



SYLLABUS

Ch. CHARAN SINGH UNIVERSITY MEERUT
DEPARTMENT OF FOOD SCIENCE & TECHNOLOGY

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:

1. PG – 260 General Biochemistry
2. PG – 261 Statistical method and Computer techniques
3. PG – 262 General Microbiology
4. PG – 263 Principles of Food Processing
5. Practical based on above courses.

II Semester:

6. PG – 264 Food Chemistry
7. PG – 265 Technology of Cereals, Pulses and Oilseeds
8. PG – 266 Principles of Food engineering
9. PG – 267 Food Microbiology
10. Practical based on above courses.

III Semester:

11. PG – 268 Principles of Food Analysis & Sensory Evaluation
12. PG – 269 Technology of Milk and Milk Products
13. PG – 270 Technology of Fruits and Vegetables.
14. PG – 271 Food Beverages
15. Practical based on above course

IV Semester:

16. Project report based on research work done by the students.

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

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I Semester

PG - 260

Course : 1 General Biochemistry

Biochemical basis of life and need for the biochemical approach.

Structure of important compounds like glucose, sucrose, starch, glycogen, cellulose, other plants and animals polysaccharides, amino acids and lipids.

Elementary idea of structure of proteins and nucleic acids.

Enzymes and their mechanism of action.

Introduction to secondary metabolites like alkaloids, vitamins, pigments (plants and animals) hormones their structure and function.

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

Reference Books:

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| 1. Bio -Chemistry | Harper |
| 2. Bio -Chemistry | Lubert Stryer |
| 3. Practical Bio -Chemistry- principles & techniques | Wilson & Walker |

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I Semester

PG- 261

Course : 2 Statistical method & Computer Techniques

PART – A

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

Central tendency and measures of dispersion : mean, mode, median, their properties. (without deviation), mean deviation, stand deviation and coefficient of variation.

Simple correlation, correlation, coefficient and regression simple & multiple.

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

Tests of significance : t – test, z – test, X tests for goodness of heterogeneity and independence of attributes, F – test.

PART – B

Computer Techniques

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

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

Reference Books :

1. Hand Book of Agriculture Statistic.
2. Fundamental of Computers

S. R. S. Chandel
Yaswant & Kanetkar



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I - SEMESTER

PG- 262

Course:3 General Microbiology

Microbes: Definition & classification, sources of microbes and their characteristics. Morphological & Physiological characteristics of different groups of bacteria, fungi, yeast and elementary knowledge of genetics of bacteria & virus.

Fermentation technology: Microbial growth, application in fermentation, Batch, fed batch, continuous cultures of microbes.

Microbial transformations: steroids, alkaloids, polysaccharides.

Single cell protein: physiological aspects, SCP from CO₂, waste material and renewable sources, improvement in SCP.

Industrial sources of enzymes: cellulose, amylases, 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. General Microbiology

Frazier

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I - SEMESTER

PG- 263

Course :4 **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, sorting.

Heat preservation and processing: Principles of thermal processing, blanching, pasteurization, UHT processing, thermal sterilization, Basic steps in thermal processing, different time-temperature, Combination, TDT curve & TDR curve, margin of safety, 12 D value, low temperature & Aseptic and in- contain- thermal inactivation & sterilization of micro-organism 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 foods.

Food dehydration and concentration: Mechanism of drying, concept of drying rate, methods of drying, effect of drying on quality of foods.

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 radiation, dosimetry, application of irradiation, doses. Effect of irradiation, principle and application ohmic heating and microwave heating in processing and preservation.

Reference Books:

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|---------------------------------------|---------------------|
| 1. Food science | Norman N.Potter |
| 2. Food Processing technology | P. Fellows. |
| 3. Technology of Food Preservation | Desosier & Desosier |
| 4. Unit operations in Food Processing | R. K. Singh & Sahai |
| 5. Food Packaging | Khetrapaul & Pania |

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- SEMESTER

PG- 264

Course:6

Food Chemistry

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

Carbohydrate: Structure, classification, properties & nutritive aspects, sugars, starch, cellulose, hemicellulose, gums, pectic substances polysaccharides.

Lipids and fatty acids: Structure, classification, function, properties and nutritive Processing, aspects, 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.

Enzymes: Classification and properties of food enzyme, 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 their significance.

Reference Books:

1. Basic food chemistry
2. Mechanism and theory in food chemistry
3. Fundamentals of food chemistry
4. Food chemistry

Frank A Lee
W.S.Wang
Orfenemma
Belity & Grosch

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II SEMESTER

PG - 265

Course : 7 **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: Structure, composition, cooking characteristics, nutritive value, parboiling and milling of rice.

Utilization of byproducts: rice bran, rice bran oil.

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

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

Oat: Structure, nutritive value, preparation of oat flakes, oatmeal.

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 & refining of oil, by-product utilization. Technology of protein isolates, concentrates.

Food grain storage and concerned agencies .

Reference Books:

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|---|-------------|
| 1. Cereal Science | Matz |
| 2. Rice chemistry and Technology | Houston |
| 3. Post harvest technology of cereals and pulses | Chakraverty |
| 4. Chemistry and technology of cereals as food and feed | Matz S.A. |
| 5. Technology of cereals | Honsley |
| 6. Technology of cereals | Kent |

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II SEMESTER

PG - 266

Course : 8 Principles of food Engineering

Fluid flow – The concept of viscosity, rheology, continuous monitoring and control, flow of falling films, transportation of Fluids.

Heat transfer methods – Mechanism, temperature measuring devices, steady state heat transfer, local- Heat transfer coefficients, unsteady – state heat transfer.

Refrigeration- Mechanical refrigeration system, condenser and evaporator, compressor, refrigeration. Load calculation, commodity storage requirements, controlled atmosphere storage.

Evaporation - Functions and principles of different types of evaporators improving the economy of evaporators essence.

Dehydration – Water activity, mass transfer in dehydration, determination of sorption, isotherm calculation of drying rate, spray drying & freeze drying.

Energy balance - General principles, energy terms, heat, properties of saturated and super heated
Steam, heat balance.

Physical separation processes- filtration, sieving , gravity separations, etc.

Reference Books :

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|---|-----------------|
| 1. Fundamentals of Food Process Engineering | T.Toledo |
| 2. Hand book of food Engineering | R.P. Singh |
| 3. Hand book of food Engineering | Aeldmam & Lunde |

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III SEMESTER

PG - 267

Course:9 **Food Microbiology**

Growth, properties, reproduction, physiological characteristics of Fungi, Mold, Yeast, Lactic acid bacteria
Lactose metabolism
Citrate Fermentation
General characteristics, Importance, and classification of different Genus: *Lactococcus*, *Streptococcus*, *Leuconostoc*, *Lactobacillus*
Pro ionic acid bacteria, *Acid bacteria*.
Family: *Bacillus*
Family: *Enterobacteriaceae- coliform- E.coli and Enterobacter*
Family: *Acetobacteriaceae, acetic acid bacteria*
Family: *Pseudomonaceae-Pseudomonas*
Factors affecting growth of microorganism in food, intrinsic and extrinsic factors
Preservation by Heating, Radiation and Freezing
Spoilage of canned foods, cereal foods, meat, egg, fish and poultry products, fruits & vegetables, wines, beer
Fermented foods
Food Poisoning(*Staphylococcus*, *Bacillus*, *Listeria*, *Salmonella*)

Reference Books:

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|---|----------------|
| 1. Food Microbiology | M.R.Adams |
| 2. Basic Food Microbiology | J.Banwart |
| 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 |

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III SEMESTER

PG - 268

Course: 11 **Principles of Food Analysis and Sensory Evaluation**

Preparation & Standardization of solutions, Buffer Methods & principle for 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 atomic absorption spectrophotometer
Vitamin-A, Vitamin- B, Vitamin- C.

Plant pigments (carotene, lycopene, chlorophyll, anthocyanins)

Blanching adequacy, non enzymatic browning

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

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

ReferenceBooks :

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|---|-----------------|
| 1. Food Analysis Theory and Practice | Y.Pomeranz |
| 2. The Chemical Analysis of Foods and Food Products | Morris B.Jacobs |
| 3. Food Analysis: Separation Techniques | W.Graenwedel |
| 4. Handbook of Analysis and Quality Control for Fruits and Vegetables | S.Ranganna |
| 5. Food Analysis | Nielson |
| 6. Handbook of Food Analysis | Nollel |

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III SEMESTER

PG - 269

Course: 12 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 dahi, cultured 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 and 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 :

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|--|-------------------------|
| 1. Milk and Milk Processing | B.L.Herrington |
| 2. Milk and Dairy Technology | Edgar Spreer |
| 3. Cheese and Butter | V.Cheke |
| 4. Handbook of Dairy Foods and Nutrition | Gregory D.Miller |
| 5. Out lines of dairy technology | Su Kumar De |
| 6. Dairy Technology | Walastra, Geuts, Normen |
| 7. Cheese – chemistry , physics & microbiology vol. I & II | Fox |

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III SEMESTER

PG - 270

Course :13 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 fruit 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 Glaced , crystallized fruits, improved equipment for manufacture of preserves. Some common preserves – 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
2. Commercial fruits & vegetable products
3. Fruit – processing
4. Fruit & Vegetales
5. Hand book of fruit science & Technology

Girdharilal
W. V . Cruess
Ramaswamy
Thompson
Salunkhe & Radam

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III SEMESTER

PG - 271

Course:14

Food Beverages

1. Fruit Juices Squashes & Cordials:

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

2. Fruit Beverages:

Squashes & Cordials,juices syrups, carbonated beverages. Fruit juice concentrate. Fruit juice powder

3.Fermented Beverages:

Beer –Brewing , raw material & manufacture,storage finishing & packaging
Grape wine-composition of grapes, wine type & their composition mold & yeast of grape & wine.
Chemistry of Fermentation 7 composition of wine .Production of red & white table wine, production of sherry sparkling wine ,desert wine vermouth wine,flavoured wine , fruit wine etc . spoilage of wine –Non bacterial & bacterial

4.Brandy & whisky production-Definition ,compounds & methods of manufactured

5.winery by products:

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

7. 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.Cruces |
| 3. Technology of wine making food science. | W.V.Cruces.S |
| 4. Technology, chemistry and microbiology of food beverages : | Varman & Sakesland |