

Construction and use of scales; Lettering; Construction of plane geometrical figures; parabola, hyperbola, and ellipse, special plane curves, epicycloid, hypocycloid, involutes and spirals, helix and simple loci. Construction of isometric scales; isometric projection of simple objects; Orthographic projection of points, lines their traces and inclination; Projection of solids like prism, cylinder, cone, pyramid and development of surface; Introduction to CAD.

ME 304**Workshop Practice**

4(2-0-2)

General; Workshop terminology, ferrous and non ferrous metals, steel and alloy steels, light alloys and non ferrous heavy metals, heat treatment, case hardening, corrossions, Plastics, glue, grease, paint, varnish and lacquers; Carpentry; Timber classification, defects in timber, description and use of tools in carpentry; Smithy; Nature of work in smith's furnace tools and their uses, safety and precautions in smithy, jigs and fixtures, hot and cold working of metals, forging drawing and spinning etc; Fitting; Description and use of files, chisels, hacksaw, vices, hammers and other measuring marking tools, precision measuring tools, dial gauges and inspection gauges; Machine Shop; Classification and description of lathe machine, milling, drilling and grinding machine, special purpose machines- Turret and Capstan –Lathes, gear cutting machines; Welding shop; Types of welding oxyacetylene gas welding, electric arc welding, argon arc welding, MIG and TIG welding, resistance welding, brazing and soldering, use of fluxes; Sheet metal shop; Description and uses of tools used in sheet metal shops, different joints, riveting; Sawing and simple joints, planning; Chipping marking and filing; Knurling, centering, drilling and threading, etc.; Forging operation; Welding joint preparation; Metal arc welding and gas welding practice; Rivetting operation for lap joint; Carpentry shop; Seasoning and preservation of timber, Glues, Paints, Varnishes and Polish; Foundry; Nature of work done in Foundry shop, Preparation of sands like – Green, dry sand, Molasses sand, hand tools and equipment used in a foundry shop, moulding, casting, patterns types, Materials and allowances, moulding sands and moulding methods, casting practices, casting defects; Fitting; Description and uses of marking tools, surface plate, drills, dye, reamers, punches, taps, gauges and other measuring tools; Welding shop; Submerged arc welding, plasma welding, TIG and MIG welding, tools and equipment welding, faults. Precaution used while welding; Machine shop; Introduction of Computer in machine shop, necessity of numerical controlled machines, parts of NC machines, features of NC machines, advantage of NC machine over conventional milling machines, NC programming, Computer numerical control machines, its advantage over NC machines, difference between CNC & DNC machine and its features, APT language, advantage of CAD / CAM (Computer aided design and manufacturing) in agricultural engineering and its applications; Simple exercises in moulding; Exercise based on drilling, fitting & tapping operation; Writing NC Programme and feeding on production NC Lathe console for milling operation; Exercise based on different types of joint in carpentry; Exercise based on taper turning, threading and milling; Exercise based on arc welding.

Practical: Sawing and simple joints, planing; Chipping marking and filing; Knurling, centering, drilling and threading, etc.; Forging operation; Welding joint preparation; Metal arc welding and gas welding practice; Riveting operation for lap joint.

MBMT 349**Introductory Microbiology**

3(2-0-1)

Systematic study of major groups of micro-organism of importance in food industry; Principles and methods of food preservation; Food spoilage and its causes. Food in relation to diseases; Sources and types of micro-organisms of milk; Starter culture; Role of micro-organism in the manufacture of milk and milk products. Microbial spoilage and dairy products and their control; Isolation and identification of micro-organisms involved in food spoilage; Enumeration and diagnosis of food poisoning organisms; Isolation of micro-organisms from milk and milk products and their identification;

Microbiological grading of milk and milk products.

Practicals: Familiarity with equipment to be used in Microbiology Laboratory, Cleaning, washing and sterilization of glass wares, Observation of permanent slides to study the structural characteristics of common bacteria, fungi, algae & protozoa, Staining techniques, Preparation and sterilization of different media types.

ECON 331 Principle of Economics 2(2-0-0)

Basic terms and concepts of Economics, Meaning and nature of Micro and Macro Economics, nature and scope of Agricultural Economics, its role and importance, characteristics of factors of production, measures to improve land productivity, Government policies Labour – division of labour, problems of unemployment under employment and disguised unemployment, capital formation in agriculture, forms of business organizations, Demand - law of demand – types of supply, law of supply – factors influencing supply, elasticity of supply. Price determination under different market situations. –Government policy Characteristic features of developed and under developed economics. International trade in Agriculture – exim policy – role of W.T.O., International Trade in Agriculture. Financial institutions and their role; RBI, IDBI, IMF, NABARD, SIDBI

APFE 301 Fundamentals of Food Technology 3(2-0-1)

Scope of food processing in India; Introduction to food processing, food preservation, food packaging, food drying and dehydration, fruit and vegetable processing, processing of meat and meat products, processing of milk and milk products, processing of marine products. Important food industries in India; role of food technology in national economy.

Practical: Estimation of moisture content of food materials; Study of Food processing equipments; Study of different packaging materials; Determination of drying characteristics of fruits, vegetables, meat and marine products.

GPT 301 Moral & Value Education 2(2-0-0)

My country and my people, the many Indians, being and becoming an Indian, Nationalism and Internationalism; Some life issues – Love, Sex and marriage, Men and Money - value of time, meaning of work, human communication, human suffering, addiction, ecology, women's issues; Understanding one's neighbor, neighbor-hood groups: their structure and functions, patterns of social interaction of group dynamics; Preparation for career, choice of vocation, motivation for study and research, The present education system: curriculum and syllabus, teaching method, examination and work experience. Definition of value education, Moral and Ethics, Laws and Moral based on Ten Commandments and two great commandments; Discovery of self, Self-awareness, Growth of intellect- Man's spiritual nature, emotions, will. Respect the rights of life, liberty, property, and truth reputation. Sin, Origin of sin, manifestation of sin, the results of sin, the remedy of sin, sin as an act, sin as a state, sin as a nature; Conscience – as defined in Oxford dictionary and Winston Dictionary, types of consciousness (such as evil, convicted, purged, pure, weak, good, void of offence).

SEMESTER II

APFE 303 Principles of Food Engineering 3(2- 0- 1)

Units and dimensions, mass and energy balance, flow of fluids, heat transfer, modes of heat transfer, heat exchanger, kinetics of chemical reaction in foods, evaporation, dehydration, drying, refrigeration, physical separation process and extraction.

Practicals: Application of psychometric chart in food engineering, measurements of pressure and fluid flow, study of heat exchangers, dryers, pulper, juicer, bottle washer, vacuum packaging, milling machines and equipments.

ME 401

Engineering Graphics-II

2(0-0-2)

Forms of screw threads-BSW square metric, representations of threads, bolts, headed counter sunk stud, screws and set screws, nuts hexagonal square, keys types taper sunk taper hallow saddle round gib head feather and woodruff keys, spline shaft. Rivet heads and Rivetted joints; Cotter joint, knuckle joint, foot step bearing, stuffing block, plumber screw jack.

CHEM 563

Food Chemistry

5(3-0-2)

Physico-chemical properties of foods. Physical properties- solutions, osmotic pressure, acids, bases, pH, buffers, boiling point, freezing point, colloids, viscosity, surface tension emulsions. Water-moisture content of food, bound water. Carbohydrates - structure, cooking properties & functions of starches dextrin's, cellulose, fibers, hemicellulose, pectins, gums in different foods, function of sugar in food browning. Lipids- classification,, physical characteristics, structure and functions & effect on cooking properties of lipids in foods, rancidity, hydration. Proteins- types of food proteins, physical characteristics, structures, functions and effects on cooking properties of various animal & plant proteins, denaturation properties, proteins gels, pigments and color. Role and effects of cooking on chlorophyll's, myco-globin, hemoglobin, authocyamins, flavoroids, tannins, carotenoids, quinones, xanthones, pectins and their contribution to acceptability of food. Use of synthetic colours in food. Flavour- sensation of taste, smell, visual appearance, flavour texture of food. Flavour compounds-terpenoids, flavoroids, sulphur compounds & others volatile flavour compounds and their role in sensory evaluations. Enzymes- enzymes in food processing, enzymic browning.

Practicals: Proximate analysis of foods, physico-chemical properties of foods, measurement of T.S.S., conductivity, pH, acidity etc. Estimation of vitamins and anti nutritional factor.

MAS 411

Engineering Mathematics – I

4(3-1-0)

Differential Calculus: Asymptotes- curves and curvature partial differentiation-Euler's theorem, total differential coefficient. Taylor's theorem for two variables, maxima and minima Lagrange's multiplier. Integral Calculus: Application of integral calculus area enclosed by curves length of arc. Volume and surface of revolution, Evolution of double and triple integrals, Gamma and Beta functions- Dirichlet's integral. Simple tests of convergence of integrals; Infinite Series: Convergence and divergence of series, tests of convergence, Alternating series, absolutely and conditionally convergent series, uniform convergence.

COMP 410

Computer and Languages

4 (2-0-2)

Details of computer organization and peripherals, types of computers, hardware –software, working in DOS and Window environment, networking, algorithms and flow charts, programme development, arithmetic expressions, programme compilation, debugging and testing. Concept of structured programming, subroutines and functions. Computer viruses, solution of engineering problems using BASIC / FORTRAN. Future trends and in computer laws and piracy. Study of computer components, computer practice of DOS commands, study of BASIC using READ, DATA, PRINT statements etc., numerical integration and differentiation using BASIC language, BASIC programme for 't' test, BASIC programme for random number generation in different ranges, FORTRAN programme- READ, WRITE AND PRINT Statement, free Format and Formatted INPUT AND OUTPUT Statements, solution of Quadratic equation using FORTRAN language, use of subroutines in the main programmes, use of function sub programmes in the main programmes, Runge - Kutta method, Trapezoidal – Simpson's rule.

Practicals: Study of computer components, computer practice of DOS commands, study of BASIC using READ, DATA, PRINT statements etc., numerical integration and differentiation using BASIC language, BASIC programme for 't' test, BASIC programme for random number generation in different ranges, FORTRAN

programme- READ, WRITE AND PRINT Statement, free Format and Formatted INPUT AND OUTPUT Statements, solution of Quadratic equation using FORTRAN language, use of subroutines in the main programmes, use of function sub programmes in the main programmes, Runge- Kutta method, Trapezoidal – Simpson's rule.

EEE 301

Basic Electrical Engineering

4(2-1-1)

Kirchhoff's laws, delta star and star delta transformation, Thevenin's and super position theorem, A.C fundamentals, average and effective values in signals, transient and steady state response of circuit, active and reactive power, resonance in circuits, filters, analysis of three phase circuits, characteristics of magnetic and dielectric materials, magnetic circuit, hysteresis and eddy current losses, two port network parameters, force acting on current carrying conductor in magnetic field, magnetic force due to electric current, statically and dynamically induced EMF, stored energy, force between parallel conductors, single phase transformer, construction principle EMF equation, transformer efficiency.

Practical: Verification of Kirchhoff's laws, measurement of current voltage, frequency and power, determination of impedance and its components, three phase power measurements, electromagnetic relays and solenoids, calibration of energy meter and watt meter, no loads and open circuit test of a transformer, efficiency of the transformer, circuits phasor diagrams of single phase circuits, relation between line and phase voltage and currents.

LNG 305

Professional Communication & Technical Writing

3(2-0-1)

Reading Comprehension- Factual- formulating translating global comprehension – language- in –use in terms of synonyms, collection in context, introduction to different types of writing – descriptive – narrative and exposition letter-writing-formal and informal –speech acts-norms of preparing introductory address, presidential address, vote of thanks; Integrated grammar by means of class exercise, common errors in English writing –use of cohesive devices – dialogue practice –orientation to different types of letters-performing different speech acts according to contexts –exercise based on examination like TOEFL, GRE and GATE.

APFE 302

Principles of Food Processing & Preservation

3(2-0-1)

Introduction and historical developments in food processing and preservation; General Principles in food processing ; Methods of food processing ; Principles of food preservation ; Preservation by high temperature; Preservation by low temperature; Sun drying , Dehydration, freeze drying , dehydrofreezing,; Preservation by chemicals; Preservation by fermentation and irradiation; Canning , can manufacture.

Practical: Estimation of water activity, Study of processing and preservation equipments, freezing and dehydration of fruits, vegetables and meat. Preservation of syrups, squashes, juices, jams , jellies and pickles

LNG 305 + communication process, grammar, letter writing (types of letter writing), Report writing - types, formats, methods, Technology based communication - email - web - mobile - telephones, Internet, communication

SEMESTER III

MAS 490

Engineering Mathematics – II

4(3-1-0)

Vector Calculus: Differentiation of vector's –directional derivatives, line surface and volume integrals statement of Gauss, Green's and Stoke's theorem and their application; Differential Equations: Differential equation of first order degree- linear differential equations with constant coefficients – Homogeneous equations with variable coefficients, application practical problems, Bessel's and Legenderes differential eqns., Partial differential equations; Matrices: Basic properties transpose,

adjoint inverse and rank of a matrix. Solution of equation. Elementary transformation –characteristics equation, Cayley- Hamilton theorem.

MBGE 455

Food Biotechnology

3(3-0-0)

Prospectus of Bio-Technology. Molecular genetics i.e. fundamentals of molecular biology with special reference to chemistry and biology and DNA. (Primary secondary and tertiary) structures. Biological role of DNA in cell metabolism. Genetic recombination mechanisms and technique used for improvement in microbial strains. Applications of genetical control mechanism in industrial fermentation process, (Induction, manipulation and recombination). Recombinant-DNA technology (plasmids and cloning): Cell and tissue culture. Continuous cultures. Secondary metabolites synthesis. Expression of foreign genes. Promoter (Enzyme). Biomass production by using various micro organisms. Application of Biotechnology in food (Food industries), pharmaceuticals and agriculture. Bio-gas plant

CE 401

Engineering Mechanics

3(3-0-0)

Introduction to mechanics and SI units, review of vector algebra and important vectors equivalent force systems, equivalent forces at a point, simplest resultant in two and three dimensions, equation of equilibrium, free body diagram, reaction, number of unknown, indeterminacy and solvability, two dimensional frames and trusses, method of members, methods of joints and methods of sections, principle of virtual work, friction forces, sliding and rolling friction, belt ropes and chain drives and powers screws, properties of surfaces, centeroids, mass centers, theorem of Pappus and Guldinus, second movement of product of inertia of plain area, parallel axis theorem and pollar moment of inertia, particle kinematics: velocity, acceleration, curvilinear coordinate system and relative motion, particle dynamics, equation of motions, sytems of particle, D' Alembert's Principle and central force.

ME 503

Heat & Mass Transfer

4(3-0-1)

Introductory concepts on conduction, convection and radiation; Conduction: Fourier's Law, thermal conductivity dependence on temperature and pressure in fluids, heat conduction through composite walls, optimum thickness of insulation, general conduction equation under unsteady-state. Transient numerical method for unsteady state conduction in simple geometrical shape e.g. slab, cylinder and sphere; Convection: free and forced convection, Newton's Law of cooling, film coefficient, correlation of Nusselt number, Prandtle number and Grashof number in natural convection systems including other empirical relations. Combined free and forced convection; Radiation: Stefan –Boltzmann law, emissivity, mechanism of radiation heat transfer in systems including solar radiation, collectors. Heat transfer analysis involving conduction, convection and radiation by network; Heat exchange: Overall heat transfer coefficient, fouling factors, log mean temperature difference heat exchange mechanism in various types of heat exchangers, eg. Tubular, extended surface and plate heat exchangers, effectiveness – NTU relationship; Steady state molecular diffusion in fluids at rest and in laminar flow – Fick's Law, mass transfer coefficients. Mass heat momentum transfer analogies, unsteady-state diffusion, diffusion in solids inter phase mass transfer; Determination of thermal conductivity of a powder and insulating material under steady state using two slab guarded hot plate method.

Practical: Determination of thermal conductivity of a powder and insulating material under steady state using two slab guarded hot plate method, Determination of thermal conductivity and thermal diffusivity of a food, Determination of specific heat using differeential scanning calorimeter (DSC), Measurement of heat transfer coefficient of air under free and forced convection using heat and mass transfer analogy, Determination of overall heat transfer coefficient in an agitated vessel, Determination of overall heat transfer coefficient of a boiling liquid, Determination of effect of packing on heat transfer in packed beds, Determination of overall heat transfer coefficient in parallel-flow and counter-flow heat exchangers, Measurement of emissivity of a surface, Study of plate heat exchanger, Study of

heat transfer from pin/tin, Study on boiling heat transfer and measurement of critical heat flux, Study of heat transfer in a fluidized bed, Determination of masses diffusivity by Winkelmann method, Generation of equilibrium data for mass transfer operations.

ECE 301

Basic Electronics

4(2-1-1)

Introduction to signals, spectra, transducers, electronics and systems, p-n junction diodes, rectifiers – half-wave, full wave, capacitive filters, Zener diodes, power supply and voltage regulation; p-n-p and n-p-n transistors, transistor characteristics, transistor as an amplifier – CE, CB, CC; biasing and bias-stability, small-signal, equivalent Circuits, H-Parameter Model, Signal Handling Capacity, Frequency Response Of Amplifiers; Concepts Of Feedback Amplifiers, negative feedback, gain-bandwidth product, regenerative feedback and conditions for oscillation, oscillators; OP-AMPS and application of OP-AMPS; Field effect devices – JEFT, MOSFET and their characteristics; SCRs, power amplifiers; Logic Gates; Flip – Flops and ICS.

Practical: Familiarity with electronic components and use of multimeters, Use of millivoltmeters, signal generators and oscilloscopes; Pulse and frequency response of R-C and C-R circuits; Half wave and full wave rectifiers, Rectification with capacitor filters and Zener diodes; Transistors, CE amplifier, biasing condition, gain and signal handling capacity; Measurement of frequency response and bandwidth of a CF amplifier; Characteristics of unity gain amplifier and summing circuits; Characteristics of OP-Amp integrators and differentiator; Characteristics of digital logic gates; Studies Flip-Flops, shift registers and counters. Characteristics of OP-Amps, inverting & non inverting amplifiers.

MAS 511

Statistical Methods

3(2-0-1)

Statistic, population parameter, frequency distribution, frequency polygon, histogram, bar chart arithmetic, weighted, geometric and harmonic mean, mode, median for grouped and ungrouped data, standard deviation, mean deviation and coefficient of variation, simple and multiple correlation coefficient, regression line, fitting equations to data by least square method, curve linear regression line, fitting equation to data by least square method, curve linear regression. Test of significance ; t,F and X² tests. Distribution: Normal, Binomial and Poisson distribution, confidence interval. Analysis of variance; definition, assumption, one way and two way classification with one per cell, probability theory.

Practical: Computation of Arithmetic, weighted, geometric, harmonic means, mean distribution, standard deviation, coefficient of variation, fitting of data, Problems on Normal, Binomial and Poisson distributions. Tests of significance. Problems on analysis of variance.

APFE 401

Engineering Properties of Biological Materials

3(2-0-1)

Introduction: Physical, Mechanical, Thermal, Electrical and Optical properties of bio-food materials, Effect of temperature on water activity, controlling food water content; Physical characteristics, shape, size, volume, density, porosity and surface area of the food materials; Basic concept of rheology, Rheological equations and models, viscoelastic characterization of food materials, Rheological properties of food materials; Force-deformatics, stress- strain, elastic – plastic, Bulk stress – strain, viscoelastic behaviour; Rheology and texture of food materials, Mechanical damage of food materials, causes, Biological and chemical reaction, Damage of food materials under static, impact and vibration; Aero-hydrodynamic characteristics and its application to agricultural products, Basic concepts of friction in food materials, solid friction, rolling resistance, internal friction, Power losses due to friction, Thermal, Electrical and Optical properties of food materials.

Practical: Determination of shape, size, roundness sphericity, Volume and density, Porosity and specific gravity of surface area, Hardness of food materials, Determination of textural properties of food materials, Visco-elastic properties; Determination of thermal properties, specific heat, Thermal

Kinematics of fluids: Lagrangian and Eulerian description of fluid motion, stream lines, path lines, streak lines, types of fluid flow: translation, rotation, circulation and vorticity; stream function, velocity potential and flow net; discharge; system, control volume and cross section; stress-strain rate relationship, linear and angular momentum theorems and application; some exact solutions of Navier-Stokes equation.

Dynamics of third: Transport theorem, conservation laws, equation of continuity, Euler's equation of motion, Bernoulli's equation, viscous flow.

Dimensional Analysis & Similitude: Ralegile's method & Buckingham's Pi theorem, types of simulates, dimensional analysis, dimensionless numbers.

Internal flow: Laminar & turbulent flow in pipes, general equation for head loss-Daicy-Weisbach and Fanning's equations, Moody's diagram, energy losses through pipe fittings, flow through network of pipes.

Non-Newtonian fluid flow:- Power law representation of shear stress-shean rate relationship, measurement of flow behaviour index and consistency co-efficient, generalized viscosity co-efficient.

Concept of boundary layer, hydrodynamic forces on immersed bodies: drag & lift; flow through orifices, mouthpieces and over weirs & notches; flow in open channels.

Practical: Study of pressure measuring devices, Relationship between depth of liquid and pressure exerted by it, Determination of metacentric height of floating vessels, Determination of pressure drop flow rate relationship for flow of air through packed bed and fluidization velocity, Determination of flow pattern, port arrangement and pressure drop in a plat heat exchanger, Verification of Bernoulli's theorem, Demonstration of laminar and turbulent flows, Determination of head loss through pipes and pipe fittings. Determination of coefficient of discharge for a venturimeter, Determination of orifice meter coefficient, Calibration of a notch , Measurement of non-Newtonian parameters of liquid foods, Determination of forces on submerged bodies, Flow visualization using smoke in a transparent tube to demonstrate path line, streak line, laminar and turbulent flows, Experiments using water table to demonstrate various flow phenomena, Measurement of viscosity surface tension of liquids, Demcnstration of momentum theorem using impulse and reaction turbines ,Estimation and measurement of flow rate through single screw extruder.

EEE 402

Electrical Machines

4(3-0-1)

D.C Machines: Constructional features and principles of operation of shunt, series and compound generators and motors including EMF equation and armature reaction; Performance characteristics of generators and motors, starting, speed control and braking of motors, 2- quadrant and 4 – quadrant operation of motors; Choice of D.C. motors for different applications; Losses of efficiency.

Transformers: Construction, E.M.F equation, principle of operation, phasor diagram on no-load, effect of load, equivalent circuit, voltage regulation, losses and efficiency, test on transformer, prediction of efficiency and regulation, auto- transformers, instrument transformers, three-phase transformer.

Induction Motors: Rotating magnetic fields, principle of operation, equivalent circuit, torque slip characteristics, starters for cage and wound rotor type induction motors, speed control and braking, single -phase induction and methods of starting.

Synchronous Machines: Construction, e.m.f. equation, effect of pitch and distribution, armature reaction and determination of regulation of synchronous generators, principle of motor operation, effect of excitation on line currents (V- curves), method of synchronization; typical application of A. C. motors industry.

Practical: Study of D.C and AC machine constructional features and connections; Study of various types of starters for D.C. and A.C motors. Saturation characteristics of a D.C machine and load test on D.C. shunt generator; Determination of performance of characteristics of shunt motor; Speed control of a D.C. compound motor; Performance characteristics of D.C compound motors; Open circuit (O.C), short circuit (S.C) and load test on a single -phase transformer; Regulation of alternators by O.C and S.C. tests; Speed control of 3 phase induction motors. Determination of V-curve of synchronous

motors; performance characteristics of 3-phase induction motors; Performance characteristics of 1-phase induction motors including capacitors start / run 1-phase motors.

SES 415

Environmental Studies – I

2(1-0-1)

Definition, Scope and Importance. Ecosystem, concept of an ecosystem, structure and function of an ecosystem, Producer, consumer and decomposes, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, Characteristic features, structures and function of the following ecosystems: forest ecosystem, grassland ecosystem, desert ecosystem and aquatic ecosystem; Social Issues and the Environment: from unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, watershed management, resettlement and rehabilitation of people; its problem and concerns, Case studies. Environmental ethics, Climatic change, wasteland reclamation, consumerism and waste products. Environmental Protection Act. Air (Prevention and control of pollution) act. Issues involved in enforcement of environmental legislation. Public awareness.

Practical: Visit of different polluted sites to assess their effect on pollution, monitoring of pollutant in ecosystem. Study of simple ecosystem- ponds, rivers, hill slopes. Study of common plants, insects, (Herbarium file/ insect box) Visit of local polluted site- urban/rural/agricultural/ industrial. To study the different purification of industrial effluents and wastes.

APFE 501

Food Handling & Storage Engineering

3(2-0-1)

Overview of material handling system and devices in food processing plants. Design of screw, bucket, belt, oscillation & vibrating conveyor. Refrigerated transportation of food materials. Principles and practices of storage: Physicochemical changes in stored products during storage, air tight, non-air tight, under ground conventional & modern storage structures for fruits, vegetables, meat and marine products ; Aerated, refrigerated and controlled atmospheric storage; Layout and Design of storage structures, economics of storage structures.

Practical: Study of bucket elevator, belt conveyor, screw conveyor and vibrating conveyor, determination of capacity of cold storages, visit and study of godown and cold storages.

APFE 513

Quantitative Techniques in Food Processing

4(3-1-0)

Definition: Principles components of decision problem; scope in Agricultural and food engineering, Application of linear and dynamic programming in food processing; Transportation and assignment models in food processing; Queing theory; Application of PERT-CPM in food processing; Optimization and simulation techniques in food processing.

APFE 411

Principles of Thermal & Non-thermal Food Processing

3(2-0-1)

Principles of Thermal and non thermal food processing, Definition and scope of thermal processing; concept of Retart technology; Thermal processing and food quality analysis and control; Radio frequency heating, microwave processing, infra red heating, instant and high heat infusion, ohmic heating, combined high pressure and thermal treatment of food; High hydrostatic pressure food processing, oscilating magnetic field food processing, Application of light, pulses in the sterilization of food and packaging material, food irradiation and hurdle technology.

Practical: Estimation of moisture content by infrared moisture meter, study of processing and sterilization of vegetable and fruits with Retert, Microwave, Infra-red, Ohmic, High pressure and pulsed electric field techniques.

SEMESTER V

ECE 512 Instrumentation & Control Engineering 3(2-0-1)

Measurement system and error analysis, measurement of level, flow, temperature, strain pressure, vacuum, force, torque, power, displacement, vibration, acceleration, pH, colour viscosity, surface tension and composition. Indicating recording instruments, digital displays, transmitting and telemetering devices.

Introduction to control system- Feedback and feed forward control strategies, block diagrams, Laplace and inverse Laplace transforms mathematics models of physical systems, transfer functions steady state analysis, dynamics of first and second order systems. Mode of control and generation of control action; P, PI and PID control elements and value positioners, frequency response and root locus analysis. Stability and quality of overall control.

Electronic, pneumatic and hydraulic control systems and their application in farm machinery, food processing industry, aquaculture and their applications milk processing plants.

Practical: Calibration of Bourdon pressure gauge; Dynamic calibration of different types of thermometers, Determination of time constants of thermometers and thermocouples. Calibration of differential pressure transmitters; Calibration of velometer and hot wire anemometer; Speed measurement using non-contact type sensors; Determination of discharge coefficient using morificemeter and venturimeter; use and calibration of rotameter, pH meter, conductivity meter and viscometer; Static calibration of flapper nozzle assembly; Calibration of pneumatic P, PI and PID controllers; Study and calibration of control valves; Cascade control of level and flow/temperature and flow.

ME 511 Boiler Technology 2(2-0-0)

Fuels; types of fuels and their properties, chemical properties, combustion, stoichiometric air requirement, burners, storing of fuels, properties of steam, mollier chart and steam tables, classification of boilers, fire tube and water tube boiler, mounting and accessories, feed water treatment; Draught, natural and force height of chimney, Plant layout, economy in heat energy, boiler maintenance and safety, Use of boilers in food industries, boiler codes, Indian Boiler Regulation Act.

MBMT 504 Principles of Food & Dairy Microbiology 3(2-0-1)

Introductory concepts. Role of intrinsic and extrinsic parameter that affect microbial growth of foods. Classification of new organism, Control of microbial population. Food Spoilage. Microbiology of foods fermentation or respiration; Mechanism of energy production oxidation and substrate level phosphorylation, Fermenters type, functions design and control, Fermentation - mechanism, conditions and factors affecting fermentation;

Practical: Isolation and identification of some important food borne microorganisms, Microbiological grading of milk and milk products on the basis of SPC, DMC, MBR, Coliform test and Rapid platform tests.

SES 416 Environmental Studies – II 2(1-0-1)

Natural Resources: forest resources, water resources, mineral resources, food resources, energy resources, land resources. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable life style.

Biodiversity and its conservation: Introduction, definition, genetic, species and ecosystem diversity. Bio geographical classification of India, Value of diversity, consumptive use, productive use, social, ethical aesthet and option values. Biodiversity at global, national and local levels. India as mega-diversity nation. Hot-spot of biodiversity. Threat to biodiversity: habitat loss, poaching of wild life, man-wild life conflicts. Endangered and endemic species of India. Conservation of biodiversity, In-situ conservation of biodiversity.

Environmental Pollution: definition, Causes effect and control measures of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards. Solid

waste management: causes effect and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster Management : flood, earthquake, cyclone and landslides.

Practical: Identification and study of different Natural resources. Determination of chloride in water sample. Determination of pH in water sample. Determination of Acidity in water sample. Determination of hardness in water sample. Determination of alkalinity in water sample. Determination of turbidity in water sample. Identification of different tools for measurement of Environmental pollution.

APFE 404 Cereals, Pulses & Oil Seeds Technology

4(3-0-1)

Composition, Structure and Processing characteristic of Cereal grains, Legumes and oilseeds, Post harvest, Post processing practices for their safe storage, Parboiling and Milling of paddy, Quality characteristics, Curing and aging of rice, Processed rice products, Wheat and its quality characteristics of milling into flour and semolina, Flour milling, Turbo grinding and air classification, Flour grades and their suitability for baking purpose, Assessment of flour quality and characteristics, Milling of Durum wheat, Macaroni products; Ingredients, Technology and quality parameters for baked products; Bread, Biscuits and cakes; breakfast cereals, Dry and Wet milling of corn, starches and its conversion products, malting of barley, Pearling of Millets, Milling of legume-pulses by traditional and improved processes; Processing of oil seeds for direct use and consumption, Oil and protein products, Processing of extracted oil refining, hydrogenation, interestrification, Processing of deoiled cake into protein concentrates and isolates; Textured protein, Functional protein preparations, peanut butter, Margarine and Spread.

Practical: Experimental milling, physico-chemical tests for flour quality of wheat, Rheological properties of dough, test baking, physico-chemical tests of rice and evaluation of cooking quality, Milling and parboiling of paddy, Dhal milling, visit to dhal mills; Preparation of protein concentrates and isolates, Antinutritional factors in pulses and extruded products.

APFE 408 Technology of Dairy Products

2(2-0-0)

Fluid Milk : Composition of milk and factors affecting it; Physico-chemical characteristics of milk and milk constituents, production and collection, cooling and transportation of milk. Packaging storage and distribution of pasteurized milk: whole, standardized, toned, double toned and skim milk. Test for milk quality and adulteration; UHT processed milk, flavored, sterilized milk. Cleaning and sanitation of dairy equipments; Cream: Definition, classification and physico-chemical properties of cream; Butter: Definition, classification, composition and methods of manufacture; Ice cream: Definition, classification, composition, constituents and their role. Preparation of mixes and freezing of ice cream, over run, judging, grading and defects of ice cream; Evaporated and condensed milk : Method of manufacture, packaging and storage. Roller and spray drying of milk solids, Instantization, flow ability dustiness, reconstituability, dispersability, wet ability, sink ability and appearance of milk powders. Manufacture of casein, whey protein, lactose from milk or use in formulated foods.

APFE 409 Processing of Marine Products

2(2-0-0)

Importance of fisheries, Classification of aquatic animals; Composition and Nutritional Quality of Fish; Transportation and storage of fish; Unit operations in fish processing, preservation by curing, chilling and freezing of fish, drying, fish products, canning of fish products, modified atmosphere packaging of fish and fish products; HACCP and quality assurance of sea food.

APFE 611 Food Packaging Technology

3(2-0-1)

Chemical and physical properties of package materials, interaction between package and food, selection and evaluation of packaging materials and systems, package design criteria, printing, computers application in packaging, modified atmospheres, Corrosion, scale-up, waste engineering, CIP systems.

Practical: Estimation of shelf life of fresh and preserved food using various packages such a metal container, glass container and flexible packages; Determination permeability of different plastic films; Estimation of protection against micro-organisms in various food packages; Identification of plastic films; Visit to Packages Limited, Lahore.

AET 400

Training – I

1(0-0-1)

SEMESTER VI

ABM 402

Agri-business Management

3(3-0-0)

Definition, History, function productive system, operations, decisions, decision frame work, produces of series & goods critical themes, operation strategy, model, objectives, types External factor, international operations, rescued operations, stages, new production introductions, new product development, technology development, quality function development, Value analysis, modular design; Quality management, quality control and improvement, process selection, service operation design, choice of technology, layout of facilities, forecasting.

APFE 403

Technology of Beverages

4(3-0-1)

Introduction, classification, Beverage industry in India, Traditional beverages; Manufacturing technology of mineral water and carbonated drinks; water quality, treatment and fortification process, Bottling, Packaging, storage and transportation, fruit beverages; squash, cordial, nectar, crush, alcoholic beverages; Milk beverages, selection and economics of different beverages packaging materials, selection, operation and maintenance of beverage machines / equipments, Automation in beverage industries, quality control and safety in beverage industries, Waste management in beverage industries, Marketing of beverages.

Practical: Preparation of different beverages, Effect of different ingredient on the quality of beverages; Water treatment, Preparation of syrups; Sensory evaluation of beverages, Chemical and microbiological analysis of different beverages, Visit to beverages Industries.

APFE 503

Technology of Meat & Poultry Products

3(3-0-0)

Meat and poultry industries in India – kinds of meat animals and poultry birds – pre-slaughter care – methods of stunning – slaughtering – dressing of meat and poultry – post slaughter care and post mortem inspection – classification and quality of meat – Aging, curing smoking, canning and irradiation preservation of meat, Freezing and dehydration of meat and meat products, curing agents and additives – meat products – formed and sectioned meat – sausage products 0 hygiene and sanitary conditions in a meat processing plant; Formation, structure, chemical composition and nutritive value of eggs – Collection, handling, grading and quality parameters of eggs – methods of preservation of egg and their products – spoilage of egg and their products – hygiene and sanitation, regulations; Recent development in meat and poultry processing, quality processing, quality and safety control measures, Planning, Layout design consideration in meat and poultry processing unit, export regulation of meat and poultry products.

Practical: Meat preservation, canning, cooking, freezing, sausage making, meat products preparation, Visit to meat processing industries.

APFE 504

Unit Operations in Food Engineering

4(3-0-1)

Principles of fluid flow, heat transfer, heat exchanger, EMC & Water activity, Evaporation, Distillation, Drying, Dehydration; Types of dryers, Material handling equipment; Size reduction, Energy requirement in Size Reduction; Sieve analysis, Mixing, Kneading, Blending, Homogenization, Size Separation, Sedimentation, Extraction, Leaching, Crystallization, Thermal Processing, Refrigeration principles, Cooling, freezing, thawing of food materials. Irradiation; absorption and adsorption, Mechanical Cleaning, Grading, Sorting, Filtration, Membranic Separation, Emulsification.

Practical: Separation efficiency of centrifugal separator, energy requirement in size reduction using burr mill, hammer mill, muller mill, economy and thermal efficiency of rotary flash evaporator for concentration of juice, collection efficiency of cyclone separator, liquid-solid separation by filtration, particle size determination by sieve analysis – visit to solvent extraction, sugar, tapioca starch and food industries, drying rate calculation, calculation of refrigeration load.

APFE 506

Fruits & Vegetable Processing

3(2-0-1)

Unit operations; receiving, washing, grading, peeling, size reduction, blanching, sulphiting / sulphuring, syruping/brining, exhausting, processing and packaging; Processing technology of the manufacture of new products from fruits and vegetables; beverages, preserved, sauces, pickles, soups and others; Preservation technologies; Packaging requirements; Spoilage of processed fruits, vegetables and their control; Nutritional evaluation of processed foods; Plant layout and hygiene; Fruit and vegetable plant layout, design, personal hygiene, plant sanitation and waste disposal; Quality control in fruits and vegetables processing industry.

Practical: Equipment for fruits and vegetable processing, Plant-layout, can seaming operation, Preparation of fruit juices, squashes, syrups and ready to served beverages; Canning of fruits and vegetable; Preparation of jams, jellies, marmalade, preserved, and candies; Preparation of pickles, chutneys, and tomato products, Drying of fruits and vegetables, quality control of processed products; Visit to fruit and vegetable processing factories, freezing of foods, Processing of mushroom.

APFE 514

Energy Management in Food Industries

2(2-0-0)

Energy: Basic concepts, energy sources, renewable and non renewable, statistics of world and Indian energy scenario, food industry, energy auditing, management of energy sources, efficiency and utilization, solar energy, drying of agricultural food products, water heating, solar distillation, power generation through photovoltaic system, fuel efficiency and performance of furnaces. Biomass gasification, application in food industry; Heat energy recovery and waste heat utilization, energy from vegetable and municipal solid waste, wind energy for pumping and electric power generation.

APFE 515

Food Additives

2(2-0-0)

Scope, permitted food additives, General principles for the use of food additives. GRAS and international regulatory status (FAO, WHO, WTO) of food additives, functions, types, modes of action, consequences of use, risks and benefits of food additives. Nutritional additives, preservatives, anti-microbial agents, antioxidants, emulsifiers, enzymes and acidulants, flavoring agents and flavor enhancers. Sweeteners, natural and synthetic, coloring agents; Methods used for safety evaluation, food additives and hypersensitivity.

APFE 605

Baking & Confectionery Technology

3(2-0-1)

Technology of baking; dough rheology; equipments; baking of bread; Sponge goods; biscuits and cookies; flaky pastry; pie; Danish pastry; bakery decorations; Confectionery ; cocoa and chocolate manufacture; role of ingredients and additives; stages of sugar cookery; machinery; confectionery products; packaging.

Practical: Rheological properties of dough; preparation of bakery items; packaging; visit to bakery; sugar confectionery stages of sugar cooking; preparation of confectionery items; visit to confectionery unit.

SEMESTER VII

APFE 505

Drying & Dehydration of Food

3(3-0-0)

Water activity its relation with shelf-life of food materials, equilibrium moisture content and latent heat of vaporization, equipments for movement and heating of air, resistance to air flow in granular bed, drying characteristics of cereals, pulses, oil seeds, spices and other food materials, heat requirement and thermal efficiency of drying systems, operation of different types of dryers, dehydration of food by microwave, dielectric and irradiation.

Practical: Estimation of equilibrium moisture content; Drying characteristics by various methods of fruits, vegetables, cereals and meat products; Effect of drying on food quality.

APFE 507

Quality Control in Food Industry

3(2-0-1)

Hygiene regulation, control of airborne contamination HACCP implementation, Indian experience, Assessing an operation, Microbiological central methods, Instrumental measurements of sensory attribute of foods; appearance, color, volume, density and specific gravity, Rheological and textural characteristics, Textural profile analysis. To relation between instrumental and sensory analysis of food quality attributes.

Practical: Methods of evaluation of sensory quality evaluation of color and rheological attributes, Detection and estimation of food additives and adulterants, Relationship between objective and subjective methods.

APFE 509

Fermented Food Products

3(2-0-1)

Food fermentation, stock culture and inoculum preparation. Lactic acid fermentation of milk, vegetables, cereals and meat. Alcoholic fermentation of fruit juices, sugar and starch substrates. Vinegar fermentation, mixed fermentation of cereal legumes and milk. Malting, brewing, steeping, germination, kilning and curing. Chemical and biochemical changes during malting and mashing. Separation of wort, wort boiling and hops addition. Fermentation, separation, maturation, carbonation and packaging.

Practical: Lactic acid fermentation. Alcoholic fermentation of fruit juices. Acetic acid fermentation and alkaline fermentation. Barley steeping. Germination, malting mashing and brewing; Preparation of wine and distillation of wine.

APFE 510

Dairy Engineering

3(2-0-1)

Market Milk- definition, composition. Physio- chemical properties of milk and other dairy products. Milk reception and storage. Processing of milk- pasteurization, sterilization, homogenization, standardization. Fortification of milk and milk products. Production and preservation of cream butter, ghee, butter oil, condensed & powdered milk, ice-cream. Technology of yogurt, paneer, cheese spread. Packaging and distribution of milk and milk product. Utilization of milk industry by- products. Milk &