



CH. CHARAN SINGH UNIVERSITY, MEERUT

चौ० चरण सिंह विश्वविद्यालय, मेरठ

Department of Food Science & Technology

Ref. No. CCSU/FST/393

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SYLLABUS

Proposed revised courses curriculum of M. Sc. Ag. Food Science & Technology

The M. Sc. Ag. Food Science & Technology is a full time four semester degree spread in four semester (Two Year). Following is the division of courses:

I Semester:		Marks
Theory Courses:	1. General Biochemistry	50+50
	2. Statistical method and Computer techniques	50+50
	3. General Microbiology	50+50
Practical – I	Practical based on above courses.	75+75
II Semester:		
Theory Courses:	4. Food Chemistry	50+50
	5. Technology of Cereals, Pulses and Oilseeds	50+50
	6. Principles of Food Processing	50+50
Practical – II	Practical based on above courses.	75+75
III Semester:		
Theory Courses:	7. Principles of Food Analysis & Sensory Evaluation	50+50
	8. Technology of Milk and Milk Products	50+50
	9. Food Microbiology	50+50
Practical – III	Practical based on above courses.	75+75
IV Semester:		
Theory Courses:	10. Technology of Fruits and Vegetables.	50+50
	11. Food Beverages	50+50
	12. Principles of Food engineering	50+50
Practical – IV	Practical based on above courses.	75+75
	13. Project report based on research work done by the students.	100

	Total:	1900

Note : Each theory paper will carry average 50 marks (50 + 50 marks of internal and external evaluation), Practical course 75 marks and the project of 100 marks.

Course - 1

General Biochemistry

Biochemical basis of life and need for the biochemical approach.

Structure of important compounds: Glucose, fructose, sucrose, starch, glycogen, cellulose, plant and animal polysaccharides, amino acids and lipids.

Basic idea of structure of proteins and nucleic acids.

Enzymes and their mechanism of action.

Introduction to secondary metabolites: Alkaloids, vitamins, pigments (plant and animal); hormones their structure and function.

Basic idea on techniques of absorption, spectroscopy, fluorescence spectroscopy, polarimetry, electron microscopy, NMR and X-ray scattering, X-ray crystallography, patch clamp technique, chromatography, electrophoresis (Agarose, PAGE and PFGE), centrifugation and tracer techniques.

Reference Books:

1. Harper. (2005). Bio -Chemistry C.B.S., Publication, Delhi.
2. Lubert Stryer. (2002). Bio -Chemistry Academic Press, Delhi.
3. Wilson & Walker (2000). Practical Bio -Chemistry- principles & techniques.
4. Fennema M. Dekk (2001). Food Chemistry. Oxford University Press.

Course - 2 Statistical Methods & Computer Techniques

Statistics: Definition and scope.

Presentation of data: Frequency distribution, graphical presentation of data by histogram, frequency polygon, frequency curve and cumulative frequency curves.

Central tendency and measures of dispersion: Mean, mode, median, their properties (with-out and with derivation), standard deviation and coefficient of variation.

Simple correlation coefficient and regression.

Tests of significance: T-test, Z-test, X^2 -test for goodness of heterogeneity and independence of attributes, F-test.

Principles of experimental designs, randomized block (RBD) and Latin square designs (LSD) and analysis of variance (ANOVA).

Introduction to computers: General idea of classification and characteristics of computers, input/output units, representation of data (bits & bytes, binary, octal and hexagonal systems).

Programming language (BASIC) as a high level language: Character constraints, variable names and arithmetic expression; BASIC statement and commands; looping and nesting subscripted variables, user definition functions, programming for correlation, regression, analysis of variance; graphic and data base searches, use of computer software linkage analysis, other relevant software; use of internet communication.

Reference Books:

1. Goulden, C.H. (1952). Methods of Statistical Analysis. John Wiley, New York.
2. Hoshmand, A. Reza. (1988). Statistical Methods for Agriculture Sciences. Timber Press, USA.
3. Gomez, A.G. and Gomez, A. A (1994). Statistical Procedures for Agriculture Research, New York.
4. Panse, V.C. and Sushatme, PM. (1967). Statistical Methods for Agriculture Workers. I.C.A.R. Delhi.
5. Raja Raman,V. Fundamentals of Computers. Printed Hall of India Pvt. Ltd. New Delhi.
6. S. R. S. Chandel (2007). Hand Book of Agriculture Statistics. Impact printing Press, Kanpur.

Course - 3 General Microbiology

Microbes: Definition & classification, isolation and identification of microorganisms, sources of microbes and their characteristics. Morphological & physiological characteristics of different groups of bacteria, fungi and yeast. Elementary knowledge of genetics of bacteria and virus. Microbial growth. Control of microorganism by physical, chemical or other agents (sterilization).

Fermentation and fermentable microbes: History and design of fermentors; types of fermentor; application in fermentation; batch, fed batch, continuous cultures of microbes. Production of alcoholic beverages. Fermentation.

Microbial transformations: Steroids, alkaloids, polysaccharides.

Single cell proteins (SCPs): Physiological aspects, SCP from CO₂, waste material and renewable sources, improvement in SCP.

Industrial production of enzymes: Cellulase, amylase, xylase, pectinase, lipases, proteases, their production and application.

Microbes in bio-conversion of waste for fuel and energy. Microbial emulsifiers and demulsifiers.

Reference Books:

1. Prescott/Harley/Klein's Microbiology. (2009). McGraw-Hill publishers, New York.
2. Frazier (2006), General Microbiology. Oxford University Press
3. S.S Purohit. (2004) Microbiology. Student publishers, Delhi.

Course – 4

Food Chemistry

Water: Structure, chemical properties, reactions and functions, concept of water activity.

Carbohydrates: Structure, classification, properties and nutritive aspects, sugars, starch, cellulose, hemicellulose, gums, pectin substances, polysaccharides.

Lipids and fatty acids: Structure, classification, function, properties and nutritive aspects processing; of oil seeds including extraction, refining effect of food quality; hydrogenation and winterization of oil, auto-oxidation of lipids, different groups of fats and oils.

Amino acids and proteins: Structure, classification, function, properties and nutritive aspects; purification and protein denaturation, changes in milk and muscle protein during processing.

Minerals and vitamins: Structure, classification, function, properties and nutritive aspects.

Fiber: Classification and importance in human diet; source of fiber.

Enzymes: Classification and properties of food enzymes, factors affecting enzyme activity, uses of enzymes in food industry.

Food and energy: PEV and GEV of food constituents, Bomb calorimeter and its functioning.

Browning reaction in foods: Enzymatic and non-enzymatic browning and its significance and use.

Reference Books:

1. Fennema M. Dekk (2001). Food Chemistry. Oxford University Press.
2. Frank A. Lee (2000). Basic food chemistry. McGraw-Hill publishers, New York.
3. W.S. Wang (1998). Mechanism and theory in food chemistry.
4. Belity & Grosch. (2001). Food chemistry, W.P. Publications, New York.

Course : 5 Technology of Cereals, Pulses and Oilseeds.

Wheat: Introduction, structure, composition, nutritive value, conditioning and milling of wheat.

Wheat flour, quality characteristics and its uses in bakery products: bread, biscuits & cakes

Rice: Grain structure, composition, cooking characteristics, nutritive value, parboiling and milling of rice. Utilization of byproducts: rice bran, rice bran oil.

Corn: Grain structure, composition, nutritive value, dry and wet milling, corn flakes, starch, corn syrup.

Barley: Structure, composition, nutritive value, malting of barley.

Oat: Grain structure, nutritive value, preparation of oat flakes, oatmeal.

Oilseeds and legume: Composition, nutritive value and antinutritional, factors in legumes and oilseeds.

Milling of different pulses and their utilization, cooking characteristics of different pulses.

Oil seeds and their processing: Processing of oilseeds, extraction and refining of oil, by-product utilization. Technology of protein isolates, concentrates. Food grain storage and concerned agencies. Functional and multigrain food products.

Reference Books:

1. Houston. Rice chemistry and technology.
2. Chakraverty. Post harvest technology of cereals and pulses.
3. Matz S. A. Chemistry and technology of cereals as food and feed.
4. N.L. Kent (2006). Technology of cereals, Wood Head Published Limited, England.

Course - 6 Principles of Food Processing

Introduction: Food science as a discipline, definition and scope.

Food quality factors in food industry: Appearance, textural, flavor factors, additional quality factors and quality standards.

Unit operations in food processing- Common unit operations, raw material and grading preparation like size reduction, mixing, homogenization, separation, cleaning and sorting.

Heat preservation and processing: Principles of thermal processing, blanching, pasteurization, UHT processing, thermal sterilization, basic steps in thermal processing, TDT curve and TDR curve, margin of safety, 12 D value, low temperature; aseptic processing; thermal inactivation and sterilization of micro-organisms and enzymes.

Cold preservation and freezing: Refrigeration and freezing, refrigeration cycle, cold storage, freezing and frozen storage, rate of freezing, methods of freezing, effect of cold storage and freezing on quality of food products.

Food dehydration and concentration: Concept and mechanism of drying, methods of drying, effect of drying on quality of food products.

Principle of food concentration- Food concentration methods and their application. Intermediate moisture foods: definition and methods of preparation and their utility.

Irradiation, microwave and ohmic processing: Ionizing radiations, methods of irradiation and effects; principle and application of ohmic heating; and microwave heating in processing and preservation.

Reference Books:

1. N. Potter. (2002). Food science Norman, C.B.S., Publication, Delhi.
2. P. Fellows. (2004). Food processing technology. Wood Head Published Limited, England.
3. Desosier & Desosier. (2006) Technology of Food Preservation. Gene Tech. Book, Delhi.
4. R. K. Singh & Sahai. (1998). Unit operations in Food Processing. C.B.S., Publication, Delhi.
5. Khetrapaul & Pania. (2004) Food Packaging Daya, Publication, Delhi.

Course - 7 Principles of Food Analysis and Sensory Evaluation

Preparation and standardization of solutions, buffers. Determinations of proximate composition:

Moisture, fat, protein, fiber, carbohydrate, ash

Analysis of starch, reducing and non-reducing sugars in foods.

Determination of minerals: Iron, calcium, phosphorus, magnesium. Water soluble and fat soluble vitamins. Plant pigments (carotene, lycopene, chlorophyll, anthocyanins)

Analysis of fats and oil (FFA, PV, RM value)

Sensory evaluation of foods, methods of sensory evaluation, selection and training of panelists, establishment of sensory evaluation laboratory.

ReferenceBooks :

1. Y. Pomeranz. Food Analysis Theory and Practice. C.B.S., Publication, Delhi.
2. Morris B. Jacobs. The Chemical Analysis of Foods and Food Products.
3. W. Graenwedel. Food Analysis: Separation Techniques. Wood Head Published Limited, England.
4. S. Ranganna. Handbook of Analysis and Quality Control for Fruits and Vegetables. Daya, Publication, Delhi.

Course- 8 Technology of Milk and Milk Products

Technology of fluid milk: Collection, chilling, transportation, cream separation, standardization, pasteurization, sterilization, homogenization, packaging, storage and distribution of fluid milk, flavoured milk, enriched milk.

Technology of fermented milk: Principles and practices of manufacture, packaging, storage and marketing of curd (dahi), butter milk, acidophilus milk, yoghurt, shrikhand.

Technology of cheese: Standards of manufacture of hard, semi-hard, soft and processed cheeses. Storage and marketing of cheese. Cheese defects and their control.

Technology of fat rich dairy products: Manufacture, packaging, storage and marketing of butter & cream, butter defects and their control.

Technology of frozen milk products: Classification, standards, manufacture, packaging, storage and marketing. Defects of frozen products and their control.

Technology of concentrated, evaporated and dried milk: Standards, manufacture, packaging, storage, defects and their control.

Technology of indigenous dairy products: Khoa (manufacture, classification and use), paneer, ghee. Technological aspects of casein manufacture- by-products utilization

Reference Books :

1. Milk and Milk Processing B.L. Herrington
2. Milk and Dairy Technology Edgar Spreer. Marcel, Dekker. Inc.
3. W.E. Peterser. Dairy Science. Asiatic Publication House, Delhi.
4. D. Miller. Handbook of Dairy Foods and Nutrition Gregory.
5. Su Kumar De. Outlines of dairy technology. Oxford University Press.
6. Walstra, G. Normen. Dairy Technology. Marcel, Dekker. Inc

Course- 9 Food Microbiology

Growth and growth curve of bacteria; properties, reproduction, physiological characteristics of fungi, mold, yeast, lactic acid bacteria

Lactose metabolism

Citrate fermentation

General characteristics, economic importance, and classification of different bacteria.

Genus: *Lactococcus*, *Streptococcus*, *Leuconostoc*, *Lactobacillus*

Family: *Bacillus*

Family: *Enterobacteriaceae coliform- E.coli and Enterobacter*

Family: *Acetobacteriaceae*, industrial production of acetic acid.

Family: *Pseudomonaceae-Pseudomonas*

Factors affecting growth of microorganism in food, intrinsic and extrinsic factors

Preservation of food.

Spoilage of food and food products.

Poultry products, fruits & vegetables, wines, beer production.

Fermented foods (fermented milk products and fermented foods)

Food poisoning (*Staphylococcus*, *Bacillus*, *Listeria*, *Salmonella*) and food infection.

Reference Books:

1. Food Microbiology M.R. Adams
2. Basic Food Microbiology J. Banwart. C.B.S., Publication, Delhi.
3. Modern Food Microbiology James M. Jay
4. Microbial Food Poisoning R. Eley
5. Practical Food Microbiology & Technology Mouny & Gould
6. Fermentation Technology Singh & Pandit

Course- 10 Technology of Fruits and Vegetables

Fruits and vegetables as living commodity, chemical composition, pre and post harvest changes, maturity standards for storage. Desirable characteristics of fruits and vegetables for processing

Post harvest handling of fresh fruits and vegetables for processing

Role of plant growth regulators in relation to storage; physical and chemical treatment to increase the shelf life conditions for transportation and storage. Post harvest diseases and defects; cold, controlled and modified storage of fruits and vegetables. Freezing of fruits and vegetables.

Canning and bottling: Quality of raw materials; preparation of materials. Preparation of syrups and brines, canning and bottling, flow sheets of typical fruits and vegetables, effect of canning and bottling on nutritive value, spoilage of canned products- detection and control .

Preserve candies and crystallize fruits: Preliminary processing, methods, storage life, changes during frozen storage. Candied, glazed, crystallized fruits; improved equipment for manufacture of preserves. Some common preserves and other preserves and candied fruits.

Jams, jellies and marmalades: Jam-definition and standards, method of jam manufacture, jelly-extraction of pectin, mechanism of gel formation, processing of jelly, processing of some typical jams jellies & marmalades.

Dehydration of fruits and vegetables; Methods, packaging, storage, quality control during and after dehydration.

Pickles and chutneys: Preparation of various types of pickles- theory and practice; preparation of sauces and chutneys; problem related to the shelf life of pickles and chutneys, quality control.

Tomato products: Preparation of sauce and ketchup, puree and paste; food standards and quality control.

Reference Books:

1. Preservation of Fruits and Vegetables Girdharilal
2. Commercial fruits & vegetable products W. V. Cruess
3. Fruit – processing Ramaswamy
4. Fruit & Vegetales Thompson
5. Hand book of fruit science & Technology Salunkhe & Radam. Marcel, Dekker. Inc.

Course -11

Food Beverages

Fruit juices, squashes and cordials: Equipment for fruit juices, double operations processes; Pulping equipment, dearator and flash pasteurization, fruit beverage- preparation & preservation. Straining, filtration and clarification. Preservation of fruit juices, preservation by addition of sugar, freezing, by carbonation and by filtration.

Fruit beverages: Squashes and cordials, juices, syrups, carbonated beverages. Fruit juice concentrate. Fruit juice powder

Fermented beverages: Beer –brewing, raw material and manufacture, storage, finishing and packaging. Grapevine- composition of grapes, wine type and their composition, mold and yeast of grapes and wine. Chemistry of fermentation. Composition of wine, production of red and white table wine, production of sherry sparkling wine, desert wine, vermouth wine, flavoured wine, fruit wine, etc. Spoilage of wine– non bacterial and bacterial.

Brandy and whisky production: Definition, compounds and methods of manufacture.

Winery byproducts.

Coffee: Production practice, processing of coffee beans into powder, instant coffee, decaffeination.

Tea: Leaf processing, various classes of tea, changes during processing of tea leaves, instant tea.

References Books:

1. Preservation of fruits & vegetable. Girdharilal & Siddappa
2. Commercial fruits & Vegetable Product. W.V. Cruées
3. Technology of wine making food science. W.V. Cruées.
4. Technology, chemistry and microbiology of food beverages: Varman & Sakesland

Course - 12 Principles of Food Engineering

Fluid flow: Properties of fluids density, specific weight, specific volume, specific gravity viscosity – kinematics viscosity, newton’s law of viscosity – variation of viscosity with temperature, type of fluid flow, steady – unsteady, uniform – non uniform, laminar – turbulent, compressible fluid etc, rate of flow and discharge, continuity equation, equation of motion, bernoulli’s equation, and euler’s equations flow of viscous fluid through circular pipe – Hagen poiseille formula.

Heat transfer: Introduction, mode of heat transfer conduction – Fourier equation, thermal conductivity, general one dimension conduction equation, Heat condition through a plane wall, composite wall, cylindrical wall and multilayer cylindrical wall. Heat exchangers – parallel flow exchanger counter flow exchanger overall heat transfer coefficient, convection heat transfer, radiation.

Energy balance: General principles, energy terms, heat, properties of saturated and superheated steam, heat balance.

Refrigeration: Law of thermodynamics, principle of operation, refrigeration cycle, reverse carnot air refrigeration cycle, working, calculations of condenser, evaporator, compressor, refrigeration load , coleman cycle, vapor compression cycle.

Evaporation: Single effect evaporators, condenser, vapor recompression, multiple-effect evaporators, psychrometry process, psychrometric chart.

Reference Books:

1. Fundamentals of Food Process Engineering T. Toledo. C.B.S., Publication, Delhi
2. Hand book of food Engineering R.P. Singh. Academic Press, Delhi.
3. Hand book of food Engineering Aeldmam & Lunde. Marcel, Dekker. Inc.