**Appendix-43**
**Resolution No. 5-20**

## Progression of GEs

| S.No. | Name of Paper | Semester | Level | Whether counted for minor |
|---|---|---|---|---|
| 1 | Food Science and Nutrition | 1 | 100 | Yes |
| 2 | Technology of Food Processing and Preservation | 2 | 100 | Yes |
| 3 | Chemistry of Foods | 3 | 200 | Yes |
| 4 | Microbes in Food and Food Safety | 4 | 200 | Yes |
| 5 | Food Engineering and Packaging Technology | 5 | 200 | Yes |
| 6 | Processing of Plant Foods | 6 | 300 | Yes |
| 7 | Processing of Meat and Marine Foods | 7 | 300 | Yes |
| 8 | Sensory Evaluation of Food | 8 | 300 | No |

**Distribution of Generic Elective papers in ODD and EVEN Semester:**

| Level | Odd Semester | Even Semester |
|---|---|---|
| 100 | Food Science and Nutrition* | Technology of Food Processing and Preservation* |
| 200 | Chemistry of Foods * | Microbes in Food and Food Safety* |
| | Food Engineering and Packaging Technology* | |
| 300 | Processing of Meat and Marine Foods* | Processing of Plant Foods * |
| | | Sensory Evaluation of Food |

***Mandatory courses for minor degree**

# GENERIC ELECTIVE COURSES (GE) FOR MINOR DEGREE IN FOOD TECHNOLOGY

| GE Code | Paper Name | Theory | Practical | Tutorial | Number Of Credits |
|---|---|---|---|---|---|
| GE FT-1 | Food Science and Nutrition (New) | 3 | 1 | - | 4 |
| GE FT-2 | Technology of Food Processing and Preservation (New) | 3 | 1 | - | 4 |
| GE FT-4 | Microbes in Food and Food Safety (New) | 3 | 1 | - | 4 |
| GE FT-5 | Food Engineering and Packaging Technology (New) | 3 | 1 | - | 4 |
| GE FT-6 | Processing of Plant Foods (New) | 3 | 1 | - | 4 |
| GE FT-7 | Processing of Meat and Marine Foods (New) | 3 | 1 | - | 4 |

# GENERIC ELECTIVE COURSE
## GE FT01- Food Science and Nutrition

## CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

| CourseTitle & Code | Credits | Credit distribution of the course | | | Eligibility criteria | Pre-requisite of thecourse (if any) |
|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical | | |
| Food Science and Nutrition | 4 | 3 | 0 | 1 | Grade XII Pass | |

### Learning Objectives

1. To equip students with a comprehensive understanding of the composition of foods, exploring both their functional roles and the chemical changes that occur during food processing.
2. To provide the knowledge of nutrients, their functions and associated deficiency diseases or metabolic disorders.

### Learning Outcomes

Students will be able to:

1. Acquire a comprehensive understanding of the chemical and physical properties of food and their impact on food processing.
2. Acquire an understanding of food composition and nutrition.
3. Understand healthy diets, importance of nutritional labelling and effect of cooking on nutritive value of foods.

### SYLLABUS

**THEORY**
**(Credits 3; Hours 45)**

**Unit I- Introduction to Food science and Nutrition** **15 hours**

The unit will provide an understanding of food components, their important reactions in foods and nutritional value.

Understanding Food Science, Food technology, Nutrition

Food composition:

- Carbohydrates- structure, classification, examples, sources, functions in body, deficiency, important reactions in food- dextrinization, Non-enzymatic browning, gelatinization
- Lipids- structure, classification, examples, types of fatty acids, sources of fats, functions in body, deficiency, important functions in food- plasticity, rancidity, shortening, emulsion.
- Protein- structure, examples, sources, functions in body, important processes in food- denaturation, role in browning.
- Vitamins- Fat and water soluble vitamins (thiamine, riboflavin, niacin, folic acid, $B_{12}$ and Ascorbic acid)- sources, general role in body (2-3 important functions of each), names of deficiency diseases and their brief explanation.
- Minerals- Macro and micro minerals- Iron, calcium, iodine, zinc- sources, general role in body (including 2-3 important functions of each), names of deficiency diseases and their brief explanation.
- Non-nutrient components- Pigments, polyphenols, role in disease prevention. Examples: Role in food- colour, enzymatic browning.

**Unit II- Plant and animal based foods based foods 20 hours**

The unit will help develop an understanding of plant and animal based foods and their importance in food processing.

- Cereals- composition, names of major cereals, millets, pseudo cereals, cereal products- examples of baked products, role of wheat in gluten formation, examples of ready to eat and traditional breakfast cereals and cereal products.
- Pulses- Composition and examples, names of toxic constituents, methods of processing of pulses, examples of pulse based fermented foods
- Fruits and vegetables- composition, enzymatic browning, ripening, climacteric and non-climacteric fruits.
- Vegetable Oils- Sources, refining of oils, hydrogenation
- Meat- Types, composition, marbling, characteristics of fresh meat, rigor mortis, ageing, animal fats- lard and tallow
- Fish- Types, characteristics of fresh fish, fish spoilage.
- Egg- Composition, characteristics of fresh egg, evaluation of egg quality, egg spoilage.
- Milk- Composition, types of market milk- toned, full cream, homogenized milk, flavoured milk. Pasteurization-importance and methods. Milk products- examples

**Unit III- Healthy Diets 5 hours**

The unit will help in developing an understanding of balanced diets, nutritional labelling, effect of cooking on nutritional value of food and association between food and lifestyle disorders.

- Balanced diets- Concept of Recommended dietary allowance and Estimated Average Requirements, food groups, relationship between food and lifestyle disorders, understanding malnutrition.
- Nutritional labelling- Concept, understanding a nutrition label
- Methods of cooking- Examples, effect of methods of cooking on food and nutrients, minimising cooking losses.

**PRACTICAL**
**(Credit-1, Hours-15)**

- Non enzymatic browning in flours and sugars.
- Enzymatic browning in fruits and vegetables.
- Gelatinization of starch.
- Gluten formation in flours.
- Egg equality inspection.
- Germination of pulses.
- Platform tests of milk.
- Identification of food sources for important nutrients using food composition tables.
- Critical analysis of nutritional labelling of food products.
- Preparation of snacks using different cooking methods.

**Essential Readings**


1. Bawa. A.S., Chauhan, O.P, Raju. P.S. (2013) ed. Food Science. New India Publishing Agency.
2. Potter, N.N., & Hotchkiss, J.H. (2012). Food Science. Springer Science and Business Media.
3. Rodey, S. (2018). Food science and Nutrition. Oxford University press. 4th edition.
4. Srilakshmi, B. (2018). Food Science. New Age Publishers. 7th edition.
5. Byrd-Bredbenner, C., Moe, G., Beshgetoor, D. & Bernning, J. (2002). Wardlaw's Perspectives in Nutrition, International Edition, 12th edition, New York:McGrow-Hill 29.
6. Chadha,R. and Mathur, P. eds. (2015). Nutrition: A Lifecycle Approach. Hyderabad, Orient Blackswan.
7. Longvah, T., Ananthan, R., Bhaskarachary K. and Venkaiah, K. ( 2017). Indian Food Composition Tables. Hyderabad: National Institute of Nutrition, Indian Council of Medical Research, Department of Health Research, Ministry of Health and Family Welfare, Government of India.


**Suggested Readings**


1. Rao, E.S. (2019). Fundamentals of Food Technology and Preservation, Variety Books, New Delhi.
2. De, Sukumar. (2007). Outline of Dairy Technology. Oxford University Press.
3. Kent, N.L. (2018). Kent's Technology of Cereals: An introduction for students of food science and agriculture. Elsevier. 5th edition.
4. Manay, N.S., & Shadaksharaswamy, M. (2008). Food- Facts and Principles, 3rd Edition. New Age International (P) Ltd. Publishers, New Delhi.
5. Rekhi, T., and Yadav, H.(2014). Fundamentals of Food and Nutrition. New Delhi: Elite Publishing House Pvt. Ltd.
6. Stewart, G.F., & Amerine, M.A. (2012). Introduction to Food Science and Technology. Elsevier. 2nd Edition.

# GENERIC ELECTIVE COURSE
## GE FT02- Technology of Food Processing and Preservation

## CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

| CourseTitle & Code | Credits | Credit distribution of the course | | | Eligibility criteria | Pre-requisite of thecourse (if any) |
|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical | | |
| Technology of Food Processing and Preservation | 4 | 3 | 0 | 1 | Grade XII Pass | |

### Learning Objectives

The objective of this subject is to impart the basic concept of food colloids, freezing, dehydration processes and equipment used during the processing, principles of thermal processing, Minimal Processing and hurdle technology and to understand the concept of water disposal and sanitation

### Learning Outcomes

Students will be able to:

1. Understand the concept of food processing operation systems such as food colloids, Freezing, Dehydration processes and equipment used in food industry.
2. Comprehend the Principles of minimal Processing, thermal processing such as aseptic Processing, UHT Irradiation and microwave heating, hurdle technology and their applications in food industry.
3. Understand the concepts of water disposal and sanitation

## SYLLABUS

**THEORY**
**(Credits 3; Hours 45)**

**UNIT I: Food Processing Operations** **20 Hours**

- **Refrigeration and Freezing:** Requirements of refrigerated storage - controlled low temperature, air circulation and humidity, changes in food during refrigerated storage, progressive freezing, changes during freezing

Freezing methods -direct and indirect, still air sharp freezer, blast freezer, fluidized freezer, plate freezer, spiral freezer and cryogenic freezing.

- **Dehydration:** Normal drying curve , effect of food properties on dehydration, change in food during drying, drying methods and equipments: air convection dryer, tray dryer, tunnel dryer ,continuous belt dryer , fluidized bed dryer, dryer, drum dryer, vacuum dryer , freeze drying, foam mat drying.
- **Thermal Processing of Foods:** Classification of thermal processes, Principles of thermal processing, commercial canning operations, Aseptic Processing, UHT Irradiation and microwave heating. Principles, Dosage, Applications of Irradiation, Mechanism of microwave heating and applications.

**UNIT II: Technology of Colloids in Food** **5 Hours**

- Surface chemistry (colloids, emulsions, foam, sols, gels, pectin gels)

**Unit III: Water Disposal and Sanitation** **5 Hours**

- Waste water , hardness of water, break point chlorination, physical and chemical nature of impurities, BOD, COD, waste water treatment, milk plant sanitation, CIP system, sanitizers used in food industry

**Unit IV: Minimal processing and hurdle technology** **5 Hours**

## PRACTICAL
**(Credit 1; Hours 30)**

- Study of canning equipment (Forming, Flanging, Seaming, Exhausting and Retort)
- Canning of foods
- Preservation of food by the process of freezing
- Drying of food using Tray dryer/other dryers
- Study of thawing characteristics of frozen foods
- Preparation of brix solution and checking by hand refractometer
- Analysis of water
- Minimal Processing of food
- Application of colloidal chemistry in food preparation

**Essential Readings (Thoery)**

1. Deman, J.M. (2007).Principles of Food Chemistry, 3rd Ed. Springer.
2. Potter, N. and Hotchkiss H. (2007).Food Science. New Delhi: CBS Publication.
3. Ramaswamy, H. and Marcotte, M. (2009).Food Processing Principles and Applications. CRC Press.
4. Fellows' Food Processing Technology Principles and Practice 5th Edition (2022) Elsevier Publishing

**Essential Readings (Practical):**

1. A., Rashida & Joy, P.P.. (2014). A Food Technology Lab Manual.
2. FSSAI, M. (2015). Manual of methods of analysis of foods. *Method*, *16*, 56-61.

3. Coles, R., McDowell, D. and Kirwan, M.J. (2003).Food Packaging Technology. CRC Press, 2003.
4. Meyer LH.(1987). Food Chemistry, CBS Publication, New Delhi

# GENERIC ELECTIVE COURSE
## GE FT04- Microbes in Food and Food Safety

## CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

| CourseTitle & Code | Credits | Credit distribution of the course | | | Eligibility criteria | Pre-requisite of thecourse (if any) |
|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical | | |
| Microbes in Food and Food Safety | 4 | 3 | 0 | 1 | Grade XII Pass | |

## Learning Objectives

1. To understand the important genera of microorganisms associated with food and their characteristics.
2. To understand the role of microbes in fermentation, spoilage and food borne diseases.
3. To understand the principles of food preservation.
4. To understand Food safety , types of hazards associated with food and current regulatory regime along with food safety management systems.

## Learning Outcomes

1. Acquaint the knowledge of the important genera of microorganisms associated with food and their characteristics.
2. Able to explain the role of microbes in fermentation, spoilage and food borne diseases and their role in food preservation
3. Understand Food safety and types of hazards associated with food
4. Introduction to current Food Regulatory regime and Food Safety Management Systems.

## SYLLABUS

**THEORY**
**(Credits 3; Hours 45)**

**Unit I: Introduction to Food Microbiology** **10 Hours**

Covers genera of microorganisms associated with food and their characteristic features , growth pattern and enumeration

- Definition and Scope of food microbiology
- Types of Microorganisms in food (bacteria, fungi and viruses )
- Sources of Microorganisms in foods
- Bacterial growth curve, Factors affecting the growth of micro- organisms in food

- Enumeration of microorganisms

**Unit II: Role of microorganisms in Food and their control 15 Hours**

Role of microbes in fermentation, spoilage and food borne diseases is the focus of this unit along with food preservation principles and techniques (

- Food Spoilage , Spoilage in different food types
- Beneficial Role of Microorganisms -Microorganisms used in food fermentations, Common Fermented Foods
- Food borne diseases and types – food infections, food borne intoxications and toxin infections
- Principles of Food preservation and common methods used in food industry, Effect of preservation methods such as thermal processing, freezing and irradiation on microbes
- Introduction to Novel Techniques of Food Preservation- HHP,PEF, Ohmic heating, Microwaves etc. and Hurdle Technology

**Unit III: Food Safety and Regulations 10 Hoous**

Covers food safety , types of hazards associated with food , current regulatory regime and

- Food safety: Definition, Types of hazards, biological, chemical, physical hazards and allergens
- Food Safety Management Tools: GHP, HACCP and ISO series
- National Regulatory Regime
- International Regulatory bodies

**PRACTICAL**
**(Credit 1; Hours 30)**

- Introduction to the Basic Microbiology Laboratory Practices and equipments used in a microbiology laboratory-autoclave , laminar air flow chamber, incubators, hot air oven ,colony counter
- Cleaning and sterilization of glassware
- Working and handling of a compound microscope
- Simple staining
- Gram’s staining
- Preparation and sterilization of culture media·
- Standard Plate Count Method
- Bacteriological Analysis of Water using MPN method

**Essential Readings**

1. Forsythe, S J. (1987) Microbiology of Safe Food. USA: Blackwell Science, Oxford, 2000 65 &Sons.
2. Frazier, William C. and Westhoff, Dennis C. (2004).Food Microbiology. New Delhi: TMH.
3. Garbutt, John.(1997). Essentials of Food Microbiology. London: Arnold.
4. Jay, James M. (2000). Modern Food Microbiology. New Delhi: CBS Publication.

**Suggested Readings**


1. De Vries. (1997). Food Safety and Toxicity. New York: CRC.
2. Lawley, R., Curtis L. and Davis,J. (2004). The Food Safety Hazard Guidebook. RSC Publishing.
3. Marriott, Norman G. (1985). Principles of Food Sanitation. New York: AVI.
4. Pelczar, M.J., Chan E.C.S and Krieg, Noel. R. (1993) Microbiology, 5th Ed.New Delhi: TMH
5. Mathur, P. (2018). Food Safety and Quality Control. Hyderabad: Orient Black Swan Pvt. Ltd.

# GENERIC ELECTIVE COURSE
## GE FT05: Food Engineering and Packaging Technology

## CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

| Course title & code | Credits | Credit distribution of the course | | | Eligibility criteria | Pre-requisite of the course (if any) |
|---|---|---|---|---|---|---|
| | | Theory | Tutorial | Practical/Practice | | |
| Food Engineering and Packaging Technology | 4 | 3 | | 1 | XII Pass with Science | |

## Learning Objectives

1. understand the fundamental engineering principles of Unit operations.
2. To acquaint with fundamentals of food engineering and its process.
3. To develop an understanding of the various packaging materials, techniques and package design used for food packaging.

## Learning Outcomes

After completing this course, students will be able to:

1. Understand the principles of Unit operation
2. Acquaint with fundamentals of food engineering and its processes
3. Develop an understanding of different food packaging materials and packaging design and techniques used for various foods

## SYLLABUS

**THEORY**
**Credits 3 (45 Hrs.)**

**UNIT I:**

**Unit Operations and Processes: Engineering Concepts** **20 hours**

- Units and Dimensions, Mass and Energy Balance
- Food Plant Layout and Design.

- Heat transfer- Laws of Conduction, convection, Radiation
- Steam: Thermodynamics of Phase change, Pressure enthalpy diagram, Boilers
- Evaporation – Evaporator types and Design of single effect evaporator
- Dehydration- Basic drying process and Principle
- Refrigeration and Freezing -VCR System, Pressure Enthalpy Charts, Mathematical expressions useful in analysis of VCR System. Freezing time prediction- Plank's Equation
- Psychrometrics- Psychrometric Chart construction and uses
- Fluid flow-Liquid Transport system, Properties and Classification of fluids, Reynolds number.

**UNIT II:**

**Separation and Size Reduction Processes** **10 hours**

- Principle and equipment used for Filtration, Extraction, Distillation, Centrifugation, Sieving.
- Milling, Grinding and Mixing of Foods

**UNIT III:**

**Food Packaging** **15 hours**

Food Packaging- Concept, Functions and Significance. Manufacturing Process and Application of Rigid, Semi Rigid and Flexible Food Packaging Material. Aseptic, Intelligent and Active packaging. Packaging Techniques for Fresh Agricultural Produce, and Processed Foods.

**PRACTICAL**
**(Credit 1; Hours 30)**

- Study the dehydration process of foods.
- Study the freezing characteristics of foods.
- Study the evaporation process.
- Study and use of psychrometric chart.
- To design layout of a food plant.
- Sieve analysis of Food samples.
- Determination of viscosity of foods using Viscometer.
- Identification and Testing of packaging materials.
- Demonstration of vacuum/gas packaging of foods.

**Essential Readings (Theory):**

1. Singh, R.P. and Heldman, D.R.(2013).Introduction to food engineering, 5$^{th}$Ed. Academic Press

2. Rao, D.G.(2010).Fundamentals of food engineering. PHI learning private Ltd.
3. Robertson, (2012) Food Packaging: Principles and Practices , CRC Press
4. Saha, N.C., Ghosh, A.K., Garg, M., Sadhu, S.D (2022) Food Packaging :Materials, Techniques and Environmental Issues, publisher springer
5. Kshitiz Kumar, Pravin M Ganorkar, Vijay Singh Sharanagat (2023). Food Packaging-Principles and Applications. Nipa® genx electronic resources & solutions p. Ltd. New Delhi.

**Essential Readings (Practical):**

1. Meenakshi Garg**,** Premlata Meena, Sushmita D Sadhu, Tanveer Alam. "Food Packaging: A Practical Guide" The Computype Media (Publishing Division), ISBN No.614027934-9; 2020.

# GENERIC ELECTIVE COURSE
## GE FT06: Processing of Plant Foods

## CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

| Course title & code | Credits | Credit distribution of the course | | | Eligibility criteria | Pre-requisite of the course (if any) |
|---|---|---|---|---|---|---|
| | | Theory | Tutorial | Practical/Practice | | |
| Processing of Plant Foods | 4 | 3 | | 1 | XII Pass | |

## Learning Objectives

1. To understand the concept of processing of plant food.
2. To understand the processing of fruits, vegetables, cereals, pulses and oilseeds.
3. To understand the processing of various spices, tea, and coffee.

## Learning Outcomes

After completing this course, students will be able to:

1. Understand different methods of fruit and vegetable processing.
2. Understand technical knowhow of Cereals, pulses, and oilseeds processing
3. Understand the processing of various spices, tea, and coffee

## SYLLABUS

### THEORY

**(Credits 3; Hours 45)**

**UNIT I: Technology of Fruits & Vegetables** **20 Hours**

This unit will focus on the preservation and processing of fruits and vegetables. Students will also learn about the techniques involved in processing fruit juices, jams, pickles, and tomato products, and shelf stability.

- Introduction & importance of fruit & vegetable preservation, history and need of preservation
- Canning and bottling of fruits and vegetables: Selection of fruits and vegetables, process of canning, containers of packing, spoilage in canned foods
- Processing and preservation of fruit juices and beverages
- Processing and preparation of jams, jellies and marmalades, defects in jelly
- Pickles- processing and types
- Tomato products, tomato puree, paste, ketchup and soup

**UNIT II: Technology of cereals, pulses and oilseeds 15 Hours**

This unit will focus on the technology of cereals, pulses, and oilseeds, covering aspects such as milling of wheat and rice, processing of pulses, milling of millet, and extraction and refining of oils from oilseeds.

- Wheat - Types, milling, flour grade
- Rice- Variety, milling, parboiling
- Pulses- Dry and Wet milling
- Millet- Variety, milling
- Oilseeds- extraction of oils and refining

**UNIT III: Spices and plantation products 10 Hours**

This unit will focus on the processing and properties of major and minor spices, extraction of essential oils and oleoresins, and the processing techniques involved in tea and coffee production.

- Spices- processing and properties of major and minor spices
- Essential oils and oleoresins
- Tea and coffee: processing

**PRACTICAL**
**(Credit 1; Hours 30)**

- Physical characteristics of wheat
- Determination of bulk density, true density and specific gravity of legumes and oilseeds.
- Study of cooking quality of rice
- Estimation of degree Brix: Acid ratio
- Cut out analysis of any plant food can
- Preparation of Jam
- Preparation of tomato products
- Dehydration and Rehydration of fruits or vegetables
- Qualitative estimation of adulteration in spices

**Essential Readings**

1. Girdharilal., Siddappaa, G.S and Tandon, G.L. (2009). Preservation of fruits & Vegetables. New Delhi: ICAR.
2. Kent. N.L. (2003). Technology of Cereal. 5th Ed. Pergamon Press.
3. Chakraverty A. (2018) Post Harvest Technology of Cereals, Pulses and Oilseeds, revised ed. Oxford & IBH Publishing Co. Pvt Ltd.
4. Srilakshmi. (2018). Food Science, 8th Edition. New Age International Ltd.

**Suggested Readings**

1. Thompson, A.K., (2003). Fruits and vegetables; Harvesting, handling and storage. Blackwell Publishing.
2. Manay, S. and Shadaksharaswami, M. (2020). Foods: Facts and Principles. New Age Publishers.
3. Ranganna S. (2017). Handbook of analysis and quality control for fruits and vegetable products. Tata Mc Graw-Hill publishing company limited, Second edition.
4. Srivastava, R.P. and Kumar, S. (2006). Fruits and Vegetables Preservation- Principles and Practices. 3rd Ed. International Book Distributing Co.

# GENERIC ELECTIVE COURSE
## GE FT07- Processing of Meat and Marine Foods

## CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

| Course title & Code | Credits | Credit distribution of the course | | | Eligibiliy criteria | Pre-requisite of the course (if any) |
|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical/ Practice | | |
| Processing of Meat and Marine Foods | **4** | **3** | 0 | **1** | XII with PCM/PCB | NIL |

### Learning Objectives

The Learning Objectives of this course are as follows

1. To understand aspects of Indian Meat industry, meat quality and slaughter processes
2. To acquire the knowledge of fish preservation and value-added fish products

### Learning outcomes

The Learning Outcomes of this course are as follows:

1. Understand the need and importance of meat and marine industry.
2. Comprehend meat and marine processing & technology.
3. Acquire knowledge about meat and fish by-products
4. Understand preservation of fish

### SYLLABUS

**THEORY**
**(Credits 3; Hours 45)**

**Unit I: Meat quality, slaughter process and by-products. 15 Hours**

- Status of livestock population in India, development of meat industry in India.
- Colour and texture of meat (Water holding capacity, Emulsification capacity of meat).
- Slaughter, antemortem and postmortem examination of Sheep/Goat.
- Classification of meat byproducts and uses

**Unit II: Fish quality and Low Temperature Preservation 15 Hours**

- Status of fishery industry in India.
- Fish: characteristics and structure of fish muscle, Effect of method of catching and handling on the quality of fish, post mortem changes, rigor mortis, autolytic changes, changes in fish proteins on storage, spoilage of fish, packaging of fish, contaminants and naturally occurring toxicants in fish

- Relationship between chilling and storage life, MAP, general aspects of freezing, freezing systems (air blast freezing, plate or contact freezing spray or immersion freezing, freezing on board, onshore processing, changes in quality in chilled and frozen storage, thawing.

**Unit III: Processing of Meat and Fish** **15 Hours**

Canning of Meat, Sausage classification and manufacture, Retort pouch meat,Traditional Meat products of India

- Salting of fish, salting methods (brining, pickling, kench curing, gaspe curing), Salted fish products- pindang, fishwood.
- Drying and Smoking: Smoke production, smoke components, quality, safety and nutritive value of smoked fish, processing and equipment, pre-smoking processes, smoking process control.
- Principles of canning of fish, canning of (Tuna, Mackerel, Sardine).
- Basic concepts of Surimi and fish mince products.

**PRACTICAL**
**1 Credit (30 Hrs)**

- Analysis of frozen meat / meat emulsion product.
- Cut out analysis of canned meat/retort pouches (Internal parameters) .
- Cut out analysis of canned meat/retort pouches ( External parameters).
- Cut out analysis of canned fish (Sardine/Mackerel/Tuna) (Internal parameters).
- Cut out analysis of canned fish (Sardine/Mackerel/Tuna) ( External parameters).
- Estimation of moisture content in meat.
- Preparation of Meat/fish product (Ideation/development of product).
- Subjective evaluation of Fresh Fish.
- Quality assessment of market sample of processed fish products.

**Essential Readings (Theory)**

1. Hall, G.M. (1997). Fish Processing Technology. 2nd ed., Blackie Academic and Professional, an imprint of Chapman & Hall., NY.
2. Sen, D.P. (2005). Advances in Fish Processing Technology, Allied Publishers Pvt. Limited.
3. Lawrie, R. A. (2017). Lawrie's meat science. 8th ed. England: Woodhead Publishing Ltd.
4. Martin, R.E., Collete, R.L. and Slavin, J.W. (1998). Fish Inspection, Quality Control

and HACCP: A Global Focus.1st ed. (Eds), CRC Press,
5. Borda, D., Nicolau. A. I. and Raspor, P. (2017). Trends in Fish Processing Technology (Contemporary Food Engineering Series). 1st edition, Taylor & Francis.
6. Hall GM, Fish Processing Technology, VCH Publishers Inc., NY, 1992.
7. Lawrie R A, Lawrie's Meat Science, 5th Ed, Woodhead Publisher, England, 1998