techniques for measuring quality of processed and packaged food and recognizing the importance of microbiological methods in food production. CO3 Recognize the importance of food safety and different regulating authorities and food laws prevalent in India and worldwide for different food industries. CO4 Quality aspects of different food products and the effect of various factors on acceptability of the product along with chemical and physical methods employed for assessing the quality of food product.
FOOD QUALITY CONTROL & PACKAGING LAB. (PRACTICAL)	CO1 Understand the need and functions of quality control and various methods used for assessing the quality of food products. CO2 Assessing the importance of packaging as a solution to various factors affecting food. CO3 Gain knowledge on shelf life of food and various methods of estimating it. CO4 Explain the different packaging materials and their properties.
FOOD RHEOLOGY & TEXTURE	CO1 To provide knowledge about basic concept of stress and strain, elastic solids, fluid behaviour etc. CO2 To provide knowledge about rheological behaviour of food, dynamic and static rheological property measurement methods of food, viscoelastic fluids. CO3 To provide knowledge about description and measurement of solid food rheology using Farinograph; Mixograph; Cone Penetrometer; Warner-Bratzler Shear; Kramer Shear Cell; Melt Flow Indexer: CO4. To provide knowledge about rheology of food hydrocolloids dispersions, food suspensions, pastes, gels, Dough, cheese, emulsions, method of measurement of texture of food material fruits and vegetables, extrudates etc.
NANO TECHNOLOGY	CO1: Understand the basis of nanotechnology in terms of bonding, types of nanomaterials. CO2 : Explain methods of synthesis and fabricating nanostructures (top down- bottom up). CO3: Relate the unique properties of nanomaterials to the reduced dimensionality of the material through characterisation. CO4 : Discuss applications of nanomaterials in various fields.
OPERATIONS RESEARCH	CO1: Define and apply Linear Programming methods, describe problem formulation, graphical method, simplex method, duality sensitivity analysis and Transportation model based problems. CO2: Describe Theory of Games, Algebraic, Graphical & Linear programming methods. Queuing Theory, elementary queuing system; single & multiple channel queuing model, , Poisson arrivals and Erlang service distribution; benefits and limitations of queuing theory.
PROJECT MANAGEMENT AND ENTREPRENEURSHIP	CO1: To consider the legal and financial conditions for starting a business venture To evaluate the effectiveness of different entrepreneurial strategies CO2: To understand the nature of entrepreneurship and functions of the successful entrepreneur. To identify personal attributes that enable best use of entrepreneurial opportunities CO3: Explain the concept and attributes of projects, project management system, process and its principles, and various stages of a project. Perform technical feasibility, marketing feasibility and commercial viability using NPV, and further to understand tax and legal aspects of

COURSE	Course outcomes
	a project. CO4: Analyse project appraisal in public & private sector and estimate shadow prices and social discount rate. Examine project risk and performance assessment. Evaluate project management techniques using case studies.