

तार : विश्वविद्यालय  
Gram : UNIVERSITY



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# बुन्देलखण्ड विश्वविद्यालय, झाँसी BUNDELKHAND UNIVERSITY, JHANSI


झाँसी (उ.प्र.) 284128

संदर्भ.....

दिनांक..11/07/2022

## The Minutes of Meeting of BOS

In reference to the BOS of department of Food.....  
..Technology....., Institute of Food Technology.....  
..... held on 11/07/2022 regarding the  
revision of syllabus in tune with CBCS/NEP-2020 and subsequent  
approval from Academic Council. This is to certify that the syllabus is  
100% revised.

  
HOD/Coordinator

## Institute of Food Technology


A meeting of Board of Studies of Institute of Food Technology was convened on 11th July 2022 to decide the course structure and syllabus of Bsc honours in Food Science and Technology and Msc Food Science and Technology as per Choice Based Credit System and New Education Policy 2020 following members were present in the meeting.


1. Prof Shiv Kumar, Convener
2. Prof SS Shukla, JNKVV Jabalpur, Expert
3. Dr Nepal Singh DFM Foods, Expert
4. Dr. DK Bhatt, Member
5. Mr Manoj Kumar, Member

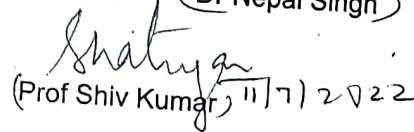
### Minutes of the meeting

1. Panels of examiners of newly designed courses at UG and PG level as per guidelines of new education policy 2020 as well as old courses were approved.
2. Ordinances of B.Sc and M.Sc. courses along with the course structures were approved.
3. Two Value Added Courses viz (1) Jam and Jelly processing Technology (2) Milk Fermentation Technology, were also approved.
4. Syllabus of courses were discussed at length and experts suggested some major changes in the syllabus.
5. It was decided that the syllabus of courses should be changed as per suggestions by experts and after incorporation of changes in the syllabus should be sent on the mails of experts for confirmation within a week.
6. After final confirmation from the experts, the recommendations of the Board of Studies should be forwarded for the approval of the academic Council of the university.
7. Dr. Nepal Singh joined the meeting with following link  
<https://meet.google.com/smj-bnuj-tiq>

  
(Mr Manoj Kumar)

  
(Dr. DK Bhatt)

  
(Prof SS Shukla) 11/7/2022

online present  
(Dr Nepal Singh)  
  
(Prof Shiv Kumar) 11/7/2022

**M.Sc. (Food Technology)**  
**SYLLABUS – 2014 and Onward**

## **FST 151/6291 FOOD AND NUTRITION**

### **Unit I (8 Lectures)**

Food production and consumption pattern in India. Role of agricultural scientists and food technologist in meeting national nutritional requirements. Post harvest losses of foods.

Concepts of Food and Nutrition - Definition of terms food nutrition, under-nutrition malnutrition, health and nutritional status.

### **Unit II (6 Lectures)**

Function of Foods.

Basic Food groups-energy yielding, body-building and protective functions.

Nutritional composition of various foods.

### **Unit III (12 Lectures)**

Specific Nutrients :

Proteins-composition, digestion, functions, sources, quality of proteins, supplementary value of proteins, effect of deficiency.

Carbohydrates - composition, classification, digestion, functions, sources, dietary fiber.

Fats – composition, digestion, functions, sources.

Minerals - Functions, sources and their relative availability, factors affecting absorption, effect of deficiency of calcium phosphorus, iron, iodine, fluorine and copper.

Vitamins -Classification, functions, sources, factors affecting destruction, factors enhancing vitamin content in foods, effects of deficiency, fat soluble and water soluble vitamins.

### **Unit IV (5 Lectures)**

Nutritional Needs - Requirements and recommended allowances of foods under normal conditions. Basic terminology - In food preparation and methods of cooking.

### **Unit V (9 Lectures)**

Food Preparations :-

Beverages : (tea and coffee) Basic rules of preparation.

Cereals : Various ways of using cereals; changes during the preparation of bakery products.

Pulses : different ways of preparation of pulses.

Vegetable and Fruits : preparation, method of cooking, cooking losses.

Milk and milk products : preparation of milk products, effects of heat, uses in cookery.

Eggs : Structure, composition, quality judgement, care in storage, principles of egg cookery, methods of cooking.

Meat, Fish and Poultry : tenderness, principles of meat cookery, methods of cooking.

Novel foods : Composition and method of preparation.

### **References-**

1-Essentials of Foods and Nutrition- M.Swaminathan

2-Introduction of Food Nutrition & food processing-Meera Vashisht

3-Food and Nutrition-B.Srilakshmi

4-Nutrition Sciences- B.Srilakshmi

5-Food Science and Nutrition-Sunetra Roday

## **FST 152/6292 DAIRY SCIENCE**

### **UNIT-I (4 Lectures)**

Definition of Milk , Chemical composition of milk from different species of animals.  
Nutritive value of milk. Factors affecting composition of milk.

### **UNIT-II (8 Lectures)**

Physico-chemical properties of milk: colour, taste, flavor, O/R - potential, surface tension, specific heat, viscosity, refractive index, boiling point, freezing point, electrical conductivity, pH and buffering capacity.

### **UNIT-III (10 Lectures)**

Colostrum: composition and physico-chemical properties, significance.  
Chemistry of milk constituent viz. fat, proteins, lactose,,enzymes and vitamins.  
Microbiology of milk: spoilage of milk.  
LP-system for milk preservation.  
Naturally occurring preservatives in milk  
Milk fermentation and significance of fermentation.

### **UNIT-IV (8 Lectures)**

Market milk Industry: Quality of raw milk, milk collection, platform testing.  
Processing operations: filtration,clarification,separation,homogenization, standardization, pasteurization, sterilization.  
Milk standardization and cream separation.

### **UNIT-V (6 Lectures)**

Judging of efficiency of processing methods.  
Determination of milk composition and milk quality tests.  
Detection of adulterants and neutralizers in milk and milk products.

## **References**

Outlines of dairy Technology - Sukumar Day

## **FST 153/6293 MICROBIOLOGY**

### **Unit I (10 Lectures)**

History and Scope of Microbiology, The discovery of Microorganism, Spontaneous generation versus biogenesis, the germ theory of disease, pure culture concept, Structural organization of prokaryotic cells and eukaryotic cells. Cultivation of Micro-organism: Types of culture media, synthetic and complex media, sterilization, aseptic transfer, isolation and incubation. Microbial nutrition (Requirements for C, H, O, N, P and S), Nutritional types of Micro-organism, Isolation of pure culture (spread, streak and pour plate method).

### **Unit II (10 Lectures)**

Microbial Metabolism: Chemical principles of metabolism, autotrophic and heterotrophic metabolism. Transport mechanism. Ecological aspects of microbial metabolism. Biogeochemical cycles - carbon, hydrogen nitrogen & sulphur cycles. Microbial Growth : The growth curve, continuous culture of Microorganism. Factors influencing Microbial growth (Oxygen, water, pH, temperature, pressure, salinity). Physical and chemical control of Microorganisms, antibiotics as chemotherapeutic agents.

### **Unit III (5 Lectures)**

Survey of Micro-Organism : A brief account of the classification of microorganisms. A general account on virus, bacteria, algae, fungi and protozoa.

### **Unit IV (6 Lectures)**

Microorganisms and Human Diseases: A general account of disease causing microorganisms in humans- Respiratory tract diseases, Genitourinary tract diseases, Sexually transmitted diseases. Normal micro flora of human body.

### **Unit V (7 Lectures)**

Applied Microbiology: Major Products of Industrial Microbiology. Amino Acid, Organic Acid, Bio conversion process. Fermentation: Lactic acid fermentation, acetic acid fermentation, alcoholic fermentation, Malo-lactic fermentation.

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## **REFERENCES**

- Microbiology – An Introduction by Tortora, Funke and Case.
- An Introduction to Microbiology by Palczar.

## **FST 154/6294 BIOCHEMISTRY**

### **Unit I (10 Lectures)**

Properties of water, weak acids, weak bases, pH and buffer. Carbohydrates: Classification, Kiliani synthesis, mutarotation, structure and importance of mono, oligo and polysaccharides. Maltose, lactose, sucrose, isomaltose, glycogen, starch, homo and hetero polysaccharides, proteoglycan, muco-polysaccharides. Lipids: simple and compound lipids, phosphoglycerides, sphingolipids, terpenes, sterols, and eicosanoids structure of biological membrane.

### **Unit II (7 Lectures)**

Amino acids: Chemical structure, general properties, and titration curve. Proteins: Structure of peptides, peptide bond, protein structure (primary, secondary, tertiary and quaternary structure of proteins). Forces stabilizing the protein structure, salting out, salting in, denaturation, and renaturation.

### **Unit III (8 Lectures)**

Enzymes: Nomenclature, classification, Michaelis-Menten equation, Lineweaver-Burk plot competition, non-competition and competition inhibition, enzyme catalysis, substrate-enzyme reaction, pro-enzyme and enzyme activation- allosteric enzyme co-operativity. Importance of enzyme. Nucleic acid: structure of nucleic acid (RNA and DNA), nucleotides, nucleosides, different forms of DNA, denaturation and renaturation.

### **Unit IV (8 Lectures)**

Metabolism: Carbohydrate metabolism; glycolysis, fermentation, gluconeogenesis, glycogenolysis, pentose phosphate pathways, TCA cycle, glyoxylate pathway, electron transport chain. Lipid metabolism: digestion, absorption, alpha, beta and omega oxidation of fatty acids. Fatty acid biosynthesis, ketone body formation, cholesterol biosynthesis, urea cycle. Nitrogen metabolism and secondary metabolism.

### **Unit V (7 Lectures)**

Molecular biology and biotechnology: replication of DNA, transcription, translation, recombinant DNA technology, plasmid, cosmid, phage vector, genomic and cDNA library, southern, northern and western blotting.

## **REFERENCES**

1. Biochemistry by Albert L Lehninger.
2. Biochemistry by Jeremy M Berg.
3. Biochemistry by U Satyanarayana & U Chakrapani.
4. Fundamentals of Biochemistry by J L Jain, Sunjay Jain & Nitin Jain.

## **FST 155/6295 Information Technology and Operating Systems**

### **UNIT-I (7 Lectures)**

Computer Evolution: History of computers, Categories of computers ( application wise), Characteristics of computers, types of computer ( analog, digital, hybrid), mini, mainframe, supercomputer, limitation of computer.

### **UNIT-II (6 Lectures)**

Computer organization; block diagram of digital computer, CPU, ALU, main component of CPU, data base, main memory, secondary memory, RAM and ROM.

### **UNIT-III (6 Lectures)**

Devices: input devices, output devices, secondary storage devices, Magnetic tape, magnetic disk, floppy disk.

### **UNIT-IV (8 Lectures)**

Number system and computer arithmetic: Base/ Radix, decimal numbers, binary numbers, numbers, hexadecimal numbers with conversions and basic operations, encoding system (BCD, ASCII, EBCDIC, CODES).

### **UNIT-V (8 Lectures)**

Concept of software and data organization: computer languages, operating system, database, management system, data communication, concept of computer networking. Operating system: introduction to types of operating system, unix, MS DOS, type of languages, lotus, word star, windows.

### **References**

1. Fundamentals of computers- V. Rajaraman
2. Fundamentals of computers- E. Balaguruswami





## **FST 251/6298 FOOD CHEMISTRY**

### **Unit I (5 Lectures)**

Water molecule, hydrogen bonding, different types of water, physical properties of water, water activity and its role in food processing and storage, industrial and nutritional significance of water.

### **Unit II (10 Lectures)**

Carbohydrates: Role of carbohydrates in food industry, sugars starch, cellulose, glucans, hemicellulose, gums, pectic substances, polysaccharides. Plant pigments and their role in food industry.

Proteins: Major protein systems and factors affecting them, the nature of interaction in proteins derived from milk. Egg proteins, meat proteins, fish muscle proteins, oil seed proteins and cereal proteins.

### **Unit III (10 Lectures)**

Lipids: Refining of crude oils, hydrogenation and winterization. Vegetables and animal fats, margarine, lard, butter, oleo oil and their use in cooking, frying and shortening. Flavour changes in fats and oils. Lipid oxidation, factors affecting lipid oxidation, autooxidation, biological significance of auto-oxidized lipids.

Enzymes: Enzyme activity in different food systems, commercial availability, food enzyme technology, immobilization of enzymes, removal of toxicants through enzymes, flavour production by enzymes.

Vitamins: Role of vitamins in food industry, effect of various processing treatments and fortification of foods.

### **Unit IV (8 Lectures)**

Meat & Fish : Nature of muscle & its conversion to meat. Edible fish. Changes produced during processing of meat and fish. Post harvest changes in fruits and vegetables, respiration, ripening, flavour, colour and texture.

### **Unit V (6 Lectures)**

Enzymatic and non enzymatic browning in foods.

Additives, Emulsifiers, Antioxidants & their role in product preparation.

### **References :-**

1. Food Chemistry by Lillian Hoagland Meyer
2. Food chemistry by Owen R. Fennema
3. Food chemistry by H..K Chopra P.S Panesar
4. Food theory and application second edition by Jane Bowers

## **FST 252/6299 FOOD MICROBIOLOGY**

### **UNIT-I (10 Lectures)**

General Characteristics of Bacteria, Yeast and Molds associated with food. Extrinsic and Intrinsic factors influencing Microbial growth in foods. Starter culture – Selection of culture, Preparation and maintenance of culture. Activity of culture and factors affecting the activity. Influence of starter culture on the flavor and texture of food.

### **UNIT-II (8 Lectures)**

Spoilage of Milk, Cream, Butter, Frozen desserts and Condensed milk. Spoilage of fruits vegetable and canned foods. Spoilage of cereals and cereal products. Spoilage of meat and meat products. Spoilage of fish poultry and egg.

### **UNIT-III (8 Lectures)**

Effect of high temperature, Low Temperature, Drying and Radiation on destruction of micro-organism. Fermented and Microbial Foods- Fermented vegetables, Fermented milk, Fermented cereals foods.

### **UNIT-IV (6 Lectures)**

Alcoholic Beverage: Microbiology, Manufacturing process, quality characteristics, Spoilage and defects – Beer, Wine and Vinegar

### **UNIT-V (5 Lectures)**

Probiotics, - Nutritional and therapeutic aspects Food Infection and Intoxication- Bacteria and Non bacteria

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### **References:**

- Food Microbiology by Adams and Moss.
- Food Microbiology by James M Jay.
- Food Microbiology by Frazier

## **FST 253/6300 MILK PROCESSING AND MANAGEMENT**

### **Unit I (6 Lectures)**

Organized market milk industry in India and abroad; Principles and practices followed in milk collection cooling, transport, loading and unloading, milk reception, grading, separation, clarification chilling and storage.

Sampling and testing of milk for physico-chemical, microbiological and sensory quality.

### **Unit II (10 Lectures)**

Principles, equipment, and processes involved in the preparation of standardized market milk and special milks viz. sterilized milk, flavoured milks, vitaminized milk, reconstituted milk, recombined milk and fermented milk. Judging and grading of processed milk, BIS and PFA standards.

### **Unit III (10 Lectures)**

Technologies involved in the manufacture of dehydrated milk products viz. condensed milk evaporated milk, dried milk and malted milk powder; fat rich milk products viz. cream, butter, butter oil and ghee; frozen milk products viz. ice-cream, ices and sherbets; and fermented milk products viz. cheese, curd and yogurt. BIS and PFA standards for milk products.

### **Unit IV (7 Lectures)**

Production and Quality management in dairy industry. Principles of cleaning and sanitation of milk processing equipments, accident prevention, building design and personal health care etc.

HACCP concept in fluid milk processing.

### **Unit V (8 Lectures)**

New physical methods for preservation of milk and milk products: Microwave processing, Pulsed electric field, High hydrostatic pressure, Sonication /Mano-thermosonation and Irradiation.

Microfiltration, Reverse osmosis and Ultrafiltration applications in milk processing.

## **References**

Outlines of dairy Technology - Sukumar Day

## **FST 254/6301 -FOOD PACKAGING AND STORAGE**

### **UNIT I (8 Lectures)**

Background of food packaging

Origin of packaging material. Different packaging materials – Paper, Glass, Tinplate, Aluminium, Plastics.

Package forms- Metal boxes, Metal cans, Bottles and Jars, Metal tubes etc.

Packaging machines, modern packaging materials.

Rigid, semi rigid and flexible packages.

Cans and Canning process.

Different forms and factors involved in the creation of packages

Packaging requirements

### **UNIT II (8 Lectures)**

Retoratable plastic packaging

Modified Atmospheric packaging : Reasons, requirements, applications for different foods, limitations

Controlled atmospheric packaging

Vacuum packaging

Irradiation techniques in packaging

Packaging for consumer convenience

### **UNIT III (6 Lectures)**

Packaging of different foods : requirements and applications :

Red meat, fish, poultry, eggs, milk and milk products, cereal products, bakery and confectionary products, fruits and vegetables : fresh and processed, oils and fats

### **UNIT IV (10 Lectures)**

Edible packaging

Microwavable packaging

Intelligent packaging

Active packaging

Aseptic packaging : principles and requirements

### **UNIT V (7 Lectures)**

Designing of food packages

Computer aided graphic designing

Bar code labeling

In format printing on the package.

Packaging laws and regulations

### **References**

- Modern Food Packaging :Indian Inst of Packaging
- Food Science :Potter
- Modern Processing, Packaging and Distribution Systems for foods:Paine
- An Introduction to Food Science Technology and Quality management:D K Bhatt and Priyanka Tomar

## **FST 255/6302 FOOD PROCESS ENGINEERING**

### **Unit I (8 Lectures)**

Basic principles of food-process engineering. Dimensions and units.  
Material and Energy Balances: Basic principles, Material balances, Energy balances.  
Fluid-Flow Theory and Applications: Fluid statics, Fluid dynamics. Viscosity, Streamline and Turbulent flow, Energy losses in flow. Measurement of fluid pressure and flow rate.  
Pumps and fans.

### **Unit II (10 Lectures)**

Heat-transfer : Theory of heat transfer; modes of heat transfer: Heat conduction, Surface heat transfer, Unsteady-state heat transfer. Radiation heat transfer. Convection heat transfer. Overall heat transfer coefficients. Heat transfer from condensing vapours. Heat transfer to boiling liquids. Heat transfer equipments in food industries.

### **Unit III (10 Lectures)**

Drying: Basic drying theory. Drying curves, Psychrometry, Equilibrium moisture content, drying methods. Drying equipments.  
Evaporation: Single-effect evaporators, Multiple-effect evaporators. Vapour recompression. Boiling-point elevation. Evaporation of heat-sensitive materials. Evaporation equipments.

### **Unit IV (6 Lectures)**

Theory of freezing, freezing curve, crystal growth, freezing time calculation, types of food freezers.  
Sterilization process engineering, D value, Z value, F value and  $F_0$  value. Heat penetration characteristics and calculation of process time.

### **Unit V (8 Lectures)**

Size Reduction: Grinding and cutting, Emulsification.  
Mixing: Characteristics of mixtures, Measurement of mixing, Particle mixing, Liquid mixing. Mixing equipments.  
Mechanical Separations: Sedimentation, Centrifugal separations, Filtration, Sieving.

### **References**

- Unit operations in food processing by R.L. Erle
- Food Engineering by Subir Chakraborty

## **FST 256/6303 TECHNOLOGY OF FOOD PRESERVATION**

### **Unit I (6 Lectures)**

Historical development and current trends; Introduction to food technology; Food attributes- colour, texture, flavour, nutritive value and consumer preference.

Post harvest losses due to physical, chemical & microbial changes and their control measures.

Principles and methods of food preservation.

### **Unit II (10 Lectures)**

Thermal processing of food: principle, advantage and disadvantages; Pasteurization, sterilization, commercial sterilization and blanching. Thermal resistance of microorganism and enzymes. Heat penetration studies. Time temperature combination .D-value, F-value, Z-value. Canning technology.

### **Unit III (8 Lectures)**

Low temperature preservation : refrigeration and freezing, advantages and disadvantages; Types of refrigerants, requirement for cold storage. Temperature requirement for the growth of microbes. Freezing point, freezing time, freezing rate, thermal arrest time. Food group based on freezing rate. Mechanism of freezing. Factors affecting freezing rate.

Thawing, Cryogenic freezing.

### **Unit IV (8 Lectures)**

Drying and Dehydration: Concept of water activity,

Methods of drying, Process of drying. Factors affecting drying rate. Physico-chemical changes during drying, Advantages and disadvantages of drying.

Rehydration and coefficient of rehydration.

### **Unit V (9 Lectures)**

Radiation preservation - mechanism, unit of radio-activity, radappertization, radurization, radicidation. Dose requirement for various foods, public health aspects of irradiated food. Dosimetry.

Microwave heating :principle and applications.

Chemical Preservation : Preservation by using additives, chemicals, antibiotics, sugar, salt and smoking.

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### **References**

- Technology of food preservation by Desrosier and Desrosier
- Food Science by NN Potter

## **FST 351/7291 FOOD EVALUATION AND QUALITY MANAGEMENT**

### **UNIT-I (8 Lectures)**

Proximate constituents of food and their analysis: Moisture, crude fibre, crude fat, ash value, pH and acidity, total solid content, crude protein and minerals. Food adulterants: tests for adulterants in tea, coffee, milk, honey, sugar, icing sugar, jaggery, softdrinks, semolina, supari, sago, pulses and cereals, saffron, spices, oils and fat.

### **UNIT-II (10 Lectures)**

Contamination of food: Microbial contamination, natural toxicants, metallic contaminants, agriculture and environmental contaminants, processing contaminants. Vegetable oils and fats: Methods of analysis of oils-moisture insoluble impurities, acid value, and free fatty acids, refractive index, specific gravity, iodine value, saponification value, unsaponifiable matter, colour of oils, tests for other oils added in pure oil. Tests for vegetable fat-melting point, peroxide value and adulterants.

### **UNIT-III (9 Lectures)**

Sensory evaluation: evaluation of sensory qualities, laboratory setup and equipments, panel selection and training, judging quality. Test methods-difference tests, paired comparison test, duotrio test, triangle test. Rating test-ranking test, single sample test, two sample difference test, multiple sample difference test, hedonic rating test, numerical scoring test, composite scoring test, sensitivity threshold test, dilution test.

### **UNIT-IV (7 Lectures)**

Basic concept of food quality- ways of describing food quality, quality control and quality assurance functions. Total quality control/TQM and the role of management, defects in food quality, statical quality control and quality costs.

### **UNIT-V (6 Lectures)**

Food standards and specifications-compulsory and voluntary trade, company standards. Consumer, company, in-process and finished product specifications. Food Laws-PFA, FPO, SWMA, BIS, MPO, AGMARK, HACCP.

### **References**

1. The chemical analysis of foods and food product- Morris B.Jacobs.
2. Quality control of fruits and vegetables product-S.Ranaganna.
3. Food analysis-Yeshafahu Pomeranz ,Clifton E. Meloan .



## **FST 352/7292 BEVERAGE TECHNOLOGY**

### **UNIT-I (8 Lectures)**

Introduction and History of growth.

Type of beverages: fruit & vegetable juices, fermented and non-fermented beverages, synthetic beverages, carbonated and non-carbonated beverages.

Tea, Coffee and Cocoa: Production, composition, processing and preparation.

### **UNIT-II (6 Lectures)**

Fruit and Vegetable Beverages:

Juice extraction, clarification, preservation, packaging, concentration and drying. Various beverages from fruit juices, their preparation and preservation.

### **UNIT-III (8 Lectures)**

Non carbonated and carbonated synthetic beverages:

Ingredients, source of carbon dioxide, chemical and physical properties of carbon dioxide, carbonating process, packaging of carbonating beverages.

### **UNIT-IV (7 Lectures)**

Alcoholic Beverages:

Non-Distilled Beverages : Beer and Wine

Distilled Beverages :Vodka, Rum, Gin, Whisky, Arack, Toddy, Brandy

### **UNIT-V (8 Lectures)**

Water for beverages: Types of water required for beverages,treatment of water.

Additives for beverages: Natural and synthetic sweeteners and colours, acids, emulsifiers, preservatives, flavours and flavour enhancers.

Quality control of beverage: Quality standards for beverages, chemical, microbial and sensory evaluation, product shelf life.

### **References:**

Foods: Facts and Principles : N. Shankuntala Manny and M. Shadaksharaswamy

## **FST 353/7293 PROCESSING OF CEREALS, PULSES AND OILSEEDS**

### **Unit I (12 Lectures)**

Wheat: Composition of grain and environmental effects on its composition. Types of wheat Enzymes of wheat and their role in the manufacture of wheat products. Principles of wheat milling, conventional and turbo milling. Aging of flour, by-products. Chemical improvers-bleaching and maturing agents. Principles of baking; bakery ingredients and manufacture of wheat products-bread, biscuits etc. Principles of extrusion cooking, pasta goods and processed cereal foods.

### **Unit II (8 Lectures)**

Rice: Composition, types of proteins, starch content, amylose and amylopectin fractions. Rice milling operations . Cooking quality, by-products of rice milling and their utilization, processed and prepared products based on rice. Parboiling of rice- technology and effect on quality characteristics; aging of rice - quality changes.

### **Unit III(7 Lectures)**

Corn: Composition, processing of corn for manufacture of corn grits, meal and flour, manufacture of corn flakes, corn syrup, corn starch.  
Sorghum: Chemical composition, refining method and nutritive value.

### **Unit IV (6 Lectures)**

Pulses: Composition, anti-nutritional factors, processing methods; wet & dry milling and modern milling methods.

### **Unit V (8 Lectures)**

Oilseeds: Extraction and refining of oil; processing of oilseeds as protein concentrates and isolates. Properties and uses of oilseed meals, technology of texturized vegetable protein; Low cost protein foods from oilseeds.

### **References**

- 1.Chakrabarty MM. 2003. Chemistry and Technology of Oils and Fats.Prentice Hall.
- 2.Hoseney RS. 1994. Principles of Cereal Science and Technology. 2nd
- 3.Kulp K & Ponte GJ. 2000. Handbook of Cereal Science and Technology. 2nd Ed. Marcel Dekker.
- 4-PHT of cereals pulses and oilseeds-A.Chakravarty
5. Food Science --- NN Potter
6. Foods: Facts and Principles  
by N. Shankuntala Manny and M. Shadaksharaswamy

## **FST 354/7294 PROCESSING OF FLESH FOODS**

### **UNIT-I (6 Lectures)**

An overview of meat, fish and poultry processing industries in India.  
Composition and structure of meat muscles.  
Nutritive value of meat, fish and poultry products.  
Microbiology of meat products.

### **UNIT-II (8 Lectures)**

Ante-mortem examination, slaughtering and post-mortem examination of meat and poultry. Postmortem carcass evaluation and storage.  
Postmortem physical and biochemical changes in meat.

### **UNIT-III (10 Lectures)**

Freezing, refrigeration and freeze drying of meat.  
Smoking techniques. Biochemical changes during smoking and storage of smoked meat.  
Meat curing, chemistry, technology and quality of cured meat.  
Meat sausages: classification and technology.  
Meat pickling techniques and quality of meat pickle.  
Canning of meat and meat products.

### **UNIT-IV(10 Lectures)**

Composition and nutritive value of fish.  
Freezing, canning, dehydration and curing of fish and fish products.  
Fish protein concentration.  
Slaughter house by-products and their utilization.  
Processing of meat, poultry, fish and their products.  
Effect of processing on nutritive value of fish and fish products.

### **UNIT-V (6 Lectures)**

Meat Food Product Order.  
Chilling and aging of carcass.  
Curing of meat.  
Manufacture of frozen, canned and dehydrated meat.  
Manufacture of sausages.  
Manufacture of canned and dehydrated fish, Surimi etc.  
Smoking of meat.  
Visit to a processing industry

### **References**

1. Poultry Product Technology (Mountney)
2. Principles of Meat Science (Forrest etal)
3. Food Science (Potter)
4. Fish processing (Gopakumar)

## **FST 355/7295 PROCESSING OF FRUITS AND VEGETABLES**

### **Unit I (10 Lectures)**

Importance of fruits and vegetables in human diet; extent of post harvest losses and need for preservation; causes of spoilage; General principles of preservation; low temperature storage of raw fruits and vegetables; grading and selection of fruits and vegetables for processing; syrups and brines used in processing; containers used for primary packaging of fresh fruits and vegetables and their processed products; General principles of thermal processing; in-container thermal processing and aseptic canning; canning processes for commercially important fruit and vegetable products.

### **Unit II (8 Lectures)**

Basic principles of juice extraction, clarification and chemical preservation; unfermented fruit beverages like squashes, nectars, cordials and syrups; Processing of tomatoes, pulping methods, different types of tomato products like tomato puree and paste, tomato sauce and ketchup-method of preparation, common defects and causes; sauces,

### **Unit III (8 Lectures)**

Principles of food concentrates; chemistry and manufacture of pectin, role in jell formation and products like jams, jellies and marmalades. Manufacture and defects of jam, jelly and marmalade.

Technology of preserves, crystallized and glazed fruits. Principles and methods of pickling, types of pickles. Nature and control of spoilage in pickles.

### **Unit IV (8 Lectures)**

Drying of fruits & vegetables: blanching / sulfuring before drying; methods of drying. Freezing preservation of fruits and vegetables: methods for freezing commercially important fruits and vegetables; storage of frozen foods; methods for thawing frozen products.

Application of ionizing radiation in preservation of fruits and vegetables: advantages and limitations; doses of radiation for various purposes like disinfestation and sprout inhibition.

### **Unit V (6 Lectures)**

FPO-scope, mode of implementation and product specifications. By-products of fruit and vegetable industry and their utilization. Controlled and modified atmosphere storage. Recent developments in fruits and vegetables processing.

### **REFERENCES**

- Fruits and vegetables preservation by R.P. Srivastava
- Fruits and vegetables preservation by Giridhari Lal

## **FST 356/7296 FOOD BIOTECHNOLOGY**

### **UNIT-I (8 Lectures)**

Food biotechnology: concept & definition of terms. Traditional uses of micro-organisms in Foods. Food fermentation.

Single-Cell Protein. Probiotics : Definition, different products of probiotic activity.

Enzymes : their production and use in food industry.

### **UNIT-II (9 Lectures)**

Metabolic pathways in microorganisms: Tri Carboxylic acid cycle, Embden Meyerhoff pathway, Entner Doudoroff Pathway, Synthesis of ATP in electron cycle, DNA replication, mutation, recombination, Strain improvement and recombinant DNA technology

### **UNIT-III (9 Lectures)**

Genetic Engineering: Nucleic acids and proteins, definition of GE, the effect and application of Genetic Engineering. Genetic modification of micro-organisms, Genetically modified crops.

Biosensors, types and application in Food Industry.

### **UNIT-IV (8 Lectures)**

#### **Applications of food biotechnology :**

Yeast based processes : Food yeast and derivatives, alcohols, bakery products.

Bacteria based processes : dairy, meat and fish, vegetable products, vinegar, polysaccharides.

Sweeteners, flavours, amino-acids, vitamins, pigments, mushrooms, cocoa, tea and coffee.

### **UNIT-V (7 Lectures)**

Waste Management: Whole-cell fermentation, Cell-free enzyme systems.

Fermentor and bioreactor system, scale up of fermentations

Application of plant cell and tissue culture.

#### **References:**

- Fundamentals of Food Biotechnology by Byong H Lee.
- Microbiology – An Introduction by Tortora, Funke and Case.
- Food Processing: Biotechnological applications by SS Marwaha and JK Arora



## **M.Sc. Food Science and Technology**

### **Program Outcomes (POs)**

1. Apply knowledge gained in food chemistry, microbiology, engineering, and sensory evaluation to the development, processing, and preservation of safe, nutritious, and high-quality food products.
2. Design food products that meet the various food regulations and laws.
3. Trained to use advanced instruments and technologies to process and analyze food products and to solve food safety problems.
4. Critically assess and analyze food science information available in the public domain in an innovative and ethical way.
5. Competencies in all aspects of production, processing, and management in food industries and other food-related sectors, including as entrepreneurs.
6. Communicate technical and other relevant information effectively in both oral and written format to a diverse audience including supervisors, colleagues, consumers and government institutions.
7. Commitment to professionalism and ethical values.

## Programme Specific Outcomes

### **M.Sc Food Science and Technology:**

- Students learn to apply the knowledge of science, engineering fundamentals, and mathematical concepts to the solution in the field of food technology for food production, food ingredient supply, food research and development, food process engineering, food quality, and safety system, food analysis, and quality control, regulatory affairs, food marketing, etc.
- Identify, formulate, review research literature, and analyze complex Food Technology/applications problems and Design solutions for complex problems and design system components or processes that meet the specified needs with appropriate consideration for the food sustainability.
- Acquire the practical knowledge and demonstrate the ability to design, conduct/troubleshoot experiments and analyze data in the field of food technology
- Understand the impact of the professional food technology solutions in societal and environmental contexts, and apply ethical principles and commit to professional ethics and responsibilities and able to communicate effectively and write effective reports and design documentation, make effective presentations.
- Understand unit operations performed in food processing industries.
- Design, development and optimization of food process machinery and process technologies for food products.
- Implementation of food safety practices, quality control measures, quality assurance procedures and statutory and legal requirements in food processing industry.
- Understanding about food industry start-up and its management



**Course Outcomes (COs) of M.Sc. Food Science & Technology**

**MSc (FST) I Semester**

**1 Food and Nutrition – 6291**

*The students will be able to know:*

- a) The basic human nutrition needs throughout the life.
- b) The relationship of digestion, absorption and metabolism to optimal health.
- c) The function of CHO, fat, protein, vitamin, and minerals and their role in promoting and maintaining health.
- d) The accuracy, reliability, validity and use of nutrition and food science information and research.
- e) The effects of diet food, food additives and eating disorders on wellness.

**2 Dairy Science – 6292**

*The students will be able to learn:*

- a) About the production and consumption of milk and milk products in India and abroad.
- b) About the milk, its composition, nutritive value and characteristics.
- c) About the microbiology of milk, spoilage, preservation and its fermentation.
- d) About the processing of fluid milk.
- e) About the milk quality and its determination.
- f) About the cleaning and sanitation of dairy plant.

**3 Microbiology – 6293**

*The students will be able to:*

- a) Know history, scope and milestones in microbiology.
- b) Understand the microbial physiology and anatomy of prokaryotes and eukaryotes.
- c) Isolate and cultivate the microorganisms using culture media in laboratory.
- d) Understand the classification of microbes based on their nutritional requirement and other criteria.
- e) Know the regulation of biochemical pathways in microbial metabolism and nutrient uptake and transport mechanism.
- f) Understand the microbial growth and control over microorganisms (*physical and chemical*) for microbial product synthesis.
- g) Gain knowledge about the biogeochemical cycles of N, S, C, P and O in ecology.
- h) Learn about bacteria, viruses, algae, protozoa and fungi.
- i) Be aware of common microbial diseases in human beings.

**4 Biochemistry – 6294**

*The students will be able to:*

- a) Understand biochemistry at the molecular level, draw molecules and know reaction mechanisms perfectly.
- b) Understand in detail about amino acid structures, types of amino acids, classifications, structure of proteins and types of proteins.
- c) Learn the molecular structures of 20 amino acids, differentiating essential and non-essential amino acids, biologically important modified amino acids and their functions.
- d) Recognize the structural levels of organization of proteins, structure of proteins, its functions, denaturation (hemoglobin, myoglobin etc.).
- e) Learn how carbohydrates and proteins are metabolized, emphasizing the role of few intermediates of their metabolism and the role of enzymes in the regulation of the pathways.
- f) Learn lipid, lipoproteins and their functions.

**5 Information Technology and Computer Applications – 6295**

*Students will get:*

- a) To apply the theory and concepts in practical with help of software applying.
- b) To learn basics of computer and IT application in day to day running of organization.
- c) To understand the concept of Office automation.
- d) To gain knowledge of pivot table and understand the validation and auditing techniques.
- e) To learn to use different report creating techniques in MS office.
- f) To learn to use different formatting techniques in office management.
- g) To provide hands on learning of application on spreadsheets and database software.

**6 Mathematics and Statistics - 6296**

*Students will be able:*

- a) To learn to conduct survey and how to collect data.
- b) To familiarize and learn to analyze statistical data.
- c) To learn critical and creative thinking of model and its component of research.
- d) To learn basic principals in designing of simple experiment.
- e) To learn understand the uncertain occurrences of situations with logical manner
- f) To learn the development of null and alternative hypothesis

## MSc (FST) II Semester

### 1 Food Chemistry – 6298

- a) Students will be able to know the chemistry underline the properties and the reactions of various food components.
- b) Properties of food molecules and the interaction with other food constituents.
- c) Students will acquire knowledge of biochemical reaction responsible for quality of food.
- d) Students will gain sufficient knowledge of food chemistry to control reaction in food.
- e) It will help in creating understanding about food constituents and their impact on palatability during processing.

### 2 Food Microbiology – 6299

*The student will be able to:*

- a) Know important microorganisms associated with foods.
- b) Know factors responsible for microbial growth in food.
- c) Understand microbiological spoilage of food products.
- d) Know impact of preservation methods on microbes.
- e) Describe the beneficial role of microorganism in fermented foods and in food processing.
- f) Understand the importance and significance of fermented foods and their therapeutic value.
- g) Understand the types of food infection and causative microbes involving contamination.

### 3 Milk and Milk Processing - 6300

*After the completion of the course, the students will be able to:*

- a) About the different types of milk products, their production & consumption in India and abroad.
- b) About the definition, classification, composition, nutritive value, manufacturing, packaging and storage of different milk products including yoghurt, cream, butter, butter oil, ice cream, cheese, condensed milk, dried milk, Indigenous milk products and by-products

## 4 Food Packaging and Storage – 6301

*On successful completion of the subject, the students will be able to:*

- a) Comprehend advance knowledge on the properties and production of various packaging materials and effect of various indicators used in supply chain management to indicate the food quality.
- b) Understand various types of scavengers and emitters for improving the food shelf life.
- c) Learn about consumer response about new packaging systems and safety and legislative requirements
- d) Acquaint about food-package interaction between package-flavor, gas storage systems for food storage, recycling and use of green plastics for reducing the pollution and their effect on food quality.

## 5 Food Process Engineering – 6302

*Student will be able:*

- a) To understand working and function of basic equipments of food processing.
- b) To understand the effect of different food processing techniques on food materials.
- c) To get knowledge of different unit operations required for food processing.
- d) To understand the basic laws of engineering system.

## 6 Technology of Food preservation – 6303

*Student will be able:*

- a) To gain knowledge of basic principles and methods of food preservation.
- b) To understand different types of equipment involve in various preservation techniques.
- c) To determine the preservation methods suitable for different food materials.
- d) To get knowledge on Post-harvest losses and different technique used to prevent these losses.
- e) To get knowledge of food spoilage and methods to increase their shelf life.

## MSc (FST) III Semester

### **1 Food Evaluation and Quality Management – 7291**

*The student will be able to:*

- a) Have basic understanding of food standard and specification, national and international food regulation.
- b) Know Aspects of food quality control and quality assurance.
- c) Perform sensory evaluation study of foods.
- d) Ensure consumer safety through analysis of food contaminants and adulterants.
- e) Understand the mechanisms and principle behind various analytical techniques.

### **2 Beverage Technology – 7292**

*Students will be able to learn*

- a) *Meaning of beverage, history & types of beverages consumed worldwide.*
- b) *About the types & manufacturing of non-alcoholic beverages.*
- c) *About the types & manufacturing of alcoholic beverages.*
- d) *About the types & manufacturing of hot drinks.*
- e) *About the water importance, types available and used in manufacturing of beverages.*
- f) *About the additives used in beverages.*
- g) *About quality evaluation and shelf life of beverages.*

### **3 Processing of Cereals , Pulses and Oilseeds – 7293**

*After successful completion of the course the students will be able to:*

- a) Knowledge about the structure and processing of cereal, pulses and oilseeds.
- b) Knowledge about technology of bakery products
- c) Knowledge on processing of edible oils and its modification.
- d) Students will acquire the understanding cereal milling and pulses milling and its based food products.
- e) Know about by-product utilization of various grains.

## 4 Processing of Flesh Food -7294

*After successful completion of the course the students will be able to:*

- a) Student will be able to have broad knowledge of status and scope of meat, egg, poultry industry worldwide.
- b) Understand need and importance of egg livestock and poultry industry.
- c) To understand technology behind preparation of various animal food products and by-product utilization
- d) To have better understanding of animal waste utilization.
- e) To understand need and importance of egg, poultry industry.

## 5 Processing of Fruits and Vegetables – 7295

*After successful completion of the course the students will be able to:*

- a) To know about role and importance of preservation techniques to improve the self-life of seasonal food.
- b) Student will be able to understand the technology behind canning of fruits and vegetables.
- c) To know about the role of physiological changes in fruits after harvesting.
- d) Understand manufacturing process and preserve different processed fruits and vegetables.
- e) Gain knowledge on different pre-processing operations involved before processing of fruits and vegetables.
- f) Identify the specific processing technologies used for vegetable, fruits and products derived from these materials.

## 6 Food Biotechnology – 7296

*After the completion of the course, the students will be able to*

- a) To know how to exploit microorganisms for food production.
- b) To extract and use of enzymes in food production
- c) Culturing microbes and using them in food sectors.
- d) Aware of Genetic engineering tools and procedures.
- e) Genetic modification of bacteria, plants and animals in food sector.
- f) Social, economic, ecological and safety issues of food biotechnology.