

Course Structure
B. Tech. Food Tech. (Process and Food Engineering)
Applicable from 2009 Batch

SEMESTER – I

S. No	Course Code	Course Title	L-T-P	Credits
1.	BIOL - 201	Elementary Biology (PCM Group)	3-0-0	3
2.	MAS - 312	Elementary Mathematics (Ag. & Bio group)	3-0-0	3
3.	PHY - 312	Engineering Physics	3-1-2	5
4.	ME - 301	Engineering Graphics -I	0-0-4	2
5.	ME - 304	Workshop Practice	2-0-4	4
6.	MBMT - 349	Introductory Microbiology	2-0-2	3
7.	ECON -331	Principles of Economics	2-0-0	2
8.	APFE - 301	Fundamentals of Food Technology	2-0-2	3
9.	GPT - 301	Moral & Value Education	2-0-0	2

SEMESTER - II

S. No	Course Code	Course Title	L-T-P	Credits
1.	APFE - 303	Principles of Food Engineering	2-0-2	3
2.	ME - 401	Engineering Graphics -II	0-0-4	2
3.	CHEM - 563	Food Chemistry	3-0-4	5
4.	MAS - 411	Engineering Mathematics -I	3-1-0	4
5.	COMP - 410	Computer and Languages	2-0-4	4
6.	EEE - 301	Basic Electrical Engineering	2-1-2	4
7.	LNG - 305	Professional Communication & Technical Writing	3-0-0	3
8.	APFE - 302	Principles of Food Processing & Preservation	2-0-2	3

SEMESTER - III

S. No	Course Code	Course Title	L-T-P	Credits
1.	MAS - 490	Engineering Mathematics -II	3-1-0	4
2.	MBGE - 455	Food Biotechnology	3-0-0	3
3.	CE - 401	Engineering Mechanics	3-0-0	3
4.	ME - 503	Heat & Mass Transfer	3-0-2	4
5.	ECE - 301	Basic Electronics	2-1-2	4
6.	MAS - 511	Statistical Methods	2-0-2	3
7.	APFE - 401	Engineering Properties of Biological Materials	2-0-2	3
8.	APFE -410	Principles of Food Quality & Safety	3-0-0	3

SEMESTER - IV

S. No	Course Code	Course Title	L-T-P	Credits
1	ME - 502	Refrigeration & Air Conditioning	2-0-2	3
2	ME - 408	Engineering Thermodynamics	2-0-2	3
3.	CE - 406	Fluid Mechanics	3-0-2	4
4.	EEE - 402	Electrical Machines	3-0-2	4
5.	SES - 415	Environmental Studies – I	1-0-2	2
6.	APFE - 501	Food Handling & Storage Engineering	2-0-2	3
7.	APFE - 513	Quantitative Techniques in Food Processing	3-1-0	4
8.	APFE - 411	Principles of Thermal and Non-thermal Food Processing	2-0-2	3

SEMESTER - V

S. No	Course Code	Course Title	L-T-P	Credits
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1.	ECE - 512	Instrumentation & Control Engineering	2-0-2	3
2.	ME - 511	Boiler Technology	2-0-0	2
3.	MBMT - 504	Principles of Food and Dairy Microbiology	2-0-2	3
4.	SES - 416	Environmental Studies – II	1-0-2	2
5.	APFE - 404	Cereal, Pulses & Oil seeds Technology	3-0-2	4
6.	APFE - 408	Technology of Dairy Products	2-0-0	2
7.	APFE - 409	Processing of Marine Products	2-0-0	2
8.	APFE - 611	Food Packaging Technology	2-0-2	3
9.	AET - 400	Training - I	0-0-2	1

SEMESTER - VI

S. No	Course Code	Course Title	L-T-P	Credits
1.	ABM - 402	Agri- Business Management	3-0-0	3
2.	APFE - 403	Technology of Beverages	3-0-2	4
3.	APFE - 503	Technology of Meat & Poultry Products	3-0-0	3
4.	APFE - 504	Unit Operations in Food Engineering	3-0-2	4
5.	APFE - 506	Fruits & Vegetable Processing	2-0-2	3
6.	APFE - 514	Energy Management in Food Industries	2-0-0	2
7.	APFE - 515	Food Additives	2-0-0	2
8.	APFE - 605	Baking & Confectionery Technology	2-0-2	3

SEMESTER - VII

S. No	Course Code	Course Title	L-T-P	Credits
1.	APFE - 505	Drying & Dehydration of Food	3-0-0	3
2.	APFE - 507	Quality Control in Food Industry	2-0-2	3
3.	APFE - 509	Fermented Food Products	2-0-2	3
4.	APFE - 510	Dairy Engineering	2-0-2	3
5.	APFE - 602	Food Process Equipment Design	2-1-0	3
6.	APFE - 604	Extrusion Technology	2-0-2	3
7.	APFE - 612	Marketing of Food Products	2-0-0	2
8.	APFE - 616	Processing of Spice and Plantation Crops	2-0-2	3
9.	AET – 699 a	Project (Project Formulation)	0-0-6	3
10.	AET - 500	Training - II	0-0-2	1
11.	AET - 580	Seminar I	0-0-2	1

SEMESTER - VIII

S. No	Course Code	Course Title	L-T-P	Credits
1.	APFE - 508	Food Plant Sanitation & Waste Management.	2-0-2	3
2.	APFE - 601	Food Plant Design & Maintenance	2-1-0	3
3.	APFE - 603	Food Plant Operations Management	3-0-0	3
4.	APFE - 613	Functional & Minimally Processed Foods	2-0-0	2
5.	APFE - 614	Food Laws & Legislation	2-0-0	2
6.	APFE - 615	Entrepreneurship in Food Industries	2-0-0	2
7.	AET - 680	Seminar - II	0-0-2	1
8.	AET – 699 b	Project (Project Execution and Report)	0-0-14	7

Detailed Course Syllabus

B.Tech Food Tech (Process & Food Engg.)

SEMESTER – I

BIOL 201 **Elementary Biology** **3(3 -0 -0)**

Life; Living and non living; Origin of Life; Oparin's abiotic theory; Evolution; Unicellular Multicellularity Complex Tissue system, Branches of Biology; Cell; Introduction Botany; History of Botany; Brief introduction of branches of Botany; Morphology; Anatomy; Taxonomy; Physiology; Palaeo Botany; Introduction Zoology: Classification of Animal kingdom; Adaptation of animals; External Morphology of Frog; Internal Anatomy of Frog, Internal organs; Different internal systems; Introduction to Lower Botany; Algae, Fungi, Bacteria, Virus; Bryophyte; Pteridophyte; Scope/Application of Biology.

MAS 312 **Elementary Mathematics** **3(3 -0 -0)**

Algebra; Theory of quadratic equations, Binomial theorem (for positive integral index only). Uses of Natural and Common Logarithms, Exponential series, Partial Fractions, Determinants (of order three only), Theory of Matrices (Addition, Subtraction), Product of Matrices, Transpose, Elementary idea of following: adjoint, Inverse of matrices by adjoint method, Solution of linear equations, Solution of inequalities, Permutation and combination; Trigonometry; Trigonometry functions, addition and subtraction formula, Double and half angle formula, Laws of sines and cosines, Solution of triangles, Height and distances, Real and complex numbers, Hyperbolic trigonometric functions, De -Moivre's theorem; Coordinate Geometry; Distance between two points, Area of triangles, Straight lines (Parallel and at right angles); Calculus; Elementary Differentiation and Integration.

PHY 312 **Engineering Physics** **5 (3-1-2)**

Surface tension; Angle of contact, Excess of pressure inside a spherical surface, Capillary rise, Determination of surface tension by Jaeger's methods; Viscosity; Stream line and turbulent motion, Coefficient of viscosity, Critical velocity, Poiseuille's equation for flow of liquid through a tube, Viscometer; Optics; Interference, Thin films, Testing of Optical plainness of surfaces. Young's double slit experiment – Coherent sources, Intensity in Young's experiments, Interference in thin films, Newton's ring and Michelson interferometer; Diffraction Fraunhofer diffraction at single slit, Diffraction at a circular aperture, Diffraction at double slit, Diffraction Gratings, Resolving and dispersive power of a grating; Polarization; Production and detection of circularly & elliptically polarized light. Quarter and half wave plates, Optical activity, Specific rotation, Lurent's half shade polarimeter, Determination of specific rotation and strength of sugar solution; Ultra Sonics; Production, application in ranging, Cleaning and drilling;

Practical: Production and measurements of vacuum. Mechanical pumps (Rotary vacuum pump) Diffusion and condensation pumps, Gettesr measurement : Manometer, Mecleod gauge, Piram gauge; Measurement of temperature; Thermo e.m.f., Measurement of thermo e.m.f. by potentiometer, Higher temperature measurement by using pyrometers and resistance thermometer.

ME 301 Engineering Graphics I**2(0-0-4)**

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(2-0-4)**

General; Workshop terminology, ferrous and non ferrous metals, steel and alloy steels, light alloys and non ferrous heavy metals, heat treatment, case hardening, corrosions, 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, planing; 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(2-0-2)**

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; Roll 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(2-0-2)

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– 2)

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.

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.

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, xyanthones, 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.

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- Dirichlets'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.

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(2-1-2)

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(2-0-2)

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(2-0-2)

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

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(3-0-2)**

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.

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 – JFET, 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.

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.

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 conductivity, Thermal diffusivity and heat transfer coefficient of food materials; Determination of friction and internal friction; Determination of electrical properties and seed separation.

Objective, function and importance of quality control, methods of quality assessment of food material; Theoretical and Practical consideration of quality assurance; Grades and Standards, Description of different quality control system (Codex, TQM, USFDA, BIS, HACCP, ISO 9000 series); Cleaning and sanitation, Local and International approaches for safe foods; Statistical quality control techniques; Permitted food additives; Food adulteration and food safety.

SEMESTER IV

ME 502**Refrigeration & Air Conditioning****3(2 - 0 – 2)**

Thermodynamic cycles, mechanical vapour compression refrigeration, properties of refrigerants, thermodynamic cycle, calculations of single stage saturation and actual cycles, two stage cycles and cascade refrigeration system, heat pump; Compressors, expansion valves, evaporators and condensers, absorption system of refrigeration, ice manufacture, air conditioning, principles of psychrometry, psychrometric processes, air conditioning, comfort chart and effective temperature and respiration heat, cooling, load calculations and design of cold storage's, conveying and distribution of processed air, air conditioning controls.

Practical: Study of various types of compressors, Study of household refrigerator and window air conditioner, Determination of volumetric efficiency of a reciprocating compressor, Determination of coefficient of performance of a vapor compression refrigeration system and absorption system, Determination of bypass factor, apparatus dew point and COP of an air-conditioning system, Determination of range approach and efficiency of a cooling tower, Determination of efficiency of an evaporative cooling washer, Determination of freezing time of food products, Determination of heat transfer coefficient inside a cold storage or refrigerator, Determination of thermal conductivity of various insulating materials.

ME 408**Engineering Thermodynamics****3(2-0-2)**

System and properties, concepts of energy, temperature and heat, first law of closed and open systems, pure substance and properties second law of thermodynamics and entropy, boiler, mountings and accessories, boiler efficiency, steam engines, Rankine cycle, indicator diagrams, steam turbines, I.C. Engines, air standard ratio, otto, diesel and joule cycles.

Practical: Study of Fire Tube boiler, Study of Water Tube boiler, Study and Working of Refrigerator; Study of velocity compounded steam turbine, Study of pressure compounded steam turbine, Study of impulse & Reaction turbine, Study of steam engine model, Study and working of two stroke petrol engine, Study and working of four stroke petrol engine, Determination of indicated H.P. of I.C. Engine by Morse Test, Study and Working of two stroke Diesel Engine, Study and working of four stroke Diesel engine, Study of Ignition system of I.C. Engine, Study of Braking system of any vehicle.

CE 406**Fluid Mechanics****4(3-0-2)**

Definition and properties of fluids. Units of measurement, fluid statics: pressure at a point and its measurement, fluid static force on submerged surface, buoyancy, condition of floating and stability of submerged and floating bodies.

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 s moke 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, Demonstration of momentum theorem using impulse and reaction turbines ,Estimation and measurement of flow rate through single screw extruder.

EEE 402

Electrical Machines

4(3-0-2)

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.

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(2-0-2)**

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(2-0-2)**

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(2-0-2)**

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 orificemeter 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(2-0-2)

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(1-0-2)

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 aesthetic 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(3-0-2)

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, interstratification, 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(2-0-2)

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(0-0-2)

SEMESTER VI

ABM 402

Agri-business Management

3(3-0-0)

Management concepts and principles, process of management, functions of management, concept of agribusiness and application of management principles to agribusiness, production, consumption and marketing of agricultural products, agricultural processing, meaning and theories of international trade, WTO provisions for trade in agricultural and food commodities, India's contribution to international trade in food and agri-commodities.

APFE 403

Technology of Beverages

4(3-0-2)

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(3-0-2)

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

APFE 602 Food Process Equipment Design 3(2-1-0)
 Application of design engineering for food processing equipments, Design parameters, codes and materials selection. Design handling and milling equipments, dryers, heat exchangers, Pressure vessels, Optimization of design with respect of process efficiency, Design of fluid conveyance system, Design of evaporator, vapor separator and condenser. Equipments lay out and ventilation in food processing plants, computer assisted design of a heat exchanger, dryers and a storage system.

APFE 604 Extrusion Technology 3(2-0-2)
 Transport phenomena during extrusion, Rheological properties of cereals during extrusion, chemical and physico-chemical transformation during extrusion scale-up and control of extruders, studies of functioning and expansion of extrudates, Extruder machines.
Practical: Development of extruded product, Study of extruders process, value addition by extrusion process, estimation of nutritional value of extruded product.

APFE 612 Marketing of Food Products 2(2-0-0)
 Nature of products. Cost concepts, cost curves and short run and long run equilibrium. Returns to scale and Economics of scale. Project preparation and feasibility analysis. Financial management. Demand, markets, marketing, market structure, marketing management and pricing strategies of firms. Marketing environment and Consumer buying behavior. Market segmentation, market measurement, market plan, marketing promotion, management of distribution and market research. Market Information System, export and government regulations, GATT and WTO.

APFE 616 Processing of Spice and Plantation Crops 3(2-0-2)
Theory : Production and processing scenario of spice, flavour & plantation crops and its scope. Major Spices: (1) Post Harvest Technology composition, processed products of following spices (2) Ginger (3) Chill (4) Turmeric (5) Onion and garlic (6) Pepper (7) Cardamom (8) aercanut, cashew nut, coco nut. Minor Spices, herbs and leafy vegetables : tea rubber and oil palm.Spartans, Processing and Utilization All spice, Annie seed, sweet Basil. Caraway seed, Cassia, Cinnamon. Clove, Coriander, cumin, Dill seed. Fern seed nutmeg, malt, mint marjoram. Rose merry, saffron, sage. Savory, Thyme, Ajowan. Asartida, curry leaves. Tea- Types, Processing, quality control. Coffee& Cocoa: Processing. Vanilla and annatoprocessing. Flavours of minor spices. Flavour of major spices. Spice oil and oleoresins. Flavours of soft drinks Baking and confectionery. Standards specification of spices. Functional packaging of spices and spice products.
Practical: Identification and characterization of flavouring compounds of spices. Valuable oil determination. Extraction of oil from clove, pepper, cardamom-chili. Extraction of oleoresins-Turmeric, ginger, pepper, clove. Piperine estimation in pepper oleoresin. Steam distillation of spices. Determination of curumin content in turmeric. Chemical analysis of spices moisture, valuable oil, specific gravity, refractive index ,acid value. Study of standard specification of spices. Packaging study of spices. Preparation of curry powder. Visit to spice Industry

AET 500 Training – II 1(0-0-2)

AET 580 Seminar – I 1(0-0-2)

AET 699 a Project (Project Formulation) 3(0-0-6)

SEMESTER VIII

APFE 508 Food Plant Sanitation & Waste Management 3(2-0-2)

Sanitary design of food process equipment, Selection of sanitizing agents for cleaning, packaging sanitation, food storage sanitation, transport sanitation and water sanitation. By-products obtained from dairy plant, egg & poultry processing industry and meat industry. Characterization of food industry wastes e.g., BOD, COD and total organic content, floatable and suspended solids in water, pretreatment, secondary treatments of solid waste, sludge volume index, advanced techniques activated bio-filtration, biological fluidized bed reactor, dried bacteria culture process tertiary treatments or advanced waste water treatment system (AWT); polishing ponds, DAF Techniques, micro trainers treatment and disposal of sludge, sand filters, removal of nitrogen, phosphorus, sulphur, physical chemical treatment process.

Practical: Flow process chart of food plant Waste utilization processes, various treatment for waste disposal analysis of cleaners & sanitizers, CIP Cleaning.

APFE 601 Food Plant Design & Maintenance 3(2-1-0)

Food Plant Design and Maintenance plant Design consideration, feasibility Analysis, financial analysis, plant location, plant layout, process selection, process flow Analysis, choice of Technology, Scheduling, Job Design Performance measurement and improvement, Replacement and maintenance.

Physical properties of food materials and energy balance calculations for preliminary estimation of plant capacity & equipment sizes. Preparation of flow sheets for material movement and utility consumption in food plant. Design of storage vessels, pressure vessels & vessels for drum drying. Design of fluid conveyance system, heat exchangers, evaporators, condenser, vapor separator etc. Performance characteristics and selection of fan, blowers ejector compressors & vacuum pumps. Design considerations for food plant, equipment lay-out and ventilation in food process plant. Performance characteristics and selection of centrifugal & positive displacement sanitary pumps. Food plant maintenance including preventive & break down maintenance.

APFE 603 Food Plant Operations Management 3 (3-0-0)

Food Plant Operation Function, Operations Strategy, Products Design, Managing Quality, Quality Control & Improvement, Process Selection, Service Operations Design, Choice of Technology, Process Flow Analysis, Forecasting, Facilities Decisions, Aggregate Planning, Independent Demand Inventory, Performance Measurement, Supply Chain Management.

APFE 613 Functional & Minimally Processed Foods 2(2-0-0)

Foods and its functions, role of nutrients, recommended dietary intakes and its use. Composition of foods, general and specific for different foods of plant and animal origin. Restoration, enrichment, fortification and supplementation of foods. Balanced diets for normal individuals. Therapeutic diets for people suffering from various ailments and disorders, sensory qualities and acceptability of foods.

APFE 614 Food Laws & Legislation 2(2-0-0)

Concept and significance of Food Legislation, Indian Food Laws and Legislation, Prevention of Food Adulteration (PFA), Bureau of Indian Standards (BIS), Agmark, Agricultural and Processed Food Products Export Development Authority (APEDA), International Standardization and Organization (ISO), Codex Alimentarius Commission (CAC), Food Laws and legislation in EU, Middle East, SAARC and ASEAN.

APFE 615 Entrepreneurship in Food Industries 2(2-0-0)

Identification of Business opportunities, market survey, project formulation, selection of product, choice of technology, financial institutions, fund flow analysis, financial ratio, techno-economic feasibility of project, costing and pricing, industrial sickness and remedies.

AET 680 Seminar – II 1 (0-0-2)

AET 699 b Project Execution & Report 7 (0-0-14)