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| MSc.,  FOOD PROCESSING |
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| **SYLLABUS**  **FROM THE ACADEMIC YEAR**  **2023 - 2024** |
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| **TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION, CHENNAI – 600 005** |

**contents**

1. PO and PSO Description
2. PG – Template
3. Methods of Evaluation & Methods of Assessment
4. Semester Index.
5. Subjects – Core, Elective, Nonmajor, Skill Enhanced, Ability Enhanced, Extension Activity, Environment, Professional Competency
6. *Course Lesson Box*
7. *Course Objectives*
8. *Units*
9. *Learning Outcome*
10. *Reference and Text Books*
11. *Web Sources*
12. *PO & PSO Mapping tables*

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| **TANSCHE REGULATIONS ON LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK FOR POSTGRADUATE EDUCATION** | |
| **Programme** | **M.Sc., Food Processing** |
| **Programme Code** |  |
| **Duration** | **PG - Two Years** |
| **Programme Outcomes (Pos)** | **PO1: Problem Solving Skill**  Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context.  **PO2: Decision Making Skill**  Foster analytical and critical thinking abilities for data-based decision-making.  **PO3: Ethical Value**  Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities.  **PO4: Communication Skill**  Ability to develop communication, managerial and interpersonal skills.  **PO5: Individual and Team Leadership Skill**  Capability to lead themselves and the team to achieve organizational goals.  **PO6: Employability Skill**  Inculcate contemporary business practices to enhance employability skills in the competitive environment.  **PO7: Entrepreneurial Skill**  Equip with skills and competencies to become an entrepreneur.  **PO8: Contribution to Society**  Succeed in career endeavors and contribute significantly to society.  **PO 9 Multicultural competence**  Possess knowledge of the values and beliefs of multiple cultures and  a global perspective.  **PO 10: Moral and ethical awareness/reasoning**  Ability to embrace moral/ethical values in conducting one’s life. |
| **Programme Specific Outcomes**  **(PSOs)** | **PSO1 – Placement**  To prepare the students who will demonstrate respectful engagement with others’ ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.  **PSO 2 - Entrepreneur**  To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.  **PSO3 – Research and Development**  Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.  **PSO4 – Contribution to Business World**  To produce employable, ethical and innovative professionals to sustain in the dynamic business world.  **PSO 5 – Contribution to the Society**  To contribute to the development of the society by collaborating with stakeholders for mutual benefit. |

**Template for P.G., Programmes**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Semester–I** | **Credit** | **Hours** | **Semester-II** | **Credit** | **Hours** | **Semester-III** | **Credit** | **Hours** | **Semester–IV** | **Credit** | **Hours** |
| 1.1. Core-I | 5 | 7 | 2.1. Core-IV | 5 | 6 | 3.1. Core-VII | 5 | 6 | 4.1. Core-XI | 5 | 6 |
| 1.2 Core-II | 5 | 7 | 2.2 Core-V | 5 | 6 | 3.2 Core-VII | 5 | 6 | 4.2 Core-XII | 5 | 6 |
| 1.3 Core – III | 4 | 6 | 2.3 Core – VI | 4 | 6 | 3.3 Core – IX | 5 | 6 | 4.3 Project with viva voce | 7 | 10 |
| 1.4 Discipline Centric  Elective -I | 3 | 5 | 2.4 Discipline Centric  Elective – III | 3 | 4 | 3.4 Core – X | 4 | 6 | 4.4Elective - VI (Industry / Entrepreneurship)  20% Theory  80% Practical | 3 | 4 |
| 1.5 Generic Elective-II: | 3 | 5 | 2.5 Generic Elective -IV: | 3 | 4 | 3.5 Discipline Centric Elective - V | 3 | 3 | 4.5 Skill Enhancement course / Professional Competency Skill | 2 | 4 |
|  |  |  | 2.6 NME I | 2 | 4 | 3.6 NME II | 2 | 3 | 4.6 Extension Activity | 1 |  |
|  |  |  |  |  |  | 3.7 Internship/ Industrial Activity | 2 | - |  |  |  |
|  | **20** | **30** |  | **22** | **30** |  | **26** | **30** |  | **23** | **30** |
| **Total Credit Points -91** | | | | | | | | | | | |

**Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF) Guideline Based Credits and Hours Distribution System**

**for all Post – Graduate Courses including Lab Hours**

**First Year – Semester – I**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credits** | **No. of Hours** |
|  | Core – I | 5 | 7 |
| Core – II | 5 | 7 |
| Core – III | 4 | 6 |
| Elective – I | 3 | 5 |
| Elective – II | 3 | 5 |
|  |  | **20** | **30** |

**Semester-II**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credits** | **No. of Hours** |
|  | Core – IV | 5 | 6 |
| Core – V | 5 | 6 |
| Core – VI | 4 | 6 |
| Elective – III | 3 | 4 |
| Elective – IV | 3 | 4 |
| Skill Enhancement Course [SEC] - I | 2 | 4 |
|  |  | **22** | **30** |

**Second Year – Semester – III**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credits** | **No. of Hours** |
|  | Core – VII | 5 | 6 |
| Core – VIII | 5 | 6 |
| Core – IX | 5 | 6 |
| Core (Industry Module) – X | 4 | 6 |
| Elective – V | 3 | 3 |
| Skill Enhancement Course - II | 2 | 3 |
|  | Internship / Industrial Activity [Credits] | 2 | - |
|  |  | **26** | **30** |

**Semester-IV**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credits** | **No. of Hours** |
|  | Core – XI | 5 | 6 |
| Core – XII | 5 | 6 |
| Project with VIVA VOCE | 7 | 10 |
| Elective – VI (Industry Entrepreneurship) | 3 | 4 |
| Skill Enhancement Course – III / Professional Competency Skill | 2 | 4 |
| Extension Activity | 1 | - |
|  |  | **23** | **30** |

**Total 91 Credits for PG Courses**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **METHODS OF EVALUATION** | | | | |
| **Internal Evaluation** | Continuous Internal Assessment Test | | **25 Marks** | |
| Assignments / Snap Test / Quiz | |
| Seminars | |
| Attendance and Class Participation | |
| **External Evaluation** | End Semester Examination | | **75 Marks** | |
| **Total** | | | **100 Marks** | |
| **METHODS OF ASSESSMENT** | | | |
| **Remembering (K1)** | | * The lowest level of questions require students to recall information from the course content * Knowledge questions usually require students to identify information in the text book. | |
| **Understanding (K2)** | | * Understanding of facts and ideas by comprehending organizing, comparing, translating, interpolating and interpreting in their own words. * The questions go beyond simple recall and require students to combine data together | |
| **Application (K3)** | | * Students have to solve problems by using / applying a concept learned in the classroom. * Students must use their knowledge to determine a exact response. | |
| **Analyze (K4)** | | * Analyzing the question is one that asks the students to break down something into its component parts. * Analyzing requires students to identify reasons causes or motives and reach conclusions or generalizations. | |
| **Evaluate (K5)** | | * Evaluation requires an individual to make judgment on something. * Questions to be asked to judge the value of an idea, a character, a work of art, or a solution to a problem. * Students are engaged in decision-making and problem – solving. * Evaluation questions do not have single right answers. | |
| **Create (K6)** | | * The questions of this category challenge students to get engaged in creative and original thinking. * Developing original ideas and problem solving skills | |

**M.Sc., FOOD PROCESSING**

**First Year – Semester-I**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Code** | **Course** | **Credits** | **Hrs** | **University Examination** | | |
| **IA** | **EA** | **Total** |
| Core-I | Food Chemistry | 5 | 7 | 25 | 75 | 100 |
| Core-II | Food Processing Technology I | 5 | 7 | 25 | 75 | 100 |
| Core – III | Food Processing Practical: I: | 4 | 6 |  |  |  |
| 1.4 Discipline Centric  Elective -I | Food Production & Agriculture | 3 | 5 | 25 | 75 | 100 |
| 1.5 Generic Elective-II: | Chemical changes in Processing & Preservation | 3 | 5 | 40 | 60 | 100 |
|  |  | **20** | **30** |  |  |  |
|  |  |  |  |  |  |  |

**First Year – Semester-II**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Core-IV | Food Microbiology | 5 | 6 | 25 | 75 | 100 |
| Core-V | Instrumentation in Food Processing  Practical II: Food Analysis Practical Continued from 1st Semester ) | 5 | 6 | 25 | 75 | 100 |
| Core – VI | Core Practical III: Food Microbiology Practical | 4 | 6 | 25 | 75 | 100 |
| Discipline Centric Elective – III | Food Biotechnology | 3 | 4 | 40 | 60 | 100 |
| Generic Elective -IV: | Human Rights (HR) | 3 | 4 | 40 | 60 | 100 |
| NME I | Computer Applications with Practical in Food Processing | 2 | 4 | 25 | 75 | 100 |
|  |  | **22** | **30** |  |  |  |
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**Second Year – Semester-III**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| . Core-VII | Food Regulations and Quality Control | 5 | 6 | 25 | 75 | 100 |
| Core-VII | Food Product Development & Entrepreneurship | 5 | 6 | 25 | 75 | 100 |
| Core – IX | Research Methodology and Statistics | 5 | 6 | 25 | 75 | 100 |
| Core – X | Food Packaging Technology | 4 | 6 | 40 | 60 | 100 |
| Elective - V Discipline Centric | Quality Control and Adulteration Practical | 3 | 3 | 40 | 60 | 100 |
| NME II |  | 2 | 3 | 40 | 60 | 100 |
| Internship/ Industrial Activity | Inplant Training in Food Industry(one month) | 2 | - |  |  |  |
|  |  | **26** | **30** |  |  |  |

**Second Year – Semester-IV**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 4.1. Core-XI | Food Industrial Waste Management | 5 | 6 | 25 | 75 | 100 |
| 4.2 Core-XII | Food Processing Technology-II  Food Analysis Practical-II | 5 | 6 | 25 | 75 | 100 |
| 4.3 Project with viva voce | Dissertation (3 months) | 7 | 10 | 40 | 60 | 100 |
| Elective VI | Animal Feed Formulation | 3 | 4 |  |  |  |
| Skill Enhancement course / Professional Competency Skill | (Industry / Entrepreneurship)  20% Theory 80% Practical | 2 | 4 |  |  |  |
| Extension Activity |  | 1 |  |  |  |  |
|  |  | **23** | **30** |  |  |  |

**\*IA = Internal Assessment**

**\*\* EA = External Assessment**

**M.Sc. Food Processing**

**1. PREAMBLE**

Food Processing is the science and art of applying the principles of food processing and technology in various Food Industries. Food processing has been started to meet the demands of the growing food processing sector. This has an immense scope on processing and preservation of food to fulfill the consumer’s satisfaction.

# OBJECTIVES OF THE COURSE:

1. To prevent the post-harvest losses.
2. To make available wholesome nutritious and appetizing food at economical rates.
3. To improve the quality, nutritive value and minimize loss of essential nutrition’s during processing and preservation.
4. Ensuring long – term storage stability.
5. Marketing the processed food of high calorie density in compact and easy to reconstitute form.
6. To prevent food poisoning, contamination and adulteration.
7. To improvise mechanical processing operations to replace or minimize labor.
8. Develop new varieties of instant or convenience food for the customers to go along with the fast moving world.

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| **Program Specific Outcomes** |
| 1. Students will apply the knowledge of food chemistry, food preservation, food processing and food packaging for the effective utilization of agricultural commodities to develop healthy and nutritious foods |
| 2. Students will design economically feasible methods for the modernization of traditional food processing methods |
| 3. Students will apply the knowledge of food processing principles from the various aspects of food science and related disciplines to solve practical and real-world problems |

**M.Sc. FOOD PROCESSING- SEMESTER –I CORE I - FOOD CHEMISTRY**

# OBJECTIVES

Gain knowledge on the properties & composition of different foods.

# COURSE OUTCOME

On the successful completion of the course, the student will be able to:

* Gain knowledge about Physico –chemical properties of foods & water properties.
* Acquire knowledge about Carbohydrate –classifications, properties & structure.
* To study the about Protein- classifications, structure, physical & chemical properties on foods.
* To gain knowledge about Lipids - classifications, physical & chemical properties & structure. Vitamins & Minerals- classifications, properties & structure.

# UNIT I

Properties of Foods: Physico-Chemical properties of foods – Organic food components, Colloids- definition, types & properties & uses in food system.

Water- Structure, Water content in foods, physical properties, Hydrogen bonding, Typesofwaterinfoods,Wateractivity-Water activity and food spoilage. Interaction of water with food components, Moisture determination.

# UNIT II

Carbohydrate- classification, occurance, structure, properties, physic-chemical reactions- Hygroscopicity& solubility, optical rotation, mailard reaction, caramalisation, gelatinization, dextrinisation, retrogradation.Fibre- classification, food sources, functional properties and uses.

# UNIT III

Proteins- classifications, structure, physical and chemical properties of proteins.Reaction of protein in Food system- Dissociation, denaturation, hydration, swelling, foam formation & Stabilisation, emulsification. Aminoacid in Maillard reaction.Nature of protein in meat, milk, egg and cereals, pulses, Reactions of protein in food system.

Lipids- Classification, physical and chemical properties, Fatty acid – Classification, structure and properties. Physiochemical reactions – Isomersation, hydrogenation, unsaturation, inter-esterification, emulsification, auto–oxidation, rancidity.

# UNIT V

Vitamins- Structure & properties of A, D, E, K , folic acid, thiamine, niacin, ascorbic acid, cholecalciferol in foods.

Minerals- Structure & Properties of Calcium, Phosphorus, Iron, Zinc, Copper & Iodine.

Phytonutrients & Bioactive component in foods

1. Coultatte,.T.O., “Food – The Chemistry of Components”, Rsc, Royal Society of Chemistry.
2. Iqbal.s.a.,Mido.Y,”FoodChemistry”DiscoveredPublishingHouses,NewDelhi,2005.
3. LilianhoaglandMeyer,”FoodChemistry”,CBSPublishersandDistributors,4596/1- A,11DaryaGanj,NewDelhi-110002(India).
4. Alais,Lindan,”FoodBiochemistry”,EllishorunrosLTD.,NewYork.
5. Potter,N.N.1978,FoodScience3rdEd.AVI,Westport.

# WEB SITE LINK

* + <https://archive.org/details/in.ernet.dli.2015.549657/page/n3/mode/2up>
  + <http://154.68.126.6/library/Food%20Science%20books/batch1/Food%20->

%20The%20Chemistry%20of%20its%20Components%20Fourth\_Edition.pdf

**M.Sc. FOOD PROCESSING- SEMESTER –I CORE II - FOOD PROCESS TECHNOLOGY – I**

# OBJECTIVES

## To enable students

* + 1. To know the principles and methods involved in the processing of Perishable foods
    2. To develop skills in the perishable food processing equipments.

# COURSE OUTCOME

On the successful completion of the course, the student will be able to

* + Know Fruits & vegetable processing, classification, preservation & drying methods.
  + Understand Dairy processing- UHT, Pasteurization & homogenization.
  + Discuss Fleshy food processing- Egg, Meat, Poultry-Canning, Drying, cooling & storage.
  + Illustrate Sea food Processing-types of pre processing& preservation. Types of Confectionery ,Sago & Sugar cane technology

# UNIT I

Fruit &Vegetable Processing- Classification, Pre- Processing, Processing & Preservation- Size reduction, Mixing, Separation, Concentration, Freezing & Refrigeration, Drying & Dehydration, Chemicals, Processing by using Pulsed Light and Irradiation; Nutritional losses during Processing, Fruit & Vegetable Intermediate moisture products, Storage.

# UNIT II

Dairy Processing- Milk Pre-Processing; Processing & Preservation - Separation, Homogenization, Pasteurization, Standardization, Sterilization (UHT), Evaporation (Spray Drying), Chilling, Freezing & Refrigeration ; Nutritional losses during Processing; Milk Product & By Products; Storage.

# UNIT III

Fleshy Food Processing – Meat, Poultry& Egg - Pre-Processing; Processing & Preservation- Smoking, Canning, Drying, Cooling, Canning Pulsed Electric Field processing; Nutritional losses during Processing; Storage.

Sea Food Processing–Types;Pre-Processing;Processing&Preservation-Dielectric, Ohmic and Infra-red heating-Nutritional losses during Processing;Storage.

# UNIT V

Miscellaneous PerishableFood:

Confectionery- Types Confectionery & Method of Preparation Sugarcane & Sago Technology – By-Product & Its Utilization

1. P.J.Fellows, Food Processing Technology. Principles and Practices, Second Edition, Woodland PublishingLtd,Cambridge,England,2002.
2. Avantina Sharma, Text Book of Food Science and Technology, International Book DistributingCo,Lucknow,UP,2006.
3. Sivasankar,FoodProcessingandPreservation,PrenticehallofIndiaPvt Ltd, NewDelhi.IIIrd Printing,2005.
4. Peter Zeuthen and Leif Bogh-Sorenson, Food Preservation Techniques, Woodland PublishingLtd,Cambridge,England,2005.

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* + <https://www.pdfdrive.com/food-science-and-technology-d41395460.html>
  + <http://154.68.126.6/library/Food%20Science%20books/batch1/Food%20->

%20The%20Chemistry%20of%20its%20Components%20Fourth\_Edition.pdf

**M.Sc. FOOD PROCESSING- SEMESTER –I**

# CORE PRACTICAL I - FOOD PROCESSING PRACTICAL COURSE OUTCOME

On the successful completion of the course, the student will be able to perform

* + Preservation of food by sugar.
  + Preservation of food by salt.
  + Preservation of food by fermentation

1. Preservation of foods by sugar-Jam, Jelly, Marmalade, Cordial, Squash, Fruit bars, Fruit Preserves-TuityFruity(Papaya),GingerMurabha(Ginger).
2. Preservation of foods by salt and acid-Vathal,Vadagam, Tomato ketchup and Squash, Pickles-Lemon, Mango, Mixed vegetable, Garlic.
3. Preservation by fermentation-Wine, Vinegar.

**M.Sc. FOOD PROCESSING - SEMESTER –I ELECTIVE I - FOOD PRODUCTION AND AGRICULTURE**

# OBJECTIVES

* 1. To learn about scope of Agriculture and production of crop in India and Tamilnadu.
  2. To improve the knowledge about post harvesting techniques of food grains.

# COURSE OUTCOME

On the successful completion of the course, the student will be able to understand the:

* + Gain understanding on the Scope, branches classification of Agronomic crops.
  + Classify Wet, dry and rain fed forming for crop production.
  + Apply their knowledge on Methods of irrigation management.
  + Relate the overall Types & role of crop manures & fertilizers Types & classification of storage structure & grains

# UNIT I

Agriculture- scope in India and Tamil Nadu, Branches of Agriculture, Agronomic classification of crops and their economic importance, Major crops of India and Tamil Nadu-Adaptation and distribution. Agro-climatic norms of major field crops, Development of scientific agriculture in world and India. Traditional Agricultural practices Vs Modern Agricultural practices

# UNIT II

Crop production- Production trends in world, India and TamilNadu. Factors affecting crop production. Zero budget agricultural production.

Systems of farming-wet, irrigated, dry and rain fed farming. Factors governing the choice and varieties, Cropping patterns and systems in India and Tamil Nadu, crop rotation -advantages of crop rotation followed in India and Tamil Nadu.

# UNIT III

General procedure for cultivation of wetland crops and garden land crops-field preparation, sowing/ planting, maintenance/ field sanitation, cost of cultivation and economics.Importance of Me-too syndrome in agricultural production.

Irrigation management – methods of irrigation suitability, advantages and limitations, irrigation systems of India and Tamil Nadu.

Weeds classification and its characteristics, principles and methods of weeds control (outline only).

# UNIT IV

Manures and fertilizers- Types and its role in crop production, factors affecting quantity of manures and fertilizers for different crops. Drawbacks of artificial fertilizers

Nutrient potential of different organic manure Agricultural, Industrial and Urban wastes- preparation enriched Farm Yard Manure (FYM) –Zinc enriched organics, compost making- coir pith, sugar cane trash, farm waste, farm weds and vermin composting.

# UNIT V

Storage of food grains- Types and characteristics of storage structures, grainstorage and distribution system in India and TamilNadu. General aspects of food security in India. Agricultural research schemes in India and TamilNadu. Government subsidy scheme for agricultural farming. Government bodies supporting agriculture – NABARD, SFAC, KVK, Horticulture board, MSME, DIC, SFC, FPO.

REFERENCES:

1. Dharma, A.K.1996. Organic Farming for sustainable Agriculture. Agri Botanical Publishers (India),Bikaner.
2. Gopal Chandra De .1997. Fundamentals of Agronomy. Oxford and IBH publishing Co.Pvt Ltd, NewDelhi.
3. Icar. 1996.Handbook of Agriculture.Indain Council of Agricultural Research, New Delhi.
4. Morachan, Y.b.1980.Crop production and Management. Oxford and IBH Publishing Co.Pvt LTD., NewDelhi.
5. Gupts, O.P.1998. Modern weed management. Mrs. Saraswathi for agro botanical, NewDelhi.
6. T.N.A.U. 1999. Crop production guide. T.N.A.U. and Directorate ofAgriculture, Chennai.

# WEB SITE LINK

* + <http://eprints.nias.res.in/755/1/2014-SP5-Organic%20Farming%20and%20Sustanability.pdf>
  + https://ncert.nic.in/textbook/pdf/hesc101.pdf

**M.Sc. FOOD PROCESSING- SEMESTER –I**

# ELECTIVE – II : CHEMICAL CHANGES IN PROCESSING AND PRESERVATION

**OBJECTIVES**

To understand the chemical changes in food processing & preservation.

# COURSE OUTCOME

On the successful completion of the course, the student will be able to understand the:

* + Comprehend Physico –chemical properties of foods
  + Understand Bio chemical changes in carbohydrates , protein & fats
  + Develop the knowledge in Isolation of toxins in foods

# UNIT –I

Chemistry of cooking- biochemical changes in carbohydrates, protein and lipids during cooking, Chemical changes in vitamins and minerals during processing.Par boiling of rice, Browning reaction- enzymatic and non- enzymatic reaction. Loss of nutrients during cooking and preservation.

# UNIT-II

Chemical changes during storage of food grains, fruits and vegetables. Environmental effects on chemical changes in foods- Environmental effects on rates of chemical reaction.Chemistry of microbial spoilage of food- chemistry and mode of action of microbial toxins.

# UNIT- III

Chemical changes during processing and preservation of foods - drying, pickling, baking, malting, canning, cold storage and freezing, chemical changes in natural pigments and flavors during processing.

# UNIT –IV

Isolation and purification of starch; starch in food industry, pectins, gums and stabilizers in food industry. Modifications of starch, Sweeteners and sugars in foods- structure activity relationship.

# UNIT-V

Isolation of protein from soyabean, milk, egg, protein hydrolysates; modification of protein; storage of proteins and stability of proteins.Enzymatic action of post harvest and post mortem foods.Oxygen

dependent enzymatic reaction in post harvest foods.

# PRACTICAL EXPERIENCE:

Isolation of starch from tubers. Isolation of protein from milk and egg. Hydrolysis of starch and proteins Chromatography.

Aflatoxins - Analysis of effluents from food industry. Rancidity of oils. Isolation and assay of industrial enzymes.

**References:**

1. Belitz.W.Grosch.1986. Food chemistry. Springer Verley Berlin Heidelberg. New York.
2. David S. Robinson. 1987. Food Biochemistry and Nutritive value. Longman Group, UK.
3. Leslie Hart, F and Harry Johnstone Fisher. 1971, Modern Food Analysis, Springer- Verlag, New York.
4. Dauthy, M.E. 1995. Fruit and Vegetable processing, FAO Agricultural Services Bulletin, 119,Rome.
5. Sadasivam, S and Manickam, 1996. Biochemical methods for Agricultural sciences, New Age International Publishers.
6. Poter. H.N: Food Science, The Av Publishing Co., Inc West Poet, Connectcut 1973.
7. Desrosier.N.W. The technology of food preservation. The Av Publishing Co., Inc West Poet, Connectcut 1973.
8. Meyer L.H: Food Chemistry, Von Nostrand
9. Chemical Changes in food during processing. T. Richandson.

# WEB SITE LINK

* + <https://www.springer.com/gp/book/9780834212657>
  + https://portlandpress.com/biochemsoctrans/article-abstract/16/4/654/81056/Food-Biochemistry-and- Nutritional-Value?redirectedFrom=PDF

**M.Sc. FOOD PROCESSING SEMESTER- II**

# CORE IV - FOOD MICROBIOLOGY

**OBJECTIVES**

1. To list the major food spoilage microorganisms
2. To analyze methods used to control or destroy microorganism commonly found in food.
3. To understand the role of beneficial microorganisms in food processing and preservation.

# COURSE OUTCOME

On the successful completion of the course, the student will be able to

* + Understand the Classification & primary source of microorganism.
  + Name and describe Microbial spoilage of cereals & milk products.
  + Enumerate Fruits ,vegetables & sugar products – contamination ,spoilage & preventive measures; Fleshy foods- contamination, spoilage& preventive measures.
  + Predict the causative agent and pathogenesis of disease causing food-borne pathogens

# THEORY UNIT I

Introduction to Food Microbiology, Classification of micro- organism, importance of micro-organisms in food- primary sources of micro-organisms in food- intrinsic and extrinsic parameters of food affecting microbial growth. Isolation and detection of micro organisms in food.

# UNIT II

Spoilage of foods - principles and types of spoilage. Microbial spoilage of cereal and cereal products and its prevention. Microbiology of milk and milk products- kinds of microorganism, sources of contamination and prevention.

# UNIT III

Contamination, spoilage and preventive measures of sugar and sugar products, fruits and vegetables- kinds, sources, prevention.

# UNIT IV

Microbiology, spoilage and preventive measures of meat, poultry, fish, egg.

# UNIT V

Food in relation to diseases- Food poisoning and intoxication- Bacterial- Bacillus, Clostridium botulinum, Clostridium perfringens, E.coli, Salmonella, Shigella, Staphylococcus aureus, Non bacterial- protozoa, fungi, virus, algae – characteristics and preventive measures. Indicators of water and food safety and quality.

REFERENCES:

1. Frazier, W.C and Westoff, 1995.Food Microbiology, Tata McGraw Hill Publishing Co.Ltd, NewDelhi.
2. Gould, G.G.1996.New methods of Food Preservation, Blackie Academic &Professional,Chennai.
3. Jay, J.M.1996. Modern Food Microbiology.CBS Publishers & Distributors, New Delhi.
4. King.R.D and P.S.J.Cheetham 1986.Food Biotechnology, Elsvier Applied Science, NewYork.
5. George J.Banwart, 1998. Basic Food Microbiology, 2nd edition, CBS Publishers, NewDelhi.

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* + [http://www.cold.org.gr/library/downloads/Docs/Handbook%20of%20Food%20Preservation.](http://www.cold.org.gr/library/downloads/Docs/Handbook%20of%20Food%20Preservation) PDF
  + https://mprc.ajums.ac.ir/\_nrc/documents/Modern%20Food%20Microbiology.pdf

**M.Sc. FOOD PROCESSING SEMESTER- II**

# CORE V - INSTRUMENTATION IN FOOD PROCESSING

**OBJECTIVES**

1. To develop the skill about operation techniques in food processing equipments.

# COURSE OUTCOME

On the successful completion of the course, the student will be able to

* Understand the general Unit operations-classification, mass & energy, types of evaporations.
* Gain knowledge of Mechanical separation, filtration equipments & size reduction
* Apply the knowledge of Mixing & crushing-energy & power requirements & solar equipments. Refrigerators-types, humidifiers & dehumidifier.

# UNIT I

Unit operations – classification – conservations of mass and energy- Dimensions and units – Dimensional and unit consistency – dimensionless ratios – Evaporators- Single and multiple effect evaporator- Vacuum evaporator- - Forced circulation evaporators.

# UNIT II

Mechanical separations- Filtration –Filter cake compressibility- Filtration equipment- Sedimentation, Gravitational sedimentation of particles in fluid and gas. Setting under combined forces- Centrifugal and liquid–Liquid separation– Centrifuge–Size reduction.

# UNIT III

Principles of combination in Crushing and Mixing – Characteristics- Particle size distribution – Energy and power requirements – Crushing efficiency- Mixing of solids, pastes, dry powders- Criteria of mixer effectiveness- Mixing index.

Solar equipments – Heaters, driers, cookers, distillators for food products.

# UNIT IV

Refrigerators – Types of refrigeration system- Mechanical vapour compression – Vapour absorption system – Components of mechanical refrigeration- Refrigerants- Properties-ComparisonofFreonandammoniasystems-coldstorages-Designofcold storages-Defrosting-Humidifiers and dehumidifiers.

# UNIT V

Principles and uses of Gas chromatography, Gas liquid chromatography, Electrophorosis, High performance liquid chromatography and Atomic Absorption Spectrophotometry, pH meter, Photoelectric colorimeter.

REFERENCES:

1. Coulson, J.M. and J.F.Richaradson, 1977. chemical Engineering. Volume I to V the pergamon press NewYor.
2. Earle, R.L.1985 unit operations in Food Processing Pergamon Press. Oxford.U.K.
3. Henderson, S.M. and R.L. Perry 1955. Agricultural process Engineering, John Wiley and sons, NewYork.
4. McCabe, W.L. and J.C.Smith 1976 unit operations of chemical Engineering. McGraw – Hill Inc. Kosaido printing Ltd. Tokyo,Japan.
5. Pande,P.H.1994PrinciplesofAgriculturalProcessing–ATextBook,Kalyan Publishers,Ludhiana.
6. Sahay, K.M. and K.K. Singh, 1994. Unit operation of Agricultural Processing,Vikas Publishing House Pvt., Ltd., NewDelhi.
7. W.W. Ewing, 1970, Instrumental Methods of Chemical Analysis, McGraw Hill Book Company, NewDelhi.

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  + https://books.google.co.in/books?id=FE6UUliY7i8C&printsec=frontcover&vq=%22Instrumentation

+and+Sensors+for+the+Food+Industry%22&source=gbs\_citations\_module\_r&cad=7#v=onepage&q

=%22Instrumentation%20and%20Sensors%20for%20the%20Food%20Industry%22&f=false

**M.Sc. FOOD PROCESSING SEMESTER- II**

# CORE PRACTICAL VI - FOOD MICROBIOLOGY PRACTICAL COURSE OUTCOME

On the successful completion of the course, the student will be able to isolate and identify specific

microorganisms in foods

# PRACTICALS

1. Isolation and identification of specific microorganisms of normal and spoiled.
   1. Fruits
   2. Vegetables
   3. Canned foods
   4. Bottled drinks
   5. Fleshy foods
   6. Fermented foods
2. Methylene Blue Reductase test for milk microbiological survey.

# REFERENCE:

1. Frazier, W.C and Westoff, 1995.Food Microbiology, Tata McGraw Hill Publishing Co.Ltd, NewDelhi.
2. Gould, G.G.1996.New methods of Food Preservation, Blackie Academic & Professional,Chennai.
3. Jay, J.M.1996. Modern Food Microbiology.CBS Publishers & Distributors, NewDelhi.
4. King.R.D and P.S.J.Cheetham 1986.Food Biotechnology, Elsvier Applied Science, NewYork.
5. GeorgeJ.Banwart,1998.BasicFoodMicrobiology,2ndedition,CBSPublishers,New Delhi.

**M.Sc. FOOD PROCESSING SEMESTER- II**

# ELECTIVE III: FOOD BIOTECHNOLOGY

**OBJECTIVES**

* 1. To develop students knowledge,understanding and skills in food biotechnology.
  2. To enhance students ability to identify current and future research directions in food biotechnology.

# COURSE OUTCOME

On the successful completion of the course, the student will be able to

* Identify the Media composition & production culture
* Illustrate the Food Fermentation- downstream& alcoholic & non-alcoholic beverages.
* Apply Modification of starch & protein .development of novel sweeteners.
* Appraise Enzyme technology, micro encapsulation.
* Interpret GM Foods production, bio safety & risk management.

# THEORY :

**UNIT I**

Important industrial micro organism. Media for industrial fermentations, criteria used in media formulation, medium composition–energy, carbon, nitrogen and other growth factors–buffering and antifoam agents. Production of culture, maintenance and preparation, bacterial culture, yeast culture and mold culture.

# UNIT II

Food Fermentation –Batch and continuous process, Fermentor design – solid substrate fermentation, downstream processing, instrumentation and control. Alcoholic beverages: Beer, wine: Non alcoholic beverages: tea, coffee, cocoa, Dairy products.

# UNIT III

Fermented vegetables-sauerkraut, soya based foods – tofu, temphe, yogurt; meat fermentation- sausage; Vinegar. Development of novel sweeteners, production of fats- Lard, aminoacids-L-aspartate, Development and formulation of probiotic foods. Isolation & purification of starch, Starch in food industry, Modification of starch. Isolation of protein from soyabean, milk, egg; Protein hydrolysates; Modification of protein.

# UNIT IV

Enzyme technology in food industry: industrial enzymes and its applications(with respect to food processing industry). Micro encapsulation, List of industrial enzymes and their applications in food industry, Production of food industrial enzymes,

Immobilization of enzymes- method of immobilization, advantage and disadvantages of immobilization. Uses of immobilized enzymes- High fructose corn syrup preparation.

# UNIT V

Ethical issues concerning GM foods; testing for GM foods; current guidelines for the production, release and movement of GM foods; labeling and traceability; trade related aspects; biosafety; risk assessment and risk management. Public perception of GM foods. IPR. GMOAct2004. (GeneticallyModifiedCropsManagementAct2004).

# REFERENCES :

1. Owen pward (1989), Fermentation Biotechnology Principles, Processes And Products, PrenticeHNewJersey.
2. Solomons, G.L.(1983), Single Cell Proteins-Critical Reviews of Biotechnology, Moo Young Compressive Biotechnology Scientists Foundations, Engineering Consideration.
3. Prescot(1987),IndustrialFoodPreservation,JohnWilleyAndSons.
4. Frazier And West Hoff (1995), Food Microbiology, Tata Mcgraw Hill Publishing CompanyLtd,NewDelhi.
5. Dubey,R.C.(2001)TextBookBiotechnologyS.ChandAndCoLtd,NewDelhi.
6. Gupta,P.K.(1996),ElementsofBiotechnology,RostogiAndCo,Meerut.
7. Paul, P.C. and Palmer (1972) Food Theory And application John Wiley Sons, New Youk
8. Gary Walsh And Denis R.Headen, Protein Biotechnology, S.Chand And Co,Ltd, New Delhi.
9. Dubey,R.C.AndMaheswari,D.K.A.TextBookofMicrobiology,S.ChandAndCo,Ltd, NewDelhi.
10. FoodScienceAndFoodBiotechnology,2003,GustaraF.Gutierrez-Lopez.
11. Lee,B.H.FundamentalsofFoodBiotechnology.VCH.2006.

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**M.Sc. FOOD PROCESSING SEMESTER- II**

# EXTRA DISCIPLINARY COURSE (EDC) FOOD PROCESSING

**UNIT I**

Functions of Food- Food Groups- Food Science, objectives of cooking- Preliminary preparation- cookingmethods.

# UNIT II

Processing of pulses, composition and nutritive value, processing methods, toxic constituents.

# UNIT III

Processing of cereals- structure, composition and nutritive value, Processing methods- fermented and unfermented products.

# UNIT IV

Processing of milk, composition, physical properties, nutritive value and effect of salt, enzymes, acid and heat, Fermented and Non-fermented milk products.

# UNIT V

Processing of meat and poultry- processing, composition, nutritive value, preservation and storage.

# REFERENCES

1. Belitz.W.Grosch.1986.Foodchemistry.SpringerVerleyBerlinHeidelberg.NewYork.
2. David S. Robinson. 1987. Food Biochemistry and Nutritive value. Longman Group, UK.
3. Leslie Hart, F and Harry Johnstone Fisher. 1971, Modern Food Analysis, Springer- Verlag, NewYork.
4. Dauthy, M.E. 1995. Fruit and Vegetable processing, FAO Agricultural Services Bulletin,119,Rome.
5. Sadasivam, S and Manickam, 1996. Biochemical methods for Agricultural sciences, NewAgeInternationalPublishers.
6. Poter.H.N:FoodScience,TheAvPublishingCo.,IncWestPoet,Connectcut1973.
7. Desrosier.N.W. The technology of food preservation. The Av Publishing Co., Inc West Poet, Connectcut1973.
8. MeyerL.H:FoodChemistry,VonNostrand
9. ChemicalChangesinfoodduringprocessing.T.Richandson.

**M.Sc. FOOD PROCESSING SEMESTER- II**

# EXTRA DISCIPLINARY COURSE FOOD PRODUCT DEVELOPMENT

**UNIT I**

Definition and classification, Characterization and factors shaping new product development. Role of ingredients and processing in defining attributes.

# UNIT II

Shelf life requirements and factors affecting shelf life and product attributes.

# UNIT III

Process of flow sheet development, preparation of concept testing documentation .

# UNIT IV

Concept testing approaches sampling methods, role of sensory evaluation. Preparation of concept testing documentation.

# UNIT V

Research and new product development- patents- patent laws- International code for Intellectual Property Rights

# REFERENCES:

1. Fuller, G. W. New Food Product Development From Concept to Marketplace. CRC Presds,BocaRaton(OnReserveinAgr.Library
2. Baker,R.C.1988.FundamentalsofNewFoodProductDevelopment
3. Dickinson&Stainsby.1988.Advancesinfoodemulsionsandfoams.ElsevierApplied Sciences
4. Gould,W.A.1991.ResearchandDevelopmentGuidelinesfortheFoodIndustry
5. Lewis,R.J.1989.FoodAdditivesHandbook.VanNostrandReinhold
6. Lyon,D.H.1992.GuidelinesforSensoryAnalysisinFoodProductDevelopmentand Quality Control. Chapman and Hall Modified starches properties and uses. CRC Press Press, Inc. SanDiego

**M.Sc. FOOD PROCESSING SEMESTER- II**

# ELECTIVE PRACTICAL I: COMPUTER APPLICATION IN FOOD PROCESSING

## Windows (2007)

1. a. DOS Commands
   1. Internal Commands.
   2. External Commands.
2. b. Windows (2007).
3. Windows Explorer.
4. Main & Accessories.

# MS-OFFICE

1. MS.WORD:

2.1.a.Starting MS-WORD, Creating, Saving, Printing (withoptions), Closing and Exiting.

b. Study of Word – Menu /toolbars.

* 1. Create a document, save it and edit the document as follows:
     1. Find and Replace options.
     2. Cut, Copy, Paste options.
     3. Undo and Redo options.
  2. Format the document:
     1. Using Bold, Underline and Italic.
     2. Change Charactersizesing the font dialog box.
     3. Formating paragraph: Center, Left aligns & Right align
     4. Changing paragraph and line spacing, Using Bullets and Numbering in Paragraphs.
     5. Creating Hanging Paragraphs.
  3. Using tap settings enhancing the documents (Header, Footer, Page Setup, Border, Opening & Closing Toolbars, Print Preview).
  4. Creating Tables in a document, Selecting Rows & Column sort the record by using tables form at painter and Auto Format.
  5. Prepare a MailMerge.
  6. Create a Macros

# MS-EXCEL

* 1. Create a worksheet, moving/ copying/ inserting/ deleting rows and columns (usage of cut, paste, commands, copying a single cell, copying a range of data, filling up a cell. Undo command, inserting a row, column, deleting rows and columns).
  2. i) Formatting numbers (Selection Command, Currency format). ii).Drawing border around cells.

iii). Printing a work sheet (Print preview, Margin Setting, Header, Footer).

* 1. Creating charts
     1. Using chart wizard
     2. Changing the chart type (Pie, Bar, Line)
     3. Inserting titles for the axes X.Y
     4. Changing colors.
     5. Printing charts.
  2. MathFunctions
     1. SUM, COUNT, AVERAGE
     2. MAX, MIN
     3. STDDEV, VAR
     4. ABS, EXP, INT
     5. LOG10ANDLOG
     6. MOD, ROUND, SORT
     7. vii)Using autosum

# MS-POWERPOINT

1. Creating a presentation using auto content wizard.
2. Different views in power point presentation.
3. Setting animation effects/ grouping/ ungrouping/ cropping power/ point objects.
4. Printing a presentation/ Importing–Exporting file.
5. Creating an organization chart in PowerPoint.

# VISUAL BASIC(6.0)

* 1. Arithmetic Calculator
  2. Create a Access data base for student mark list and generate a data report.
  3. Create a database for reservation (Bus, Train & Air) and generate a data report

**M.Sc. FOOD PROCESSING SEMESTER- III**

# CORE VII - FOOD REGULATIONS AND QUALITY CONTROL OBJECTIVES

To enable the students

* 1. To standardize food products through sensory evaluation.
  2. To understand the fundamental food quality control procedures.
  3. To know about Food standards and Laws

# COURSE OUTCOME

On the successful completion of the course, the student will be able to understand the:

* Understand the Principles of quality control & attributes.
* Enumerate Methods of food quality evaluation.
* Name and describe Food adulteration, contamination & nonnutritive food components and its health effects.
* Develop the knowledge Standards for food quality Rules & regulation for setting up a processing unit.

# UNIT I

General principles of quality control – quality attributes size, shape, colour, consistency, viscosity, texture, taste and flavor.

# UNIT II

Methods of evaluation of food quality–sensory, objective technique, microbiological methods of quality evaluation, shelf life assessment

# UNIT III

Common adulterants, tests to detect adulterants contaminants, naturally occurring toxins in food metallic pesticide and preservative contaminants. Nonnutritive food components and their potential health effects, phoyphenols, tannins, phyto oestrogens, cyanogenic compounds, lecithin, saponins.

# UNIT IV

Government and trade standards for quality–food laws and regulations– PFA, FPO and Food Safety Act 2006. BIS standards, Agmark standards, Compulsory National legislation Act, Essential Commodities Act, Consumer protection Act. International Standards for export, Codex Alimentarius, WTO, ISO, WHO and FAO, FSSAI, APEDA and MPEDA.

# UNIT V

Rules and regulations for setting up of a processing unit.Criteria for ingredients and finished products. Aspects of microbiological safety in food preservation technologies, Establishment and implementation of HACCP, Continuous Assessment System, Total quality management and quality audits in food industries.

# PRACTICAL EXPERIENCE

Examination of food products in relation to different standards PFA. Agmark, Visit to BIS centre, AGMARK Centre. District level quality control laboratory and food processing industries, market survey of foods for quality.

# REFERENCES :

1. BIS Standards
2. GiridarillalSidappa G.S., and Tandon, G.L. (1979) Preservation of fruits and vegetables,ICAR,NewDelhi.
3. FPO(1955)Qualitycontrol.
4. Horace D.Graham. 1980 The safety of foods, 2nd End. AVI Publishing Co. Inc. Westport.
5. JulieMillerJones.1992FoodSafety,EnaganPress,USA.
6. Lewis M.J. 1987 Physical Properties of Food and processing system. Ellis Horwood Ltd.,England.
7. Picgott,J.R.1984.SensoryanalysisofFoodsElsevier.AppliedSciencePublisher,New York.
8. Principles and practices for the safe processing foods,DavidAshapton.
9. Early.R.(1995):GuidetoQualityManagementSystemsfortheFoodIndustry.

# WEB SITE LINK

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**M.Sc. FOOD PROCESSING SEMESTER- III**

# CORE VIII - FOOD PRODUCT DEVELOPMENT & ENTREPRENEURSHIP

**OBJECTIVES:**

To know about principle and steps involved in new food product development & Marketing Strategy.

# COURSE OUTCOME

On the successful completion of the course, the student will be able to

* + Know the basic principles, concept of food product development & factors involved in food habit alteration
  + Understand the steps in product development & calculate the nutritive value, cost of production
  + Formulate of new food products for all age groups
  + Apply the Concept of market & marketing efficiency

# UNIT I

Basic principles & concept of food product development. Cultural approach to development of dietary pattern of various groups- linguistic, regional, religious (ethnic). Factors involved in food habit alteration, availability, importance & role of different research & development departments in food production industry.

# UNIT II

Steps in product development –material resources based on market demand, standardization methods involved in product development. Portion size & portion control, Calculation of nutritive value & cost of production, Shelf life & storage stability evaluation procedure of developed food products.

# UNIT III

Formulation of new food products for infants, preschool children, adolescents, pregnant & nursing mothers, old age, sports persons. Selection & training of judges, Development of score card analysis of data. Role of advertisement & technologies in promotion of new products.

# UNIT IV

Concept of market & marketing- Approaches of study marketing & marketing functions, market structure, marketing efficiency. Role of government in promoting agricultural marketing. Conditions for sale, license & identification & quality of processing. Studying the global market status, economic feasibility of new products.

# UNIT V

Entrepreneurship- concept definition of entrepreneurship, Types of entrepreneurship, women entrepreneur, growth, prospects & problems.

Small business: Definition & composition of small business- Economic contribution of small business. Strategic planning for small business– Steps in strategic planning.

# REFERENCES:

1. Sivaramaprasad.A,1985,Agricultural Marketing in India-Mittal Publications, New Delhi.
2. Acharya.S.S,andN.L.Agarwal,1992,AgriculturalMarketinginIndia-Oxfordand IBH PublishingPvt.,Ltd.,NewDelhi.
3. DevelopingNewFoodProductsForaChangingMarketPlace,2nd Edition,2005,Aaron,L.Brody,JohnB.Lord.
4. NewFoodProductDevelopment,2004,GordonW.Fuller.
5. John Kao , Creativity & Entrepreneurship package Compatibility, toxicity, tainting and corrosion. Packaging andenvironment.

# WEB SITE LINK

* + https://books.google.co.in/books/about/New\_Food\_Product\_Development.html?id=pnhI6e\_zSWAC &printsec=frontcover&source=kp\_read\_button&redir\_esc=y
  + https://books.google.co.in/books?hl=en&lr=&id=nC7OGhzZn5YC&oi=fnd&pg=PR9&dq=info:PDil BbWmXuEJ:scholar.google.com/&ots=i3fMfkzxS6&sig=3O0kzW- HVZR86EV\_mEsjx0PPqaI#v=onepage&q&f=false

**M.Sc. FOOD PROCESSING SEMESTER- III**

# CORE IX - RESEARCH METHODOLOGY AND STATISTICS

**OBJECTIVES:**

To know about research & their types ,coding, report writing , & their probability.

# COURSE OUTCOME

On the successful completion of the course, the student will be able to

1. Classify the types of research
2. Apply the methods of data collection.
3. To test the goodness of fit and independence of attributes

# UNIT I

Meaning of Research, Role of Statistics and research in Home Science Discipline, objectives of research, Types of research and their application, selection and formulation of research problem, Hypothesis, Designing a research – different types, census and sample method, Theoretical basis of sampling, Sampling methods- Random sampling methods, size of sample, sampling and Non- sampling errors.

# UNIT II

Methods of collecting primary data- Questionnaire, preparation of schedules, interview method, case- study method, Experimentation method, sources of secondary data, precautions while using secondary data. Editing and coding the data, Organization of data, classification- meaning and objectives, types of classification, formation of discrete and continuous frequency distribution, Tabulation – role, parts of a table, general rules of tabulation, types of tables.

# UNIT III

Representation of data- Diagrammatic and graphical representation- significance of diagrams and graphs, general rules for constructing diagrams, Types of diagrams, graphs of time series, graphs of frequency distribution.

Interpretation and report writing- meaning of interpretation technique, precautions, format of research report, types, steps and stages, mechanism and style, essential of good report, footnotes and bibliographical citations. Scale of measurements.

# UNIT IV

Measures of central tendency- mean, median, mode, their relative advantages and disadvantages, measures of dispersion- mean deviation, standard deviation, quartile deviation, co-efficient of variation, percentile and percentile ranks. Association of

attributes, contingency tables, correlation, coefficient of correlation and its interpretation, rank correlation, regression equations and predictions.

# UNIT V

Probability-Rules of probability and its applications. Distribution-Normal, binomial, their properties, importance of these distributions in statistical studies. Tests of significance, large and small samples,“t”and F test, tests for independence using chi- square test. Analysis of variance–One-way and two-way classification.

# REFERENCES:

1. Kothari,C.R.(2002), ResearchMethodology
2. Gupta,S.P.(2002),StatisticalMethods,SultanaChandandsons,31strevisededition
3. Devadas, R.P.(1989), A Handbook on Mehodology of Research, Sri Ramakrishna Vidhyalaya,Coimbatore.
4. Ramakrishnan,P.(2001),Biostatistics,Saraspublication.
5. Donald, H.M.C.Burney (2002), Research Methods, Fifth edition, Thomson and WadsworthPublications
6. Shanthi,P., Sophia and Bharathi (2000), Computer oriented statistical methods/ probabilityandstatistics,charulathapublications,secondedition.
7. Pillai,R.S.NandBagavathi,V(2001),Statistics,Chandandcompanylimited.

## Practical /RelatedExperiences:

1. Identifying the research problems under each type
2. Formulation of Questionnaires and schedules.
3. Consolidating data and forming tables.
4. Drawing graphs and diagrams appropriately.
5. To understand and select a suitable saying methods for a given situation.
6. Working out numerical sums for all statistical analysis and interpret.
7. Demonstration of SPSS.

# WEB SITE LINK

* + https://books.google.co.in/books?id=hZ9wSHysQDYC&printsec=frontcover&dq=Kothari,C.R.(2002

),+Research+Methodology&hl=en&sa=X&ved=2ahUKEwiGl8mFxM3uAhXZ8XMBHXdvBf8Q6A EwAHoECAAQAg

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**M.Sc. FOOD PROCESSING SEMESTER- III CORE X - FOOD PACKAGING TECHNOLOGY**

# OBJECTIVES:

1. To understand the various properties of food packaging materials.
2. To Select suitable packaging material for different food substances.
3. To under standthe concept tof canning of food products.

# COURSE OUTCOME

On the successful completion of the course, the student will be able to

* + Understand the basic concepts of food packaging
  + Comprehend on protective packaging of foods
  + Study about the packaging materials used for the different food materials
  + Comprehend the packaging standards and regulations

# THEORY :

**UNIT I**

Packaging-Concepts, definition, significance, classification, Flexible packaging materials and packaging forms-paper, regenerated cellulose, film, aluminum foils, and lamination, wrappers, bags, pouches and collapsible tubes.

# UNIT II

Spiral packaging methods- vacuum packaging, gas packaging and shrink packaging. Packaging of milk and milk products–milk, condensed milk, evaporated milk, milk powder, cream, butter & cheese.

Semi rigid packaging materials & forms–Aluminum Containers, set up paper cartons, folding paper board cartons, moulded pulp containers and plastic containers.

# UNIT III

Rigid packaging materials-glass containers and Compostie Containers.Rigid packagingmaterialsandpackageforms-Aerosolcontainers,Solid&Corrugatedfiber board Containers, wooden boxes & crates. Cylindrical shipping containers and problems in packaging dehydrated foods.

Packaging requirements & materials for chocolate and Confectionaries-chocolate, candy, confectionary peanut butter, chewing gum, jams & jellies. Packaging requirements and materials for beverages, vegetables and fruits juices, carbonated soft drinks.

# UNIT IV

Packaging requirements and materials for fish- fresh, frozen, salted, smoked fish meal.Packaging of egg products.

Packaging equipment, principles of weighing filling, sealing, wrapping, cartooning, capping, labeling, coding, marking including bar coding and strapping.

# UNIT V

Packaging –Laws and regulations. Aseptic and retort packaging. Testing and evaluation of packaging media- retail packs and transport packages. Produce package Compatibility, toxicity, tainting and corrosion. Packaging and environment.

1. StainleySacharous, Roger.C.Griffin, Principles of food packaging 2nd edition, AVI. Publishing.Co.,Westport.
2. Paine, F.A. & Paine, H.Y.A.hand book jof food packaging Leonard Hill.BlackieSon's Ltd,London.
3. Sacharow, S.Hand Book of packaging materials, A VI Publishing company, WestPort.
4. Croshy,N.T.Foodpackagingmaterials,AppliedSciencepublicationlimited,London.
5. Paine,F.A.Thepackagingmedia,BlackieandSon'sLtd,London.
6. Sacharow and Grilin, Food Packaging, AVI Publications Hotchikess, Food and Packaginginteractin-AmericanChemicalSociety.
7. Robertson,G.L.FoodpackagingTechnology,NewsPort,MarcellDekkar,Inc.
8. FoodPackagingPrinciplesAndpractice,1998,GordonL.Robertson.
9. NovelFoodPackagingTechniques,2003,RaijaAhvenainen.
10. ActivePackagingForFoodApplications,Aaron,L.Brode,EugeneR.Strupinsky,2001. Practical/RelatedExperiences:Avisittopackagingunit.

# WEB SITE LINK

* + https://books.google.co.in/books?id=- OA4szVQvsAC&printsec=frontcover&dq=food+packaging+technology+ppt&hl=en&sa=X&ved=2a hUKEwjP8eD8ss3uAhWD-2EKHdqYDsIQ6AEwAHoECAEQA
  + https://books.google.co.in/books?id=BizOBQAAQBAJ&printsec=frontcover&dq=food+packaging+t echnology+ppt&hl=en&sa=X&ved=2ahUKEwjP8eD8ss3uAhWD- 2EKHdqYDsIQ6AEwAnoECAIQAg

**M.Sc. FOOD PROCESSING**

**SEMESTER- III**

**CORE PRACTICAL IV - QUALITY CONTROL AND ADULTERATION PRACTICAL**

**COURSE OUTCOME**

On the successful completion of the course, the student will be able to

* + Establish sensory panels
  + Perform Adulteration test for foods
  + Demonstrate Quality test for milk, ghee and other food materials

1. Establishing Sensory Panels- Designing Sensory Testing Facilities-Analytical Test- Conduct a Sensory Evaluation Test- Designing Score card, objective evaluation, Instruments used for texture evaluation
2. Adulteration test- for adulterants in milk. Fat and oil, spices and Condiments.
3. Quality test for milk and ghee.
4. Quantitative test:
   1. Titrable acidity
   2. Gluten content (wet&dry)
   3. Total Soluble Solids
   4. Bulk Density
   5. Water absorption capacity
   6. Oil absorption capacity
   7. Foaming stability.

**M.Sc. FOOD PROCESSING- SEMESTER- IV**

# CORE XI- FOOD INDUSTRIAL WASTE MANAGEMENT

**OBJECTIVES**

To learn treatment methods, waste disposal methods from food industry.

# COURSE OUT COME

On the successful completion of the course, the student will be able to

* Understand Classification & characterization of food industrial waste**.**
* Handle Industrial waste disposal methods and economical aspects.
* Apply Treatment methods for liquid waste and solid waste from food industry
* Control environmental pollution by proper treatment of food waste

# UNIT I

Introduction; Classification & characterization of food industrial wastes from fruit and vegetable processing industry, beverage industry, fish, meat and poultry industry, sugar industry and dairy industry.

# UNIT II

Waste disposal methods- physical, chemical and biological; Economical aspects of waste treatment and disposal.

# UNIT III

Treatment methods for liquid wastes from food process industries; Design of activated sludge process, Rotating biological contactors, Trickling filters, UASB, Bio gas plant.

# UNIT IV

Treatment methods of solid wastes; Biological compositing, drying and incineration; Design of solid waste management system; Landfill digester, Vermicomposting pit.

# UNIT V

Bio filters and bio clarifiers, Ion exchange treatment of waste water, Drinking – water treatment, Recovery of useful materials from effluents by different methods.

# REFERENCE

1. Food Industry Wastes: Disposal and Recovery; Herzka A & Booth RG; 1981, Applied Science PubLtd.
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**M.Sc. FOOD PROCESSING   
COREIXII - FOOD PROCESSING TECHNOLOGY – II**

# OBJECTIVES

## To enable students

1. To know the principles and methods involved in the processing of Non-Perishable foods
2. To develop skills in the Non-perishable food processing equipment.

# COURSE OUTCOME

On the successful completion of the course, the student will be able to

* + Understand the outlines of Rice & Wheat –processing & storage conventional methods.
  + Appreciate the importance Major & minor millets-types, processing & storage, nutritional losses.
  + Comprehend Pulse Technology-processing & methods to remove toxic factors.
  + Identify different Oil seed technology –Processing & preservation techniques. Spice technology- processing & extraction of Oleoresin

# UNIT I

Cereal Technology-Rice-Parboiling and milling methods, High-Pressure Processing, by products of rice milling and their utilization; Wheat- Milling, by- products of milling, Nutritional losses during Processing; Storage. Conventional and non- conventional foods-Breakfast, Extruded products.

# UNIT II

Millets Technology- major and minor millets- Types, Pre- Processing, Processing & methods to remove toxic factors; Nutritional losses during Processing; Storage.

# UNIT III

Pulse Technology - Types, Pre- Processing, Processing & methods to remove toxic factors; Nutritional losses during Processing; Storage.

# UNIT IV

Oil seed Technology-Types;Pre-Processing;Processing&Preservation-Extractionof oils, meal concentrates and Value Addition; Nutritional losses during Processing;

Storage.

# UNIT V

Spice Technology (Indian) - Classification, Anti-Microbial & Antioxidant Properties, Processing, By-Products of Spices – Extraction of Oleoresin, Essential oil & Spice Blends, Medicinal Value of Spices; Nutritional losses during Processing; Storage.

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1. NIIRBoardofFoodandTechnologist,ModernTechnologyofFoodProcessingandAgro basedindustries,NationalInstituteofIndustrialResearch,Delhi,2005.
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3. SumanBhatti, Uma Varma, Fruit and vegetable processing organizations and institutions,CBSPublishing,NewDelhi,1stEdiion-1995.
4. MirdulaMirajkar, SreelathaMenon, Food Science and Processing Technologyvol-2, Commercialprocessingandpackaging,Kanishkapublishers,NewDelhi-2002.
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  + https://libro.eb20.net/Reader/rdr.aspx?b=1640043

**M.Sc. FOOD PROCESSING**

**FOOD ANALYSIS PRACTICAL CORE PRACTICAL II -**

# COURSE OUTCOME

On the successful completion of the course, the student will be able to undertake the nutrient analysis of food- calories, fiber, moisture, ash, calcium, phosphorous, iron, vitamin A &C ,

fat ,iodine number, lipid content.

**Analysis of food for**:

* 1. Calories(Demo)
  2. Crude fiber
  3. Moisture
  4. Nitrogen (Demo)
  5. Ash
  6. Calcium
  7. Phosphorus
  8. Iron
  9. Vitamin-A
  10. Vitamin-C
  11. Fat (Demo)
  12. Saponification value
  13. Iodine number
  14. Acid number
  15. Lipid content in egg yolk
  16. Carbohydrate by anthrone method
  17. Estimation of total sugar in honey by phenol sulphuric acid
  18. Protein by Lowry's method
  19. Thiamine (Demo)
  20. Riboflavine (Demo)

# REFERENCES :

1. Raghuramulu,N.Nair,K.A.AndKalyanasundraram,A.(1983)AmanualofLaboratory Techniques,National,InstitureofNutrition,SilverPrints,Hyderabad.
2. Oser, B.L.,(1954) Hawke's Physiological Chemistry, XIV Edition, Tata MC Graw Hill PublishingCompanyLtd,Mumbai.
3. Jayaram.J.(1996), Laboratory Manual In Biochemistry, New Age International Ltd, Publishers,NewDelhi,FifthReprint.
4. Sadasivam,SAndManickam,A(1991)BiochemicalMethods,NewageInternational Pvt.Publishers,NewDelhi,2ndEdition.

**M.Sc. FOOD PROCESSING SEMESTER- IV**

# PROJECT

Each student shall be required to prepare a training report on the basis of a training undergone by the candidate in Food Industrial Organization, suggesting a possible solution for problems of current interest in the area of processing. The Report Should demonstrate the capability of the student for some creative potential and original approach to solve the practical problems in today's Business or Industry. The report should include industrial research, experiments, interpretations, planning and design of an improved and integrated processing, management systems, presented in a comprehensive manner with recommendations for solutions based on scientifically worked out date. It contains less than 200 pages.

Topic of dissertation may be chosen from any broad area of Food Processing. The Dissertation to be submitted should include

* 1. Abstract
  2. Introduction
  3. Objectives of the study
  4. Materials and Methods employed
  5. Results and Discussion
  6. Summary and Conclusions and
  7. Bibliography

**M.Sc. FOOD PROCESSING SEMESTER- IV**

# ELECTIVE PAPER VI - ANIMAL FEED FORMULATION

**OBJECTIVES:**

1. To provide the students with knowledge on feed composition, their digestion process, and nutrient metabolism.

1. To learn to evaluate the nutritional value of the different components, through the application of various systems.

# COURSE OUTCOME

On the successful completion of the course, the student will be able to

* Understand the nutrient requirements of Cattle & Buffalo
* Understand the nutrient requirement for growth in milk production of goals
* To know about the pigs nutrient requirements for growth & milk production
* To know about the nutrient requirements & feeding of sheep & poultry .Understand the leaves, shrub straws crop residues & preparation of feed.

# UNIT I

Nutrient requirements of cattle and buffalo, growth pattern in India domestic buffalo, Intestine meat production from buffalo.

# UNIT II

Nutrient requirement for growth, milk production, feeding of goats, natural common feeds and Fodders of goats.

Nutrient requirement & feeding of Dogs & Ducks.

# UNIT III

Nutrient requirements- reproduction, feeding of sheep and weaning pigs, feeding schedule, growers rations.

# UNIT IV

Nutrient requirements of poultry, formulation of poultry rations, feed requirement for production, feeding schedule.

# UNIT V

Tree leaves and shrub straws and crop residues- agro- industrial by-products, rations for feeding during scarcity, preparation of feed.

# WEB SITE LINK

* https:/[/www](http://www.researchgate.net/publication/40185239_Feeding_standards_and_feeding_systems).[researchgate.net/publication/40185239\_Feeding\_standards\_and\_feeding\_systems](http://www.researchgate.net/publication/40185239_Feeding_standards_and_feeding_systems)
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3. Razdan,M.N.,Bhosreker,M.RandRay,SN.,1965.Ind.J.DairyScie.18,96.

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