

# 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	3-1-1	5
4.	ME - 301	Engineering Graphics -I	0-0-2	2
5.	ME - 304	Workshop Practice	2-0-2	4
6.	MBMT - 349	Introductory Microbiology	2-0-1	3
7.	ECON -331	Principles of Economics	2-0-0	2
8.	APFE - 301	Fundamentals of Food Technology	2-0-1	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	2-0-1	3
2.	ME - 401	Engineering Graphics -II	0-0-2	2
3.	CHEM - 563	Food Chemistry	3-0-2	5
4.	MAS - 411	Engineering Mathematics -I	3-1-0	4
5.	COMP - 410	Computer and Languages	2-0-2	4
6.	EEE - 301	Basic Electrical Engineering	2-1-1	4
7.	LNG - 305	Professional Communication & Technical Writing	3-0-0	3
8.	APFE - 302	Principles of Food Processing & Preservation	2-0-1	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	3-0-1	4
5.	ECE - 301	Basic Electronics	2-1-1	4
6.	MAS - 511	Statistical Methods	2-0-1	3
7.	APFE - 401	Engineering Properties of Biological Materials	2-0-1	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	2-0-1	3
2	ME - 408	Engineering Thermodynamics	2-0-1	3
3.	CE - 406	Fluid Mechanics	3-0-1	4
4.	EEE - 402	Electrical Machines	3-0-1	4
5.	SES - 415	Environmental Studies – I	1-0-1	2
6.	APFE - 501	Food Handling & Storage Engineering	2-0-1	3
7.	APFE - 513	Quantitative Techniques in Food Processing	3-1-0	4
8.	APFE - 411	Principles of Thermal and Non-thermal Food Processing	2-0-1	3

**SEMESTER - V**

S. No	Course Code	Course Title	L-T-P	Credits
1.	ECE - 512	Instrumentation & Control Engineering	2-0-1	3
2.	ME - 511	Boiler Technology	2-0-0	2
3.	MBMT - 504	Principles of Food and Dairy Microbiology	2-0-1	3
4.	SES - 416	Environmental Studies – II	1-0-1	2
5.	APFE - 404	Cereal, Pulses & Oil seeds Technology	3-0-1	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	2-0-1	3
9.	AET - 400	Training - I	0-0-1	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	3-0-1	4
3.	APFE - 503	Technology of Meat & Poultry Products	3-0-0	3
4.	APFE - 504	Unit Operations in Food Engineering	3-0-1	4
5.	APFE - 506	Fruits & Vegetable Processing	2-0-1	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	2-0-1	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	2-0-1	3
3.	APFE - 509	Fermented Food Products	2-0-1	3
4.	APFE - 510	Dairy Engineering	2-0-1	3
5.	APFE - 602	Food Process Equipment Design	2-1-0	3
6.	APFE - 604	Extrusion Technology	2-0-1	3
7.	APFE - 612	Marketing of Food Products	2-0-0	2
8.	APFE - 616	Processing of Spice and Plantation Crops	2-0-1	3
9.	AET – 699 a	Project (Project Formulation)	0-0-2	2
10.	AET - 500	Training - II	0-0-1	1
11.	AET - 580	Seminar I	0-0-1	1

**SEMESTER - VIII**

S. No	Course Code	Course Title	L-T-P	Credits
1.	APFE - 508	Food Plant Sanitation & Waste Management.	2-0-1	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	0-0-1	1
8.	AET – 699 b	Project (Project Execution and Report)	0-0-7	7



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

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, 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(2-0-1)**

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; 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(2-0-1)**

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, 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.

**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





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 X<sup>2</sup> 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 spherocity, 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 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(3-0-1)**

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



# 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



**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)**





milk product standards. Process flow chart for product manufacture, Batch & Continuous drying systems, Freezing and Low Temperature Preservation of Food.

**Practical:** Treatment of raw milk –chilling, clarification & infiltration, Cream separation & standardization of milk. Operation of LTLT, HTST pasteurizer and sterilizer & UHT plant. Preparations of paneer, chena, ghee, dahi, khoya, kulfi, etc. Preparation of butter, ice creams, cheese yogurt, casein etc. Evaluation of milk & dairy products.

**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(2-0-1)**

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(2-0-1)**

**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 annattoprocessing. 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

<b>AET 500</b>	<b>Training – II</b>	<b>1(0-0-1)</b>
<b>AET 580</b>	<b>Seminar – I</b>	<b>1(0-0-1)</b>
<b>AET 699 a</b>	<b>Project (Project Formulation)</b>	<b>2 (0-0-2)</b>

## **SEMESTER VIII**

<b>APFE 508</b>	<b>Food Plant Sanitation &amp; Waste Management</b>	<b>3(2-0-1)</b>
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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.

<b>APFE 601</b>	<b>Food Plant Design &amp; Maintenance</b>	<b>3(2-1-0)</b>
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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.

<b>APFE 603</b>	<b>Food Plant Operations Management</b>	<b>3 (3-0-0)</b>
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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.

<b>APFE 613</b>	<b>Functional &amp; Minimally Processed Foods</b>	<b>2(2-0-0)</b>
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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.

<b>APFE 614</b>	<b>Food Laws &amp; Legislation</b>	<b>2(2-0-0)</b>
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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, functional ratio, techno-economic feasibility of project, costing and pricing, industrial sickness and remedies.

**AET 680 Seminar – II 1 (0-0-1)**

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