

**Course Structure of B.Sc. Food Technology  
Semester-I**

S.No.	Course Code	Name of the Course	Credits
1	ME-301	Engineering Drawing	2 (0-0-2)
2	ME-304	Workshop Practice & Technology	2 (0-0-2)
3	BAM-401	Cooperation Marketing & Finance	3 (2-0-1)
4	EEE-303	Electrical Engineering	3(2-0-1)
5	DM-301	Fundamentals of Microbiology	3 (2-0-1)
6	ECON-331	Principles of Economics	2(2-0-0)
7	GPT-301	Moral Value & Education	2(2-0-0)
8	BIOL - 201	Elementary Biology (Deficiency course- PCM Group)*	3 (3-0-0)
	MAS – 312	Elementary Mathematics (Deficiency course -Ag. & Bio group)*	3 (3-0-0)
<b>Total</b>			<b>20</b>

**Semester-II**

1	CHEM-563	Food Chemistry	4(3-0-1)
2	APFE - 302	Principles of Food Processing & Preservation	3 (2-0-1)
3	FST-304	Post Harvest Management of Fruits & Vegetable	3 (2-0-1)
4	DT-304	Milk & Milk Processing	3 (2-0-1)
5	FST-305	Food Microbiology	3 (2-0-1)
6	DC-512	Biochemistry & Human Nutrition	3 (2-0-1)
7	COMP-410	Computer And Languages	4(2-0-2)
<b>Total</b>			<b>23</b>

**Semester-III**

1	DE-401	Refrigeration and Air Conditioning	3 (2-0-1)
2	DT-401	Condensed & Dried Milks	5 (3-0-2)
3	ME-503	Heat and Mass Transfer	4 (3-0-1)
4	MBGE – 455	Food Bio-technology	3(3-0-0)
5	MAS-410	Applied Mathematics	4(3-1-0)
6	APFE -410	Principles of Food Quality & Safety	3(3-0-0)
7	MAS - 511	Statistical Methods	3(2-0-1)
<b>Total</b>			<b>25</b>

**Semester-IV**

1	DT-304	Fat Rich & Traditional Dairy Products	3 (2-0-1)
2	FST-509	Sensory evaluation of food Products	3 (2-0-1)
3	FST-401	Cereal Processing	3 (2-0-1)
4	FST-403	Fermentation & Industrial Microbiology	3 (2-0-1)
5	FST-508	Legumes & oilseed technology	3 (2-0-1)
6	ENV-417	Environmental Studies	3(3-0-0)
7	BAM-501	Marketing Management & International Trade	2 (2-0-0)
8	FST-515	Quality Assurance and Certification	2 (2-0-0)
<b>Total</b>			<b>22</b>

**Semester-V**

1	COMP-	IT Application in Food Industry	2 (1-0-1)
2	FST-504	Techniques in Food Analysis	3 (2-0-1)
3	FST-513	Specialty Foods	3 (2-0-1)
4	FST-506	Food Industry Byproducts & Waste Utilization	3 (2-0-1)
5	FST-507	Food Safety and Microbial Standards.	3 (2-0-1)
6	APFE-409	Processing of Marine Products	2 (2-0-0)
7	APFE-611	Food Packaging Technology	3 (2-0-1)
		<b>Total</b>	<b>19</b>

**Semester-VI**

1	DE-601	Food Engineering	4 (3-0-1)
2	ABM-402	Agri-Business Management	3 (3-0-0)
3	APFE-614	Food Laws and Legislation	2 (2-0-0)
4	APFE-605	Baking & Confectionary Technology	3 (2-0-1)
5	APFE-503	Technology of Meat and Poultry Products	3 (3-0-0)
6	APFE-506	Fruits and Vegetable Processing	3 (2-0-1)
7	APFE-515	Food Additives	2 (2-0-0)
		<b>Total</b>	<b>20</b>

**Semester-VII**

1	APFE-616	Processing of Spices and Plantation Crops	3(2-0-1)
2	BAM-502	Entrepreneurship Development and Communication Skill	2(1-0-1)
3	FST-512	Product Development and Formulation	3(2-0-1)
4	FST-514	Food Production Trends and Programs	2(2-0-0)
5	FST-516	Food Plant Design And Layout	3(2-0-1)
6	APFE-604	Extrusion technology	3(2-0-1)
7	APFE-507	Quality control in food industry	3(2-0-1)
8	APFE-509	Fermented Food Products	3(2-0-1)
9	FST-517	Seminar	1(0-0-1)
		<b>Total</b>	<b>23</b>

**Semester-VIII**

1	FST-518	Industrial Training	<b>30</b>
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**Eligibility:** Inter(PCM)/(PCB)/(Ag.)

**SYLLABUS OF B.SC. FOOD TECHNOLOGY****Semester I**

<b>1</b>	<b>ME-301</b>	<b>Engineering Drawing</b>	<b>2 (0-0-2)</b>
	<p>Introduction to the engineering drawing, machine drawing, conventional lines and breaks. Drawing section symbols of various materials</p> <p>Projection, principal planes, orthographic projection, a brief introduction to oblique, perspective and isometric views</p> <p><b>Practicals</b></p> <p>1. Drawing elevation, side and plane of simple objects/machine parts to scale in both 1<sup>st</sup> angle projection and 3rd angle projection systems. 4</p> <p>2. Drawing sectional views of various machine parts such as pulleys, bearings keys and couplings, pipe joint, etc. From given pictorial/isometric views. 4</p> <p>3. Fastening, temporary and permanent. Helix, screw threads-various forms. 3</p> <p>4. Multiple start screw threads rivets and riveted joints. 3</p> <p>5. Drawing an isometric view. 2</p> <p>6. Exercise on development of surfaces 2</p> <p>7. Preparation of working drawing of a simple machine part. 2</p>		
<b>2</b>	<b>ME-304</b>	<b>Workshop Practice &amp; Technology</b>	<b>2 (0-0-2)</b>
	<p>Introduction to workshop practice, safety, care and precautions in workshop.</p> <p>Wood working tools and their use, carpentry and pattern making, mould material and their applications.</p> <p>Heat treatment processes: hardening, tempering, annealing, normalizing etc. metal cutting.</p> <p>Soldering &amp; brazing; electric arc welding, gas welding.</p> <p>Smithy and forging operations, tools and equipment.</p> <p>The bench: flat surface filing, chipping, scraping, marking out, drilling and screwing.</p> <p>Use of jigs and fixtures in production.</p> <p>Introduction to: (a) lathe; (b) milling machine; (c) shaper and planer; (d) drilling and boring machines; (e) grinder.</p> <p>Introduction to the engineering drawing, machine drawing, conventional lines and breaks. Drawing section symbols of various materials.</p> <p>Projection, principal planes, orthographic projection, a brief introduction to oblique, perspective and isometric views.</p> <p><b>Practicals</b></p> <p>1. Filing, fitting, chipping and hack sawing 2</p> <p>2. Chiseling, tapping and smithy practice. 2</p> <p>3. Simple exercises in arc, gas and argon welding. 4</p> <p>4. Simple exercises in soldering and brazing 2</p> <p>5. Basic joints in carpentry 2</p>		
<b>3</b>	<b>BAM-401</b>	<b>Cooperation Marketing &amp; Finance</b>	<b>3 (2-0-1)</b>
	<p>Co-operation–philosophy and principles: History of Indian Co-operative movement, Cooperative credit structures in regional level and their study and singly window systems. Marketing – importance in economic development. Classification of Markets, Marketing functions, Market</p>		

	<p>functionaries. Marketable and Marketed surplus, Marketing costs, margins and price spread, problems in marketing of agricultural commodities – perishables, grains, oilseeds and processed foods. Remedial measures for problems in Agricultural marketing. Agricultural marketing institutions, Regulated markets, Co-operative marketing societies, MARKFED, NAFED, Ware Housing Corporation, Food Corporation of India, Nature of agricultural product prices, Agricultural price policy and need for price stabilization. Methods of fixation of MSP for agricultural commodities. Commission on agricultural costs and prices. Finance–nature and scope: Credit – meaning, definition and classification. Credit analysis and repayment plans. History of financing Agriculture in India. Commercial banks – Nationalization of Commercial banks, Lead Bank scheme, Regional Rural Banks, Scale of finance, Higher financing agencies – RBI, NABARD, AFC, ADB, World Bank. Insurance and credit guarantee corporation of India. Crop Insurance. Contract farming – strategy and scope.</p> <p><b>Practical:</b> Study of a regulated market, Study of a vegetable market, Study of a fruit market, Study of a cattle market, Computation of market costs, margins and price spread, Study of Andhra Pradesh State Warehousing Corporation , Study of Central Warehousing Corporation, Study of Food Corporation of India, Study of MARKFED, Study of functioning of a commercial bank , Study of a regional rural bank, Study of food processing enterprise, Formulation of project reports for financing food Industry, Working out repayment plans, Study of Primary Agricultural Credit Society, Study of Farmers’ Service Society</p>		
4	<b>EEE-303</b>	<b>Electrical Engineering</b>	3(2-0-1)
	<p>Alternating current fundamentals: Electromagnetic induction magnitude of induced E.M.F. Alternating current, R.M.S. value and average value of an alternating current. Phase relations and vector representation. A.C. series and parallel circuits, Concept of resonance, polyphase alternating current circuits, three-phase concept, Star and delta connections, star delta transformation, Energy measurement. Transformers: Fundamental of transformer, Theory, vector diagram without load and with load, Losses, voltage regulation and efficiency of transformer, auto-transformer. Induction motors : Fundamental principles, production of rotating fields, construction, Rotor winding-squirrel cage and phase wound rotors, Analysis of current and torque, starting of induction motors, Motor housing, selection of motor and its controls. D.C. Machines &amp; AC machines : Construction and operation of D.C A. C. Motors, Types of generators, Various characteristics of generator, D.C. motors, torque-speed characteristics of D.C. motors, Starting and speed control of D.C. motors. Electric Power Economics: Electrification and load estimation Maximum demand charge, Load factor and power factor correction. Strength of Material – engineering materials, material science, use of various metals, including plastic glass, etc in food industry, selection and specification – material design, concepts and manufacturing of various equipments and machineries for food processing plant – Characteristics properties and uses of common building materials i.e. stone, brick, lime, cement, paints ad varnishes, etc.</p> <p><b>Practical:</b> Study of voltage resonance in L.C.R. circuits at constant frequency. (a) Star connection-study of voltage and current relation (b) Delta connection-study of voltage and current relation. Measurement of power in 3-phase circuit. (a) For balanced loads. (b) For unbalanced loads, by wattmeter and energy meters Polarity test, no-load test, efficiency and regulation test of single phase. Voltage and current relation in a 3-phase transformer of various kinds of primary and secondary connection systems. Starting of induction motor by the following starters : (i) D.O.L. (ii) Manual star-delta (iii) Automatic star-delta (iv) Manual auto-transformer. Starting of slip-ring induction motor by normal and automatic rotor starters. Test on 3-phase induction motor, determination of efficiency, line current, speed, slip, power factor at various outputs. To determine</p>		

	relation between the induced armature voltage and speed of separately excited D.C. generator. Magnetization characteristic of D.C. generator. Study the starter connection and starting reversing and adjusting speed of a D.C. motor. Studies of building material, property and characterization. Studies on engineering materials, construction and properties. Studies of machine design of food processing plant.		
<b>5</b>	<b>DM-301</b>	<b>Fundamentals of Microbiology</b>	<b>3 (2-0-1)</b>
	<p>Microbiology: history and scope; contributions of Leeuwenhock, Pasteur and Koch. Principle of microbiology: Light Microscopy (Bright field, dark field, phase contrast, fluorescence); preparation and staining of specimens; electron microscopy. Microbial taxonomy: principles; numerical taxonomy; major characteristics used in taxonomy; classification according to Bergey's manual of systematic bacteriology. Structure and functions of prokaryotic cells; difference between prokaryotes and eukaryotes. Microbial growth and nutrition: the growth curve; factors affecting growth of microorganisms, estimation of bacterial growth; bacteriostatic and bactericidal agents; the common nutrient requirements and nutritional types of microorganisms. Bacterial genetics; DNA as the genetic material; structure of DNA; bacterial mutations (spontaneous and induced); genetic recombination- (transformation, transduction, conjugation). Micro flora of air, soil and water: methods for controlling microorganisms in air; water as carrier of pathogens.</p> <p><b>Practical:</b> General instruction for microbiological laboratory. Microscope- simple and compound; Microbiological equipments; autoclave, hot air oven, incubator, centrifuge, colorimeter, laminar airflow, membrane filter. Simple staining- methylene blue; crystal violate; negative staining. Differential staining (Gram, spore, acid fast). Mortality of microorganisms; hanging drop technique. Measurement of microorganisms by micrometry. Preparation of commonly used growth media liquid and solid: simple and differential media. Isolation technique for microorganisms- Streak &amp; pour plate Enumeration of microorganisms in air and soil. Enumeration of microorganisms in water: total viable count, coliform (MPN).</p>		
<b>6</b>	<b>ECON-331</b>	<b>Principles of Economics</b>	<b>2(2-0-0)</b>
	<p>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</p>		
<b>7</b>	<b>GPT-301</b>	<b>Moral Value &amp; Education</b>	<b>2(2-0-0)</b>
	<p>My country and my people, the many Indians, Being and becoming and Indian, nationalism and Internationalism.</p> <p>Some life issues- Love, Sex and Marriage, Men and money- value of time, Meaning of work, Human communication, Human suffering, Addiction, Ecology, Women's issue.</p> <p>Understanding one's neighbor. Neighbourhood groups: their structure and function, Patters of social interaction of group dynamics.</p>		

	<p>Preparation for a career, Choice of vocation, Motivation for study and research. The present educational system. Curriculum and Syllabus, Teaching methods, Examination and work experience. Definition of value Education, Moral and ethics, laws and Morale based on Ten Commandments and two great commandments.</p> <p>Discovery of self, self- awareness growth of Intellect- mans spiritual Nature emotions, Will, Respect the Rights of Life, Liberty, property, Truth Reputation.</p> <p>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 nature.</p> <p>Conscience- as defined in Oxford Dictionary and Winston Dictionary, Types of consciousness (Such as Evil, convicted, purged, pure, weak, good, void of offence)</p>		
8	<b>BIOL - 201</b>	<b>Elementary Biology (Deficiency course- PCM Group)*</b>	<b>3 (3-0-0)</b>
	<p>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.</p>		
	<b>MAS – 312</b>	<b>Elementary Mathematics (Deficiency course -Ag. &amp; Bio group)*</b>	<b>3 (3-0-0)</b>
<p><b>Algebra:</b> Theory of quadratic equations. Binomial index (for positive integral index only), Exponential and logarithm series, partial fractions, theory of matrices, sum, difference and multiplication of matrices, transpose, elementary idea of ad joint, inverse of matrices, solution of linear equations, permutation and combination.</p> <p><b>Trigonometry:</b> Complex numbers, De Meoivere's theorem and its simple application.</p> <p><b>Coordinate geometry:</b> Equation of standard curves and their identification. Differentiation tangents and normals, maxima &amp; minima.</p> <p><b>Integral calculus:</b> definite integrals, standard methods of integrations, Applications of integral calculus to are enclosed by curve, length of arc, volume and surface of revolution.</p> <p><b>Vector analysis:</b> Scalars and vectors, sum and difference of vectors, dot and cross products.</p>			

## Semester-II

1	CHEM-563	Food Chemistry	5(3-0-2)
	<p>Nature Scope and development of food chemistry: Moisture in foods; Role and type of water in foods, Functional properties of water, water activity and sorption isotherm, Molecular mobility and foods stability. Dispersed systems of foods; Physicochemical aspects of food dispersion system, a) Sol b) gel c) foam d) emulsions. Rheology of diphase systems.</p> <p>Carbohydrates; Functional characteristics of different carbohydrates, Changes of carbohydrates on cooking, Modification of carbohydrates, Dietary fibres and carbohydrates digestibility. Proteins in foods; Functional characteristics of proteins and amino acids, Pure proteins of plant and animal origin with their functional characteristics, Processing induced, physical, chemical and nutritional changes in protein, Chemical and enzymatic modification of protein. Lipids in foods: Role and use of lipids /fat, Physicochemical aspects of fatty acids in natural foods, crystallization and consistency, Chemical aspects of lipdysin antoxidation, thermal decomposition, Chemistry of frying Technology of fat and oil processing; a) Refining, b) Hydrogenations c) Inter etherification d) Safety use of oils and fats in food formulation. Enzymes in food industry; Carbohydrases, Proteasase, Lipases.</p> <p><b>Practical:</b> Determination of moisture content of foods using different methods. Studies of absorption isotherms of different foods. Swelling and solubility characteristics of starches. Rheological properties of diphase systems. Determination of crude proteins by microkjeldhal method. Determination of essential amino acids i.e. Lysine, tryptophan, methionine etc. Isolation of egg and milk protein. Preparation of protein isolates and concentrate of plant proteins. Determination of acid value, saponification value and iodine number of fat/ oil. Assay of amylases, papain and lipases.</p>		
2	APFE - 302	Principles of Food Processing & Preservation	3 (2-0-1)
	<p>Sources of food, scope and benefit of industrial food preservation, perishable, non perishable food, causes of food spoilage. Preservation by salt &amp; sugar – Principle, Method, Equipment and effect on food quality. Thermal processing methods of preservation – Principle and equipments: Canning, blanching, pasteurization, sterilization, evaporation. Use of low temperature – Principal, equipment and effect on quality. Chilling, cold storage, freezing. Preservation by drying dehydration and concentration – Principle, Methods, Equipment and effect on quality :Difference, importance of drying &amp; dehydration over other methods of drying and dehydration, equipments and machineries, physical and chemical changes in food during drying and dehydration .Need and Principle of concentration, methods of concentration – Thermal concentration, Freeze concentration, membrane concentration, changes in food quality by concentration. Preservation by radiation, chemicals &amp; preservatives. Definition, Methods of Irradiation, Direct &amp; Indirect effect, measurement of radiation dose, dose distribution, effect on microorganisms. Deterioration of Irradiated foods-physical, chemical and biological; effects on quality of foods. Presentation of foods by chemicals, antioxidants, mould inhibitors, antibodies, acidulates etc. Preservation by fermentation- Definition, Advantages, disadvantages, types, equipments.</p> <p>Recent methods in preservation : Pulsed electric field processing, High pressure processing, Processing using ultrasound, dielectric, ohmic and infrared heating. Theory, equipments and effect on food quality.</p> <p><b>Practical:</b> Demonstration of various machineries used in processing. Demonstration of effect of blanching on quality of foods. Preservation of food by heat treatment- canning. Canning of fruits and vegetables. Preservation of food by high concentration of sugar i.e. preparation of jam. Preservation of food by using salt- Pickle. Preservation of food by using acidulants i.e. pickling by</p>		

	acid, vinegar or acetic acid. Preservation of food by using chemicals. Preservation of Bread, Cake using mold inhibitors. Preservation of coconut shreds using humectants. Drying of pineapple slices, apple slices in cabinet drier. Demonstration on drying of green leafy vegetables. Drying of Mango/other pulp by foam mat drying. Drying of semisolid foods using roller dryers. Drying of foods using freeze-drying process. Demonstration of preserving foods under cold v/s freezing process. Processing foods using fermentation technique i.e. preparation of saurcraut.		
<b>3</b>	<b>FST-304</b>	<b>Post Harvest Management of Fruits &amp; Vegetable</b>	<b>3 (2-0-1)</b>
	<p>Post harvest technology of fruits and vegetables: An over view of concept and science, importance of loss reduction, role in export, economy, and employment generation. Morphology, structure and composition of fruit and vegetable.- Physical, Textural characteristics, structure and composition. Maturity standards; Importance, methods of Maturity determinations maturity indices for selected fruits and vegetables. Harvesting of important fruits and vegetables. Fruit ripening- chemical changes, regulations, methods. Storage practices: Control atmospheric, Bead atmosphere, hypotactic storage, cool store, Zero emerge cool chamber, stores striation. Commodity pretreatments - chemicals, wax coating, prepackaging. Physiological post harvest diseases chilling injury and disease. Handling and packaging of fruits and vegetables ; Post Harvest handling system for citrus, mango, banana, pomegranate, tomato, papaya and carrot packaging house operations. Principles of transport and commercial transport operations.</p> <p><b>Practical:</b> Studies on morphological features of some selected fruits and vegetables. Studies of maturing indices. Studies of harvesting of fruits and vegetables. Determination of RQ. Studies of export of pre cooling and storage of fruits and vegetables. Studies on wax coating on apples, papaya, citrus, mango, aonla. Studies on use of chemicals for ripening and enhancing shelf life of fruits and vegetables. Studies of regulations of ripening of banana, mango, papaya. Studies on various storage systems and structures. Studies on prepackaging of fruits. Studies on prepackaging of vegetables. Studies on physiological disorders – chilling injury of Banana and custard apple. Visit to commercial packaging house – grape, mango, pomegranate. Visit to commercial storage structures- Onion, garlic, potato.</p>		
<b>4</b>	<b>DT-304</b>	<b>Milk &amp; Milk Processing</b>	<b>3 (2-0-1)</b>
	<p>Definition of milk. Physico-chemical properties of milk. Factors affecting the composition of milk. Reception and preliminary testing of milk at plant.</p> <p>Processing of market milk:</p> <p>Practices for reception, chilling, clarification, Separation, storage of raw milk. Homogenization of milk: definition, pretreatment of milk for homogenization, homogenization, synchronization of homogenization with HTST plant.</p> <p>Effect of homogenization on physico-chemical properties of milk.</p> <p>Pasteurization, sterilization, UHT -processing. Pasteurization methods: LTLT/HTST.</p> <p>Manufacture of sterilized milk.</p> <p>Manufacture of special milks: reconstituted recombined milks, flavoured milks, homogenized/ vitaminized milks, lactose-hydrolysed milk.</p> <p><b>Practicals</b></p> <ol style="list-style-type: none"> <li>1. Reception of milk at the plant.</li> <li>2. Pre-treatment of raw milk: chilling, clarification, filtration.</li> <li>3. Cream separation, standardization of milk.</li> <li>4. Operation of LTLT, HTST pasteurizer</li> <li>5. Preparation of special milks, vitaminized, homogenized milks, flavoured milk, toned, double</li> </ol>		



	toned, sterilized, recombined milks, lactose hydrolysed milk.		
<b>5</b>	<b>FST-305</b>	<b>Food Microbiology</b>	<b>3 (2-0-1)</b>
	<p>Microbial spoilage of foods, Chemical changes caused by microorganisms, Principles of Food Preservation. Control of microorganisms by use of low and high temperature. Asepsis, water activity , drying, preservatives, radiation and pressure for control of microorganisms. Microbiology of milk and milk products. Sources of contamination, spoilage and prevention. Microbiology of fruits and vegetables. Sources of contamination, spoilage and prevention. Microbiology of cereal and cereal products. Sources of contamination, spoilage and prevention. Microbiology of meat and meat products. Sources of contamination, spoilage and prevention. Microbiology of fish and other sea foods. Sources of contamination, spoilage and prevention. Microbiology of poultry and eggs. Sources of contamination, spoilage and prevention. Microbiology of sugar and sugar products. Sources of contamination, spoilage and prevention. Microbiology of salts and spices. Sources of contamination, spoilage and prevention. Microbiology of canned foods. Sources of contamination, spoilage and prevention.</p> <p><b>Practical:</b> Isolation of molds from foods. Microbial examination of cereal and cereal products. Identification, isolation and confirmation. Microbial examination of vegetable and fruits. Identification, isolation and confirmation. Microbial examination of meat and meat products. Identification, isolation and confirmation. Microbial examination of fish and other sea foods. Identification, isolation and confirmation, Microbial examination of Eggs and poultry. Identification, isolation and confirmation. Microbial examination of milk and milk products. Identification, isolation and confirmation. Microbial examination of sugar, salts and spices. Identification, isolation and confirmation. Thermal Death Time determination.</p>		
<b>6</b>	<b>DC-512</b>	<b>Biochemistry &amp; Human Nutrition</b>	<b>3 (2-0-1)</b>
	<p><b>Biochemistry:</b> Enzymes Ribozymes, isozymes, allosteric enzymes, zymogens, regulatory, Classification and mechanism of enzyme action, Factors affecting rate of enzyme catalyzed reaction, enzyme inhibition, Enzymes coenzymes and co-factors immobilization of enzymes, Nucleic acids and Bioenergetics : Structure and function, definition and composition. Structure of RNA &amp; DNA- Anabolism and Catabolism of carbohydrates, lipids and proteins. Vitamins and Hormones : Structure &amp; functions, general description. Relationship between vitamins and hormones in terms of their biological role. Elementary knowledge of milk synthesis in mammary gland.</p> <p><b>Human nutrition:</b> Theory and definition, Scope of Nutrition : Functions of the various nutrients in body. Digestion, absorption and assimilation of nutrients. Comparative requirements and nutritional requirement of different age groups. (WHO and ICMR standard) Methods of evaluation of nutritive value of foods Nutritional value of cow, buffalo and human milk. Milk intolerance: lactose deficiency and protein hyper sensitivity. Safety aspects of food additives, toxic elements, radionuclides, pesticides and antibiotic residues in milk and milk products. Institutional feeding of workers. Planning and implementation of national food and nutrition policies and programme. Regulatory aspects of nutrition, IDF code on nutrition, nutrition facts under NLEA, Nutrient descriptors, serving size and nutritional claims.</p> <p><b>Practical:</b> Biochemistry Estimation of alkaline phosphatase and the effect of temperature and pH on its activity. Estimation of catalases and the effect of temperature and pH on its activity. Determination of the Michealis constant of an enzyme. Estimation of RNA by colorimetric method Estimation of DNA by colorimetric method. Measurement of proteolysis. Lipolysis, Amylase activity.</p>		

	Estimation of vitamin 'A; in ghee. Estimation of ascorbic acid in milk. Estimation of vitamin D in milk. Estimation of proteins by Lowry's method. Buret method. Estimation of Lipids and Lipids analysis by TLC. Estimations of cholesterol in milk. Estimation of denaturation of proteins in heated milk by dye binding method. Estimation of HMF content in food.		
<b>7</b>	<b>COMP-410</b>	<b>Computer And Languages</b>	<b>4(2-0-2)</b>
	<p><b>Computer Applications in Dairy Industry</b>  Programming Concepts and computer languages.  Database concepts: Characteristics of Database, approaches to data base, Normalization. dBase Programming: Commands decision making, branching and looping structures, use of functions, writing programmes, Multiple data -file handling.  Information systems: Types of Information and information systems(OLTP, MIS, DSS): Characteristics of MIS, Design of MIS, System development life cycle.</p> <p>Applications in Dairy industry: Use of RDBMS, Milk procurement and, Financial accounting system, 'Personnel management system etc.  Use of spread sheet: Cost analysis of milk and milk products, Estimation of labour efficiency, Monitoring quality standards of dairy products, Budgeting and forecasting, Estimation of losses in manufacturing and packaging, etc.  Use of linear Programming package, formulation of least cost mix for ice-cream, cattle feed, baby-food, etc.</p> <p>Introduction to process control, control systems, process control principles, process description, process control block diagrams, control system evaluation, analog and digital processing, units, standards and definitions, process control diagrams, time response, significance and statistics.  Computers in process control, Programmable controllers, data logging, supervisory control, computer based controllers, characteristics of digital data, sampled data system,</p> <p>Development of controller software, Input -data operations, controller modes, Computer controller, examples.</p> <p><b>Practicals</b>  1. Writing simple programmes with basic, Cobol, FORTRAN, C+  2. File maintenance programmes  3. MIS report generation programmes  4. Development of MIS case studies  5. Spreadsheet package of case studies  6. Use of LP Packages  8. Use of SPSS Packages  9. Visit to a Dairy Plant: Demonstration of Process description &amp; control system in Dairy Plant</p>		

Semester-III

1	DE-401	Refrigeration and Air Conditioning	3 (2-0-1)
<p>Basic refrigeration cycles and concepts : Standard rating refrigerating machines, Elementary vapour compression refrigeration cycle with reciprocating, rotary and centrifugal compressors. Theoretical vapour compression cycle, Departure from theoretical vapour compression cycle, representation on T- and p-h diagrams, Mathematical analysis of vapour compression refrigeration system. Refrigerants: Primary and secondary refrigerants, common refrigerants (Ammonia, Freon), Brine, their properties and comparison. Multiple evaporator and compressor systems: Applications, One compressor systems: dual compression, comparison of system, Control of multiple evaporator system, Working and mathematical analysis of above systems. Refrigeration equipments: Compressor, Condenser, evaporator, Cooling tower, spray pond, Basic elements of design, Construction, operation and maintenance, balancing of different components of the system. Refrigeration Controls: Low side and high side float valves, capillary tube, thermostatic expansion valve, automatic expansion valve, solenoid valve, High pressure and low pressure cutouts, thermostat, overload protector, common defects and remedies. Refrigeration Piping: Purpose, materials, joint and fittings, water and brine pipe size selection. Absorption Refrigeration Systems: Simple vapour absorption refrigeration systems, Practical absorption system, Refrigerant absorbent combinations Absorption cycle analysis. Psychrometry: definition, properties of air-vapour mixtures, Psychrometric charts, Processes involving air vapor mixtures, Dehumidification, humidifiers, Humidity measurements, humidity control. Wet bulb, dry bulb temperature dew point temperature. Cooling load calculations: Types of loads, design conditions for air cooling, air conditioning loads. Cold storage: Types of cold storage, Types of loads in cold storage, Construction of cold storage. Insulating materials and vapour barriers.</p> <p><b>Practical :</b> Study of tools used in installation of a refrigeration plant including charging and detection of leaks. To study different parts and learn operation of bulk milk cooler. Study of different parts and learn the operation of a refrigeration plant/ice plant using ammonia refrigerant. Study of different parts and learn the operation of a vapour absorption refrigeration plant. Dismantling and assemble an open compressor and a sealed unit. Study different parts and refrigeration controls of the following (a) Refrigerator (b) Water cooler (c) Deep Freezer (d) Compare their cooling coils and other systems. To find out the rating (cooling rate) at different suction temperatures (temperature differences) and air handling capacity of the air cooling unit. Plotting the practical refrigeration cycle on a pressure enthalpy diagram and to compare it with a theoretical refrigeration cycle. Study different parts and operation of a (a) Air washer, (b) Room cooler, (a) Air conditioner, (d) Chemical dehumidifiers, (e) Cooling. Plotting of psychrometric process: Sensible heating &amp; cooling. Dehumidification &amp; cooling and heating &amp; humidification. Study of different humidity indicating, recording and controlling devices. Problems on cold storage. Visit to cold storage.</p>			
2	DT-401	Condensed & Dried Milks	5 (3-0-2)
<p>History, status and scope in India and abroad, Definition and legal standards: Condensed milk, sweetened condensed milk and evaporated milk., Manufacturing techniques; a) Manufacture of evaporated milk including pilot sterilization test b) Manufacture of sweetened condensed milk c) Recombined sweetened condensed milk. Grading and quality of raw milk for condensed and evaporated milk, Physico-chemical changes taking place during manufacture of condensed milk, Heat stability of milk and condensed milk, Physico-chemical properties of condensed milk and role of stabilizers in the stability of condensed milk, Chemical defects in condensed milk, their causes and prevention., Microbiological qualities of condensed milks, preservative used in evaporated, condensed &amp; dried milks, a) Type of microorganisms occurring in condensed milks b) Survival and</p>			

	<p>growth of microorganisms during manufacture and storage.c) Microbiological standards, d) Type of spoilage and their prevention. Recent advances with reference to freeze concentration and membrane concentration, Dried Milks: History and status in India and abroad, Grading and quality of raw milk for dried milks, Manufacture of skim milk powder (SMP), whole milk powders and heat classified powders, Physico-chemical changes taking place during manufacture of dried milks, Physical properties of dried milks, Defects in dried milk during manufacture and storage, their causes and prevention, PFA, BIS and International Standards for dried milk, Manufacture of infant foods, malted milk foods and other formulated dried products, Microbiological quality of various dried milks including infant foods and Management of condensed and dried milk industry.</p> <p><b>Practical:</b> Manufacture of plain skim concentrated milk. Chemicals and microbiological examination of concentrated and dried milks for (a) Moisture, T.S., Fat, lactose, sucrose, bulk density, solubility index, and (b) SPC, coliforms, yeasts and molds, toxins etc. Manufacture of SCM. Manufacture of EM. Concentration of milk by membrane processing. Manufacturing of SMP by spray drying/roller drying. Manufacture of instant milk powder.</p>		
<b>3</b>	<b>ME-503</b>	<b>Heat and Mass Transfer</b>	<b>4(3-0-1)</b>
	<p>Basic heat transfer process, thermal conductivity, convective film co-efficient, Stefan Boltzman's constant and equivalent radiation co-efficient, Overall heat transfer co-efficient, physical properties related to heat transfer. Working principles and application of various instruments for measuring temperature. One-dimensional steady state conduction: Theory of heat conduction, Fourier's law, Derivation of Fourier's equation in Cartesian co-ordinates, Linear heat flow through slab, cylinder and sphere. Heat flow through slab, cylinder and sphere with non-uniform thermal conductivity. Concept of electrical analogy and its application for thermal circuits, Heat transfer through composite walls and insulated pipelines. One dimensional steady state heat conduction with heat generation : Heat flow through slab, hollow sphere and cylinder with uniform heat generation, Development of equations of temperature distribution with different boundary conditions. Steady-state heat conduction with heat dissipation to environment :Introduction to extended surfaces (FINS) of uniform area of cross-section. Equation of temperature distribution with different boundary conditions. Effectiveness and efficiency of the FINS. Introduction to unsteady state heat conduction. Convection: Forced and free convection, use of dimensional analysis for correlating variables affecting convection heat transfer, Concept of Nusselt number. Prandtl number, Reynolds number, Grashoff number, Some important empirical relations used for determination of heat transfer coefficient. Heat Exchangers: General discussion, fouling factors, jacketed kettles, LMTD, parallel and counter flow heat exchangers, Shell and tube and plate heat exchangers, Heat exchanger design. Application of different types of heat exchangers in dairy and food industry. Fick's Law of diffusion, steady state diffusion of gases and liquids through solids. Equimolal diffusion. Mass transfer co-efficient and problems on mass transfer.</p> <p><b>Practical :</b> Determination of thermal conductivity: milk, solid dairy &amp; food products. Determination of overall heat transfer co-efficient of : Shell and tube, plate heat exchangers and Jacketted kettle used in Dairy &amp; Food Industry. Studies on heat transfer through extended surfaces. Studies on temperature distribution and heat transfer in HTST pasteuriser. Design problems on heat exchangers. Study of various types of heat exchangers. Design problems on Mass Transfer.</p>		
<b>4</b>	<b>MBGE - 455</b>	<b>Food Bio-technology</b>	<b>3(3-0-0)</b>
	<p>Prospectus of BioTechnology. Molecular genetics i.e. fundamentals of molecular biology with special reference to chemistry and biology and DNA. (Primary secondary and tertiary) structures.</p>		

	<p>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. Biogas plant.</p> <p><b>Practical:</b> Study of auxotroph, Micropropagation through tissue culture, Strain improvement through U.V. mutation for lactose utilization, Chemical mutagenesis using chemical mutagens (Ethidium bromide), Determination of survival curves using physical and chemical mutagens. Isolation and analysis of chromosomal / genomic DNA from E.coli and Bacillus cereus. Separation of protoplast using cellulytic enzymes. Production of Biomass from fruit and vegetable waste. Introduction of ELISA / Southern blot / DNA finger printing etc. Agarose gel electrophoresis of plasmid DNA. Pesticide degradation by pseudomonas spp.</p>		
<b>5</b>	<b>MAS-410</b>	<b>Applied Mathematics</b>	<b>4(3-1-0)</b>
<p><b>Differential Calculus:</b>  Rolley's theorem, Langrange's theorem,  Expansion of functions in a Taylor Series  Maxima and Minima of functions to application of theory  of maxima and minima of functions, the solution of problems  Partial derivative of function of several variables  Partial derivatives of higher order.</p> <p><b>Integral Calculus:</b>  Geometric &amp; Mechanical application of Definite Integral  The Arc length of curve, computation of surface area  Computation of volume of solid of revolution  Computation of moment of inertia of a circle and a cylinder by means of definite integral.</p> <p><b>Vector Analyses:</b>  Dot product and cross product of vectors.  Scaler triple product, Vector Triple Product  Vector function of one variable, Differential of vector function  The operator, Gradient of scaler function, Curl and divergence of vector function.  Line, surface and volume integral, divergence and stokes theorems.</p> <p><b>Ordinary Differential Equation</b>  Separable first order equations,  Homogenous first order equations  Exact first order equations  Application of first order differential equations  The general linear second order equations  The homogenous linear equation with constant coefficients  The non - homogenous equation and Particular integrals  Application of second order differential equations.</p> <p><b>Fourier Series:</b> Introduction; Euler coefficients, Euler - Fourier Formula; Fourier expansion of periodic functions.</p>			

6	APFE -410	Principles of Food Quality & Safety	3(3-0-0)
	<p>Food quality and its role in food industry; Definition of Food quality, Role of food quality in Food Industry. Quality attributes; Classification of quality attributes, Color and gloss: Definition, Different colors, color measurement by spectrophotometer, muncell color system, lovibond tintometer, role in food qualities. Role of viscosity and consistency in food quality. Size and shape: Production, role in Food industry Measurements: weight, volume, weightvolume ratio, length, width, diameter, symmetry, curvature, area. Defects: Classification, Genetic physiological defects Structural, off color, character, Entomological Defects: holes, Scars, lesions, off coloring, curled aves, pathological defects. Mechanical defects, Extraneous or foreign material defects. Measurement of defects: Improving visibility by dilution, white background, color differences, standardization of conditions, reference standards, counts and measures, isolation of defects by floatation, elution, electronic sorting, Internal defects. Flavour: Definition and its role in food quality, Taste, classification, taste qualities, relative intensity, reaction time, effect of disease, temperature, and taste medium on taste, basic tastes, interaction of tastes. Odour : definition, Classification, neutral mechanisms, Olfactory abnormalities, odor testing, techniques, thresholds, odor intensities, olfaction. Visual, Auditory, Tackle and other senses, Vision, audition, oral perception other than taste. Factors influencing sensory measurements: Attitudinal factors, motivation psychological errors in Judgment, relation between stimulus and perception adaptation. Correlation of sensory and instrumental analysis. Quality Measurements: Laboratory measurement: types of tests, panel selection and testing environment, serving procedures, instruction to judges, Difference tests, directional difference tests, classification of difference tests, two sample tests, three sample tests, multisampling tests, comparison of procedures, ranking, scoring, hedonic scaling, dilution procedures, descriptive sensory analysis, contour method, other procedures, Consumer measurement: Factors influencing acceptance and preference, objectives of consumer preference studies, information obtained from consumer study, factors influencing results from consumer surveys, Methods of approach, development of the questionnaire, types of questionnaires, serving procedures. Comparison of laboratory panels with consumer panels. Limitations of consumer survey. Quality of raw materials: Physical, Chemical and microbial quality. Quality of products during processing &amp; after processing color, taste, texture, flavour, appearance. Factors influencing the Food qualities: Soil, field practices, harvesting practices, procedures, packaging, transportation, storage, conditions, processing conditions, packaging and storage conditions of finished products. Recording and reporting of quality.</p> <p><b>Practical:</b> Sensory evaluation of product. Quality evaluation of raw materials. Quality evaluation of product for colours, size, shape. Sensory evaluation of product for taste. Market testing of products. Evaluation of food standards. Determination of color by using lovibond tintometer. Visit to food factory to know sensory evaluation problems. Consumer study for food quality. Visit to fruit &amp; Vegetable market for quality assessment.</p>		
7	MAS - 511	Statistical Methods	3(2-0-1)
	<p>Definition and scope; Statistics.  Methods of condensation of data, frequency distribution Graphical representation  Measures of central tendency  Measures of dispersion  Moments, skewness and kurtosis.  Elementary notions of probability  Laws of addition and multiplication probability.  Theoretical frequency distributions  Binomial distributions and its applications  Poisson distribution and its applications  Normal distribution and its applications</p>		

	<p>Concept of sampling</p> <p>Simple random sampling with replacement</p> <p>Simple random sampling without replacement</p> <p>Introduction to testing of hypotheses and Tests of Significance</p> <p>'Z' and 'T' test for one sample problems</p> <p>'Z' and 'T' test for two sample problems</p> <p>'Chi-square' test for independence of attributes and goodness of fit. Simple correlation coefficient and its test of significance</p> <p>Lines regression, Rank correlation</p> <p>Practicals</p> <ol style="list-style-type: none"><li>1. Formation of frequency distribution and graphical representation.</li><li>2. Measures of central tendency.</li><li>3. Measures of dispersion.</li><li>4. Applications of 'Z' test for one and two sample problems</li><li>5. Applications of 'T' test for one and two sample problems.</li><li>6. Applications of Chi-square test.</li><li>8. Rank correlation coefficient.</li></ol>
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**Semester-IV**

1	DT-304	Fat Rich & Traditional Dairy Products	3 (2-0-1)
	<p>Cream: a) Definition &amp; Legal standards, Methods of separation, Efficiency of cream separation and factors affecting it; control of fat concentration in cream. Neutralization, standardization, pasteurization and cooling of cream.</p> <p>Butter: introduction to the butter-making process; batch and continuous methods. Technology of butter manufacture; over-run in butter; packaging and storage.</p> <p>Butter-making equipment: construction, operation, and continuous butter making machines.</p> <p>Khoa: Classification of types, standards methods of manufacture and preservation factors affecting yield of khoa. Physicochemical changes during manufacture and storage of khoa. Mechanization in manufacture of khoa. Product identification, process description, factors affecting yield physicochemical changes during manufacture. Chhana: Product description, Standards method of manufacture, packaging and preservation. Paneer: Product description standards method of manufacture packaging and preservation. Physicochemical changes during manufacture and storage.</p> <p>Ghee: Methods of ghee making-batch and industrial processes, innovations in ghee production, procedure, packaging and preservation of ghee.</p> <p><b>Practical</b> : Standardization, neutralization, pasteurization and cooling of cream. . Preparation of cooking butter by the hand-operated churn. Manufacture of table butter using the power-driven chum. Preparation of khoa from cow, buffalo and concentrated milk. Analysis of khoa, chhanna and paneer for total solids, moisture, fat and acidity. Preparation of chhana from cow and buffalo milk and mixed milk. Preparation of paneer from cow and buffalo milk and mixed milk.</p>		
2	FST-509	Sensory evaluation of food Products	3 (2-0-1)
	<p>Introduction, definition and importance of sensory evaluation in relation: to consumer acceptability and economic aspects; factors affecting food acceptance. Terminology related to sensory evaluation. Design and requirements of sensory evaluation laboratory. Basic principles: Senses and sensory perception and the way we perceive them, Physiology of sensory organs, Classification of tastes and odours, determination of threshold value. Factors affecting senses, visual, auditory, tactile and other responses. Introduction to sensory techniques. Fundamental rules for scoring and grading of food and food products. Procedure: Types of tests –overall difference tests, attribute difference tests, affective tests, Panel selection, screening and training of judges. Requirements of sensory evaluation, sampling procedures. Factors influencing sensory measurements. Guidelines for choice of techniques. Judging and grading of milk and milk products.. Judging and grading of food and food products –sensory evaluation of beverages, baking and confectionary products, meat and poultry products Consumer acceptance studies: Objectives. Methods, types or questionnaires, development of questionnaires, comparison of laboratory testing and Consumers studies, limitations. Interrelationship between sensory properties of food and dairy products and various instrumental and physicochemical tests. Preparation of food and dairy products with defects, techniques for simulation.</p>		
3	FST-401	Cereal Processing	3 (2-0-1)
	<p>Present status and future prospects of cereals (Rice, Wheat, Corn, Sorghum, Rye); Morphology of Rice: Physical properties; Density, Bulk density, Angle of repose, Hardness, asperity, porosity, stack of milling and moisture on physical properties. Chemical composition, Distribution of</p>		



	<p>nutrients and Aroma of rice. Drying of paddy: general principles and methods of drying, cracking phenomenon prevention. Methods of drying, batch type, continuous type driers. Milling of rice: i) Conventional Milling ii) Modern milling iii) Advantages and disadvantages of milling machineries. iv) By products of rice milling. Parboiling of rice: Aging of rice: Enrichment: Need of Enrichment, Methods of enrichment, Enrichment levels, fortification of amino acids. Processed Foods from rice: Breakfast cereals, flakes, puffing, canning and instant rice. Wheat: Morphology, Physicochemical properties, Wheat Quality, Wheat Milling. Corn: Morphology, Physicochemical properties, Corn milling, Milling fractions and modify starches. Barley: Morphology, Physicochemical properties and processing (Malting) Sorghum: Morphology, Physicochemical properties, Milling, Malting, Pearling and industrial utilization. Millets – Oat / Rye: Importance of Millet, composition, processing of millets for food uses.</p> <p>Practical: Morphological characteristics of cereals. Physical properties of cereals. Chemical properties of cereals. Determination of colour of cereals. Parboiling of Paddy. Cooking quality of rice, Milling of rice, Conditioning of wheat. Production of sorghum flakes. Production of Popcorns Preparation of sorghum Malt. Determination of Gelatinization Temp. By amylograph. Extraction of oil from rice bran. Visit to Cereal processing unit.</p>		
<b>4</b>	<b>FST-403</b>	<b>Fermentation &amp; Industrial Microbiology</b>	<b>3 (2-0-1)</b>
	<p>Microbes as friend's primary secondary screening and the organizations involved microbiological work. Industrially important secondary metabolites, organic acids, citric acid, antibiotics, probiotics, therapeutic and medicinal value. Bacteriocins Nisin, biocolours carotenoids, Bcarotene, lycopane, Ang kak, plant growth regulators from microbes gibberlins, IAA etc. hormones, production of microbial enzymes Downstream processing of enzymes and application of microbial enzymes. Microbial polysaccharides, types of polysaccharides and their applications xanthan, Dextran and pullulan, production of amino acids, vitamins, bioinsecticides. Plant cell cultures and metabolites, production of SCP, Safety of SCP, bakers yeast. Fermentation Technology – Types, Food based fermented products, Biochemical changes, Microbial standards. Industrial fermentors and accessories. Economic feasibility studies of few products advances in strain improvements of for high yields of metabolites, Blue green algae. Mushrooms – production, preservation and quality.</p> <p><b>Practical:</b> Standardization of physical factors for higher yields of citric acid. Production and assay of antibiotics. Isolation, identification of cultures producing biocolours. Production and assay of <math>\beta</math>carotene. Production of Ang kak (Red rice) and estimation of colouring compounds. Production, purification and assay of fungal analyses / proteases. Production of xanthan / pullulan. Production and assay of amino acids. Plant cell culture. Production and assay of nisin from Lactic acid bacteria. Single Cell Protein production. Bakers yeast effect in Bread Preparation. Mushroom Production. Preparation of food based fermented product</p>		
<b>5</b>	<b>FST-508</b>	<b>Legumes &amp; oilseed technology</b>	<b>3 (2-0-1)</b>
	<p>Present status and future prospectus of Legumes and Oil seeds Morphology of legume. Classification and types of legumes and pulses. Chemical composition and nutritional value. Antinutritional factors, their chemistry, methods of removal of antinutritional factors. Processing of legumes of Food uses: Home scale, Cottage Scale and commercial methods of dehulling. Modern techniques in Dal mills. Processing of Red gram,. Bengal gram, Green gram, Black gram. Dal milling – Principle, methods, equipments and effect on quality. Principle products, Dry and Wet milling of pulses, Fermented Products of legumes. Soaking – Principles, Methods of soaking Sprouting, Puffing, Roasting &amp; Parboiling of Legumes, Physical and Biochemical changes during these processes. Cooking quality of dhal – methods, factors affecting quality of dhal and cooking of dhal. Quick cooking dhal, Instant dhal. Introduction, Present and future prospects of oil seeds,</p>		

	<p>chemical composition and characters of oil seed and Oils, Antinutritional factors, elimination Methods. Post Harvest Technology of Oil seeds, Handling Drying, Storage, Grading, Pretreatments, cleaning, Dehulling, Size reduction and flaking. Oil extraction: Traditional Methods, Ghani, Power Ghani, Expellers Principle of Expeller, structure design of expeller. Solvent extraction process: Principle, Pretreatment Breaking, Cracking, flaking. Extraction principles, factors affecting the extraction process. Desolventization. Refining of Oils Degumming, neutralization, bleaching, filtration, deodorization, their Principles and process controls. New Technologies in oil seed processing, utilization of oil seed meals of different food uses. High protein Product, like protein concentrate and isolates.</p> <p><b>Practical</b> : Physical properties of Legumes and Oil seeds. Estimation of protein. Estimation of Fat Methods and Principles of dehulling; Application Oil &amp; Application Red Earth slurry. Dal Milling Process. Antinutritional factors, Methods of Elimination. Soaking studies .Sprouting of legumes. Cooking quality of Dal. Fermented product of legumes Dosa, Idli, Wada, Dhokala, etc. Extraction of oil by expeller press. Production of protein rich product. Visit to Dal Mill and oil extraction plant.</p>		
<b>6</b>	<b>ENV-417</b>	<b>Environmental Studies</b>	<b>3(3-0-0)</b>
	<ol style="list-style-type: none"> <li>1. Definition, Scope and Importance of Environment and Environmental Studies Multidisciplinary Nature of Environmental Studies.</li> <li>2. Eco-system <ul style="list-style-type: none"> <li>• Concept, structure and function of an ecosystem(Producers, consumers and decomposes)</li> <li>• Introduction, types, characteristics features, structures and function of the following ecosystem: (a) Forest Ecosystem (b) Grassland Ecosystem (c) Desert Ecosystem (d)Aquatic Ecosystem (Ponds, streams, lakes, rivers, oceans, estuaries)</li> </ul> </li> <li>3. Social Issues and the Environment <ul style="list-style-type: none"> <li>• Water conservation, rain water harvesting, Water shed Management, Climate Change, global warming, acid rain, ozone layer depletion, wasteland reclamation</li> <li>• Environment Protection Acts</li> </ul> </li> <li>4. Natural Resources <ul style="list-style-type: none"> <li>(a) Forest resources (b) Water Resources (c) Mineral Resources (d) Food Resources (e) Energy Resources (f) Land resources, Role of and individual in conversation of natural resources for sustainable life style.</li> </ul> </li> <li>5. Biodiversity and its conservation Introduction- Definition: genetic, species and ecosystem diversity, bio-geographical classification of India, vale of diversity: consumptive use, productive use, social and ethical aesthetic values, Bio-diversity at global, nationa and local levels, India as mega-diversity nation, Hot-spots of biodiversity, conservation of biodiversity:in-situ and ex-city conversation of bio-diversity.</li> <li>6. Environmental pollution Definition, causes, effects and controlling measures of <ul style="list-style-type: none"> <li>(a) Air pollution (b) Water pollution (c) Pollution (d) Noise pollution</li> </ul> <p>Solid waste Management: causes, effect and control measures of urban and industrial wastes</p> </li> </ol>		

<b>7</b>	<b>BAM-501</b>	<b>Marketing Management &amp; International Trade</b>	<b>2 (2-0-0)</b>
<p>Concept of marketing; Functions of marketing ; concepts of marketing management; scope of marketing management ; marketing management. Process ; concepts of marketing- mix, elements of marketing- mix. Market Structure and Consumer Buying Behaviour: Concept of market structure, marketing environment, micro and macro environments. Consumers buying behaviour, consumerism. Marketing Opportunities Analysis: Marketing research and marketing information systems; Market measurement- present and future demand; Market forecasting; market segmentation, targeting and positioning. Allocation and Marketing resources. Marketing Planning Process. Product policy and planning : Product- mix; product line; product life cycle. New product development process. Product brand, packaging, services decisions. Marketing channel decisions. Retailing, wholesaling and distribution. Pricing Decisions. Price determination and pricing policy of milk products in organized and unorganized sectors of dairy industry. Promotion-mix decisions. Advertising; How advertising works; Deciding advertising objectives, advertising budget and advertising message; Media Planning; Personal Selling, Publicity; Sales Promotion. Food and Dairy Products Marketing. International Marketing and International Trade. Salient features of International Marketing. Composition &amp; direction of Indian exports; International marketing environment; Deciding which &amp; how to enter international market; Exports- Direct exports, indirect exports, Licensing, Joint Ventures, Direct investment &amp; internationalization process, Deciding marketing Programme; Product, Promotion, Price, Distribution Channels. Deciding the Market Organization; World Trade Organization (WTO)</p>			
<b>8</b>	<b>FST-515</b>	<b>Quality Assurance and Certification</b>	<b>2 (2-0-0)</b>
<p>Quality inspection, quality control, quality management and Quality Assurance. Total quality management; Good Manufacturing Practices, Good Agricultural Practices, Good Laboratory Practices, Quality Management systems QSS. Quality Circles, SQC., ISO System. HACCP, Principles, Implementation. Plan Documentation, types of records. Auditing, Surveillance; Audit, Mock audit, third party quality certifying audit, Auditors and Lead auditors. Certification, Certification procedures, Certifying bodies, Accrediting bodies, International bodies.</p> <p><b>Practical:</b> Quality Assurance procedure. T&amp;M, GMP, GAP documentation. Preparation Quality Policy &amp; documentation (Quality Manuals). Preparation of Laboratory manuals. Application of HACCP to Products. Preparation of documentation and records. Auditing Surveillance, Mock audit. Visit to units implementing GMP, GAP. Visit to units with ISO systems. Visit to units with HACCP certification.</p>			

Semester-V

1	COMP-	IT Application in Food Industry	2(1-0-1)
<p>Importance of Computerization and IT in Food Industries: Computers, operating environments and information systems for various types of food industries, Principles of Communication. Role of Computer in Optimization; Introduction to operation Research. A Computer Oriented Algorithmic approach; Queuing systems and waiting models, PERT, CPS and CPM. Food Process Modeling and Simulation, Introduction to SCADA and INTELUTION, CAD and CAM in Food Industry; Instrumentation, Process Control Inventory Control: Automation, Robotics, Expert system and artificial intelligence, Instrumentation.</p> <p><b>Practical:</b> Applications of MS Excel to solve the problems of food technology: Statistical quality control, Sensory evaluation of food, Chemical kinetics in food processing. Use of word processing software for creating reports and presentation. Familiarization with the application of computer in food industries: Milk plant, Dairy units, Fruit &amp; Vegetable processing unit Familiarization with software related to food industry, Ergonomics application in the same, Visit to Industry and knowledge of computer.</p>			
2	FST-504	Techniques in Food Analysis	3 (2-0-1)
<p>Nature and concepts of food analysis; Rules and regulations of food analysis, Safety in laboratory, sampling techniques. Principles and methodology involved in analytical techniques: PH Meter and use of ion selective electrodes –Spectroscopy,Ultra violet visible, florescence, Infrared spectro, Atomic absorption and emission, Mass spectroscopy, Nuclear magnetic resonance and electron spin resonance. Chromatography –Adsorption, Column , Partition, Gelfiltration, Affinity, Ionexchange, Sizeexclusion method, Gas liquid, High performance liquid chromatography. Separation techniquesDialysis, Electrophoresis i) Paper ii) DS gel electrophoresis iii) Immuno electrophoresis Sedimentation, ultrafiltration, ultracentrifugation, Isoelectric focusing, Isotopic techniques, Manometric techniques. Principles and methodology involved in analysis of foods ; Rheological analysis, Textural profile analysis of foods. Immuno assay techniques in food analysis; Isotopic and Nonisotopic immuno assay, Enzymeimmuno assay. Evaluation of analytical data ; Accuracy and precision, Statistical significance, Correlations regression, Computers for data analysis and result interpretation. Sensory analysis of food; Objective method, Objective method.</p> <p><b>Practical:</b> Analysis of heavy method using atomic absorption spectrophotometer. Estimation of physic acid using spectrophotometer. Separation of amino acids by towdimensional paper chromatography. The identification of sugars in fruit juice using TLC. Separation of pralines by Ionexchange chromatography. Molecular weight determination using sephadoxgel. Identification of organic acids by paper electrophoresis. Gelectrophoresis for analytic techniques. Quantitative determination of sugars and fatty acid profile by GLE. Quantitative makeup of water and fat soluble vitamins using HPLC.</p>			
3	FST-513	Specialty Foods	3(2-0-1)
<p>Need and scope of specialty foods: Specialty food based on ease in preparation cost health benefits; Functional foods, Convenience food, Health care and medical benefits, Nutritional status, Low cost foods. Specialty foods based on sources ; Cereals and millets, Legumes and pulses, Fruits and vegetables, Animal food sources, By product based, Non conventional foods. Specialty foods based on process ; Innovative process technology, Food additives basis, Bioactive</p>			

	<p>components, Novel nutraceuticals products, Packaging techniques, Adaptable technology basis, Fast and PET foods. Specialty food based on genetics ; Genetically modified foods, Transgenic foods, Biotechnological aspects of detoxification. Proprietary foods. Supplementary foods. Therapeutic foods ; Modification of diets in disorders, feeding purposes Disease oriented of different organs ex: digestive tract, liver, cardiovascular system, kidney , metabolic disorders, allergy, endocrine disorders. Specific consumer oriented foods; Defence persons, Space / astronaut, High altitude mountain climbers, Disaster situation – crises, care, maintenance. Specialty foods based on growing condition organic , inorganic farming.</p> <p><b>Practical:</b> Preparation of specialty foods based on ; Functionality, Convenience, Low cost, Nutritional purpose. Preparation of specialty food using locally available foods crops, fruit and vegetables few products. Assessment of byproduct for preparation of value added specialty food. Isolation of phytochemical/ bioreactive agent of plant sources and their utilization in proprietary foods. Preparation of specialty food as per requirement of; Location, Nature of work, Status of worker. Evolution of food cultivated under organic conditions.</p>		
<b>4</b>	<b>FST-506</b>	<b>Food Industry Byproducts &amp; Waste Utilization</b>	<b>3 (2-0-1)</b>
	<p>Industrial Byproducts and Waste: Potentials and prospects of developing byproducts industry in India. Agricultural waste and agro based industrial waste management. By products of cereals. By products of legumes. By products of oil seeds. By products of dairy. By products of fruit and vegetables processing industries. By products of meat, poultry and eggs. By products of fish processing units. By products of plantation crops and spices. Uses of byproducts of agro based industries in various sector. Byproducts of fermentation industries. By products of sugar and bakery industries.</p> <p><b>Practical:</b> Extraction of banana fiber. Extraction of leaf proteins. Alcohol production from molasses. Use of crop residues for the production of cellulose. Use of mango kernels for starch manufacture. Pectins from organic waste. Extraction of volatile oils from organic waste.</p>		
<b>5</b>	<b>FST-507</b>	<b>Food Safety and Microbial Standards.</b>	<b>3 (2-0-1)</b>
	<p>Dietary Toxins: Naturally occurring in food Endogenous toxin, Exogenous toxin. Microbial toxins ; i) Bacterial, ii) Mold. Intrinsic toxin produced during processing and storage. M as toxin – sources, conditions, causes and Elimination. Pesticidal residues as toxin; i) chlorinated ii) Non – chlorinated. Non – Permitted food additives. Microbial standards of processed and preserved foods. Risk assessment and management during food preparation.</p> <p><b>Practical :</b> Estimation bacterial toxins from food samples.(Different types of foods). Estimation of fungal toxins from food samples. (Different types of foods).Heavy metal detection (lead) .Risk assessment and management determination. HACCP for food industries by taking few models. Study of national and international microbial quality standards. Visit to export oriented food processing industry.</p>		
<b>6</b>	<b>APFE-409</b>	<b>Processing of Marine Products</b>	<b>2(2-0-0)</b>
	<p>Types of fish, composition, structure and post mortem change in fish and quality evaluation. Handling of fresh water fish. Processing and preservation of fish canning, smoking, chilling and freezing of fish. Salting, sun drying and salt curing of fish. Fish sausages. Freezedrying of fish/shrimp. Radiation processing and safety. Fish fermented products. Fish protein concentrates. Marine oils and fish meals. Marine algal products. Production of fish and sea foods &amp; utilization fish byproducts. MFPO and BIS specifications of fish and fish products.</p> <p><b>Practical:</b> Anatomy and dressing of fish. Quality evaluation of fish. Preparation of sun dried and</p>		

	salt cured fish, fish sausages. Chilling and freezing of fish. Preparations of fish protein concentrate. Preparation of fishmeal. Preparation of marine oils and various fish products. Utilization of fish byproducts. Preparation of marine algal products.		
7	<b>APFE-611</b>	<b>Food Packaging Technology</b>	<b>3 (2-0-1)</b>
	<p>Introduction to subject, Packaging situations in World, India, need of packaging, plastic consumption/use in World, India etc. Package requirements, package functions, Hazards acting on package during transportation, Storage and atmospheric package, labeling laws. Package Materials: classification packages, paper as package material its manufacture, types, advantages corrugated and paper board boxes etc. Glass as package material, Manufacture, Advantages, disadvantages. Metal as package material manufacture, Advantages, disadvantages, Aluminum as package material, Its advantages and disadvantages, plastic as package material classification of polymers, properties of each plastics, uses of each plastics, chemistry of each plastic such as polyethylene, Polypropylene, polystyrene, polycarbonate, PVC, PVDC, Cellulose acetate, Nylon etc. Lamination Coating and Aseptic packaging. Lamination, need of lamination, types, properties, advantages &amp; disadvantages of each type. Coating on paper &amp; films, types of coatings : Need of coating, methods of coatings. Aseptic packaging Need, Advantaged, process, comparison of conventional &amp; aseptic packaging system of aseptic packaging and materials used in aseptic packaging. Machineries used in Packing foods. Packaging of Specific Foods. Packaging of specific foods with its properties, Like bread, Biscuits, Coffee, Milk powder, egg powder, carbonated beverages. Snack foods etc. Mechanical and functional tests on Package. Various mechanical and functional testes perform in laboratories on package boxes and package materials.</p> <p><b>Practical:</b> Classification of various packages based on material and rigidity. Measurement of thickness of paper, paper boards. Measurement of basis weight of paper and paperboards. Measurement of grammage and water absorption of paper, paper boards. Measurement of bursting strength of paper of paper boards. Measurement Tear resistance of papers. Measurement of puncture resistance of paper and paperboard. Measurement of tensile strength of paper of paper boards. Measurement of grease resistance of papers. Determination of gas transmission rate of package films. Determination of WVTR and QTR of films. Determination of coating on package materials. Identification of plastic films. Finding chemical resistance of films. Prepackaging practices followed for packing fruits, vegetables.</p>		

Semester-VI

1	DE-601	Food Engineering	4 (3-0-1)
	<p>Rheology of processed food, properties of fluid foods, Rheological method, Measurement of rheological parameters, properties of granular food and powders, Properties of solids foods, Visco-clastic models. Measurement o food texture. Food Freezing : Thermal properties of frozen foods. Predication of freezing rates. Plank's equation, Neumanna problem and Tao solution. Design of food freezing equipment, Air blast freezers, Plate freezers and immersion freezers, storage of frozen foods. Food dehydration : Estimation of drying time for food products, constant rate period and falling rate period dehydration. Diffusion controlled falling rate period. Use of heat and mass balanced in analysis of continuous dryers, fixed tray dehydration, cabinet drying, tunnel drying. Freeze Dehydration : Heat and mass transfer, Calculation of drying times, Industrial freeze drying. Equipment for pulping, Fruit juice extraction, Balanching, Dehulling, Size reduction and distillation.</p> <p><b>Practical:</b> Study of rheological properties of foods. Study of freezers and freeze dryers. Design problems on batch freezers. Design problems for continuous freezers. Design problems on dryer. Visit to cold storage. Visit to food processing plant.</p>		
2	ABM-402	Agri-Business Management	3 (3-0-0)
	<p>Definition, History, function productive system, operations, decisions, decision frame work, produces of series &amp; 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.</p>		
3	APFE-614	Food Laws and Legislation	2 (2-0-0)
	<p>Introduction to subject, Need of enforcing the laws and various types of laws. Mandatory food laws; The food safety and standards bill 2005, Establishment of the authority, composition of authoring functions of chief executive officer, scientific part, General principles to be followed in administration of act, General provisions as to articles of food, special responsibility as to safety of food, analysis of food offences of penalties. Preventions of Food adulteration act; Definition, object of act, central committee for food standards; public analysis, food inspector, duties of Food inspectors, Report of Public analyst, sealing, fastening and dispatch of samples, powers of court. Other Mandatory acts. Standard weight of measure act, essential commodity act, consumer protection act, Environmental protection act insecticide act. Export (quality control &amp; inspection) act. Various food orders; Fruit product order, Milk &amp; Milk product order, plant food seed (Regulation of imports in India) order, edible oil package order meat food products order. Optional food standards; Scope of these standards, their need, procedure to obtain that standard, Agmark, Bureau of Indian Standards. Codex Standards; Scope of codex standards, codex standards for cereals, pulses, fruit &amp; vegetables, Meat &amp; Poultry products, Recommerided international code of hygiene for various products.</p> <p><b>Practical:</b> Examination of Cereals &amp; pulses from one of godown and market shop in relation to FPO &amp; BIS specification. Examination of Ghee for various standards of Agmark &amp; BIS. Examination of honey for various Agmark and BIS standards. Examination of spices for Agmark &amp; BIS standards. Examination of milk &amp; Milk products for BIS, of milk product order standards. Examination of fruit Jam of two to three different companies for FPO specifications. Examination of two different industries squash for FPO specifications. Examination of ketchup of two to three</p>		

	different Companies for FPO specifications. Visit to BIS Laboratory, Visit to Agmark laboratory, Visit to quality control laboratory and Food processing industry.		
<b>4</b>	<b>APFE-605</b>	<b>Baking &amp; Confectionary Technology</b>	<b>3 (2-0-1)</b>
	<p>History, Traditional confectionary goods, Types of confectionary, classification. Basic Technical considerations, TS, TSS, pH, acidity, ERH, Sugar, Invert Sugar, Glucose syrup, RH, Crystallization. Raw Materials: Sugar, Sugar qualities, Physical, Chemical, Optical properties. Sugar grinding, Dextrose, Fructose, Lactose, caramel, maltose, Honey, sorbitol, xylitol, Iso malt, soy maltose, Polydextrose, Lactitol, Maltitol. Whipping, Release agent, thickeners, Acidulents, Flavours, for confectionery, emulsifiers and other additives, starch derivatives, colours used in confectionary. Production of glucose syrup, Acid hydrolysis, enzyme hydrolysis. Cocoa Processing: Cocoa bean, processing, roasting, Fermentation, Production of Cocoa butter Cocoa powder, its quality. Chocolate Processing: Ingredients, Mixing, Refining, Conching, Tempering, Molding, Cooling, Coating, Fat bloom. High Boiled Sweets: Introduction, Composition, Properties of high boiled sweets, preparation of high boiled sweets, Traditional, batch and continuous Method of preparation. Different types of higher boiled sweets, Recipes. Caramel: Definition, Composition, Factors affecting quality of caramel, caramel Manufacture process, batch type, continuous types, checking of faults in caramel. Toffee: Definition, Composition, types of toffee Ingredient and their role. Batch and Continuous method of toffee. Fondant: Fudge/Creamy: ingredients, Methods, Productivity. Lozenges: Definition recipe, Method of Manufacture, Compositions, factors affecting quality, Industrial production, checklist of faults. Tablets: Definitions, recipe, composition, wet granulation, Slugging, Manufacture of Tablet, and Checklist of tablet faults. Marshmallow and. Nougat: Definition, composition, recipe, and method of manufacture. Nougat. Panning: Process, types of Panning, soft and hard panning. Quality of confectionery, Standards and regulations, Packaging requirements of confectionary, economics and marketing of confectionary goods. Bakery Products, Role of Bakery ingredients (major and minor), From Hard Wheat: Bread: Processes of bread making mainly straight and sponge, role of each ingredient, quality control. Testing of raw material. Testing of final product. Bread faults, staleness, ropyness. Baked Products from soft wheat: Cookies, crackers, Biscuits, Cakes: Types, ingredients, Process, Causes, remedy. Other bakery Products: Pizza, Pastry and its Types. Macaroni Products: Including spaghetti, Noodles, VermicelliProcess. Nutritional improvement of bakery Products. Setting of bakery Unit, Bakery norms. Specifications for raw materials. Packaging. Marketing of Products. Project report on bakery. Visit to wheat milling Industry. Visit to Bakery.</p> <p><b>Practical:</b> Classification of wheat based on physicochemical properties. Conditioning of wheat. Milling of wheat. Quality Testing of flour: Falling number and <math>\alpha</math> amylase activity, Sedimentation value, Pelshenke value, Farinograph, Mixograph, Extensiograph, Alveograph. Manufacture of Bread, Types, Faults, remedies, shelf life bread, quality of bread Biscuits, cookies, crackers, buns: Types and quality. Other baked products Pastry, pizza. Extruded Products from wheat: Vermicelle, noodles etc. Physical properties of sugar. Production of invert sugar. Determination of Moisture in Sugar. Determination of Reducing Sugar</p>		
<b>5</b>	<b>APFE-503</b>	<b>Technology of Meat and Poultry Products</b>	<b>3 (3-0-0)</b>
	<p>Sources and developments of meat and poultry industries in India and importance of meat and meat industries in national economy. Muscle structure, chemical composition and physico-chemical properties of meat muscle. Abattoir design and layout. Pre-slaughter transport and care and anti mortem inspection. Slaughtering of animals and poultry, postmortem inspection and grading of meat. Factors affecting post-mortem changes, properties and shelf life of meat. Egg structure: Composition, quality characteristics, processing and preservation of eggs. Processing and preservation of meat- mechanical deboning, aging or chilling, freezing, pickling, curing,</p>		



	<p>cooking and smoking of meat. Meat tenderization. Meat emulsions. Technology of manufacture of meat and poultry products. Meat plant sanitation and safety. By-products utilization</p> <p><b>Practical:</b> Pre-slaughter operations of meat animals and poultry birds. Slaughtering and dressing of meat animals. Study of post-mortem changes. Meat cutting and handling. Evaluation of meat quality. Preservation of meat by different methods and preparation of meat and poultry products. Evaluation of quality and grading of eggs. Preservation of shell eggs. Experiments in by-products utilization.</p>		
<b>6</b>	<b>APFE-506</b>	<b>Fruits and Vegetable Processing</b>	<b>3 (2-0-1)</b>
	<p>Production and processing scenario of fruits and vegetable: India and World. Scope of Fruit and Vegetable Preservation Industry in India. Present status, constraints and prospectus. Overview of principles and preservation methods of fruits and Vegetables. Commercial processing Technology of Following fruits and vegetables. Mango: Pulp, RTS, Squash canned Mango pulp. Toffee amchur, pickle Mango Powder, bar. Banana: Wafers, puree, dried banana powder. Papaya: Jam, Candy RTS, Nectar, Squash, and Papain. Pomegranate: Juice, Squash, syrup, Anardana, Dalimbmanuka, Anargoli. Guava; Jelly, Cheese, Juice, Canned guava, Squash, Toffee. Grape: Raisin, Juice, Wine. Fig: Pulp, dried fig, Toffee Powder, bar fig. Citrus Fruits: Jelly, Marmalade RTS Squash, candy. Aonla; Preserve, Jam, Candy, Juice, Squash, powder, Dried shreds, chuyenprash, pickle, chutney sauce, sweets. Tamarind: Pulp, Powder, Toffee, Bar, RTS, Slab Jamun: Jelly, RTS, Syrup, wine, Wood apple: Jelly, Marmalade, Tomato: Ketchup, sauce, puree, soup, chutney, pickle, Ginger: Preserve, Candy, dried, Ginger pickle, RTS, Syrup. Onion: Dried Onion, Powder. Garlic: Dried Garlic, Powder, Oil. Potato: Wafer; starch, Papad, Carrot: Preserve, candy, Pickle, Jam. Cauliflower and cabbage: Dried cauliflower and cabbage, Sauerkraut, Pickle Leafy vegetables; Dried Leafy Vegetables. (Spinach, Fenugreek, Coriander leaves, Curry leaves). Bitter gourd: Pickle, Dried bitter gourd</p> <p><b>Practical:</b> Canning of Mango/Guava/Papaya. Preparation of Fruit Jam: Apple/Mango/Guava,/Papaya/Aonla/Strawberry. Preparation of fruit Jelly: Wood apple, Sweet orange/mandarin/Guava,/Tamarind. Preparation of fruit marmalade: Ginner Marmalade. Preparation of fruit preserve and candy. Preparation of fruit RTS and candy Preparation of fruit squash. Preparation of fruit syrup. Preparation of grape raisin, dried fig and dried banana. Preparation of Anardana and dalmab manuka. Preparation of papain /guava cheese. Preparation of pickle, mixed pickle. Preparation of dried ginger. Preparation of Amchur. Preparation of dried onion and garlic, Preparation of Banana and Potato wafers, Preparation of dehydrated leafy vegetable.</p>		
<b>7</b>	<b>APFE-515</b>	<b>Food Additives</b>	<b>2 (2-0-0)</b>
	<p>Intentional and unintentional food additives, their toxicology and satry evaluation. Naturally occurring food additives. Food colour (natural and artificial).Pigments their importance and utilization as food colour. Taste and flavour inducer, potentiater. Food preservatives and their chemical action. Role mode of action salt, chelating agents stabilizers and thickeners, polyhydric alcohol, anticaking agent, firming and colouring agent, flour bleaching agent, antioxidants, nonnutritional sweetness and antimicrobial agents.</p> <p><b>Practical:</b> Evaluation of GRAS aspect of food additives. Identification of food colour by TLC. Isolation and identification of naturally occurring food pigments by paper and TLC. Spectrophotometric method of total chlorophyll (A&amp;B). Determination of diacetyl content of Butter. Role mode of action of chelating agent in fruit juice. Role and mode of action of stabilizer and thickener in frozen dairy products. (Icecream ). Role and mode of clarifying agent in fruit juices. Role and mode of antioxidant in frozen fish. Role of leaving agent in baked food product.</p>		

**Semester-VII**

1	APFE-616	Processing of Spices and Plantation Crops	3(2-0-1)
	<p>Production and processing scenario of spice, flavour &amp; 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&amp; Cocoa: Processing. Vanilla and annatto processing. 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.</p> <p><b>Practical:</b> Identification and characterization of flavouring compounds of spices. Valuable oil determination. Extraction of oil from clove, pepper, cardamomchili. Extraction of oleoresinsTurmeric, 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.</p>		
2	BAM-502	Entrepreneurship Development and Communication Skill	2(1-0-1)
	<p>Entrepreneurship Development: Assessing overall business environment in the Indian economy. Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs. Globalisation and the emerging business / entrepreneurial environment. Concept of entrepreneurship; entrepreneurial and managerial characteristics; managing an enterprise; motivation and entrepreneurship development; importance of planning, monitoring, evaluation and follow up; managing competition; entrepreneurship development programs; SWOT analysis, Generation, incubation and commercialization of ideas and innovations. Government schemes and incentives for promotion of entrepreneurship. Government policy on Small and Medium Enterprises (SMEs) / SSIs. Export and Import Policies relevant to horticulture sector. Venture capital. Contract farming and joint ventures, publicprivate partnerships. Overview of food industry inputs. Characteristics of Indian food processing industries and export. Social Responsibility of Business. Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and nonverbal communication; listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, précis writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.</p> <p><b>Practical:</b> Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, précis writing, summarizing, abstracting; individual and group presentations.</p>		
3	FST-512	Product Development and Formulation	3(2-0-1)
	<p>Need, importance and objectives of formulation for new product development. Ideas, business philosophy and strategy of new product. Formulation based on sources availability and cost</p>		

	<p>competitiveness for concept developments of new products. Standardization of various formulation and product design. Adaptable technology and sustainable technology for standardized formulation for process development. Process control parameters and scaleup, production trials for new product development at lab and pilot scale. Quality assessment of new developed products. Market testing and marketing plan. Costing and economic evaluation. Commercialization / product launch.</p> <p><b>Practical:</b> Market survey of existing various products. Formulation of new products based on corporate decision; Proteinenergy rich, Low calorie (fat replacer), Low sodium content, Glycemic index based, Cholestrolemic index based, Phytochemical based. Product development based on above formulation depending on local sources/ technology. Quality assessment. New product development for; Infant / weaning foods, Geriatric, Physiological status, Athletes.</p>		
<b>4</b>	<b>FST-514</b>	<b>Food Production Trends and Programs</b>	<b>2(2-0-0)</b>
	<p>Food demand and supply – Qualitative and quantitative requirements. Expected Technological advances to meet the needs. Future priorities in Food Production needs –Status of Food Industry in India and Abroad. Magnitude and Inter dependence of Food Production and processing agencies. Food availability, production Trends – Factors of Production – Types of Foods like processed semi processed, Ready to eat Foods, Fast Foods. Food Characteristics Nutritional significance of major food groups. Present trends of consumption, Further requirements. Consumers change of aptitude in Food Products consumption. New food products developed Programmes aimed for making more food availability to increasing population and their prospects – Merits and drawbacks, prospects for future growth in India. National and International Trends and Programmes in Food handling, processing and marketing Potentials and Prospects of developing Food Industry in India. Food Losses –Factors affecting – Programmes and strategies to eliminate the losses and rate the required demand .Global demand for food. World Food Day – Importance and action plans.</p>		
<b>5</b>	<b>FST-516</b>	<b>Food Plant Design And Layout</b>	<b>3(2-0-1)</b>
	<p>Overall design of an Enterprise: Plant design, sales planning for plant design. Plant Location, levels of Plant location. Location of layout : location factors, plant site selection. Location theory and models, industrial buildings and grounds. Classification of Dairy and Food Plants, farm level collection and Chilling center. Space requirement. Preparation of a Plant Layout : Plant Layout problem, importance, objectives, classical types of layouts. Evaluation of Plant Layout. Advantages of good layout. Organizing for Plant Layout, Data forms. Development and Presentation of Layout : Development of the pilot layout, constructing the detailed layout : Functional design : Siting of different sections in a plant, Layout installations. Quantitative analysis for Plant Layout: Engineering economy. Linear programming. Queing theory. Common Problems in Plant Layout and Process scheduling. Siting of Process sections, Equipment selection and capacity determination, Arrangement of process, and service equipment. Estimation of Services and Utilities. Office layout, line balancing, Flexibility. Practical Layouts. Common materials of construction of Food plant, building. Maintenance of Food Plant Building, Illumination and ventilation, Cleaning &amp; sanitization, painting and colour coding, Fly and insect control.</p> <p><b>Practical:</b> Preparation of project report. Preparation of feasibility report. Layout of Food storage wares and godowns. Layout and design of cold storage. Layout of preprocessing house. Layout of Milk and Milk product plants. Low shelf life product plant. Bakery and related product plant. Fruits processing plants. Vegetable processing plants. Layout of multi product and composite food Plants Evaluation of given layout. Waste treatment and management of food plant.</p>		

<b>6</b>	<b>APFE-604</b>	<b>Extrusion technology</b>	<b>3(2-0-1)</b>
	<p>Food proteins; Types, sources, Availability, need, properties etc. Food problems, Role, Means for increasing food supply. Amino acid fortification of foods ; Cereals, infant foods, bread, baked products. Legumes and oilseed foods ; Isolate, concentrate, and substitute to milk, variation in composition and nutritive value. Meat Analog; Commercial development, nutritional aspect, marketing aspect. New protein foods; TOFU, Miso, Texturized vegetable protein, hydrolyzed vegetable protein, formulation and quality control. Extrusion Technology; Importance, principles of extrusion cooking, methods of extrusion cooking. Extruders; Types of extruders, single screw, twin screw their applications, effect of dependent and independent variables on the product quality. Extruded products; Raw materials, process of manufacture, properties, quality, evaluation, packaging requirement, marketing.</p> <p><b>Practical:</b> Physicochemical properties, functional properties of proteins, protein rich products, weaning foods, beverages, Texturized Products, Protein rich bakery products, Type of food extruders, preparation of extruded products, Factors affecting extrusion cooking, Moisture content, Diameter, Temperature, Pressure, screw speed, time, quality evaluation of these products.</p>		
<b>7</b>	<b>APFE-507</b>	<b>Quality control in food industry</b>	<b>3(2-0-1)</b>
	<p>Hygiene regulation, central of airborne contamination HACCP implementation, Indian experience, Assessing an operation, Microbiological central methods, Instrumental measurements of sensory attribute of foods; appearance, color, volume, density and specific gravity, Rheological and textural characteristics, Textural profile analysis. To relation between instrumental and sensory analysis of food quality attributes.</p> <p><b>Practical:</b> Methods of evaluation of sensory quality evaluation of color and rheological attributes, Detection and estimation of food additives and adulterants, Relationship between objective and subjective methods.</p>		
<b>8</b>	<b>APFE-509</b>	<b>Fermented Food Products</b>	<b>3(2-0-1)</b>
	<p>Food fermentation, stock culture and inoculum preparation. Lactic acid fermentation of milk, vegetables, cereals and meat. Alcoholic fermentation of fruit juices, sugar and starch substrates. Vinegar fermentation, mixed fermentation of cereal legumes and milk. Malting, brewing, steeping, germination, kilning and curing. Chemical and biochemical changes during malting and mashing. Separation of wort, wort boiling and hops addition. Fermentation, separation, maturation, carbonation and packaging.</p> <p><b>Practical:</b> Lactic acid fermentation. Alcoholic fermentation of fruit juices. Acetic acid fermentation and alkaline fermentation. Barley steeping. Germination, malting mashing and brewing; Preparation of wine and distillation of wine</p>		
<b>9</b>	<b>FST-517</b>	<b>Seminar</b>	<b>1 (0-0-1)</b>

**Semester – VIII**

## COURSE STRUCTURE OF I.D.D.(DAIRY TECHNOLOGY)

### SEMESTER I

Course Code	Course Title	L-T-P	Credits
IDD-301	Dairy Technology I (Indian Dairy Industry & Market Milk)	3-0-2	4
IDD-302	Dairy Chemistry I (Chemistry of Milk & Milk constituents)	3-0-2	4
IDD-303	Dairy Microbiology I (Basic Microbiology)	3-0-2	4
LNG-300	English & Basic Technical Writing	3-0-0	3
IDD-304	Dairy Production –I (Fodder Production & Cattle Nutrition)	3-0-2	4
IDD-305	Applied Maths & Statistics	3-1-0	4

### SEMESTER II

Course Code	Course Title	L-T-P	Credits
IDD-308	Dairy Production II (Cattle Breeding & Gen. Mgt.)	2-0-2	3
IDD-309	Dairy Engineering- I (Drawing & Workshop Practices)	3-0-2	4
IDD-310	Dairy Chemistry- II (Chemistry of Milk Products)	3-0-2	4
IDD-311	Dairy Microbiology -II (Microbiology of Milk)	3-0-2	4
IDD-312	Dairy Technology- II (Fat Rich Dairy Products)	3-0-2	4
IDD-313	Dairy Technology- III (Indigenous Milk products & Milk based sweets)	2.-0-1	3

SEMESTER III

<b>Course Code</b>	<b>Course Title</b>	<b>L-T-P</b>	<b>Credits</b>
IDD – 319	Dairy Production –III (Cattle Health & Reproduction)	2-0-2	3
IDD – 320	Dairy Engineering – II (Refrigeration & Steam Engineering)	3-0-2	4
IDD - 321	Dairy Microbiology – III (Microbiology of Milk Products)	3-0-2	4
IDD – 322.	Dairy Technology – IV (Cheese Fermented Milk Foods & By Products)	3-0-2	4
IDD – 323	Dairy Technology – V (Condensed & Dried Milks)	3-0-2	4
IDD – 324	Economic Principles and Financial Accounting in Dairy Business	3-1-0	4

SEMESTER IV

<b>Course Code</b>	<b>Course Title</b>	<b>L-T-P</b>	<b>Credits</b>
_IDD 331	Dairy Engineering – III	3-0-2	4
IDD- 332	Dairy Engineering – IV	3-0-2	4
IDD – 333	Dairy Technology- VI (Ice Cream & Frozen Dairy Products)	3-0-2	4
IDD – 334	Quality Assurance of Dairy Products	2-0-1	3
IDD – 335	Dairy Plant Management	3-0-0	3
COMP- 401	Computer Application	1-0-2	2

**SYLLABUS OF I.D.D.(DT)****FIRST SEMESTER****IDD-301****DAIRY TECHNOLOGY- I  
INDIAN DAIRY INDUSTRY & MARKET MILK****4 Credits**

1. Market Milk: Market Milk Industry in India and Abroad
2. Clean Milk production, collection of Milk and practices followed at rural milk collection centres, chilling of milk, milk preservation by hydrogen peroxide and LP systems
3. Transportation of milk. Reception of milk. Platform tests
4. Filtration, clarification and separation of milk, Standardization of milk
5. Pasteurization of milk
6. Homogenization of milk
7. Sterilization of milk by conventional method UHT processing of milk sterilization
8. Special milks, recombined milk, toned milk, double toned milk, filled milk, vitaminised milk, flavoured milk
9. Packaging and distribution of milk
10. Metals in dairy equipments manufacture
11. Cleaning and sanitation of dairy equipment
12. Defects in milk, their causes and prevention

**Practical**

1. Reception of milk and platform tests
2. Fat. SNF and acidity tests of milk
3. Filtration and clarification of milk
4. Preparation of standardized, recombined, toned double toned milks
5. Preparation of flavoured and sterilized milk
6. Can washing and sanitation of dairy equipments.
7. Separation of milk
8. Homogenization of milk and efficiency of homogenization.
9. Pasteurization of milk
10. Filling/ Packing of milk by FFS Machines, common problems

IDD-302

DAIRY CHEMISTRY - I

4 Credits

**CHEMISTRY OF MILK & MILK CONSTITUENTS**

- i. Composition of Milk:  
Definition of Milk: Gross Composition of milk (Cow, buffalo, goat, sheep, and human). Factors affecting composition: Colostrum and Abnormal milk. Market Milk: Standard, toned, double toned, skim, sterilized flavoured, recombined and reconstituted milks and UHT Milk.
- ii. Physical properties of milk:  
Colour and flavour, factors responsible, Density and specific gravity: Methods of measurements: Calculation of total solids and solids-not-fat using formula. Factors affecting density and specific gravity of milk. Racknagel effect.  
  
Freezing point and boiling point: effect of dissolved substance on freezing point and boiling point; Use of cryscope in detecting adulteration of milk with water.  
  
Surface tension: Explanation, factors affecting  
  
Viscosity: Factors affecting, importance.  
  
Electrical conductivity: factors responsible, application in detection of mastitis.  
  
Refractive, Index: Explanation, importance.  
  
pH and titratable acidity pH of milk, its importance; milk acidity- natural and developed; constituents responsible: extent of contribution.  
  
Buffer value: Explanation, Buffering agents in milk.  
  
Oxidation:- Reduction potential: Explanation, factors affecting, significance.
- iii. Neutralisers and preventives in milk;
- iv. Milk constituents and their chemical properties:
  - i) Milk lipids; Definition and composition of fat glycerides, fatty acids, saponifiable and unsaponifiable matter, sterols, fat soluble vitamin, phospholipids; Properties of milk fat- density, refractive index, iodine value, RM value, polenske value, saponification value, melting point. Relation of milk fat constants to fatty acid composition; importance in quality control.



- ii) Milk proteins:  
Structure, nomenclature, classification, Isolation, fractionation. Determination major milk proteins. Non protein nitrogen constituents. Properties of milk proteins-hydration, solubility, denaturation, isoelectric point, hydrolysis and colour reactions.
- (iii) Major milk enzymes:  
Level in milk and their role in milk processing.  
Functions, influence of processing parameters.
- (iv) Water soluble vitamins in milk:  
Levels in milk, effects of light and heat
- (v) Carbohydrates:  
Definition, classification, presence in milk.  
Lactose – structures, physical forms. Solubility, reducing property, hydrolysis, status of lactose in milk, estimation of lactose in milk.
  
- (vi) Minerals in milk:  
Major and trace elements: salt balance (Physical equilibrium-colloidal, soluble and Ionic) and its importance: Factors affecting physical equilibrium among the salts-temperature, pH and concentration.

### Practical

1. Preparation and standardization of sodium hydroxide, hydrochloric acid, sulphuric acid, silver nitrate, potassium permanganate and sodium thisulphate.
2. Sampling of milk for chemical analysis Platform tests of milk.
3. Determination of titratable acidity of milk
4. Preparation of Gerber acid and determination of fat in milk by Gerber and Milk tester methods.
5. Determination of fat by Mojonier method
6. Determination of lactose in milk by Lane Eynon and polarimetric method.
7. Determination of milk proteins by Kjeldahl and Pyne's methods.
8. Determination of ash, phosphorus, calcium and chloride of milk.
9. Phosphates test
10. Detection of preservatives, neutralizers and adulterants in milk.
11. Detection of adulteration of milk with water by freezing point method.

IDD-303

DAIRY MICROBIOLOGY - I

4 Credits

**BASIC MICROBIOLOGY****A. General Microbiology**

1. Introduction to Microbiology; Definition, History of Microbiology, Microbiology, Microscope & its uses.
2. Nutrition & Metabolism of Bacteria
3. Bacterial growth
4. Effect of environment of growth of bacteria
5. Destruction of bacteria by physical & chemical modes.
6. Salient features of Moulds
7. Salient features of Actinomycetes, Rickettsiae and virus.

**B. Salient features of Applied Microbiology**

1. Soil Microbiology
2. Air Microbiology
3. Water Microbiology
4. Silage Microbiology
5. Industrial Microbiology

**Practical**

1. Familiarity with common equipment used in microbiological work; use of ovens, steam sterilizers, pressure sterilizers, refrigerators, care of microscope.
2. Common Bacteriological Techniques;  
Cleaning & sterilization of glassware, preparation of media, pH adjustment, preparation of dilution blanks, preparation of stains and indicators and their use in microbiology.  
Simple staining and differential staining; motility of microorganisms.
3. Evaluation of Bacterial population on agar plate and direct cell enumeration.
4. Study of important characteristics of microbes; Staphylococci, Streptococci, Micrococci, Enterococci, Aerobic and Anaerobic bacteria, Lactic acid bacteria, coliforms, streptococci, micrococci, ciliates, yeasts and moulds.
5. Microbiological examination of Soil, Air, Water and Silage.

LNG-300

ENGLISH &amp; BASIC TECHNICAL WRITING

3 CREDIT

**1. Language:**

- a. Word Enrichment- Antonyms, Synonyms, One word substitution
- b. Sentence – Types, Structure & Parts
- c. Inflection – Noun
- d. Tenses
- e. Parts of speech

f. Voice

## 2. Reading

Comprehension:

- a. Listening
- b. Reading

## 3. Writing:

Composition

- a. Precis Writing
- b. Essay Writing
- c. Letter Writing (Components, Formats & different types)
- d. CV
- e. Resume

**IDD-304**

### **DAIRY PRODUCTION –I (Fodder Production & Cattle Nutrition)**

**4 CREDITS**

- A Fodder Production:
1. Systems of forage farming and dairy production in India.
  2. Classification of soils, factors affecting fertility of soil acidity, salinity and methods of reclamation.
  3. Tillage, tools and implements used for tillage.
  4. Manures and fertilizers, methods of application
  5. Methods of sowing and implements used for sowing.
  6. Weeds and their eradication methods.
  7. Study of plant disease and pests, plant protection methods, use of weedicides and pesticides in fodder crops.
  8. Sources of irrigation, methods of irrigation, water requirement of fodder crops, drainage of water.
  9. Parts of plants and nutrients required for plant growth.
  10. Classification of fodder crops, selection of fodder crop.
  11. Cultivation of grasses- Hybrid Napier, Guinea grass, para grass etc.
  12. Cultivation of cereal fodders- maize, oats barley, teosinte etc.
  13. Cultivation of Millet fodders- jowar, ragi, bajra etc.
  14. Cultivation of legumes- berseem, Lucerne, cowpea, dolichos etc.
  15. Study of fodder trees and shrubs- subabul, susbenia, gliricidia etc.
  16. Important crop rotations in different regions of the country, importance of crop rotations mixed cropping.
  17. Conservation of fodder- silage and hay making
  18. Cost of production of forage crops- working standards of labour and machinery.
  19. Seed production for fodder crops available sources

#### **Practicals**

1. Use of common tools and implements for tillage.

2. Seed bed preparation- ploughing, harrowing, leveling making bunds and channels.
3. Identification of forage crops, parts of plants, quality of crops.
4. Preparing rootslips and transplanting grasses.
5. Identification of seeds, sowing maize and Lucerne, application of manures and fertilizers.
6. Study of irrigation and drainage practice.
7. Application of weedicides and pesticides.
8. Harvesting of fodder crops, assessment of fodder yield and their quality aspects.

#### B **Animal Nutrition:**

1. Digestive system: Digestive enzymes, their classifications and properties.
2. Importance of salivary secretion in ruminants (Amount, composition and action of saliva).
3. Digestion in the ruminant stomach, movements of the rumen.
4. Rumination and its nervous control (regurgitation, mastication, reinsalivation) Absorption through the rumen wall.
5. Functions of abdominal secretion Digestion in the small intestine.
6. Regulation and control of intestinal secretions. Role of pancreas.  
Absorption at various levels of the gut.
7. Feeding of Dairy animals; Feeding stuffs – their classifications for growth and milk production of dairy animals.
8. Importance of major and trace elements and their requirements for growth and milk production of dairy animals.
9. Vitamins necessary for dairy cattle, variation of chemical composition of feeding stuff in relation to soil fertility, soil plant, animal and human inter-relationship.
10. Digestion, absorption and utilization of feed nutrients in ruminants.
11. Digestibility coefficients, Total digestible nutrients, Nutritive ratio, starch equivalent.
12. Various measures of feed energy-gross, metabolisable and net energy.
13. Feeding standards in different countries.
14. Basal metabolism, Maintenance requirement. Requirement for growth and milk production.
15. Feeding standards, Computation and preparation of balanced rations under various conditions.
16. Machines used for feed processing:: formulation of concentrate feed stuffs for various categories of cattle.
17. BIS standards –least cost ration formulation for dairy animals. Concentrate preparation as mash and pellets.
18. Complete feed formulation and feeding system.

#### **Practical**

1. Identification of common feeds and fodders Examination of common concentrate feeds for quality control.
2. Chemical composition of feeds for moisture, crude and true protein, ether extract, fibre, total and soluble ash, calcium and phosphorous.
3. Study of feed mixing and pellet making plant and its operations. Visit to a feed factory in organized sector.
4. Metabolism trial. Least cost ration formulations for various categories of cattle.

**Applied Maths****1. Differential calculus**

Differential co-efficient, simple applications, meaning of the sign of differential co-efficient, application to small errors and the theory of equations. Higher order derivatives, Leibnitz theorem, Geometrical applications, Tangent and normal's, angle between curves, sub-tangent and sub-normal, Asymptotes, Curvature radius of curvature, centre of curvature, Concavity and convexity, points of inflexion, maxima and minima of functions of single variable, elements of curve tracing, Partial differentiation. Roll's theorem, mean value theorem, Taylors theorem, Taylors and Maclaurins series, evaluation of indeterminate forms, L' Hospital's rule.

**2. Integral calculus.**

Definite integral as a limit of a sum, rectification of simple plans curves, areas of plane curves, areas of plane curves, surfaces and volumes of revolution, theorem of pappar. Centre of gravity, centre of pressure, moment of inertia, Approximate integration, transpezidal, Simposons rule.

**3. Vector calculus**

Scalar and vector fields, Directional derivative, gradient of a scalar field, divergence and curl of vector field. Line integral, evaluation of line integrals, Multiple integrals and their evaluation. Surface and volume integrals, Divergence theorem and strokes theorem.

**Basic Statistics**

Compilation of Data: Introduction, Scores: Discrete and Continuous, Frequency distributions, graphical Representation of the data (Polygon, histogram & pie- diagram)

Measures of Central Value Arithmetic Mean, Median, Mode

Measures of Dispersion of scores – range, Q, mean deviation, standard deviation, co-efficient of variation.

Normal curve- characteristics, Non- normal curves- skewness and kurtosis.

Causes of non- normality

Significance of the difference between two means by t- test,  $\chi^2$  – test (chi- square test)

Significance of the differences among more than two means by F-test

Sampling methods: types, requisites for randomization, use of random numbers.

## SECOND SEMESTER

IDD-308

**Dairy Production II  
(Cattle Breeding & Gen. Mgt.)****3 Credit**

**General Introduction:** Importance of inheritance and environment in development of cattle, concept and significance of Dairy Farm management.

**Cattle Breeding:** Systems of breeding and their relative advantages and disadvantages. Inbreeding coefficient, Heat and its detection in cows.

**Artificial Insemination :** Merits, demerits, limitations, A.I. for higher rate of conception. Current breeding policies and salient features.

**Dairy Farm Management:** Indian and exotic breeds of cattle, systems of raising calves, care of milking herd, marking of animals, Dehorning and disbudding, Castrating male calves, clean milk production.

**Practicals**

1. Identification of different equipments used in animal reproduction and dairy farm management.
2. Problems on inbreeding co-efficient.
3. Familiarity with various breeding records maintained at dairy farm.
4. Care of newly born calf.
5. Marking and dehorning disbudding of animals
6. Detection of heat in cow.

IDD-309

**DAIRY ENGINEERING- I  
(DRAWING & WORKSHOP PRACTICES)****4 Credit**

1. Engineering Drawing: Principles, first and third angle projections, Principal planes, orthographic projection
2. Isometric Views
3. Drawing elevation, side and plan of simple objects/machine parts.
4. Elements of Workshop Technology's workshop practice, safety care
5. Welding, brazing and soldering, gas and electric welding
6. Working of lathe, milling machine, shaper & planer
7. Grinding machines and drilling machines
8. Hydraulics: Pressure, pressure head units: Measurements of pressure
9. Meaning of laminar and turbulent flow:  
Statement of continuity equation
10. Bernoulli's theorem and its application

11. Flow measurement with orifice, venture meter and rotameter.
12. Water supply for the Dairy: Sources, water Quality
13. Selection of pumping equipment: Classification of pumps: principles of working, operation and maintenance of centrifugal and reciprocating pumps, sanitary pumps
14. Elements of heat transfer: Modes of heat transfer: Fouriers law.
15. Heat transfer through slab and composite wall: Overall heat transfer coefficients
16. Typ3es of heat exchangers and their application in the Dairy: Efficiency of plate heat exchangers Heat insulators.
17. Temperature measurement devices

#### **PRACTICALS**

1. Operation of lathe machine
2. Operation of drilling and grinding machine
3. Soldering and welding practice
4. Performance of a centrifugal pump
5. Study of sanitary milk pumps
6. Measurement of thermal conductivity
7. Pressure, temperature and flow measurement in liquid lines.
8. Preparation of G.I. and S.S. pipe joints and fittings.
9. Study of different types of heat eschangers.

**IDD-310**

#### **Dairy Chemistry- II (Chemistry of Milk Products)**

**4 Credit**

1. Physicochemical changes in milk and milk constituents during heating, concentration and drying: effect on nutritional value.
2. Cream: Creaming, strokes law; factors affecting creaming, rheological characteristics of cream, composition and properties of dry cream, standards.
3. Butter: Structure of butter, mechanism of churning, factors affecting fat losses. Ageing: Churning time and consistency of butter. Influence of fatty acid composition and physical state of state of fat on the consistency of butter, defects in butter, flavour of butter, standards, packaging.
4. Butter oil and Ghee: Composition, characteristics far constants, organoleptic properties. Genesis of flavour and texture. Hydrolytic and auto oxidative spoilage of ghee and its prevention. Natural and synthetic anti oxidants , Ghee residue. Common adulterants and their detection, standards, packaging.
5. Concentrated milk: Evaporated and sweetened condensed milk. Physico chemical aspects involved in the manufacture of evaporated and condensed milk. Heat stability of concentrated milk as affected by process variables. Milk constituents and additives. Storage defects and their prevention, standards, packaging.

6. Dried milk: roller drying and spray drying. Instantisation. Physico-chemical aspects during processing. Factors influencing the formation and quality of the products. Storage defects, standards packaging.
7. Infant milk foods: Milk for infant feeding Special features.
8. Malted milk foods: Composition, physico chemical aspects in the preparation of malted milk foods, standards packaging
9. Coagulated products: milk clotting enzymes from different sources- Animal, microbial and plant. Factors affecting coagulation of milk and characteristics of curd. Rennet action: Changes taking place during manufacture and ripening of cheese. Types of cheese. Packaging, standards.
10. Fermented products: Varieties, change in milk constituents during fermentation. Flavour development Nutritional and therapeutic value of fermented milk products. Packaging, standards.
11. Indigenous milk products: khoa, chhana, paneer, chakka, srikhand, peda, burfi, rasagolla, basundi etc. composition, quality attributes and defects, packaging, standards.
12. Frozen products: Composition of icecream and kulfi, emulsifiers and stabilizers, role of different constituents and processing parameters (Homogenization, whipping, over run) in Physical attributes of ice cream and kulfi. Defects in ice cream and kulfi, Packaging, standards.
13. Caseinates and co-precipitates: Different types of casein preparations, their uses and standards, preparations of co-precipitates. Functional properties of caseinates and co-precipitates.
14. Whey proteins: Whey proteins concentrate and whey protein isolates. Applications of whey proteins as functional proteins in various food systems.
15. Lactose: manufacture and use in food and pharmaceutical preparations.
16. Nutritional quality of Dairy foods: Nutritive requirements of specific groups. Nutritive value of dairy foods and their constituents. Effects of processing and storage on the nutritive value of dairy foods.

### **Practicals**

- (a) Cream: Sampling and analysis of cream for fat acidity.
- (b) Butter: Determination of moisture, fat, salt, curd, and acidity.
- (c) Ghee: Determination of fat constants: melting point, refractive index. RM and potenke values, saponification value. Iodine value, determination of acidity and peroxide value.
- (d) Concentrated milk: Sampling determination of total solids, fat, proteins, sucrose and lactose.
- (e) Milk powder: sampling, determination of moisture, total solids, fat, proteins, total ash, carbohydrates, lactose, solubility percent. Insolubility index bulk density.
- (f) Infant foods and malted milk foods, moisture, total ash and insoluble ash, solubility, starch.
- (g) Cheese: Sampling, determination of moisture, fat, protein, salt and acidity.
- (h) Dahi: sampling, Determination of total solids, fat and acidity.
- (i) Yoghurt: determination of sugar.



- (j) Indigenous products: Sampling and analysis of Khoa, channa, chakka, and paneer, for moisture/ total solids, fat and proteins.
- (k) Ice- cream; sampling, Determination of overrun, acidity, fat total solids, protein and sucrose.
- (l) Caseinate and co-precipitates, Analysis for moisture, fat, ash, colour.

IDD-311

**DAIRY MICROBIOLOGY- II  
(MICROBIOLOGY OF MILK)**

4 Credits

**A Microbiology of Milk**

1. Sources of microbial contamination of milk and their importance
2. Milk – borne disease
3. Important groups of spoilage of micro organisms and their manifestation in milk.
4. Microbial growth in milk during storage and transport
5. Taints and abnormal conditions in milk
6. Principles of sanitation practices at all stages of production and processing
7. Bacteriology of heat-treated milks
8. Evaluation of bacteriological features of milks

**B Microbiology of Foods**

1. Classification of foods
2. Natural functional systems of food and their interactions on shelf life
3. Food processing compulsions and options
4. Types of food spoilage and their aetiology
5. Methods of limiting microbial proliferation in foods
6. Features of food fermentations as a desirable change
7. Evaluation of microbiological features of foods

**Practical****A Microbiology of milk**

1. Sampling of milk for microbiological analysis
2. Application of rapid tests for evaluation of milk quality
3. Enumeration of bacterial numbers by direct and indirect methods
4. Methods used for determining psychrotropic organisms in milk
5. Assessment of pasteurized milk based on the following; standard plate count. E coil test. Phosphate test, thermoduric and thermophilic numbers
6. Evaluation of utensils and equipments for sanitation

**B Microbiology of foods**

1. Comparative study of raw and processed foods
2. Study of food enzymes in relation to their profiles at shelf life
3. Effect of storage temperature on shelf life foods
4. Microbiology of vegetables, eggs, meat, flour, bread, cereals and spices
5. Role of salt, sugar, inorganic acids and alkalies in food preservation

IDD-312

**DAIRY TECHNOLOGY- II  
(FAT RICH DAIRY PRODUCTS)**

4 Credit

Status of fat rich dairy products in India and abroad.

Introduction to milk lipids - definition and general composition of milk fat.

**Cream:** efficiency of cream separation and factors affecting it; control of fat concentration in cream. Receiving, grading, sampling and weighing of raw cream; neutralization, pasteurization and cooling of cream. Preparation and properties of different types of cream; table cream, sterilized cream, whipped cream, plastic cream, frozen cream and cultured cream. Preparation of cream for butter making. .

**Butter:** introduction to the butter-making process; theory of churning; batch and continuous methods. Technology of butter manufacture; over-run in butter; control off at losses in ~utter milk; packaging and storage; transportation; defects in butter; rheology of butter; uses of butter.

Butter-making equipment: construction, operation, care and maintenance of cream separators, coolers and vacreator, factory butterchurn and continuous butter making machines.

**Special butters and related products:** *manufacture, packaging, storage and properties of whey butter, flavoured butter, whipped butter, renovated butter/fractionated and poly-unsaturated milk, fat products, vegetable oil-blended products and low-fat spreads.*

Manufacture, packaging, storage, and characteristics of Margarine of different types.

**Ghee and butteroil:** Methods of ghee making - batch and industrial processes, innovations in *ghee* production, procedure, packaging and preservation of ghee; utilization of substandard milk and old/stored butter in the manufacture of ghee.

Continuous process for the production of ghee.

Methods of manufacture, packaging, storage, distribution and uses of butter- oil.

Nutritional aspects of cream, butter, butter-milk, ghee and ghee residue.

Health aspects of milk fat.

Technical control in butter industry: Factors affecting plant operations' efficiencies,. Losses of milk solids, methods of improving operational efficiency and product accounting.

**Practicals**

1. Standardization, neutralization, pasteurization and cooling of cream
2. Preparation of sterilized cream.
3. Preparation of cooking butter by the hand-operated chum.
4. Preparation of *desi* butter.
5. Manufacture of table butter using the power-driven chum.
6. Preparation of a low-fat spread.
7. Preparation of *ghee* from cream and butter.
8. Plant visit.

IDD-313

**DAIRY TECHNOLOGY- III  
(INDIGENOUS MILK PRODUCTS & MILK BASED SWEETS)**

3 Credit

**INDIGENOUS MILK PRODUCTS**

1. **Ghee:**
  - (a) Definition of ghee, importance of ghee in India
  - (b) Methods of manufacturing ghee
  - (c) Grading of Ghee and factors influencing quality of ghee
  - (d) Difference of ghee & butter oil
  - (e) Utilization of ghee and resedue.

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2. **Khoa**      3. **Chhana**      4. **Paneer**      5. **Dahi**      6. **Indigenous Cheese**
- (a) Preparation & Packaging, yield and composition.  
(b) Factor affecting quality  
(c) Packaging & Preservation  
(d) Marketing and grading  
(e) Legal standards

### **MILK BASED SWEETS**

1. Place of milk based sweets in India and abroad.
2. Method of manufacture, packaging, storage and transportation of Rasogulla, Gulab jamun, Kalakhand, Rabri, Keer, Khurcha, malai, Rasmalai, Barfi, Peda, Srikhand, Sandesh, Chakka, Milk cake, Pantoa, Payodhi and lassi.

### **Practicals**

1. Preparation of *khoa*
2. Preparation of Ghee from butter and cream.
3. Preparation of *Paneer*.
4. Preparation of *chhana*
5. Preparation of *Dahi*
6. Preparation of Surti Cheese
7. Preparation of milk based sweets

**THIRD SEMESTER****IDD-319****DAIRY PRODUCTION -III  
(CATTLE HEALTH & REPRDUCTION)****3 Credits**

1. General Management: Importance of ruminants, classification of breeds of the basis of utility.
2. Important dairy breeds of indigenous and exetic cattle and buffaloes.
3. Calf rearing different methods
4. Management of dairy heifers and bull calves
5. Care of pregnant animals during and after parturition.
6. Management and care of milking stock, dry stock and breeding bulls.
7. Cleaning and sanitation of cattle yard premises.
8. Clean milk production, principles of milking, milk recording. Records essential to good herd management.
9. Milk secretion.
10. Preparation of animals for cattle shows, transport of animals by roads and rail.
11. The principles and practices of breeding dairy stock.
12. Medelism, Different systems of breeding
13. In breeding, line breeding, cross breeding, grading up, pregnancy testing, culling and selection of animals in the open market.
14. Anatomy of reproductive organs Artificial Insemination.
15. Embryo transfer technology- a general concept and its role in national perspective.
16. Signs of health and ill health.
17. Diagnosis and detection of diseases care and feeding of sick animals
18. Disinfections, isolation and prophylaxis measures during cutbreak of contagious diseases of cattle like foot and mouth, Rinder Pest, Brucellosis, T.B. Jhones and mastitis.
19. Diseases of young stock, Navel-III, Pheumonia, scours, Ring work and Mange.

**Practicals**

1. Layout of a cattleyard, living space for each category of animal from health point of view.
2. Recognition of body parts of dairy animals
3. Physical character of the breeds maintained.
4. Calf feeding, Tatting, Dehorning, Grooming.
5. Estimation of age and body weight
6. Preparation of animals for milking, milk cooling, observations of signs of oestrus and pregnancy.
7. Cleaning and sanitation of milking sheds and milk record room.
8. Judging of milch cows
9. Preparation of animals for show
10. Study of important cattle records

11. Identification of common cattle feeds computation of rations
12. Recording observations on temperature, pulse and respiration.
13. Identification and use of common first aid drugs and pharmaceutical instruments used in the cattle yard.
14. Dressing of wounds and bandaging
15. Diagnosis and treatment of mastitis.
16. Practice in Artificial Insemination
17. Demonstration on Embryo Transfer Technology at the appropriate centre

**IDD – 320**

**DAIRY ENGINEERING – II  
(REFRIGERATION & STEAM ENGINEERING)**

**4 Credits**

1. Steam and steam generators; Wet, dry and super heated steam; dryness fraction, internal energy and enthalpy; Use of steam tables.
2. Classification of boilers; constructional features and operations of vertical fire tube, horizontal return flue and automatic boilers.
3. Boiler mountings, accessories and their uses
4. Capacity and horsepower of boilers; scaling of boiler and water treatment plant.
5. Electrical Engineering: Simple and three phase power supply; star and delta connections.
6. Types and working principles of transformers
7. Principles of working, operation, selection and maintenance of single and three phase induction motors and starters.
8. Instruments for measurements of voltage current. Power and energy
9. Refrigeration Engineering: Unit of refrigeration; important components and controls of Mechanical vapour compression refrigeration system and their functions.
10. Common refrigerants
11. Application of sealed units
12. Ice bank systems
13. Features of cold stores, insulating materials, vapour barriers etc.

**Practical**

1. Study of constructional features of vertical fire tube boiler
2. Study of constructional features of horizontal return flue type boiler
3. Boiler fittings
4. Boiler safety devices
5. Measurement of electrical power in A.C. circuits
6. Fluorescent tube connections
7. Starting of three phase induction motor with DOL starter
8. Star delta starters
9. Study of different types of motors
10. Study of performance of different types of compressors
11. Study of refrigeration evaporators and condensers

12. Study of different types of expansion devices
13. To determine C.O.P. of a refrigeration system

**IDD - 321**

**DAIRY MICROBIOLOGY – III  
(MICROBIOLOGY OF MILK PRODUCTS)**

**4 Credits**

1. Starter cultures; Functions, classifications, maintenance, evaluation of cultures, heterophages and recent concepts of starter technology.
2. Microbiology of fermented milk; History, features of fermentation, nutritive and therapeutic values. Methods of manufacture, problems of spoilage and evaluation.
3. Microbiology of cheese: classification, features of cheese in relation to microbial metabolism, selection of starter systems. Brief techno-microbial features of Cheddar, Gouda, Swiss, Blue, Camembert, Brie, soft unripened and Cream cheeses.
4. Microbiology of cream and Butter: types of cream. Microbiology of raw cream and their manifestations; evaluation of raw cream. Pasteurization of cream, storage and its evaluation.

Definition and composition of butter, comparative microbiology of Desi and Creamery butter, Microbial metabolism in butter, Ripened and cultured butter, and their manifestation.

Influence of technologies on microbial load and functioning. Production, handling, storage and microbial defects in butter, Ripened and cultured butter, their advantages and limitations.

5. Microbiology of ice – cream and other frozen dairy products; Definition and composition of ice-cream. Microbial load in ice cream. Growth of microorganisms in ice cream mix. Types of organisms found in ice cream.

Effect of addition of ingredients on quality of ice cream. Sources of contamination during production, handling and packaging. Brief description of Kulfi and other frozen milk products.

6. Microbiology of dry milks; Types of dried milks, Brief description of drying methods. Effect of process technology on microbial content. Influence of packing and storage on microbiological features, public health safety and evaluation.

Microbiology of reconstituted dry milks, dry milk as food adjunct and its impact on foods.

7. Microbiology of frozen desserts; Types of frozen desserts- Microbiological integrity of ingredients used. Public health hazards. Processing features and their impact on microflora. Effect of storage, transport, retailing and parlour dispensing on microbiology, plant and handling sanitation and evaluation.
8. Microbiology of indigenous milk products; Paneer/ Chahana; Physio-chemical features and their influence on microbial metabolism. Sanitation practices to check flora. Effect of storage spoilage and evaluation.

Khoa/ burfi/ mawa; Products suitability for proliferation of Microbes. Production and handling hygiene. Public health hazards. Shelf life, spoilage and evaluation.

Chakka/ Shrikhand; Microbial features in relation to basal material, production hygiene and storage. Spoilage and evaluation.

#### Practical

1. Preparation and evaluation of starter cultures Microbiological examination of
2. Cream, butter
3. Ice cream
4. Cheese
5. Evaporated milk, sweetened condensed milk. Plain condensed milk & dried milks
6. Dahi, Yoghurt, Acidophilus
7. Khoa and Channa

**IDD – 322**

### **DAIRY TECHNOLOGY – IV (CHEESE FERMENTED MILK FOODS & BY PRODUCTS)**

**4 Credits**

1. Fermented Products:- History and development
2. Production of Dahi, Yoghurt, Acidophilus milk, Lassi
3. Packaging of fermented products
4. Nutritive value and legal standards
5. History of cheese making
6. Legal standards
7. Classification and composition of common varieties of Cheese
8. Technology of manufactures of Cheddar, Gauda, Mozzarella, Cottage cheeses
9. Processed cheese, Cheese spread, Cheese foods and cheese
10. Stabilizers and emulsifiers used in processed cheese
11. Physical, Chemical and Bacteriological changes during ripening process, packaging and defects.
12. Judging and grading of cheese
13. By products- classification and characterization
14. Use of whey, preparation of whey protein
15. Manufacture of lactose and its use
16. Manufacture of casein and its use

**Practical**

1. Production of Dahi, Yoghurt, Acidophilus milk, lassi
2. Production of cheddar Cheese
3. Production of Gouda Cheese
4. Production of Mozzarella cheese
5. Production of processed cheese and cheese spread
6. Production of cottage cheese
7. Packaging and analysis of cheese
8. Judging and grading of cheese
9. Manufacture of Byproduct (Preparation of lactose lactical rennet casein, calcium caseinate, whey protein concentrate, whey powder and whey drink)
10. Preparation of lactic acid and rennet casein
11. Preparation of calcium caseinates
12. Preparation of whey protein concentrates
13. Preparation of whey powder
14. Preparation of lactose
15. Preparation of whey milk.

**IDD – 323****DAIRY TECHNOLOGY – V  
(CONDENSED & DRIED MILKS)****4 Credit**

1. Status of condensed and dried milk industry in India and abroad
2. Composition and legal standards of condensed and dried milk products
3. Technology of manufacture of Sweetened condensed milk and evaporated milk
4. Defects, causes and remedies
5. Packaging and keeping quality of condensed and evaporated milks
6. Principle of drum drying, spray drying, foam drying
7. Manufacture of skim, whole, malted milk powders
8. Defects in dried milks and their causes
9. Packaging and storage
10. Instantized milk powder, infant food formulation and method of manufacture

**Practical**

1. Vacuum pan operation
2. Operation of roller and spray drier
3. Production of sweetened condensed and evaporated milks
4. Production of roller and dried milk powders
5. Production of spray dried skim milk powder
6. Production of malted milk
7. Judging and grading of condensed and dried milk products



IDD – 324

**ECONOMIC PRINCIPLES AND FINANCIAL  
ACCOUNTING IN DAIRY BUSINESS**

4 Credit

1. Basic concept; Nature of Economics, Meaning, definition, scope of Economics, Utility, Goods value, Wealth.
2. Concept of consumption: Meaning and importance, determination and characteristics, classification of wants, Law of Diminishing utility, Law of Equi-marginal utility.
3. Concept of Production: Meaning, Factors of production, Land, Labour, Capital, organization, Enterprise.
4. Concept of Exchange: Meaning, Definition, Advantages of Exchange, Forms of Exchange.
5. Concept of Market, Meaning, Definition, Degree of competition in market, Demand and supply.
6. Concept of Distribution: Meaning, Definition, problem of distribution, Method of Distribution, Rent, Wages, etc.
7. Financial Management and its planning: Meaning, Objectives.
8. Concept of Financial accounting: Subject matter, Basic principles, classification and its importance.
9. Concept of Accounting procedure, Journal, Definition, Meaning, Role for Debit and Credit.
10. Concept of Double Entry System: Advantages of Double entry system.
11. Ledger: Concept, Necessities, Types of ruling, Deference between Journal and Ledger
12. Cashbook: Meaning, Types of cash book, Advantages, Difference & Sanitarities with Ledger.
13. Trial Balance: Meaning, Definition, Its objectives, advantages, and Limitation, Characteristic s
14. Concept of Depreciation: Definition, Meaning Objectives, Different method of calculating Depreciation.

**Practical**

1. Preparation of Journal
2. Preparation of Ledgers
3. Preparation of Cash Book
4. Preparation of Trial Balance
5. Preparation of Format of milk reception
6. Preparation of stock sheet
7. Calculation of Depreciation

**FOURTH SEMESTER****IDD 331****DAIRY ENGINEERING – III****4 Credits**

1. Sanitary metal and features of sanitary designs
2. S.S. Pipes and Fittings
3. Receiving room equipments
4. Working and maintenance of mechanical can washers
5. Different types of milk chilling equipments and their application.
6. A study of constructional features of milk storage tanks.
7. Principles of centrifugal separation: cream separators: self desludging clarifiers.
8. Efficiency, capacity and maintenance of separators
9. Constructional features, operation and maintenance of batch and HTST: pasteurizers and controls.
10. Equipment for milk sterilization and UHT processing
11. Homogenizers: Constructional features, operation and maintenance of homogenizers and accessories.
12. A study of milk sachet and aseptic filling machines and their maintenance.
13. C.I.P. cleaning systems.

**PRACTICALS****To conduct the study of constructional features and operation of:**

1. Mechanical can washer
2. Plate chiller
3. Milk storage tank
4. Cream separator
5. Study of Homogenizers
6. Batch Pasteurizer
7. H.T.S.T. pasteurizer
8. FDV controller
9. Sachet filling machine

**IDD- 332****DAIRY ENGINEERING – IV****4 Credits**

1. A study of equipments for indigenous dairy products
2. Equipments for fermented and coagulated dairy products.
3. Ice cream freezers: batch type
4. Ice cream freezer continuous type, accessories
5. Equipments for condensed milk, vacuum pan
6. Classification of continuous evaporators
7. Multiple effect evaporator and accessories Equipments for drying milk: roller drier: parallel and counter flow spray driers and their accessories

8. Plant layout and design: site selection
9. Factors concerning design and layout; example
10. Features of dairy floors and ventilation
11. Dairy waste treatment and methods of disposal

### **PRACTICALS**

#### **To conduct the study of constructional features and operation of:**

1. Equipments for manufacture of indigenous dairy products.
2. Cheese equipment.
3. Butter churn
4. Vacuum pan
5. Multiple effect evaporator
6. Roller drier
7. Spray drier

#### **To draw layouts for:**

8. Chilling centers
9. Market milk plant
10. A plant with market milk and milk products  
(Composite milk plant)

**IDD– 333**

### **DAIRY TECHNOLOGY- VI (ICE CREAM & FROZEN DAIRY PRODUCTS)**

**4 Credit**

1. Status of Ice Cream Industry
2. Classification of Frozen dairy products
3. Composition of Ice Cream, BIS and PFA standards for Ice Cream. Calculation of mixes. Ice Cream ingredients, stabilizers and emulsifiers, flavouring and colouring materials
4. Mix processing, Ice cream freezers, packaging and handling of Ice Cream
5. Judging and grading of Ice Cream
6. Fruit Ice Cream, Nut Ice cream, Kulfi preparation
7. Frozen Yoghurt, characteristics and production
8. Defects in frozed products, prevention and remedies

#### **Practical**

1. Selection of ingredients for Ice cream, calculation of mix preparation
2. Preparation of Ice Cream and kulfi
3. Preparation of Fruit Ice Cream
4. Preparation of Casata Ice Cream
5. Studies on the characteristics of stabilizer and emulsifiers
6. Effect of homogenization on the quality of Ice Cream
7. Production of Frozen yoghurt
8. Judging and grading of frozen dairy products
9. Packaging materials and packaging of Frozen Dairy products.

**Chemical Quality Control:**

1. Responsibility and organization of quality control department general principles.
2. Food and laws and standards – PFA, BIS, Agmark, IDF
3. Calibration: Calibration of dairy glassware lactometer, butyrometer, milk pipette end.
4. Colour and gloss: Natural synthetic colours, Specification of colour for dairy foods.
5. Flavour: Flavor components in dairy foods, Artificial flavours.
6. Addictive: stabilizers, emulsifiers, sweeteners, vitamins, minerals, amino acids/ protein hydrolysate antioxidants, preservatives, neutralizers, coloring matter and flavouring agents.
7. Packaging: packaging material for dairy foods- types and properties.
8. Contaminate pesticide residues, heavy metals, toxins, antibiotics, detergents, sanitizers and contaminants from packaging materials.
9. Sensory evaluation: General introduction, testing conditions, taste, odour, aroma, texture appearance, and other parameters. Difference testes and ranking tests. Individual tests, Individual steps in selection of test subjects.
10. Water, analysis, treatment
11. Detergents and sanitizers: types, properties and analysis.
12. Elementary knowledge of instrumental analysis.
13. Prediction of self- life of dairy products including UHT processed Sterilized milk

**Practical**

1. Standardization of milk testing equipments butyrometer, lactometer, milk pipette, thermometers etc,
2. Physical properties of dairy foods, Estimation of pH, acidity, density, specific gravity, viscosity, surface tension, electrical conductivity, buffering capacity and oxidation potential.
3. Estimation of browning in dairy foods.
4. Estimation of antioxidant, preservatives, neutralizers and monostearate.
5. Estimation of organ chlorine pesticide residue in dairy foods.
6. Sensory evaluation of dairy foods for colour, appearance, taste, odour, texture and acceptability. Difference taste and ranking taste.
7. Estimation of temporary and permanent hardness of water.
8. Estimation of alkanities in detergent solutions.
9. Estimation of available chlorine and Iodine in sanitizer.
- 10 Determination of iron in fortified dairy foods.
11. Separation of dairy food colours by thin layer chromatography.

**Microbiological Quality Assurance:**

1. Basic Concept of Food biology: their relation to quality assurance. Food class orientation plant and animal origin. Problems associated with natural foods for human consumption. Role of microbial systems in conversation of Taw foods for better utility.
2. Food Safety: Traditional problems. Emerging problems

3. Regulatory systems/ agencies: Government / NGO / Professional / Other agencies. Mandatory regulation like PFA, etc, Optional Advisory systems like BIS, IDF Agmark based etc. Comparative standards of milk produce and milk foods of countries pioneering in specified foods.
4. Role of supporting service systems in quality food processing: water, Air, Personnel, their health, hygiene and habits, equipments design, material used, construction, finish, maintenance and hygiene, packing material, nature, design and type: warehousing and condition of their maintenance, shipping, transport systems and their handling.
5. Food plant hygiene: Need for providing consumer guidance on the time limit for safe consumption. Consumer assessable methods for safety of canned feeds.
6. Sampling procedure for microbiological evaluation of foods.
7. Total quality management system for food industry, Quality audit concepts (ISO etc ) a wholistic growth from elementary. Quality control to quality Assurance culminating in total quality system.
8. Hazard analysis of critical control points (HACCP): HAACCP- an essential tool for supporting operation of TQM in food processing industries.
9. Microbiological quality of milk and milk products Historical to current state of art.
10. Organization of microbiological evaluation laboratories, setting up laboratories to support TQM system.
11. Food industry effluent management: Biochemical characteristics of food industry effluents, methods for reduction of organic matter in waste waters, recycling of water for better management of ecology.

#### Practicals

- a. Sampling procedures for microbiological evaluation of foods.
- b. Evaluation of foods for public health safety, salmonella, shigella, staphylococci, clostridia, Listeria, bacillus cereus, Campylobacter.
- c. Monitoring microbial density of air-environment of processing plant.
- d. Evaluation of microbiological quality of water for the processing plant.
- e. Assessment of hygiene of personnel working in the plant.
- f. Evaluation of equipment decision, material used, consyruction, finish and maintenance, for hygiene.
- g. Assessment of packing material for hygiene.
- h. Assessment of warehouse and their maintenance of microbiological contamination.
- i. Evaluation of basic cleaning systems, detergent support and sanitisers.
- j. HAACP evaluation of manufacturing process.
- k. Assessment of microbiological quality of milk and milk products.
- l. Study of microbiological laboratories with reference to their layout and their functioning.

**IDD – 335**

**DAIRY PLANT MANAGEMENT**

**3 Credit**

Production management

Definition, functions and structure of production management.

Production planning and control, work study and measurement, motion and method study.

Plant operations: efficiency factors, losses, BEP, financial and managerial efficiency.

Provisions of industrial legislation in India particularly for the dairy industry.

Personnel management: manpower planning. recruitment. training. transfer and promotion policies.

Job specifications, job evaluation, job enhancement, job enrichment, MBO.

### Practicals

1. Flow Process Charts of different milk products
2. Identification of steps of material losses in the plant.
3. Identification of hazardous processes and equipments, safety and precautions
4. Identification and uses of common lubricants
5. Waste utilization processes

### COMP- 401

### COMPUTER APPLICATION

2 Credit

1. Introduction to Computers
2. H/W and S/W Concepts and Terminology
3. Operating System
  - (a) DOS
  - (b) Windows
4. Introduction to commonly used application software
  - (a) MS Word
  - (b) MS Excel
5. Computer Languages & Introduction to 'C' Programming Language
  - (a) Input & Out put statements
  - (b) Declaration of variables
  - (c) Operators
  - (d) Control Statements (Branching and Looping)
6. Introduction to computer Networks
7. Introduction to Internet
8. Application of I.T.

### Practical List:

- (a) Working with operating systems like MS. DOS, Windows
- (b) Study of Software packages, Like MS Word, MS Excel and MS. PowerPoint
- (c) Packages related to medical applications
- (d) How to search data, workable knowledge of Internet
- (e) Simple programs in C languages
  - (i) To find the largest among three numbers
  - (ii) To check whether the given number is palindrome or not.
  - (iii) To find whether the given number is the prime
  - (iv) To find sum and average of n integer using linear array
  - (v) To generate the Fibonacci series
  - (vi) To find factorial of a given number using functions.

## COURSE STRUCTURE OF I.D.D.(DAIRY HUSBANDRY)

### SEMESTER I

<b>Course Code</b>	<b>Course Title</b>	<b>L-T-P</b>	<b>Credits</b>
IDD-301	Dairy Technology I (Indian Dairy Industry &Market Milk)	3-0-2	4
IDD-302	Dairy Chemistry I (Chemistry of Milk & Milk constituents)	3-0-2	4
IDD-303	Dairy Microbiology I (Basic Microbiology)	3-0-2	4
LNG-300	English & Basic Technical Writing	3-0-0	3
IDD-306	Dairy Production-I (Forage Production)	3-0-2	4
IDD-307	Dairy Production-II (Cattle Nutrition)	3-0-2	4

### SEMESTER II

<b>Course Code</b>	<b>Course Title</b>	<b>L-T-P</b>	<b>Credits</b>
IDD-314	Elementary Statistics	2-1-0	3
IDD-315	Dairy Production III (Genetics & Cattle Breeding)	3-0-2	4
IDD-316	Dairy Production IV (General Mgt. & Care of Dairy Herd)	3-0-2	4
IDD-311	Dairy Microbiology II (Microbiology of Milk)	3-0-2	4
IDD-317	Dairy Technology II (Milk Products)	3-0-2	4
IDD-318	Dairy Farm Engg.	3-0-2	4

**SEMESTER III**

<b>Course Code</b>	<b>Course Title</b>	<b>L-T-P</b>	<b>Credits</b>
IDD – 325	Dairy Production – V (Animal Physiology and Reproduction)	3-0-2	4
IDD – 326	Dairy Production – VI (Animal Disease & Hygiene)	3-0-2	4
IDD – 327	Poultry Production	3-0-2	4
IDD – 328	Extension Education	3-0-2	4
IDD – 329	Principles of Economics	3-0-0	3
IDD – 330	Financial Accounting in Dairy Business	3-0-0	3

**SEMESTER IV**

<b>Course Code</b>	<b>Course Title</b>	<b>L-T-P</b>	<b>Credits</b>
IDD – 336	Breeding & Management of Sheep	2-0-2	3
IDD – 337	Breeding & Management of Goats	2-0-2	3
IDD – 338	Breeding & Management of Pigs	2-0-2	3
IDD – 339	Dairy Business Management	3-0-2	4
IDD- 340	Preservation & Processing of Animal Foods	3-0-2	4
COMP- 401	Computer Application	1-0-2	2



**SYLLABUS OF I.D.D.(DH)****FIRST SEMESTER**

IDD-301

DAIRY TECHNOLOGY- I

4 Credits

**INDIAN DAIRY INDUSTRY & MARKET MILK****S.No.****Topic****No. of  
Lectures**

1. Market Milk: Market Milk Industry in India and Abroad
2. Clean Milk production, collection of Milk and practices followed at rural milk collection centres, chilling of milk, milk preservation by hydrogen peroxide and LP systems
3. Transportation of milk. Reception of milk. Platform tests
4. Filtration, clarification and separation of milk, Standardization of milk
5. Pasteurization of milk
6. Homogenization of milk
7. Sterilization of milk by conventional method UHT processing of milk sterilization
8. Special milks, recombined milk, toned milk, double toned milk, filled milk, vitaminised milk, flavoured milk
9. Packaging and distribution of milk
10. Metals in dairy equipments manufacture
11. Cleaning and sanitation of dairy equipment
12. Defects in milk, their causes and prevention

**Practical**

1. Reception of milk and platform tests
2. Fat. SNF and acidity tests of milk
3. Filtration and clarification of milk
4. Preparation of standardized, recombined, toned double toned

milks

5. Preparation of flavoured and sterilized milk
6. Can washing and sanitation of dairy equipments.
7. Separation of milk
8. Homogenization of milk and efficiency of homogenization.
9. Pasteurization of milk
10. Filling/ Packing of milk by FFS Machines, common problems

IDD-302

DAIRY CHEMISTRY - I

4 Credits

**CHEMISTRY OF MILK & MILK CONSTITUENTS**

1. Composition of Milk:  
Definition of Milk: Gross Composition of milk (Cow, buffalo, goat, sheep, and human). Factors affecting composition: Colostrum and Abnormal milk. Market Milk: Standard, toned, double toned, skim, sterilized flavoured, recombined and reconstituted milks and UHT Milk.
2. Physical properties of milk:  
Colour and flavour, factors responsible, Density and specific gravity: Methods of measurements: Calculation of total solids and solids-not-fat using formula. Factors affecting density and specific gravity of milk. Racknagel effect.  
  
Freezing point and boiling point: effect of dissolved substance on freezing point and boiling point; Use of cryscope in detecting adulteration of milk with water.  
  
Surface tension: Explanation, factors affecting  
  
Viscosity: Factors affecting, importance.  
  
Electrical conductivity: factors responsible, application in detection of mastitis.  
  
Refractive, Index: Explanation, importance.  
  
pH and titratable acidity pH of milk, its importance; milk acidity- natural and developed; constituents responsible: extent of contribution.  
  
Buffer value: Explanation, Buffering agents in milk.

Oxidation:- Reduction potential: Explanation, factors affecting, significance.

3. Neutralisers and preventives in milk;
4. Milk constituents and their chemical properties:
  - i. Milk lipids; Definition and composition of fat glycerides, fatty acids, saponifiable and unsaponifiable matter, sterols, fat soluble vitamin, phospholipids; Properties of milk fat- density, refractive index, iodine value, RM value, polenske value, saponification value, melting point. Relation of milk fat constants to fatty acid composition; importance in quality control.
  - ii. Milk proteins:
 

Structure, nomenclature, classification, Isolation, fractionation. Determination major milk proteins. Non protein nitrogen constituents. Properties of milk proteins-hydration, solubility, denaturation, isoelectric point, hydrolysis and colour reactions.
  - (iii) Major milk enzymes:
 

Level in milk and their role in milk processing.  
Functions, influence of processing parameters.
  - (iv) Water soluble vitamins in milk:
 

Levels in milk, effects of light and heat
  - (v) Carbohydrates:
 

Definition, classification, presence in milk.  
Lactose – structures, physical forms. Solubility, reducing property, hydrolysis, status of lactose in milk, estimation of lactose in milk.
  - (vi) Minerals in milk:
 

Major and trace elements: salt balance (Physical equilibrium-colloidal, soluble and ionic) and its importance: Factors affecting physical equilibrium among the salts-temperature, pH and concentration.

### **Practical**

1. Preparation and standardization of sodium hydroxide, hydrochloric acid, sulphuric acid, silver nitrate, potassium permanganate and sodium thisulphate.
2. Sampling of milk for chemical analysis Platform tests of milk.
3. Determination of titratable acidity of milk
4. Preparation of Gerber acid and determination of fat in milk by Gerber and Milk tester methods.
5. Determination of fat by Mojonnier method
6. Determination of lactose in milk by Lane Eynon and polarimetric method.
7. Determination of milk proteins by Kjeldahl and Pyne's methods.
8. Determination of ash, phosphorus, calcium and chloride of milk.

9. Phosphates test
10. Detection of preservatives, neutralizers and adulterants in milk.
11. Detection of adulteration of milk with water by freezing point method.

**IDD-303**

**DAIRY MICROBIOLOGY - I**  
**BASIC MICROBIOLOGY**

**4 Credits**

**A. General Microbiology**

1. Introduction to Microbiology; Definition, History of Microbiology, Microbiology, Microscope & its uses.
2. Nutrition & Metabolism of Bacteria
3. Bacterial growth
4. Effect of environment of growth of bacteria
5. Destruction of bacteria by physical & chemical modes.
6. Salient features of Moulds
7. Salient features of Actinomycetes, Rickettsiae and virus.

**B. Salient features of Applied Microbiology**

1. Soil Microbiology
2. Air Microbiology
3. Water Microbiology
4. Silage Microbiology
5. Industrial Microbiology

**Practical**

1. Familiarity with common equipment used in microbiological work; use of ovens, steam sterilizers, pressure sterilizers, refrigerators, care of microscope.
2. Common Bacteriological Techniques;  
Cleaning & sterilization of glassware, preparation of media, pH adjustment, preparation of dilution blanks, preparation of stains and indicators and their use in microbiology.  
Simple staining and differential staining; motility of microorganisms.
3. Evaluation of Bacterial population on agar plate and direct cell enumeration.
4. Study of important characteristics of microbes; Staphylococci, Streptococci, Micrococci, Enterococci, Aerobic and Anaerobic bacteria, Lactic acid bacteria, coliforms, streptococci, micrococci, ciliates, yeasts and moulds.
5. Microbiological examination of Soil, Air, Water and Silage.

LNG-300

English &amp; Basic Technical Writing

3 Credit

**1. Language:**

- a. Word Enrichment- Antonyms, Synonyms, One wordk substitution
- b. Sentence – Types, Strucsture & Parts
- c. Inflection – Noun
- d. Tenses
- e. Parts of speech
- f. Voice

**2. Reading**

Comprehension:

- a. Listening
- b. Reading

**3. Writing:**

Composition

- a. Precis Writing
- b. Essay Writing
- c. Letter Writing (Components, Formats & different types)
- d. CV
- e. Resume

IDD-306

Dairy Production-I  
(Forage Production)

4 Credits

1. **Soils** – Definition, functions, composition, texture, structure, moisture, K, pH, acid, alkaline and saline soils and reclamation, soil organism, fertility and productivity, important soil types of India, erosion and control.
2. **Tillage**- Definition of Tillage and tilth, objective, implements-primary, secondary sowing, planting-functions. Farm mechanization- advantages, limitations and scope under Indian conditions.
3. **Irrigation**- Definition of irrigation- needs, irrigation water sources quality, devices and methods of irrigation commonly used, measurement of irrigation water factors determining frequency, water requirement of important forage crops.
4. **Drainage**- Definition needs principles of layouts systems and layouts.
5. **Dry farming**- Definition, objectives, practices, crops suited manure- fertilizers- classification of plant nutrient- major, minor micro, N.P.K.- role on plant growth, deficiency symptoms, role and deficiency symptoms of minor and trace elements, classification of manures and fertilizers: FYM, compost, liquid

manure, slurry, green manure, concentrated organic manures, composition of commonly used nitrogenous, phosphatic and potassium fertilizers, method and time of application of manures and fertilizers and residual effects.

6. **Weeds-** Definition, economic weed, common weeds and methods of eradication
7. **Forage crop classification-** Herbs, shrubs, trees, grasses, legumes and others, common crops in each group, plant habits-annual, biennials, perennials-common crops in each group, cash crops, companion crops, soiling crops, silage crops hay crops.  
**Cropping seasons-** Zaid (prekharif), Khrif and Rabi- common crops in each group. Important objectives in forage evaluation factors determining selection of forage crops.
8. **Cultivation of important crops-** Botanical name, common name, morphology, origin, package of practices, varieties, utilization, nutritive values, cost of production-per hectare, per unit of green, per unit of D.G.P. & T.D.N. – maize, Jowar, bajra, Cowpea, Guar, Rice bean and tetrakalia, oats, Berseem Lucerne, Mustards, Japanrape, Chinese Cabbage, Hybrid Napier (Napier X Bajra) Para Guinea, Dinanath, forage beet, Tapioca, fodder, turnip, fodder trees.
9. **Cropping schemes-** Rotations- Definition, principles advantages, common rotations with fodder crops. Mixed cropping- definition, advantage, principles, common mixtures of fodder crops, cropping schemes – definition advantages, points to be considered, intensity of cropping, carrying capacity. Drawing of model schemes for supply of fodder all the year round varied conditions- high, medium, low marsyland irrigated non-irrigated and partly irrigated conditions. Comparative economics of forage crops v/s cereal and cash crops.
10. **Pastures** – Different kinds, advantages, scope in India, Characteristics of good pasture species, and name of important pasture crops, establishment & management of pasture rotational grazing, silvi –pastoral concept and practices, social forestry.
11. **Forage seeds** - Importance of good seed, standard, sources, storage, protection.
12. **Conservation of fodder** – Need, forms, advantages and limitations silage making- objective, biochemical changes, types of silos, suitability of types, method of filling and co erring, crops for silage, stages of harvesting, additives and preservatives, silage quality. Hay making-crops, stage of harvesting, methods, quality under different methods. Losses in silage and hay making-comparison, comparative advantages & disadvantages of silage and hay making under different conditions.
13. **Agro Industrial By Products** – Utilisation, feed values, need under Indian condition.

#### Practical

1. General Introduction to a fodder farm, study of hand tools and uses, stud of bullock drawn implements, ploughing methods and practices-bullock drawn,

operation of a disc harrow, operation of cultivator, rollers and wooden planks, Identification of manures and fertilizers, application of F.Y.M., application of fertilizers, compost making, Demonstration on water lifting devices and methods of irrigation, practice on flood irrigation study to drainage system and practice on surface drainage. Methods of sowing-practices on broadcasting and line sowing. Demonstration of drilling. Identification of forage crops, harvesting of different forage crops and loading on trailers. Testing of seeds for germination and purity. Seed bed preparation for principal forage crops-non-irrigated and irrigated. Silage making practices, hay making practices-barn curing, estimation of quantity of straw in stacks. Cost of cultivation of important forage crops. Layout of a fodder farm. Study different types of farm fence-cost per running metre.

IDD-307

**Dairy Production-II  
(Cattle Nutrition)**

4 Credits

1. **General Introduction-** Importance of Science of Animal Nutrition, role of feeds in maintaining life process, Nutrients- definition, essential nutrients in feeds water, proteins, lipids, carbohydrates, minerals vitamins. Harmful substances in feeds names, sources and their effects.
2. **Digestive organs and Processes in cattle-** Introduction, significance of the term "Digestion" digestive system- division and functions (i) Alimentary canal and (ii) Accessory Organs, identification of the parts with the help of diagrams and models.
3. **Digestive Processes-** Mechanical, secretary, chemical, role of enzymes, digestion, absorption and metabolism of carbohydrates, fat and proteins, factors affecting digestibility and measures to improve digestion of feeds in cattle.
- 4 **Feed quality and Nutritive Value-** Importance and methods, chemical analysis-proximate analysis- tractions of feed components, Digestibility trail-conventional type-estimation of Energy contents- by calculation of TDN from digestion trail, Evaluation of protein quality-DGP estimation by digestion trial, calculations of Digestive co-efficient, Digestive Nutrients, TDN & DGP, different system of expressing feed value. (Elementary ideas only).
5. **Nutritional Requirements-** Ration, maintenance and production ration, requirements of dry matter, energy requirements for maintenance and lactation, feeding standards, formulation of ration-principles and requirements according to different categories of animals.
6. **Classification of feedstuffs for cattle-** Roughages and concentrates, coarse fodder and succulent fodder, straws and their uses in feeding cattle, fortification of paddy straw urea treatment, treatments for oxalates, mineral supplementations concentrates – energy rich grains, seeds, brans, chuni,

roots, oil cakes their feed values and extent of their uses.

Whole Milk, skimmed milk powder, tapioca roots, molasses feed values and extent of their uses, scarcity fodders under adverse conditions-tree leaves, seed kernels, water hyacinth extent of their uses.

Use and minerals and vitamins in cattle feed requirement and limitations, feed additives-their extent of uses.

7. **Computation of Rations for cattle-** Desirable characteristics of a balances ration, general considerations for computation of ration, computation of ration for cattle at different stages of growth feeding of calf of different ages, milk replacers, calf of different ages, milk replacers, calf starters, pregnant heifers, cows in milk, dry cow, bull in service, working bullock, economics of feed formulation, unit cost calculation.
- Compounding of feed- selection of feed ingredients, grinding, mixing, bagging, storage and distribution- different methods and limitations of their uses under different conditions, quality control of compounded feeds and chemical processes.

#### Practicals

Identification of digestive organs of cattle and accessory digestive organs.

Identification of fodders and feeds

Feeding of colostrums and milk to calves, measurement of total milk yield of cow

Computation of ration for different categories of animals, compounding of feed-grinding, mixing, bagging stitching and storage programme.

Identification of glasswares, equipment and apparatus for proximate analysis of feed stuff.

Demonstration on proximate analysis of feeding stuff

Estimation of drymatter in fodder and feeds.

Estimation of watter requirements

Quality control of compounded feeds-sampling , physical analysis, chemical analysis

Demonstration on microscopic study of the histological characteristics of digestive organs of cattle.

Demonstration on identification of carbohydrates, lipids and proteins by qualities tests.



**SECOND SEMESTER****IDD-314****ELEMENTARY STATISTICS****3 Credit**

Compilation of Data: Introduction, Scores: Discrete and Continuous, Frequency distributions, graphical Representation of the data (Polygon, histogram & pie- diagram)

Measures of Central Value Arithmetic Mean, Median, Mode

Measures of Dispersion of scores – range, Q, mean deviation, standard deviation, co-efficient of variation.

Normal curve- characteristics, Non- normal curves- skewness and kurtosis.

Causes of non- normality

Significance of the difference between two means by t- test,  $\chi^2$  – test (chi- square test)

Significance of the differences among more than two means by F-test

Sampling methods: types, requisites for randomization, use of random numbers.

**IDD-315****DAIRY PRODUCTION III  
(GENETICS & CATTLE BREEDING)****4 Credits**

1. General Management: Importance of ruminants, classification of breeds of the basis of utility.
2. Important dairy breeds of indigenous and exotic cattle and buffaloes.
3. Calf rearing different methods
4. Management of dairy heifers and bull calves
5. Care of pregnant animals during and after parturition.
6. Management and care of milking stock, dry stock and breeding bulls.
7. Cleaning and sanitation of cattle yard premises.
8. Clean milk production, principles of milking, milk recording. Records essential to good herd management.
9. Milk secretion.
10. Preparation of animals for cattle shows, transport of animals by roads and rail.
11. The principles and practices of breeding dairy stock.
12. Inbreeding, Different systems of breeding
13. Inbreeding, line breeding, cross breeding, grading up, pregnancy testing, culling and selection of animals in the open market.
14. Anatomy of reproductive organs Artificial Insemination.
15. Embryo transfer technology- a general concept and its role in national

perspective.

16. Signs of health and ill health.
17. Diagnosis and detection of diseases care and feeding of sick animals
18. Disinfections, isolation and prophylaxis measures during outbreak of contagious diseases of cattle like foot and mouth, Rinder Pest, Brucellosis, T.B. Jhones and mastitis.
19. Diseases of young stock, Navel-III, Pneumonia, scours, Ring worm and Mange.

#### Practical

1. Layout of a cattleyard, living space for each category of animal from health point of view.
2. Recognition of body parts of dairy animals
3. Physical character of the breeds maintained.
4. Calf feeding, Tattooing, Dehorning, Grooming.
5. Estimation of age and body weight
6. Preparation of animals for milking, milk cooling, observations of signs of oestrus and pregnancy.
7. Cleaning and sanitation of milking sheds and milk record room.
8. Judging of milch cows
9. Preparation of animals for show
10. Study of important cattle records
11. Identification of common cattle feeds computation of rations
12. Recording observations on temperature, pulse and respiration.
13. Identification and use of common first aid drugs and pharmaceutical instruments used in the cattle yard.
14. Dressing of wounds and bandaging
15. Diagnosis and treatment of mastitis.
16. Practice in Artificial Insemination
17. Demonstration on Embryo Transfer Technology at the appropriate centre

**IDD-316**

**DAIRY PRODUCTION IV  
(GENERAL MGT. & CARE OF DAIRY HERD)**

**4 Credit**

**General Introduction:** Definition of Dairying, Present condition and status of Dairying in Indian, Present condition and status of dairy farmers in India, Seasonal nature of milk production, Mixed farming.

**Breeds:** Indian and exotic breeds of cattle, Breeds of buffaloes in India.

**General Management and Care of Dairy Herd:** Rearing and management of calves, Weaning of calves, management and care of milking herd, care of breeding bulls. Different systems of housing for dairy animals, Marking of animals, Dehorning/ disbudding of dairy animals, Castration of male calves, Clean milk production, principles and methods of milking.

#### Practicals

1. General Introduction to Institute dairy farm.
2. Recognition of body parts of cow.

3. Care of newly born calf.
4. Feeding of milk to calf by pail method.
5. Identification of different equipments used on dairy farm.
6. Estimation of body weight by measurements.
7. Practice on marking, disbudding and milking of dairy animals
8. Cleaning and disinfections of barn.

**IDD-311****DAIRY MICROBIOLOGY- II  
(MICROBIOLOGY OF MILK)****4 Credits****A Microbiology of Milk**

- 1) Sources of microbial contamination of milk and their importance
- 2) Milk – borne disease
- 3) Important groups of spoilage of micro organisms and their manifestation in milk.
- 4) Microbial growth in milk during storage and transport
- 5) Taints and abnormal conditions in milk
- 6) Principles of sanitation practices at all stages of production and processing
- 7) Bacteriology of heat-treated milks
- 8) Evaluation of bacteriological features of milks

**B Microbiology of Foods**

- 1) Classification of foods
- 2) Natural functional systems of food and their interactions on shelf life
- 3) Food processing compulsions and options
- 4) Types of food spoilage and their aetiology
- 5) Methods of limiting microbial proliferation in foods
- 6) Features of food fermentations as a desirable change
- 7) Evaluation of microbiological features of foods

**Practical****A Microbiology of milk**

- 1) Sampling of milk for microbiological analysis
- 2) Application of rapid tests for evaluation of milk quality
- 3) Enumeration of bacterial numbers by direct and indirect methods
- 4) Methods used for determining psychrotropic organisms in milk
- 5) Assessment of pasteurized milk based on the following; standard plate count. E coil test. Phosphate test, thermoduric and thermophilic numbers
- 6) Evaluation of utensils and equipments for sanitation

**B Microbiology of foods**

- 1) Comparative study of raw and processed foods
- 2) Study of food enzymes in relation to their profiles at shelf life
- 3) Effect of storage temperature on shelf life foods
- 4) Microbiology of vegetables, eggs, meat, flour, bread, cereals and spices
- 5) Role of salt, sugar, inorganic acids and alkalies in food preservation

IDD-317

## Dairy Technology II (Milk Products)

4 Credit

Status of fat rich dairy products in India and abroad.

Introduction to milk lipids - definition and general composition of milk fat.

**Cream:** efficiency of cream separation and factors affecting it; control of fat concentration in cream. Receiving, grading, sampling and weighing of raw cream; neutralization, pasteurization and cooling of cream. Preparation and properties of different types of cream; table cream, sterilized cream, whipped cream, plastic cream, frozen cream and cultured cream. Preparation of cream for butter making. .

**Butter:** introduction to the butter-making process; theory of churning; batch and continuous methods. Technology of butter manufacture; over-run in butter; control off at losses in ~utter milk; packaging and storage; transportation; defects in butter; rheology of butter; uses of butter.

Butter-making equipment: construction, operation, care and maintenance of cream separators, coolers and vacreator, factory butterchurn and continuous butter making machines.

**Special butters and related products:** *manufacture, packaging, storage and properties of whey butter, flavoured butter, whipped butter, renovated butter/fractionated and poly-unsaturated milk, fat products, vegetable oil-blended products and low-fat spreads.*

Manufacture, packaging, storage, and characteristics of Margarine of different types.

**Ghee and butteroil:** Methods of ghee making - batch and industrial processes, innovations in *ghee* production, procedure, packaging and preservation of ghee; utilization of substandard milk and old/stored butter in the manufacture of ghee.

Continuous process for the production of ghee.

Methods of manufacture, packaging, storage, distribution and uses of butter- oil.

Nutritional aspects of cream, butter, butter-milk, ghee and ghee residue.

Health aspects of milk fat.

Technical control in butter industry: Factors affecting plant operations' efficiencies,. Losses of milk solids, methods of improving operational efficiency and product accounting.

### INDIGENOUS MILK PRODUCTS

#### 3. Ghee:

- a) Definition of ghee, importance of ghee in India
- b) Methods of manufacturing ghee
- c) Grading of Ghee and factors influencing quality of ghee
- d) Difference of ghee & butter oil
- e) Utilization of ghee and resedue.

#### 4. Khoa

#### 3. Chhana

#### 4. Paneer

#### 5. Dahi

#### 6. Indigenous Cheese

- a) Preparation & Packaging, yield and composition.
- b) Factor affecting quality
- c) Packaging & Preservation
- d) Marketing and grading
- e) Legal standards

### MILK BASED SWEETS

3. Place of milk based sweets in India and abroad.

4. Method of manufacture, packaging, storage and transportation of Rasogulla, Gulab jamun, Kalakhand, Rabri, Keer, Khurcha, malai, Rasmalai, Barfi, Peda, Srikhand, Sandesh, Chakka, Milk cake, Pantoa, Payodhi and lassi.

#### Practicals

1. Standardization, neutralization, pasteurization and cooling of cream
2. Preparation of sterilized cream.

3. Preparation of cooking butter by the hand-operated chum.
4. Preparation of *desi* butter.
5. Manufacture of table butter using the power-driven chum.
6. Preparation of a low-fat spread.
7. Preparation of *ghee* from cream and butter.
8. Plant visit.
9. Preparation of *khoa*
10. Preparation of Ghee from butter and cream.
11. Preparation of *Paneer*.
12. Preparation of *chhana*
13. Preparation of *Dahi*
14. Preparation of Surti Cheese
15. Preparation of milk based sweets

**IDD-318**

**Dairy Farm Engg.**

**4**

1. Farm machinery and power: Conventional country tools & implements type, principal parts & functions deshi plough, patella, hoe, sickles, Khurpi etc, yokes for desi bullocks, crossbred bullocks.  
Internal combustion engine and its principal parts and principles of operations: Agricultural Tractor and its principal parts maintenance and selection, driving the tractor, common troubles and remedies terminology.
2. Associated Implements in mechanized farming: Functions, principal parts and maintenance of board and disc plough, harrows, and cultivators, seed drill chaff cutter, weighing machine and its principal parts types maintenance. Milking machine principal parts, operation and maintenance.
3. Electrical machines: A.G. motors- principal parts, function types, difference between generator and motor, maintenance of motor.
4. Refrigeration: Importance in dairy industry, natural refrigeration, artificial refrigeration by mechanical compression system or absorption system, calculation of quantity of ice or dry ice required for certain amount of cooling, Mechanical refrigeration cycle, refrigerants, bulk milk coolers –construction function and maintenance, cold stores, operation and maintenance of cold stores
5. Water supply :- Principles of water supply, water requirement, sources of water, pumps terminology, general construction of pumps, types-positive pumps, non-positive pumps, calculation of requirements of H.P., sanitary and irrigation pumps, maintenance of total head discharge.
6. Dairy machinery: milk cans- constructional features, metals used, types- conventional and insulated maintenance, handling cleaning, storage, Gerber's centrifuge- principles, construction function and maintenance.
7. Storage tank: Types functions and constructional features, types and maintenance of clarifiers separators, homogenizers, heat exchangers, pasteurizers, milk sterilizers, can washers bottle washers ghee kettles, butter churns ice cream freezing equipments.
8. Farm building- principles of site selection, layout farm building, factors involved in assembling, lighting and ventilation requirements, importance of ventilation in dairy farm building factors involved in constructive features for temperatures and ventilation control, maintenance of building, feed go downs- constructional features, storage space and space requirement, damp and rodent proofing ventilation, anticorrosive measures, disinfection, fumigation cleaning.

9. Bio –Gas Plant: Need for drainage and sewage in dairy farm, disposal and cattle hardware, biogas plant constructional and operational features, uses of biogas plant, products and by products and utilization.
10. Feed grinding and mixing machines: Constructional features, maintenance and improvements in trailers and animal drawn vehicles, functions, types, milk van tanker-types, constructional features and maintenance.
11. Meteorology: Introduction to agricultural meteorology, importance, study of meteorological instruments in an Agr met observatory.
12. Fencing: uses, types, constructional features, estimation, periodical checks and maintenance.

Practicals:

- (a) Identification of principal parts and practice on starting stopping- petrol engine, diesel engine and tractor.
- (b) Identification of principal parts and hitching to a tractor- mould board and disc ploughs and disc harrow.
- (c) Chaff cutter- principal parts and their functions, operations of chaff cutter- milking machine- principal parts and their functions and operations.
- (d) Phase induction motor with star delta and their functions, demonstration of operation, calculation of discharge.
- (e) Demonstration of operation of dairy plant machinery. Study of the general features of feed grinder and mixture- principal parts and their function
- (f) Acquaintance with carpentry tools- their functions and operations.
- (g) Acquaintance with agricultural meteorological equipment, apparatus and their functions.
- (h) Acquaintance with soldering, gas, and arc welding equipment their functions and operations.
- (i) To Draw a plan of a –
  - (i) Model of milking shed
  - (ii) Model of bull pen
  - (iii) Model of calf pen
  - (iv) Model of calving shed

**THIRD SEMESTER****IDD – 325****Dairy Production – V  
(Animal Physiology and Reproduction)****4**

**General Introduction:** Familiarity with the concept of Animal Physiology and reproduction and its significance in Livestock rearing.

**Reproduction and Lactation:** Hormones- classification and functions, Male and female reproductive organs in dairy cattle, Sexual cycle, Heat and its detection in cows, Ovulation, Fertilization, Implantation, pregnancy diagnosis, parturition, sterility and infertility. Lactogenesis and galactopoiesis, milk let down.

Artificial Insemination: History merits, demerits and limitations, phases of A.I. viz, collection of semen, evaluation of semen, Dilution of semen, Storage of semen and deposition of semen for higher rate of conception.

**Practicals**

1. Identification of male and female reproductive organs.
2. Identification of different equipments used in animals Physiology and reproduction.
3. Detection of heat in cows.
4. Preparation of artificial vagina and collection of semen.
5. Evaluation of semen- Macroscopic, Microscopic and chemical.
6. Preparation of semen- dilutors
7. Maintenance of records at A.I. sub centre.
8. Study of morphology of udder.

**IDD – 326****Dairy Production – VI  
(Animal Disease & Hygiene)****4 Credit**

**General Introduction:** Definition and concept of disease and health. Factors affecting the health of animal, signs of ill health.  
Care and feeding of sick animals.

**Immunization:** Types of immunity, Antigens and antibodies, vaccination.

**Communicable Diseases:** causes of communicable diseases, FMD, Rinderpes, cowpox, Tuberculosis John's Disease, Haemorrhagic Septicaemia, Anthrax, Black Quarter and their etiology, incubation period, mode of infection, mortality, symptoms, treatment and prophylactic measures.

**Common Parasites Disease:** Causes, symptoms, treatment and preventive measures of common parasitic diseases.

**Diseases of Digestive & reproductive organs:** Causes , symptoms, treatment and preventive measures of common diseases of digestive and reproductive tract viz, Bloat, Impaction of rumen, diarrhea, dysentery, vaginitis, Trichomoniasis, vibriosis etc.

**Practicals**

1. Identification and use of common instruments and drugs.
2. Practice on casting and castration of animals
3. Signs of ill health.
4. Methods of drug administration.

**IDD – 327**

**POULTRY PRODUCTION**

**4 Credits**

<u>S.No.</u>	<u>Topic</u>	<u>No. of Lectures</u>
1.	Poultry keeping in India:- History, status of poultry in India, various improvement programmes	3
2.	Breeds: Breeds of Ducks, geese, Fowl, Quails	8
3.	Feeds and Feeding: Digestion & Digestive system of fowl, composition, classification of poultry feeds, formulation of Balanced ration for various class of birds.	6
4.	Breeding: Reproductive systems of fowl, systems and methods breeding	4
5.	Health care & Management: Hygiene and sanitation, common poultry diseases, prevent in India, vaccination programme for broilers and layers. Poultry housing & equipment, Breeding, Management of layer, management of broiler.	20
6.	Poultry products: Egg structure, Formation composition grading & preservation. Slaughter of poultry for meat. Defething, removal of waste processing and preservation of meat.	8
7.	Economics of poultry farming: economics of Eggs production, Economics of Broiler production.	6

**Practical**

1. Body parts of fowl
2. Visceral organ of domestic fowl
3. Slaughtering of poultry
4. Defething of Poultry
5. Evisceration, removing & cleaning of giblets
6. Calculation of dressing percentages
7. Candling and grading of eggs
8. Egg quality and their measurement
9. Preservation of eggs
10. Sising of chicks
11. Feeding, watering and space requirement for various class of poultry under different housing system.
12. Care of day old chicks
13. Management of broilers
14. Post mortem of birds
15. Computation of balance ration for various class of poultry.



1. Dairy Extension- meaning and purpose, extension education- meaning, history, objectives, philosophy and principles, basic elements of effective extension work.
2. Rural sociology- meaning and role in rural development, characteristics of rural life-physical structure of village society- social structure, concepts of culture, society, social change and their relevance to extension work.
3. Extension Education and Dairy Extension- role of extension education in development of Dairying. Training of extension personnel at different levels, extension teaching – methods and techniques and teaching aids, basic principles of learning and teaching, visit and training method.
4. Planning an extension programme- objectives, principles and steps, extension evaluation. Planning and execution of extension work in relation to development of animal husbandry and Dairying. Involvement of youth, women and other strategic units in development work.
5. Dairy Development Project and other Rural Development Projects- contribution to Animal Husbandry and Dairy Development- Operation Flood- I & II, National Extension Service (NES), Community Development Programme, Intensive Agricultural District Programme (I.A.D.P.) Drought Prone Area Programme (D.P.A.P.) Command Area Development (C.A.P.), Intensive Agricultural Area Programme (I.A.A.P.) High Yielding Varieties Programme (H.Y.V.P.), Integrated Tribal Development (I.T.P.), Integrated Dryland Agricultural Development (I.D.A.D), Margin Farmers and Agricultural Labour Programme (M.F.A.L), Small Farmers Development Agency (S.F.D.A.), Integrated Rural Development Programme (I.R.D.P.) Krishi Village Scheme (K.V.S) Intensive Cattle Development Project (I.C.D.P.), Cattle and Dairying Development (C.D.D.), Farmers Training Centre (F.T.C.), Krishi Vighyan Kendra (K.V.K.-ICAR), Trainers Training Centre (T.T.C.) Lab to Land programme and other technology transfer programmes.

#### **Practicals**

Observation and study of village extension work carried out at the key village (1.) Artificial Insemination (2) Fodder Development (3) Animal Management (4) Other rural extension activities (5) Visit and observation of village panchayats (6) Block Development Committee, (7) N.E.S. Block Development and District Planning meeting.

Practice in use of extension education methods- such as (8) Group discussion method and result demonstrations (9) Use of audio visual aid in extension teaching, use of puppetry, song, poetry and drama for extension work in the villages, Preparation of extension teaching materials such as (10) posters (11)

Charts exhibits etc (12) Organization of vikas melas, vikas Sammelans (13) Cattle shows and rallies with emphasis on dairy and animal husbandry development, (14) Survey of a village for the purpose of planning extension programme for Dairy and Animal husbandry development

**IDD – 329                      PRINCIPLES OF ECONOMICS                      3 Credit**

1. Basic concept; Nature of Economics, Meaning, definition, scope of Economics, Utility, Goods value, Wealth.
2. Concept of consumption: Meaning and importance, determination and characteristics, classification of wants, Law of Diminishing utility, Law of Equi-marginal utility.
3. Concept of Production: Meaning and definition, Factors of production, Land, Labour, Capital, organization, Enterprise.
4. Concept of Exchange: Its Meaning, Definition, Advantages and form of Exchange.
5. Concept of Market, Meaning, Definition, Degree of competition in market, Demand and supply.
6. Concept of Distribution: Meaning, Definition, problem of distribution, Rent, Wages, Interest Profit etc.

**IDD – 330                      FINANCIAL ACCOUNTING IN DAIRY BUSINESS                      3 Credits**

1. Financial Management; its planning meaning, objective, functions, its role and importance
2. Concept of financial accounting; its subject matter, basic principles involve in accounting, classification and importance.
3. Concept of Accounting procedure; Journal, Definition; Role of debits
4. Concept of Double Entry System; meaning, advantages of Double Entry System
5. Ledger: Its concept, necessity, types ruling, difference between Journal and Ledger
6. Cash book; Meaning, types of cash, advantages, difference and similarities with ledger.
7. Trial balance; its meaning, definition, objective and characteristics of Trial balance, limitation etc.

Tutorial

1. Preparation of Journal
2. Preparation of Ledger
3. Preparation of cash book
4. Preparation of Trial balance
5. Preparation of Purchase Book
6. Preparation of Purchase return Book

7. Formate of sales return book
8. Formate of sales book
9. Formate preparation of Inventory
10. Preparation of Purchase register
11. Preparation of Sales register
12. Depreciation

**FOURTH SEMESTER****IDD – 336****BREEDING & MANAGEMENT OF SHEEP****3 Credit**

1. Contribution of sheep industry in India and its statistics.
2. Breeds and breeding of sheep:
  - Indian and exotic breeds of sheeps
  - Mating and A.I. in sheeps
3. Feeds and feeding of sheeps
  - Nutrient contents of daily diets, feeding of lamp and ewe at and after lambing
  - Common diseases of sheep and their control measures
4. Sheep products:
  - Sheep production statistics
  - Wool: Parameters of judging, wool quality, grading system of wool.
  - Economics of sheep farming

**Practical**

1. Body parts of sheep
2. Feeding, watering and space requirement for different class of sheep under various housing system
3. Marking of sheep
4. Shearing
5. Docking of lamp
6. Castration of lamp
7. Grading of wool
8. Economics of sheep farming
9. Cleaning and disinfection of houses

**IDD – 337****BREEDING & MANAGEMENT OF GOATS****3 Credits**

1. Importance of goat farming in India
2. Annual production statistics of goat and goat products
3. Breeds and breeding of goat:
  - Indian breeds of goats, Exotic breeds of goats
  - Breeds and breeding management of goats
4. Feeds and feeding of goats:
  - Nutrient requirement for goats
  - Feeding systems and feeding strategies for goats
  - Feeding management of goats
5. Management of goats:
  - Housing Management

- Tathering, Determination age of goats, disbudding, castration, exercise, hoof trimming
  - Clean milk production
  - Care of doe after kidding
- 6. Health care for Goats:
  - control measures of common diseases
  - Health management
- 7. Economics of goat farming

### **Practical**

1. Body parts of goat
2. Feeding, watering and space requirement for different classes of goats under various housing system
3. Determination of age of goats
4. Disbudding in Kids
5. Castration
6. Cleaning and disinfections of houres
7. Hoof trimming in goats
8. Economics of goat farming

## **IDD – 338 BREEDING & MANAGEMENT OF PIGS**

**3 Credits**

1. Scope and importance of swine farming statics on swine
2. Breeds and breeding of pigs Important feeds of pigs experience in India
  - Guidelines for selection of sow and boar
  - Guidelines for normal reproduction in pigs and detection of heat in sows
3. Feeds and feeding of pigs: Nutritive requirement, creep feeding weaning Recommended rations for different class of pits
4. Management practices for hogs Housing of hogs castration management at farrowing, Pig fenders, Pig wallows, management at breeding (flushing), Needle teeth Common disease of pigs and their control vaccination
5. Pork:
  - Steps of slaughter of hogs
  - Curing of pork
  - Economics of pig farming

### **Practical**

1. Body parts of pig
2. Feeding watering and space requirement for different class of pigs under various housing system
3. Marking of pig
4. Removal of needle teeth in piglets
5. Feed mixing for pigs
6. Castration of pigs

7. Slaughtering of pigs
8. Economics of pig farming
9. Cleaning and disinfections of houses

**IDD – 339****DAIRY BUSINESS MANAGEMENT****4 Credit**

1. Genesis of the Management- Introduction, Dairying as a Business, Selection of Enterprise, Management.  
Industrial Management: Principles of Farm Management, Law of substitution, Authority, responsibility.  
Organization: Types, methods of organization, line organization, Functional organization.
2. Dairy Development: Historical of Dairy Industry in the country present status of dairying in India, Livestock statistics, Important Magazines and Journals of Dairying.
3. Management Functions: What is good management, function of Management, Leadership, Quality of a Leaders, Quality of a Supervisor, Attitude towards himself, Attitude towards others, Attitude towards his job.  
Delegation of authority: responsibility, authority, decision making.  
Reviewing management performance: Objectives
4. Personnel management: organization and control of labour, Duties of labour department, control of labour, labour efficiency.  
Staff Welfare:  
Public relations: What is public relations, public relations and its three purposes, public relations and its application to Dairy Industry, Public relations with reference to consumers, Public relation with reference to local authorities and government.  
Labour Legislation in India: factory act 1948 amended in 1954, Definition, Inspection, health and cleanliness, safety.  
Employee Morale: Introduction – Meaning.

**IDD- 340****PRESERVATION & PROCESSING OF ANIMAL FOODS****4 Credits**

1. Cooling, Pasteurisation and Preservation of milk
2. Indian meat industry
3. Structure, composition and nutritive value of meat tissues
4. Post mortal changes
5. Meat quality parameter
6. Meat cutting and packing
7. Principles of various preservation techniques:-  
Chilling, freezing, curing and smoking dehydration and freeze drying
8. Processing of meat and meat products- curing and smoking of Pork, grading, packaging & preservation of eggs as well as dressed chicken, chevon, mutton and pork.

9. Factors affecting meat quality.

10 Meat products:-

- (ii) Sausage
- (iii) Salami
- (iv) Kabab
- (v) Tanduri chicken
- (vi) Ham and bacon

#### Practical

1. Familiarity with various tools and equipments of meat processing
2. Slaughtering of Animals and Birds
  - (a) Halal Method
  - (b) Jharka Method
  - (c) Jewish method
3. Dressing of Birds, packing and sale
4. Judging of meat of different animals
5. Grading, judging and preservation of eggs as well as carcass
6. Cut- up parts of carcass- display
7. Curling of pork
8. Egg parts.

**COMP- 401**

**COMPUTER APPLICATION**

**2 Credit**

1. Introduction to Computers
2. H/W and S/W Concepts and Terminology
3. Operating System
  - (c) DOS
  - (d) Windows
4. Introduction to commonly used application software
  - (c) MS Word
  - (d) MS Excel
5. Computer Languages & Introduction to 'C' Programming Language
  - (e) Input & Out put statements
  - (f) Declaration of variables
  - (g) Operators
  - (h) Control Statements (Branching and Looping)
6. Introduction to computer Networks
7. Introduction to Internet
8. Application of I.T.

#### **Practical List:**

1. Working with operating systems like MS. DOS, Windows
2. Study of Software packages, Like MS Word, MS Excel and MS. PowerPoint

3. Packages related to medical applications
4. How to search data, workable knowledge of Internet
5. Simple programs in C languages
  - (i) To find the largest among three numbers
  - (ii) To check whether the given number is palindrome or not.
  - (iii) To find whether the given number is the prime
  - (iv) To find sum and average of n integer using linear array
  - (v) To generate the Fibonacci series
  - (vi) To find factorial of a given number using functions.