PROPOSED SYLLABUS

B.Sc. (H) FOOD TECHNOLOGY
Choice Based Credit System

Submitted to UGC
2015
# PROPOSED SCHEME FOR CHOICE BASED CREDIT SYSTEM FOR B. SC. HONOURS IN FOOD TECHNOLOGY

<table>
<thead>
<tr>
<th>Semester</th>
<th>CORE COURSE (14)</th>
<th>Ability Enhancement Compulsory Course (AECC) (2)</th>
<th>Skill Enhancement Course (SEC) (2)</th>
<th>Elective: Discipline Specific DSE (4)</th>
<th>Elective: Generic (GE) (4)</th>
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<tr>
<td>I</td>
<td>C1 –Fundamentals of Food Technology</td>
<td>(English Communication/ MI L)/ Environmental Science</td>
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<td>C10- Technology of Meat, Poultry and Egg</td>
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<td>C12- Food Chemistry-I</td>
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<td>C14-Food Quality and Sensory Evaluation</td>
<td>DSE *</td>
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*Any 4 DSE, 2 SEC AND 4 GE to be picked up by the student.
STRUCTURE OF B.SC HONOURS FOOD TECHNOLOGY UNDER CBCS

CORE COURSE (14 Courses) Total Credits 84

CREDITS – 6 Each (4 Credits Theory + 2 Credits Practical = 6)

C1 – Fundamentals of Food Technology: 4 Credits Theory + 2 Credits Practical
C2 – Principles of Food Science: 4 Credits Theory + 2 Credits Practical
C3 – Technology of Food Preservation: 4 Credits Theory + 2 Credits Practical
C4 – Food Processing Technology: 4 Credits Theory + 2 Credits Practical
C5 – Food and Nutrition: 4 Credits Theory + 2 Credits Practical
C6 – Technology of Fruits, Vegetables and Plantation Crops: 4 Credits Theory + 2 Credits Practical
C7 – Technology of Dairy and Sea Food: 4 Credits Theory + 2 Credits Practical
C8 – Technology of Cereals, Pulses and Oilseeds: 4 Credits Theory + 2 Credits Practical
C9 – Food Microbiology: 4 Credits Theory + 2 Credits Practical
C10 – Technology of Meat, Poultry and Egg: 4 Credits Theory + 2 Credits Practical
C11 – Food Engineering: 4 Credits Theory + 2 Credits Practical
C12 – Food Chemistry-I: 4 Credits Theory + 2 Credits Practical
C13 – Food Chemistry-II: 4 Credits Theory + 2 Credits Practical
C14 – Food Quality and Sensory Evaluation: 4 Credits Theory + 2 Credits Practical

DISCIPLINE SPECIFIC ELECTIVE (ANY FOUR) (4 x 6 = 24 Credits)

CREDITS – 6 Each (4 Credits Theory + 2 Credits Practical = 6)

DSE-1 Food Safety: 4 Credits Theory + 2 Credits Practical
DSE-2 Food Quality Management: 4 Credits Theory + 2 Credits Practical
DSE-3 Bakery Technology: 4 Credits Theory + 2 Credits Practical
DSE-4 Food Packaging: 4 Credits Theory + 2 Credits Practical
DSE-5 Nutraceutical and Functional Foods: 4 Credits Theory + 2 Credits Practical
DSE-6 Food Plant Sanitation: 4 Credits Theory + 2 Credits Practical
SKILL ENHANCEMENT ELECTIVE COURSE (ANY TWO) (2 x 2 = 4)
CREDITS – 2 Each (2 Credits Theory or Practical = 2)
SEC-1 Entrepreneurship Development: 2 Credits Theory
SEC-2 Food Product Development: 2 Credits Practical
SEC-3 Food Fermentation Technology: 2 Credits Practical
SEC-4 Confectionary Technology: 2 Credits Practical
SEC 5 Project and Technical Report: 2 Credits Practical

GENERIC ELECTIVE (ANY FOUR) (4 x 6 = 24)
CREDITS – 6 Each (4 Credits Theory + 2 Credits Practical = 6)
GE 1. Food Processing and Preservation: 4 Credits Theory + 2 Credits Practical
GE 2. Chemistry of Food: 4 Credits Theory + 2 Credits Practical
GE 3. Sensory Evaluation of Food: 4 Credits Theory + 2 Credits Practical
GE 4. Food Microbiology and Food Safety: 4 Credits Theory + 2 Credits Practical
GE 5. Food Engineering and Packaging: 4 Credits Theory + 2 Credits Practical
GE 6. Technology of Plant and Animal Foods: 4 Credits Theory + 2 Credits Practical
### B. Sc. (H) FOOD TECHNOLOGY – SCHEME OF EXAMINATION

<table>
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<tr>
<th>Semester</th>
<th>Course Opted</th>
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<td><strong>Total</strong></td>
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Total Credits: 84 Core + 24 DSE + 4 SEC + 4 AECC + 24 GE = 140
PREAMBLE

The course in Choice Based Credit System would be of 3 year duration having 6 semesters, divided into 14 Core papers, 4 Discipline Specific Elective courses, 2 Skill Enhancement Elective Courses and 4 Generic Elective Courses. Each Year would consist of 2 semesters. The new course has been prepared keeping in view, the unique requirements of B.Sc. (H) Food Technology students. The objectives of the course are-

- To impart knowledge of various areas related to Food Science and Technology,
- To enable the students to understand food composition and its physico-chemical, nutritional, microbiological and sensory aspects,
- To familiarize the students about the processing and preservation techniques of pulses, oilseeds, spices, fruits and vegetables, meat, fish, poultry, milk & milk products,
- To emphasize the importance of food safety, food quality, food plant sanitation, food laws and regulations, food engineering and packaging in food industry.

The contents have been drawn-up to accommodate the widening horizons of the discipline of Food Technology. They reflect the current changing needs of the students. For the Generic elective(GE) to be chosen by Food Technology students, It is recommended that subjects like Biochemistry, Biology, Chemistry, Maths & statistics, Biostatistics, Physics be chosen as they are synergistic to the curriculum. However, students are free to pick up any of the Generic Elective Courses offered by other departments.

- For each paper, the objectives have been listed and the contents divided into units.
- The detailed syllabus for each paper is appended with the list of suggested readings.
- Teaching time allotted for each paper shall be 4 periods for each theory paper and 4 periods for each practical class per week for each paper per week . Each practical
batch should ideally be between 15-20 students so that each student receives individual attention.
CORE COURSES

Core Course 1: FUNDAMENTALS OF FOOD TECHNOLOGY
(CREDITS: THEORY – 4 PRACTICAL - 2)

THEORY

Objectives:

- To understand the history and evolution of food processing.
- To study the structure, composition, nutritional quality and post harvest changes of various plant foods.
- To study the structure and composition of various animal foods.

CONTENTS

UNIT 1 Introduction (4 lectures)

- Historical evolution of food processing technology.

UNIT 2 Compositional, Nutritional and Technological aspects of Plant foods

I. Cereals and Millets (10 lectures)

- Structure and composition of cereals
- Wheat- structure and composition, types (hard, soft/ strong, weak) Diagrammatic representation of longitudinal structure of wheat grain.
- Malting, gelatinization of starch, types of browning- Maillard & caramelization.
- Rice- structure and composition, parboiling of rice- advantages and disadvantages.

I. Pulses (6 lectures)

- Structure and composition of pulses, toxic constituents in pulses, processing of pulses- soaking, germination, decortications, cooking and fermentation.

II. Fats and Oils (6 lectures)

- Classification of lipids, types of fatty acids - saturated fatty acids, unsaturated fatty acids, essential fatty acids, trans fatty acids.
- Refining of oils, types- steam refining, alkali refining, bleaching, steam deodorization, hydrogenation.
- Rancidity –Types- hydrolytic and oxidative rancidity and its prevention.
IV. Fruits and Vegetables

- Classification of fruits and vegetables, general composition, enzymatic browning, names and sources of pigments, Dietary fibre.

Post harvest changes in fruits and vegetables – Climacteric rise, horticultural maturity, physiological maturity, physiological changes, physical changes, chemical changes, pathological changes during the storage of fruits and vegetables.

UNIT 3 Compositional, Nutritional and Technological aspects of Animal foods

I. Flesh Foods - Meat, Fish, Poultry

- Meat - Definition of carcass, concept of red meat and white meat, composition of meat, marbling, post-mortem changes in meat- rigor mortis, tenderization of meat, ageing of meat.
- Fish - Classification of fish (fresh water and marine), aquaculture, composition of fish, characteristics of fresh fish, spoilage of fish- microbiological, physiological, biochemical.
- Poultry - Structure of hen’s egg, composition and nutritive value, egg proteins, characteristics of fresh egg, deterioration of egg quality, difference between broiler and layers.

II. Milk and Milk Products

- Definition of milk, chemical composition of milk, its constituents, processing of milk, pasteurization, homogenization. An overview of types of market milk and milk products.

FUNDAMENTALS OF FOOD TECHNOLOGY

PRACTICAL

1. Study different types of browning reactions: enzymatic and non enzymatic.
2. To study gelatinization behavior of various starches
3. To study the concept of gluten formation of various flours.
4. To study malting and germination.
5. To study dextrinization in foods.
6. Identification of pigments in fruits and vegetables and influence of pH on them.
7. Quality inspection of animal foods.

Recommended Readings
3. B. Srilakshmi, Food science, New Age Publishers,2002

Core Course 2 : PRINCIPLES OF FOOD SCIENCE
(CREDITS: THEORY – 4 PRACTICAL - 2)

THEORY

Objectives:

To impart basic knowledge of:

- Food Dispersions
- Sensory science
- Food Science
- Food Sanitation
- Packaging Materials

CONTENTS

UNIT 1 Food dispersions (10 lectures)
- Characteristics, sols, gels, pectin gels, colloidal sols, stabilization of colloidal system, syneresis, emulsions, properties of emulsions, formation of emulsion, emulsifying agent, food foams, formation stability and destruction of foam, application of colloidal chemistry to food preparation.

(CH 11 Manay, Ch 3 Meyer and Ch 2 Deman)

UNIT 2 Sensory evaluation of food (5 lectures)
- Objectives, type of food panels, characteristics of panel member, layout of sensory evaluation laboratory, sensitivity tests, threshold value, paired comparison test, duo-trio test, triangle test, hedonic scale, chemical dimension of basic tastes, Amoore’s classification of odorous compounds. Sherman and Sczezniak classification of food texture.

(CH 19 Ranganna and Ch 7, 8 Deman)
UNIT 3 Growth of microorganisms in foods (4 lectures)

- Food as a substrate for microorganism, factors affecting growth of microbes: pH, water activity, O-R potential, nutrient contents, inhibitory substance and biological structure.

(Ch 1, Frazier)

UNIT 4 Hurdle technology (5 lectures)

- Principles and applications, Hurdle effect in fermented foods, shelf stable products, intermediate moisture foods, application of hurdle technology.

UNIT 5 Minimal processing (5 lectures)

- Minimal processing of foods with thermal methods and non thermal methods-safety criteria in minimally processed foods-Minimal processing in practice-fruits and vegetables-seafood-effect on quality-Future developments

(Ch 3, Ramaswamy)

UNIT 6 Ohmic heating and High Pressure processing (5 lectures)

- Principles, equipment and processing, effect on food.

(Ch 11 Potter and Ch 3 Ramaswamy)

UNIT 7 Water disposal and sanitation (5 lectures)

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

(Ch 22 Potter, Ch 1 De)

UNIT 8 Packaging (9 lectures)

- Objectives of packaging, flexible packaging, properties of the following packaging materials-low density polyethylene, high density polyethylene, polypropylene, polyvinyl chloride, polyvinylidene chloride, ethylene vinyl alcohol, polystyrene, polyethylene terephthalate, nylon, ethylene vinyl acetate, ethylene acrylic acid, ethylene methacrylic acid, ionomers.

(Ch 21 Potter, Ch 4 Jenkins and Ch 7 Coles)
PRINCIPLES OF FOOD SCIENCE

PRACTICAL

1. Estimation of reducing sugar by Fehlings procedure
2. Estimation of salt content in brine
3. Estimation of salt content in butter
4. Preparation of brix solution and checking by hand refractometer
5. Application of collioidal chemistry to food preparation
6. Demonstration of the Soxhlet method for determination of fat content
7. Determination of acidity of water
8. Determination of alkalinity/hardness of water
9. Demonstration of the Kjeldahl’s method for estimation of protein content

Recommended Readings

4. Frazier WC and Westhoff DC, Food Microbiology, TMH Publication, New Delhi, 2004

Core Course 3: TECHNOLOGY OF FOOD PRESERVATION
(CREDITS: THEORY – 4 PRACTICAL - 2)

THEORY

Objectives:

- To study the importance microorganisms in food preservation
- To introduce the basics of various food processing and preservation technologies.

CONTENTS

Unit 1 Food Microbiology (10 lectures)

Unit II Food Preservation by Low temperature (10 lectures)

Freezing and Refrigeration: Introduction to refrigeration, cool storage and freezing, definition, principle of freezing, freezing curve, changes occurring during freezing, types of freezing i.e. slow freezing, quick freezing, introduction to thawing, changes during thawing and its effect on food.

Unit III Food Preservation by high temperature (8 lectures)

Thermal Processing- Commercial heat preservation methods: Sterilization, commercial sterilization, Pasteurization, and blanching.

Unit IV Food Preservation by Moisture control

Drying and Dehydration - Definition, drying as a means of preservation, differences between sun drying and dehydration (i.e. mechanical drying), heat and mass transfer, factors affecting rate of drying, normal drying curve, names of types of driers used in the food industry. (9 lectures)

Evaporation – Definition, factors affecting evaporation, names of evaporators used in food industry. (4 lectures)

Unit V Food Preservation by Irradiation

Introduction, units of radiation, kinds of ionizing radiations used in food irradiation, mechanism of action, uses of radiation processing in food industry, concept of cold sterilization. (7 lectures)

TECHNOLOGY OF FOOD PRESERVATION

PRACTICAL

1. Methods of Sampling.
2. Concept of shelf life of different foods
3. To study the concept of Asepsis and sterilization
4. Determination of pH of different foods using pH meter.
5. Study quality characteristics of foods preserved by drying/dehydration/ freezing.
6. To perform pasteurization of fluids using different methods.
7. To perform blanching of different plant foods.
Recommended Readings

1. B. Srilakshmi, Food science, New Age Publishers,2002
4. Frazier WC and Westhoff DC, Food Microbiology, TMH Publication, New Delhi, 2004

Core Course 4: FOOD PROCESSING TECHNOLOGY
(CREDITS: THEORY – 4 PRACTICAL - 2)

THEORY

Objectives:
To impart basic knowledge of:
1. Cold Preservation and freezers
2. Dehydration
3. Irradiation
4. Food Packaging
5. Thermal Processing

FOOD PROCESSING OPERATIONS:

UNIT 1 Cold preservation (4 lectures)
- Freezing: requirements of refrigerated storage - controlled low temperature, air circulation and humidity, changes in food during refrigerated storage, progressive freezing, changes during freezing – concentration effect and ice crystal damage, freezer burn. Refrigeration load, factors determining freezing rate-food composition and non compositional influences

(Ch 9, Potter)

UNIT 2 Freezing- Mechanism and freezers (6 lectures)
- Freezing methods - direct and indirect, still air sharp freezer, blast freezer, fluidized freezer, plate freezer, spiral freezer and cryogenic freezing.

(Ch 9, Potter)

UNIT 3 Dehydration (10 lectures)
- 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, spray dryer, drum dryer, vacuum dryer, freeze drying, foam mat drying.

(Ch 10, Potter)
UNIT 4 Food Irradiation and Microwave Heating (7 lectures)

- Ionizing radiation and sources, unit of radiations, direct and indirect radiation effects, safety and wholesomeness of irradiated food. Microwave heating and application.

(Ch 11, Potter)

UNIT 5 Packaging of foods (8 lectures)

- Packaging: Properties of packaging material, factors determining the packaging requirements of various foods and brief description of packaging of frozen products, dried products, fats and oils and thermally processed foods

(Ch 1, 9-12, Paine and Paine)

UNIT 6 Material handling (3 lectures)

- Elementary concept of material handling in food industry, equipment and functioning of belt conveyor, screw conveyor, bucket elevator and pneumatic conveyor.

(Ch 26, Rao)

UNIT 7 Thermal processing (5 lectures)

- Introduction, classification of Thermal Processes, Principles of thermal processing, Thermal resistance of microorganisms, Thermal Death Time, Lethality concept, characterization of heat penetration data, Thermal process Calculations

(Ch 3, Ramaswamy)

UNIT 8 Separation processes (5 lectures)

- Principles and methods of: distillation, extraction, washing, filtration, sedimentation, sieving and centrifugation

(Ch 13, 14 Toledo)

**FOOD PROCESSING TECHNOLOGY**

**PRACTICAL**

1. Comparison of conventional and microwave processing of food
2. Preservation of food by the process of freezing
3. Drying of food using Tray dryer/other dryers
4. Preservation of food by canning(Fruit/Vegetable/meat)
5. Cut-out analysis of canned food
6. Osmotic dehydration
7. Minimal Processing
8. Testing of Packaging material

Recommended Readings

1. Desrosier NW and Desrosier JN, The Technology of Food Preservation, CBS Publication, New Delhi, 1998
3. Potter NH, Food Science, CBS Publication, New Delhi, 1998

Core Course 5 : FOOD AND NUTRITION
(CREDITS: THEORY – 4 PRACTICAL - 2)

THEORY

Objectives :

This course will enable the student to:

- Understand the relationship between food, nutrition and health.
- Understand the functions of food.
- Learn about various food groups and balanced diet.
- Understand digestion, absorption and function of various nutrients and their sources.

CONTENTS

UNIT I: INTRODUCTION TO FOOD AND NUTRITION (2 lectures)

Basic terms used in study of food and nutrition, BMI and Nutritional Status, Understanding relationship between food, nutrition and health.

UNIT II: BALANCED DIET (3 lectures)

Functions of food-physiological, psychological and social, Concept of Balanced Diet, Food Groups, Food Pyramid.
UNIT III: NUTRIENTS  
(37 lectures)

Classification, digestion, functions, dietary sources, RDA, clinical manifestations of deficiency and excess and factors affecting absorption of the following in brief:

- Energy
- Carbohydrates, lipids and proteins
- Fat soluble vitamins-A, D, E and K
- Water soluble vitamins – thiamin, riboflavin, niacin, pyridoxine, folate, vitamin B12 and vitamin C
- Minerals – calcium, iron, iodine, fluorine, copper and zinc

UNIT IV: CONCEPTS OF MEAL PLANNING  
(2 lectures)

Factors affecting meal planning, understanding specific considerations for planning meal for different groups of people.

UNIT V: METHODS OF COOKING  
(2 lectures)

Dry, moist, frying and microwave cooking, Advantages, disadvantages and the effect of various methods of cooking on foods.

UNIT VI: NUTRITIONAL LABELING  
(2 lectures)

Importance, global trends, codex guidelines, nutritional labelling in India, FSSAI guidelines.

Recommended Readings

6. Food Safety and Standards Authority of India portal, Government of India
CONTENTS

1. Identification of food sources for various nutrients using food composition tables.
2. Record diet of self using 24 hour dietary recall and its nutritional analysis.
3. Introduction to meal planning, concept of food exchange system.
4. Planning of meals for adults of different activity levels for various income groups.
5. Planning of nutritious snacks for different age and income groups.
6. Preparation of nutritious snacks using various methods of cooking.
7. Nutritional labeling of food products.
8. Estimation of BMI and other nutritional status parameters.

RECOMMENDED READINGS


Core Course 6 : TECHNOLOGY OF FRUITS, VEGETABLES AND PLANTATION CROPS
(CREDITS: THEORY – 4 PRACTICAL - 2)

THEORY

Objectives

1. To impart knowledge of different methods of fruits and vegetable processing.
2. To learn about processing of various spices, tea, coffee and cocoa.

CONTENTS

TECHNOLOGY OF FRUITS AND VEGETABLES:
UNIT 1 INTRODUCTION (3 Lectures)
Importance of fruits and vegetable, history and need of preservation, reasons of spoilage, method of preservation (short & long term). (Chapter 1–Girdharilal).

UNIT 2 CANNING AND BOTTLING OF FRUITS AND VEGETABLES (8 Lectures)
Selection of fruits and vegetables, process of canning, factors affecting the process- time and temperature, containers of packing, lacquering, syrups and brines for canning, spoilage in canned foods. (Chapter 2–7–Girdharilal)

UNIT 3 FRUITS BEVERAGES (7 Lectures)
Introduction, Processing of fruit juices (selection, juice extraction, deaeration, straining, filtration and clarification), preservation of fruit juices (pasteurization, chemically preserved with sugars, freezing, drying, tetra-packing, carbonation), processing of squashes, cordials, nectars, concentrates and powder. (Chapter 9–Girdharilal).

UNIT 4 JAMS, JELLIES AND MARMALADES (6 Lectures)
Introduction, Jam: Constituents, selection of fruits, processing & technology, Jelly: Essential constituents( Role of pectin, ratio), Theory of jelly formation, Processing & technology, defects in jelly, Marmalade: Types, processing & technology, defects. (Chapter 11–Girdharilal).

UNIT 5 PICKLES, CHUTNEYS AND SAUCES (5 Lectures)
Processing, Types, Causes of spoilage in pickling. (Chapter 14–Girdharilal).

UNIT 6 TOMATO PRODUCTS (4 Lectures)
Selection of tomatoes, pulping & processing of tomato juice, tomato puree, paste, ketchup, sauce and soup. (Chapter 13–Girdharilal).

UNIT 7 DEHYDRATION OF FOODS AND VEGETABLES (4 Lectures)
Sun drying & mechanical dehydration, process variation for fruits and vegetables, packing and storage. (Chapter 16–Girdharilal).

TECHNOLOGY OF PLANTATION PRODUCTS: 13

UNIT 8 SPICES (6 Lectures)
Processing and properties of major and minor spices, essential oils & oleoresins, adulteration. (Chapter 20–Manay).

UNIT 9 TEA, COFFEE AND COCOA (5 Lectures)
Processing, Variety and Products. (Chapter 12–Manay).

TECHNOLOGY OF FRUITS, VEGETABLES AND PLANTATION CROPS

PRACTICAL

CONTENTS
1. Estimation of total soluble solids (TSS).
2. Estimation of pH and acidity of products.
3. Estimation of brix: acidity ratio
4. Estimation of ascorbic acid and effect of heat treatment on it.
5. To study the steps of can making process.
6. Preparation and evaluation of pectin products.
7. Adulteration of spices.
8. Dehydration of fruits and vegetables.
9. Rehydration of fruits and vegetables.

**Recommended Readings**


**Core Course 7 : TECHNOLOGY OF DAIRY AND SEA FOOD**

*(CREDITS: THEORY – 4 PRACTICAL - 2)*

**THEORY**

**Objectives**

- To know the need and importance of dairy and fishery industry
- To know the compositional and technological aspects of milk and fish.
- To study processed milk and fish products.

**CONTENTS**

**UNIT I  Introduction**

(2 Lectures)

Status of fishery industry in India.

**UNIT 2  Chilling and Freezing of fish**

(3 Lectures)
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 3 Fish Curing and Smoking  
(8 lectures)

Drying and salting of fish, water activity and shelf-life, salting process, salting methods (brining, pickling, kench curing, gaspe curing), types of salts, dried and salted fish products- pindang, fishwood, dried shrimp. Preservation by smoking, smoke production, smoke components, quality, safety and nutritive value of smoked fish, processing and equipment, pre-smoking processes, smoking process control. Traditional chimney kiln, modern mechanical fish smoking kiln, examples of smoked and dried products.

UNIT 4 Canning of fish  
(4 lectures)

Principles of canning, classification based on pH groupings, effect of heat processing on fish, storage of canned fish, pre-process operations, post process operations, cannery operations for specific canned products. (Tuna, Mackerel, Sardine).

UNIT 5 Fishery by-products  
(6 lectures)

Surimi- Introduction, fish muscle proteins, the surimi process, traditional and modern surimi production lines, quality of surimi products, comparison of surimi and fish mince products. 

*(Ch- 3 Hall)*

Fish protein concentrates (FPC), fish protein extracts (FPE), fish protein hydrolysis (FPH)

UNIT 6 Fermented fish  
(2 Lectures)

Flowchart of Indigenous products- Fish sauce and Paste

UNIT 7 Concept of other Sea foods  
(2 lectures)

Crabs, lobsters, prawns, shrimps, shell- fish.

TECHNOLOGY OF MILK AND MILK PRODUCTS

UNIT 8 Physical properties of milk  
(2 Lectures)

Color, taste, pH and buffering capacity, refractive index, viscosity, surface tension, freezing, boiling point, specific heat, OR, electrical conductivity.

*(Chapter 1 of Outlines of dairy technology by Sukumar De)*

UNIT 9 Lactose  
(1 Lecture)

Lactose (alpha and beta forms and their differences)  
Significances of lactose in dairy industry.
UNIT 10  Milk fat  (5 Lectures)
Composition and structure, factors affecting melting point, boiling point, solubility and Refractive Index, fat constants (saponification value, iodine value, RM value, Polenske value, peroxide value).
Chemical reactions of fat (hydrolysis, auto-oxidation), condition favouring auto-oxidation, prevention, measurement of auto-oxidation.
(Chapter 4 of Fundamentals of dairy chemistry by Webb & Johnson)

UNIT 11 Protein and Enzymes  (5 Lectures)
General structure, amphoteric nature, difference between casein and serum protein, different types of casein (acid and rennet), uses of casein, fractionation of protein.
Enzymes- catalase, alkaline phosphatase, lipases and proteases.
(Chapter 3 of Fundamentals of dairy chemistry by Webb & Johnson)

UNIT 12 Market milk industry and milk products  (5 Lectures)
Systems of collection of milk
Reception, Platform testing
Various stages of processing
- Filtration, Clarification
- Homogenization
- Pasteurization

Description and working of clarifier, cream separator, homogenizer and plate heat exchanger.

Flow diagram of following milk products –  (6 Lectures)
Butter, ghee, flavored milk, yoghurt, dahi, shrikhand, ice-cream, condensed milk, milk powder, channa, paneer, cheese (cheddar).
(Chapter 1-11 of Outlines of dairy technology by Sukumar De)

TECHNOLOGY OF DAIRY AND SEAFOOD

PRACTICAL

CONTENT
1. To perform platform tests in milk (Acidity, COB, MBRT, specific gravity, SNF).
2. To estimate milk protein by Folin method.
3. To estimate milk fat by Gerber method.
5 To prepare casein and calculate its yield.
6 Quality evaluation of fish/prawn.
7 Subjective evaluation of Fresh Fish.
8 Cut out examination of canned fish.(Sardine,Mackerel,Tuna)
9 Fish product formulation/canning.

Recommended Readings


Core Course 8: TECHNOLOGY OF CEREALS, PULSES AND OILSEEDS
(CREDITS: THEORY – 4 PRACTICAL - 2)

THEORY

Objectives
- To teach technology of milling of various cereals
- To impart technical knowhow of pulses and oilseeds refining

CONTENTS

UNIT 1 TECHNOLOGY OF CEREALS
Introduction (chap 1,2&3, Kent) (2 lectures)
Wheat --Types, milling, flour grade, flour treatments (bleaching, maturing), flour for various purposes, Products and By-products. (Chap 4,6,7,8&9, Kent) (7 lectures)
Rice – Physicochemical properties, milling (mechanical & solvent extraction), parboiling, ageing of rice, utilization of by products. (Chap 15, Kent) (6 lectures)
Corn – Milling (wet & dry), cornflakes, corn flour (Chap 16,Kent) (4 lectures)
Barley- Milling(pearl barley, barley flakes & flour) (Chap 12, Kent) (3 lectures)
Oats – Milling (oatmeal,oatflour & oatflakes) (chap 13, Kent) (3 lectures)
Sorghum and millets – Traditional & commercial milling (dry & wet) (4 lectures)
(Chap 17, Kent)
Rye and triticale—milling (flour), uses (Chap 14, Kent) (2 lectures)

UNIT 2 TECHNOLOGY OF PULSES (Chap 13, Chakraverty) (4 lectures)
Milling of pulses, Dry milling, Wet milling, Improved milling method

UNIT 3 TECHNOLOGY OF OILSEEDS (Chap 14, 15, 16, Chakraverty) (9 lectures)
Introduction, Extraction of oil and refining, Sources of protein (defatted flour, protein concentrates and isolates), properties and uses, protein texturization, fibre spinning

UNIT 4 ALCOHOLIC BEVERAGES (Chap 12.6, Manay) (4 lectures)
Beer, Wine, Distilled Spirits

TECHNOLOGY OF CEREALS, PULSES AND OILSEEDS
PRACTICAL

CONTENTS
1. Physical characteristics of Wheat.
2. Estimation of Gluten Content of flour.
5. Fermenting power of yeast.
6. Physical Characteristics of Rice and paddy.
7. Cooking characteristics of rice.
8. Determination of sedimentation power of flour

Recommended Readings:

Core Course 9: FOOD MICROBIOLOGY
(CREDITS: THEORY – 4 PRACTICAL - 2)

THEORY

Objectives
- To know the important genera of microorganisms associated with food and their characteristics.
• To understand the role of microbes in fermentation, spoilage and food borne diseases.

CONTENTS

UNIT 1. Introduction to Food Microbiology (3 Lectures) (Chapter 1, Garbutt, Chapter 1, Pelczar et.al)
• History and Development of Food Microbiology
• Definition and Scope of food microbiology
• Inter-relationship of microbiology with other sciences

UNIT 2. Characteristics of Microorganisms in Food (5 Lectures) (Chapter 1, Jay)
• Types of microorganisms associated with food, their morphology and structure
• Significance of spores in food microbiology

UNIT 3. Microbial Growth in Food (4 Lectures) (Chapter 4 and 6, Garbutt)
• Bacterial growth curve and microbial growth in food
• Factors affecting the growth of microorganisms in food

UNIT 4. Microbial Food Spoilage (8 Lectures) (Part 3, Frazier and Westhoff, Chapter 8, Garbutt)
• Sources of Microorganisms in foods
• Some important food spoilage microorganisms
• Spoilage of specific food groups- Milk and dairy products, Meat, poultry and seafoods, Cereal and cereal products, Fruits and vegetables and Canned products

UNIT 5. Food Fermentations (8 Lectures) (Part 4, Frazier and Westhoff, Chapter 10, Garbutt)
• Fermentation—definition and types
• Microorganisms used in food fermentations
• Dairy Fermentations-starter cultures and their types, concept of probiotics, Fermentated Foods-types, methods of manufacture for vinegar, sauerkraut, tempeh, miso, soya sauce, beer, wine and traditional Indian foods

UNIT 6. Foodborne Diseases (3 Lectures) (Chapter 9, Garbutt)
• Types—foodborne infections, foodborne intoxications and toxiiinfections
UNIT7. Cultivation of Micro-organisms (6 Lectures)(Chapter 5, Garbutt)

- Pure culture technique
- Methods of isolation and cultivation
- Enumeration of Microorganisms- qualitative and quantitative

UNIT8. Control of Microorganisms in Foods (8 Lectures) (Part 2, Frazier)

- Principles and methods of preservation
- Physical Methods of Food Preservation- Dehydration, Freezing, Cool Storage, Heat Treatment (esp.thermobacteriology), Irradiation,
- Biopreservatives esp. Bacteriocins
- Introduction to Hurdle concept and Non Thermal methods

UNIT9. Trends in Food Microbiology (3 Lectures) (Chapter 11, Garbutt)

- Rapid Methods of Detection
- Recent Advances

FOOD MICROBIOLOGY

PRACTICAL

CONTENTS
1. Introduction to the Basic Microbiology Laboratory Practises and Equipments
2. Functioning and use of compound microscope
3. Cleaning and sterilization of glassware
4. Preparation and sterilization of nutrient broth
5. Cultivation and sub-culturing of microbes
6. Preparation of slant, stab and plates using nutrient agar
7. Morphological study of bacteria and fungi using permanent slides
8. Simple staining
9. Gram’s staining
10. Standard Plate Count Method

Recommended Readings
1) Frazier William C and Westhoff, Dennis C. Food Microbiology, TMH, New Delhi, 2004
2) Jay, James M. Modern Food Microbiology, CBS Publication, New Delhi, 2000
Core Course 10: TECHNOLOGY OF MEAT, POULTRY AND EGG
(CREDITS: THEORY – 4 PRACTICAL - 2)

THEORY

Objectives:

• To understand need and importance of livestock, egg and poultry industry
• To study structure, composition and nutritional quality of animal products.
• To study processing and preservation of animal foods.
• To understand technology behind preparation of various animal food products and by-product utilization.

CONTENTS

UNIT 1 Introduction (2 lectures)

Livestock and poultry population in India, Development of meat and poultry industry in India and its need in nation’s economy, Glossary of live market terms for animals and birds. (Misc. Internet)

UNIT 2 Meat quality (4 Lectures)

Effects of feed, breed and environment on production of meat animals and their quality
Meat Quality-color, flavor, texture, Water-Holding Capacity(WHC), Emulsification capacity of meat Chapter 13,14 Shai Barbut

UNIT 3 Slaughter process (8 lectures)

Slaughter, inspection and grading, Antemortem examination of meat animals, slaughter of buffalo, sheep/goat, poultry, pig A Generic HACCP model, dressing of carcasses, post-mortem examination of meat Chapter 4,12 Shai Barbut

UNIT 4 Preservation of meat (10 lectures)

Refrigeration and freezing, thermal processing- canning of meat, retort pouch, dehydration, irradiation, and RTE meat products, meat curing. Sausages-processing, types and defects

UNIT 5 By-products (3 lectures)
Importance, classification and uses, Manufacture of Natural casings

UNIT 6 Egg Industry and Egg Production Practices (12 lectures)

The egg industry, its techniques of working, General management, structure, composition and nutritive value of egg and its products.

UNIT 7 Preservation of eggs (6 lectures)
Refrigeration and freezing, thermal processing, dehydration, coating. Chapter 11 and 14, Stadelman

UNIT 8 Quality identification of shell eggs (3 lectures)
Factors affecting egg quality and measures of egg quality.

TECHNOLOGY OF MEAT, POULTRY AND EGG

PRACTICAL

CONTENTS

1) Estimation of moisture content of meat
2) Cutout analysis of canned meats/retort pouches
3) Estimation of protein content of meat
4) Analysis of frozen meat/meat emulsion products
5) To study shelf-life of eggs by different methods of preservation
6) Evaluation of eggs for quality parameters(market eggs,branded eggs)
7) To perform freezing of yolk/albumen
8) Meat/Egg product formulation

Recommended Readings

2) Parkhurst & Mountney, Poultry Meat and Egg Production, CBS Publication, New Delhi, 1997
3) Pearson & Gillet Processed Meats,3 Ed, CBS Publication, New Delhi, 1997
4) Shai Barbut, Poultry Products Processing,CRC Press 2005
Core Course 11 : FOOD ENGINEERING
(CREDITS: THEORY – 4 PRACTICAL - 2)

THEORY

Objectives:
1) To understand the principle of Unit operation
2) To acquaint with fundamentals of food engineering and its process
3) To understand the basics of designing of food plant and systems

CONTENTS

UNIT 1- Introduction (Singh and Heldman 2003) (2 Lectures)
• Concept of Unit operation,
• Units and dimensions, Unit conversions, dimensional analysis
• Mass and Energy Balance.
• Related numericals

UNIT 2- Design of food plant (Rao 2010) (2 Lectures)
• Important considerations for designing of food plants
• Types of layout

UNIT 3 – Grinding and mixing (Fellow 1988) (2 Lectures)
• Principle and equipments used in food industry

UNIT 4 - Fluid Flow in food Processing (Singh and Heldman 1993) (8 Lectures)
• Liquid Transport systems
• Properties of Liquids
• Newton’s Law of Viscosity
• Principle of Capillary tube and rotational viscometer
• Properties of Non-Newtonian fluids,
• Flow characteristics, Reynolds Number, Bernoulli”s Equation
• Concept of Flow Measurement devices
• Related basic numericals

UNIT 5 – Refrigeration and Freezing (Singh and Heldman 2003) (8 Lectures)
• Concept and selection of a refrigerant
• Description of a Refrigeration cycle
• Pressure Enthalpy charts and Tables
• Mathematical expressions useful in analysis of vapour compression refrigeration cycle
• Numericals based on VCR system, Freon 12 and R-717, superheating and sub cooling
• Freezing time calculation using Plank’s Equation
• Frozen food storage
• Related basic numericals

UNIT 6 – Heat and Mass Transfer (Singh and Heldman 2003) (12 Lectures)
• Systems for heating and cooling food products
• Thermal Properties of Food
• Modes of heat transfer
• Application of steady state heat transfer- estimation of conductive heat transfer coefficient, convective heat transfer coefficient, overall heat transfer coefficient
• Fick’s Law of Diffusion
• Membrane separation systems-Electrodialysis system, Reverse Osmosis
• Membrane System, and Ultrafiltration Membrane System
• Membrane devices used for RO and UF: Plate and Frame, Tubular, Spiral wound and hollow fiber devices.

UNIT 7 - Psychrometrics (Singh and Heldman 2003) (4 Lectures)
• Properties of Dry Air
• Properties of Water Vapour
• Properties of air Vapour mixture
• Psychrometric Chart
• Related basic numericals

UNIT 8- Steam, Evaporation and Dehydration (Singh and Heldman 1993, Rao 2006) (10 Lectures)
• Generation of steam
• Construction and functions of fire tube and water tube boilers
• Thermodynamics of Phase change
• Steam tables
• Boiling point elevation
• Types of evaporations
• Design of single effect evaporators
• Basic Drying Process
• Moisture content on wet basis and dry basis
• Dehydration systems
• Dehydration system Design.
• Related basic numericals

FOOD ENGINEERING

PRACTICAL
CONTENTS

1. Plant layout design
2. Determination of drying characteristics
3. Determination of viscosity of Newtonian and non Newtonian fluids
4. Study of effect of temperature on viscosity
5. Screen analysis of food sample
6. Study of evaporation process
7. Freezing time calculation
8. Psychrometrics- use and application.

Recommended Readings
4) Fellow P. 1988 Food processing technology

Core Course 12 : FOOD CHEMISTRY – I
(CREDITS: THEORY – 4 PRACTICAL - 2)

THEORY
Objectives:
• To understand the chemistry of foods - composition of food, role of each component and their interaction.
• To understand the functional aspects of food components and to study their role in food processing.

CONTENTS

UNIT 1. Introduction to Food Chemistry (1 Lecture)Chapter-1-3, Potter
• Definition
• Composition of food

UNIT 2. Water (8 Lectures) Chapter-1, DeMan
• Definition of water in food
• Structure of water and ice
• Types of water
• Sorption phenomenon
• Water activity and packaging
• Water activity and shelf-life

UNIT 3. Lipids (9 Lectures) Chapter-2, DeMan

• Classification of lipids
• Physical properties-melting point, softening point, specific gravity, refractive index, smoke, flash and fire point, turbidity point.
• Chemical properties-reichert meissel value, polenske value, iodine value, peroxide value, saponification value.
• Effect of frying on fats
• Changes in fats and oils- rancidity, lipolysis, flavor reversion
• Auto-oxidation and its prevention
• Technology of edible fats and oils- Refining, Hydrogenation and Interesterification, Fat Mimetics

UNIT 4. Proteins (10 Lectures)

Chapter-3, DeMan

• Protein classification and structure
• Nature of food proteins (plant and animal proteins)
• Properties of proteins (electrophoresis, sedimentation, amphotericism and denaturation,)
• Functional properties of proteins eg. organoleptic, solubility, viscosity, binding gelation / texturization, emulsification, foaming.

UNIT 5. Carbohydrates (9 Lectures)

Chapter-4, DeMan

• Classification (mono, oligo and poly saccharides)
• Structure of important polysaccharides (starch, glycogen, cellulose, pectin, hemicellulose, gums)
• Chemical reactions of carbohydrates –oxidation, reduction , with acid & alkali
• Modified celluloses and starches

UNIT 6. Vitamins (7 Lectures)

Chapter-9, DeMan

• Structure , Importance and Stability
• Water soluble vitamins
• Fat soluble vitamins

UNIT 7. Flavour (6 Lectures)

Chapter-7, DeMan
• Definition and basic tastes
• Chemical structure and taste
• Description of food flavours
• Flavour enhancers

FOOD CHEMISTRY – I

PRACTICAL

CONTENTS
1. Preparation of primary and secondary solutions
2. Estimation of moisture content
3. Determination of gelatinization temperature range (GTR) of different starches and effect of additives on GTR.
4. Determination of refractive index and specific gravity of fats and oils.
5. Determination of smoke point and percent fat absorption for different fat and oils.
6. Determination of percent free fatty acids
7. Estimation of saponification value

Recommended Readings:
2. Whitehurst and Law, Enzymes in Food Technology, CRC Press, Canada, 2002

Core Course 13: FOOD CHEMISTRY – II
(CREDITS: THEORY – 4 PRACTICAL - 2)

THEORY
Objectives:
• To understand the chemistry of food components and their interactions.
• To know about the role of enzymes and various processing treatments in food industry.
• To understand the concept of new product development.

CONTENTS
UNIT 1  **Minerals** (4 Lectures) (Chap. 5, deMan)
- Major and minor minerals
- Metal uptake in canned foods
- Toxic metals

UNIT 2  **Natural Food Pigments** (8 Lectures)
- Introduction and classification
- Food pigments (chlorophyll, carotenoids, anthocyanins and flavonoids, beet pigments, caramel)

UNIT 3  **Browning Reactions In Food** (8 Lectures) (Chap.9, Fennema)
- Enzymatic browning
- Non – Enzymatic browning
- Maillard reaction
- Caramelization reaction
- Ascorbic acid oxidation

UNIT 4  **Enzymes** (10 Lectures) (Chap.13, Fennema)
- Introduction, classification
- General characteristics
- Enzymes in food processing
- Industrial Uses of Enzymes
- Immobilized enzymes

UNIT 5  **Physico-chemical and nutritional changes occurring during food processing treatments** (10 Lectures) (Chap. 10 deMan and Chap.1, Whitehurst and Law)
- Drying and dehydration
- Irradiation
- Freezing
- Canning

UNIT 6  **New product development** (8 Lectures) (Chap. 1 Desrosier and Desrosier)(Chap. 1, Fuller)
- Definition
- Importance
- Need of product development
- Steps of product development
- Product development tools
- Reasons for failure
FOOD CHEMISTRY – II

PRACTICAL

CONTENTS
1. Estimation of total ash
2. Estimation of minerals - demo
3. Determination of thermal inactivation time of enzymes in fruits and vegetables.
4. Estimation of iodine value
5. Estimation of peroxide value
6. Determination of carotenoids w.r.t flour pigments.
7. Extend of non-enzymatic browning by extraction methods.
8. Introduction of the concept of new product development

Recommended Readings
5. Whitehurst and Law, Enzymes in Food Technology, CRC Press, Canada, 2002

Core Course 14 : FOOD QUALITY AND SENSORY EVALUATION
(CREDITS: THEORY – 4 PRACTICAL - 2)

THEORY

UNIT 1 Introduction to quality attributes of food (4 Lectures)
- Appearance, flavour, textural factors and additional quality factors.

UNIT 2 Gustation (10 Lectures)
- Introduction and importance of gustation
- Structure and physiology of taste organs- tongue, papillae, taste buds, salivary glands.
- Mechanism of taste perception
- Chemical dimensions of basic tastes- sweet, salt, sour, bitter and umami
- Factors affecting taste quality, reaction time, taste modification, absolute and recognition threshold
- Taste measurement- Electronic Tongue
- Taste abnormalities

UNIT 3  Olfaction  (10 Lectures)

- Introduction, definition and importance of odour and flavor
- Anatomy of nose, physiology of odour perception
- Mechanism of odour perception
- Theories of odour classification, chemical specificity of odour.
- Odour measurement techniques – historical perspective and emphasis on recent techniques- e- nose etc.
- Olfactory abnormalities

UNIT 4  Colour  (10 Lectures)

- Introduction and importance of colour
- Dimensions of colour and attributes of colour; gloss etc.
- Perception of colour.
- Colour Measurement: Munsell colour system, CIE colour system, Hunter colour system, etc.
- Colour abnormalities

UNIT 5  Texture  (14 Lectures)

- Introduction, definition and importance of texture
- Phases of oral processing
- Texture perception, receptors involved in texture perception
- Rheology of foods
- Texture classification
- Texture measurement – basic rheological models, forces involved in texture measurement and recent advances in texture evaluation.
- Application of texture measurement in cereals, fruits and vegetables, dairy, meat and meat products

FOOD QUALITY AND SENSORY EVALUATION

PRACTICAL

CONTENT

1. Training of sensory panel.
2. To perform sensitivity tests for four basic tastes
3. To perform analytical and affective tests of sensory evaluation.
4. Recognition tests for various food flavors.
5. Sensory evaluation of milk and milk products.
6. Flavor defects in milk
7. Extraction of pigments from various fruits and vegetables and study the effect of temperature and pH
8. Texture evaluation of various food samples- cookies/ biscuits/ snack foods
9. Textural measurement of various food products using Texture Analyzer
10. Measurement of colour by using Tintometer/ Hunter Colour Lab etc.

Recommended Readings


DISCIPLINE SPECIFIC ELECTIVES

DSE 1: FOOD SAFETY  
(CREDITS: THEORY – 4 PRACTICAL - 2)

THEORY

Objectives
- To understand the following:
  - Food safety and hygiene
  - Types of hazards associated with food
  - Food regulations (national as well as international)
  - Design and implementation of food safety management systems such as ISO series, HACCP and its prerequisites such as GMP, GHP etc.
  - Emerging concerns

CONTENTS

UNIT 1 Introduction to Food Safety (3 Lectures) (Chap.1, Forsythe)

- Definition
- Types of hazards, biological, chemical, physical hazards
- Factors affecting Food Safety
- Importance of Safe Foods
UNIT 2 Food Hazards of Physical and Chemical Origin (5 Lectures) (Chap. 2, Lawley et. al)
- Introduction
- Physical Hazards with common examples
- Chemical Hazards (naturally occurring, environmental and intentionally added), Packaging material as a threat
- Impact on health
- Control measures

UNIT 3 Food Hazards of Biological Origin (7 Lectures) (Chap. 5, Forsythe and Chap. 2, Lawley et. al)
- Introduction
- Indicator Organisms
- Food borne pathogens: bacteria, viruses and eukaryotes
- Seafood and Shell fish poisoning
- Mycotoxins

UNIT 4 Management of hazards (5 Lectures) (Chap. 7, Forsythe)
- Need
- Control of parameters
- Temperature control
- Food storage

UNIT 5 Hygiene and Sanitation in Food Service Establishments (8 Lectures) (Chap. 1 Marriott)
- Introduction
- Sources of contamination
- Control methods using physical and chemical agents
- Waste Disposal
- Pest and Rodent Control
- Personnel Hygiene

UNIT 6 Food Safety Management Tools (8 Lectures) (Chap. 7, Forsythe)
- Basic concept
- Prerequisites- GHPs, GMPs,
- HACCP
- ISO series
- TQM - concept and need for quality, components of TQM, Kaizen.
• Risk Analysis
• Accreditation and Auditing

UNIT 7 Microbiological criteria (5 Lectures) (Chap. 8, Forsythe)
• Microbiological standards and limits (for processed food, water)
• Sampling
• Basic steps in detection of food borne pathogens
• Water Analysis

UNIT 8 Food laws and Standards (4 Lectures) (Chap. 10, Forsythe and FSSA act)
• Indian Food Regulatory Regime
• Global Scenario
• Other laws and standards related to food

UNIT 9 Recent concerns (3 Lectures) (Chap 1, Rawley et. Al and Chap. 1, De Vries)
• New and Emerging Pathogens
• Genetically modified foods \ Transgenics
• Organic foods
• Newer approaches to food safety

FOOD SAFETY

PRACTICAL

CONTENTS
1. Preparation of different types of media (complex, differential and selective)
2. Enumeration of aerial microflora using PDA
3. Identification of Molds by lactophenol blue staining
4. Negative Staining
5. Microbiological Examination of food
6. Bacteriological Analysis of Water by MPN method
7. Assessment of surface sanitation by swab and rinse method
8. Assessment of personal hygiene

Recommended Readings
1. Lawley, R., Curtis L. and Davis, J. The Food Safety Hazard Guidebook, RSC publishing, 2004

**DSE 2: FOOD QUALITY MANAGEMENT**  
(CREDITS: THEORY – 4 PRACTICAL - 2)

**THEORY**

**Objectives:**

- To learn about quality management in food production chain.
- To learn about physical, chemical contaminants in foods
- To learn about latest trends and techniques in food science
- To understand the significance of safe processing of foods.

**CONTENTS**

**UNIT 1 Food Quality Management (Ch-1, Pieterm) (10 Lectures)**

- Introduction to food quality management – Definition of quality, quality concepts, quality perception, quality attributes.
- Concepts of quality management: Objectives, importance and functions of quality control and quality assurance; Quality management systems in India
- Quality in the Agri- food production chain- Techno- managerial approach, food quality relationship and food quality management functions. Dynamics on the agri- food production chain, core developments in food quality management.

**UNIT 2 Contamination in Food Chain (Ch-11, DeMan) (10 lectures)**

- Contamination in Food: Physical, chemical contaminants (heavy metals, pesticide residues, antibiotics, agrochemicals, veterinary drug residues, environmental pollutants, radionucleides, solvent residues, chemicals) and Natural toxins.
- Contaminants formed during processing & packaging – nitrosamines, acrylamide, alloys, benzene, dioxins and furans, persistent organic pollutants, polymers, etc.
- Chemicals from processing such as fumigants, autoxidation products, carcinogens in smoked foods.; intentional and unintentional additives.
UNIT 3 Food Additives (Ch-11, DeMan, Barren-Ch 1,2, 3,4,5,6,8,9,15,17) (14 Lectures)

- Chemical, technological and toxicological aspects
- Risk assessment studies- Safety and quality evaluation of additives and contaminants, Acute and chronic studies, NOEL, ADI, LD₅₀
- Introduction, need of food additives in food processing and preservation. Characteristics and classification of food additives.
- Antimicrobial agents. -Nitrites, sulphides, sulphur dioxide, sodium chloride, hydrogen peroxide.
- Antioxidants - Introduction, mechanism of action, natural and synthetic antioxidants, technological aspect of antioxidants.
- Sweeteners- Introduction, importance, classification- natural and artificial, chemistry, technology and toxicology, consideration for choosing sweetening agents.
- Colors- Introduction, importance, classification- natural, artificial, and natural identical, FD&C Dyes and Lakes. Use of plant tissue culture, polymeric colors etc for color

UNIT 4 Basic principles and application of processing techniques (14 Lectures)

- High fructose corn syrup, cryogenic freezing, supercritical fluid extraction, fat mimetics, flavour encapsulation, use of nano technology in foods etc.

FOOD QUALITY MANAGEMENT

PRACTICAL

CONTENT

1. Qualitative tests for hydrogenated fats, butter, and ghee.
2. Quality inspection of various food stuffs- cereals, pulses, spices and condiments etc.
3. Estimation of sulphur dioxide in foods
5. Analysis of edible common salt for moisture content, MIW and total chlorides.
7. Estimation of benzoic acid/ sorbic acid in foods.

Recommended Readings

2. Brannen and et al., Food Additives, Marcel Dekker, New York, 1990
DSE 3: BAKERY TECHNOLOGY
(CREDITS: THEORY – 4 PRACTICAL - 2)

THEORY

Objectives
• To understand the fundamentals of baking
• To learn the technologies behind bakery products.
• To understand industry trends

CONTENTS

UNIT-I BAKERY INDUSTRY (8 lectures)
Current status, growth rate, and economic importance of Bakery Industry in India. Product types, nutritional quality and safety of products, pertinent standards & regulations.

UNIT II BREAD, BUNS AND PIZZA BASE (10 lectures)
Ingredients & processes for breads, buns, pizza base, Equipments used, product quality characteristics, faults and corrective measures

UNIT III CAKES (10 lectures)
Ingredients & processes for cakes, Equipments used, product quality characteristics, faults and corrective measures. Different types of icings.

UNIT IV BISCUITS, COOKIES & CRACKERS (10 lectures)
Ingredients & processes, Equipments used, product quality characteristics, faults and corrective measures.

UNIT VI MODIFIED BAKERY PRODUCTS (4 lectures)
Modification of bakery products for people with special nutritional requirements e.g. high fibre, low sugar, low fat, gluten free bakery products.

UNIT VII BREAKFAST CEREALS, MACARONI PRODUCTS AND MALT (6 lectures)
Production and quality of breakfast cereals, macaroni products and malt.

Recommended Readings:
BAKERY TECHNOLOGY

PRACTICAL

CONTENTS
1. Preparation of pizza base and assessment of its quality
2. Preparation of bread and assessment of its quality
3. Preparation of buns and assessment of quality
5. Preparation of sponge cake with icing and assessment of its quality.

Recommended Readings:

DSE 4: FOOD PACKAGING
(CREDITS: THEORY – 4 PRACTICAL - 2)

THEORY

Objectives:
• To impart comprehensive overview of the scientific and technical aspects of food packaging.
• To instill knowledge on packaging machinery, systems, testing and regulations of
unit packaging.

**Unit 1: Introduction to Food Packaging** (Chapter 1,2 Paine & Paine, 1992) (5 Lectures)
Packaging Functions and Requirements,, Printing of packages .Barcodes & other marking, Labeling Laws

**Unit 2: Food Packaging Materials** ( Chapter 6,7,8 Robertson, 2012 and Chapter7 Coles et al, 2003) (15 Lectures)
Paper and paper-based materials, corrugated fiber board (CFB).
Plastics, formation- Injection molding, Blow molding, Types of plastics, Lamination, Biodegradable plastics, Edible packaging and Bio-composites. Environmental Concerns-recycling and disposal of plastic waste
Metal packaging- Metals: Tinplate, tinning process, components of tinplate, tin free can (TFC) types of can, metallic films, lacquers
Glass: Composition, Properties, Methods of bottle making, Types of closures.

**Unit 3: Package Designing for Foods** (Chapter 7,8,9,10,11,13 Paine and Paine, 1992) (15 Lectures)
Package design for fresh horticultural produce and animal foods, dry and moisture sensitive foods, frozen foods, fats and oils, thermally processed foods and beverages.

**Unit 4: Testing and Regulatory Aspects of Food Packaging** ( Chapter 22 Robertson, 2012) (5 Lectures)
Testing Procedures for Packaging Materials- thickness, tensile strength, puncture resistance, bursting strength, seal strength, water vapor permeability, CO2 permeability, oxygen permeability, grease resistance,
Testing Procedures for Packaged Foods - Compatibility and shelf life studies, evaluation of transport worthiness of filled packages.
Food Packaging Laws and Regulations.

**Unit 5 Packaging Machinery and Systems**(Chapter 4 ,Paine & Paine, 1992,Coles et al, 2003) (8 Lectures)
Bottling machines, Cartoning systems, Seal and Shrink packaging machine; Form, Fill and Sealing machine (FFS).
Vacuum, Controlled and Modified atmosphere packaging systems; Aseptic packaging systems; Retort packaging, Active and Intelligent packaging systems

**Recommended Readings:**
2. Paine FA and Paine HY, A Handbook of Food Packaging, Blackie Academic and
Professional, 1992

FOOD PACKAGING

PRACTICAL

CONTENTS

1. Testing of physical/mechanical properties of food packaging material.
5. Edible packaging of Food Samples.
7. Packaged food cut-out analysis.
8. To study the operation of FFS machine.

Recommended Readings:
2. Paine FA and Paine HY, A Handbook of Food Packaging, Blackie Academic and Professional, 1992

DSE 5: NUTRACEUTICALS AND FUNCTIONAL FOODS
(CREDITS: THEORY – 4 PRACTICAL - 2)

THEORY

Objectives:
• To develop comprehensive understanding of different nutraceuticals and functional foods
• To understand the potential of various functional foods in promoting human health

CONTENTS

Unit 1: Introduction (8 lectures)
Background, status of nutraceuticals and functional food market, definitions, difference between nutraceuticals and functional foods, types of nutraceutical compounds and their health benefits, current scenario. (Ch 1 Wildman, 2001 and Journals)
Unit 2: Nutraceuticals (17 lectures)
Types of nutraceutical compounds – Phytochemicals, phytosterols and other bioactive compounds, peptides and proteins, carbohydrates (dietary fibers, oligosaccharides and resistant starch), prebiotics, probiotics and synbiotics, lipids (Conjugated Linoleic Acid, omega-3 fatty acids, fat replacers), vitamins and minerals; their sources and role in promoting human health. (Ch 2-10, 17-19, 25-27 Wildman, 2001 and Journals)

Unit 3: Functional Foods (17 lectures)

Unit 4: Legal Aspects (6 lectures)
Stability of nutraceuticals. Safety, Consumer acceptance and assessment of health claims, labeling, marketing and regulatory issues related to nutraceuticals and functional foods. (Ch 30-31 Wildman, 2001 and Journals)

Recommended readings:
4. Various journals of food technology, food science and allied subjects.

NUTRACEUTICALS AND FUNCTIONAL FOODS

PRACTICAL

CONTENTS

1. Identification of various nutraceuticals and functional foods available in the market
2. Estimation of chlorophyll content of green vegetable
3. Determination of lycopene in fruit/vegetable
4. Determination of total pectin in plant material
5. Estimation of crude fibre/dietary fibre content in cereals and their products
6. Estimation of anthocyanins in food sample
7. Preparation and evaluation of probiotic/prebiotic foods
Recommended Readings

**DSE 6: FOOD PLANT SANITATION**
(CREDITS: THEORY – 4 PRACTICAL - 2)

**THEORY**

**Objectives**
1. To study design of plant and processing equipment.
2. To develop comprehensive understanding of waste product handling and management.

**CONTENTS**

**UNIT 1 Food Plant Layout and Equipment Design** (Chapter -10,24,25 Rao, D. G. (2010))
(15 Lectures)
General principles of food plant Design and layout ,Design of food processing equipments :Size Reduction, mixing, separation, extraction, filtration, centrifugation, distillation and, gas absorption equipments.

**UNIT 2 Warehousing and Cold Chain Management** (Chapter1,13,23. James 2013) (15 Lectures)
Food hygiene and safety in transportation, with a focus on warehouse storage and refrigerated ships- Safe food storage at shopping outlets: use of coolers/chillers/freezers, length of time in storage ,Design of warehouses
Scope of Cold Chain for enhancing marketing potentials of perishables in domestic and international markets
Principles of Cold Chain Creation and Management.
Physicochemical changes in stored products during storage
Air tight, Non-air tight, Under ground, Conventional & Modern storage structures for fruits, vegetables, meat and marine products .
Aerated, refrigerated and controlled atmospheric storage.
Layout and Design of storage structures, economics of storage structures

**UNIT 3 Food Plant Hygiene and Sanitation** ( Chapter 5,6,7,8. Norman G. et al 2006) (18 Lectures)
Waste disposal, Control methods using Physical and Chemical Agents, Pest and Rodent Control, ETP Design and Layout. Food storage sanitation, transport sanitation and water sanitation.
By-products utilisation obtained from dairy plant, egg & poultry processing industry and meat industry.
Wastewater and solid waste treatment: - Waste-types-solid and liquid waste characterization, physical, chemical, biological, aerobic, anaerobic, primary, secondary and tertiary (advanced) treatments.

**Recommended Readings:**

**FOOD PLANT SANITATION**

**PRACTICAL**

**CONTENTS:**
1. Design and layout of various food processing systems and food service areas.
2. Design and layout of cold storage and warehouse.
3. Determination of physico-chemical properties of wastewater.
4. Preparation of a sanitation schedule for food preparation area.
5. Testing of sanitizers and disinfectants.
7. Determination of BOD (biological oxygen demand)/ COD in waste water.
8. Study of waste water treatment system/ETP.

**Recommended Readings:**

**SKILL ENHANCEMENT ELECTIVE COURSES**

**SEC 1: ENTREPRENEURSHIP DEVELOPMENT**

(CREDITS: THEORY – 2)
CONTENTS

UNIT I: ENTREPRENEURIAL DEVELOPMENT (10 lectures)
• Case studies of successful entrepreneurs
• Exercises on ways of sensing opportunities – sources of idea, creating efforts, SWOT Analysis
• Entrepreneurial skill assessment test
• Techniques of development of entrepreneurial skills, positive self image and locus of control

UNIT II: FOOD BUSINESS MANAGEMENT (14 lectures)
• Case studies of Food Processing Business and its aspects
• Business opportunity Identification and Assessment techniques
• Business Idea Generation and evaluation exercise
• Market Assessment study Analysis of competitive situation
• SWOT Analysis for business and for competitors
• Preparation of business plan
• Preparation of project report
• Methods of Arrangement of inputs – finance and material

Recommended Readings

SEC 2: FOOD PRODUCT DEVELOPMENT
(CREDITS: PRACTICAL - 2)

Objectives
• To understand the concept of development of a new product and prepare new products based on special dietary requirements, functionality, convenience and improvisation of existing traditional Indian foods.
PROJECTS

**Development of New Product** (Chapter-3,4,5,6,14,15,19,Anil Kumar et al. and Chapter 13,14Moskowitz and Saguy)
Definition, Importance, objectives & Need of product development, Reasons of failure, Types and Steps of product development, Product development Tools and their use

Projects on:
1. Market and literature survey to identify the concepts of new products based on special dietary requirements, functionality, convenience and improvisation of existing traditional Indian foods.
2. Screening of product concept on the basis of techno-economic feasibility.
3. Development of prototype product and Standardization of formulation process.
4. Proximate Analysis of New Product
5. Packaging, labeling and shelf-life studies
6. Cost analysis and Final Project Report

Each team/group of students would develop a food product on the basis of above mentioned lines/ steps and would submit a project report

**Recommended Readings**

**SEC 3: FOOD FERMENTATION TECHNOLOGY**

(CREDITS: PRACTICAL - 2)

**Objectives**
- To understand the principles of food fermentation technology
- To study the types of starters used in Food Industry
- To study the production of various fermented food

1. Food Fermentation Technologies.
3. Starter cultures.
4. Production of Baker’s Yeast
5. Production of yoghurt using DIV cultures
6. Development of a fermented food/drink utilizing plant products/animal products or byproducts as substrate

**Recommended Readings:**


**SEC 4: CONFECTIONARY TECHNOLOGY**

**(CREDITS: PRACTICAL - 2)**

**Objectives**

- Understanding status of confectionary industry in India
- To learn the technologies of confectionary products.
- To know about innovations in this sector.

Sugars- Types and sources, methods of preparation of sugars, jaggery, khandsari, raw and refined sugar. Principles of sugar cookery, crystalline and non-crystalline candies. Chapter 26–Manay

Confectionary Products: Cake icings, hard-boiled candies, toffees, fruit drops, chocolates and other confections- ingredients, equipment’s & processes, product quality parameters, faults and corrective measures. (Chapter 5, 7 & 8 – Minifie.)

**Practicals**

1. Determine the effect of heat on sugar solution and perform the thread and cold water test.
2. To study the process of inversion, melting and caramelization in sucrose.
3. Preparation of fondant, fudge and brittles.
4. Preparation of Shakarpara and Chhana murki.
5. Preparation of candy and toffee and to perform quality assessment tests.
6. Preparation of cake decorations.

**Recommended Readings:**
SEC 5: PROJECT AND TECHNICAL REPORT
(CREDITS: PRACTICAL - 2)

GENERIC ELECTIVE (GE)

GE 1: FOOD PROCESSING AND PRESERVATION
(CREDITS: THEORY – 4 PRACTICAL - 2)

THEORY

Objectives:
To impart basic knowledge of:
- Freezing, Dehydration processes and equipment
- Principles of thermal processing
- Technology of colloids
- Water disposal and sanitation
- Minimal Processing and hurdle technology

CONTENTS:

UNIT 1. FOOD PROCESSING OPERATIONS:

Refrigeration and Freezing (Ch.9, Potter N) (9 lectures)
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 (Ch.10, Potter N) (9 Lectures)
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 (Ch.3, Ramaswamy H and Marcotte M) (7 Lectures)
Classification of thermal processes, Principles of thermal processing, commercial canning operations, Aseptic Processing, UHT. Irradiation and microwave heating (Ch.11, Potter N) (5 Lectures) Principles, Dosage, Applications of Irradiation, Mechanism of microwave heating and applications.

UNIT 2. TECHNOLOGY OF COLLOIDS IN FOOD (Ch.11, Manay NS and Shadaksharaswamy M) (6 Lectures)

Characteristics, sols, gels, pectin gels, colloidal sols, stabilization of colloidal system, syneresis, emulsions, properties of emulsions, formation of emulsion, emulsifying agents, food foams, formation stability and destruction of foam, application of colloidal chemistry to food preparation.

UNIT 3. WATER DISPOSAL AND SANITATION (Ch.22, Potter N) (6 Lectures)

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 4. MINIMAL PROCESSING AND HURDLE TECHNOLOGY (Journal) (6 Lectures)

UNIT 5. FOOD ADDITIVES, CONTAMINANTS AND REGULATIONS (CH-11, DEMAN) (10 lectures)

Food Additives - Introduction, need of food additives in food processing and preservation, Characteristics and classification of food additives, Chemical, technological and toxicological aspects. Contamination in Food- : Physical, chemical (heavy metals, pesticide residues, antibiotics, veterinary drug residues, dioxins, environmental pollutants, radionucleides, solvent residues, chemicals) Natural toxins. Food Laws and Regulations- Codex, HACCP, ISO, FSSA etc

Recommended Readings:


PRACTICAL

1. Canning of foods
2. Preservation of food by the process of freezing
3. Drying of food using Tray dryer/other dryers
4 Estimation of Chemical Oxygen Demand (Demonstration)
5 Preparation of brix solution and checking by hand refractometer
6 Analysis of water
7 Minimal Processing of food
8 Application of colloidal chemistry in food preparation

Recommended Readings:

GE 2: CHEMISTRY OF FOOD
(CREDITS: THEORY – 4 PRACTICAL - 2)

THEORY

Objectives:
- To understand the chemistry of foods - composition of food, role of each component
- To understand the effect of processing on various food components

UNIT 1. Introduction (Ch-1,Deman,Ch-1,Fennema) (1 Lecture)
Introduction to Food Chemistry, Composition of food

UNIT 2. Water (Ch-1,Deman) (3 Lectures)
Definition of water in food, Structure of water and ice, Types of water, Role of water activity

UNIT 3. Lipids (Ch-2,Deman) (5 lectures)
Classification of lipids, Physical and chemical characteristics, Chemical deterioration of fats and oils (auto oxidation, rancidity, lipolysis, flavor reversion)

UNIT 4. Proteins (Ch-3,Deman) (5 lectures)
Protein classification and structure, types of food proteins (plant and animal proteins), Physicochemical and functional properties of proteins

UNIT5. Carbohydrates (ch-3,Fennema) (4 Lectures)
Classification, Structure and Chemical reactions of carbohydrates

UNIT 6. Vitamins (Ch-9,Deman) (4 Lectures)
Types (Water soluble vitamins and Fat soluble vitamins)

UNIT 7. Flavour (Ch-7,Deman) (4 Lectures)
Definition and basic tastes, Description of some common food flavors.

UNIT 8. Minerals(Ch-5,Deman) (2 Lectures)
Major and minor minerals, Toxic minerals in food

UNIT 9. Natural Food Pigments(Ch-9,Fennema) (4 Lectures)
Introduction and classification, Types of food pigments (chlorophyll, carotenoids, anthocyanins and flavonoids, beet pigments, caramel)

UNIT 10. Browning Reactions in Food (Ch-3,Fennema) (4 Lectures)
Types, Enzymatic and Non enzymatic Browning and their control measures

UNIT 11 . Enzymes (3 Lectures)
Introduction, classification, General characteristics, Important enzymes in food processing

UNIT 12. Physico-chemical and nutritional changes occurring during food Processing (Desrosire and Desrosier) (4 Lectures)

UNIT 13. New Food Product Development (2 Lectures)
Introduction, need, objectives and types

PRACTICAL
1. Preparation of primary and secondary solutions
2. Estimation of moisture content
3. Determination of gelatinization temperature range (GTR) of different starches and effect of additives on GTR
4. Determination of percent free fatty acids
5. Estimation of Peroxide Value
6. Estimation of Total Ash
7. Estimation of Protein Content

Recommended Readings:
GE 3: SENSORY EVALUATION OF FOOD  
(CREDITS: THEORY – 4 PRACTICAL - 2)

THEORY

CONTENTS

UNIT 1 Taste (Amerine, Rao)  
(12 Lectures)

Introduction and importance of taste
- Structure and physiology of taste organs- tongue, papillae, taste buds, salivary glands
- Mechanism of taste perception
- Chemical dimensions of basic tastes- sweet, salt, sour, bitter and umami
- Factors affecting taste quality, reaction time, taste modification, absolute and recognition
- threshold Taste abnormalities
- Taste measurement

UNIT 2 Odour (Amerine, Rao)  
(12 Lectures)

Introduction, definition and importance of odour and flavor
- Anatomy of nose, physiology of odour perception
- Mechanism of odour perception
- Odour classification, chemical specificity of odour.
- Odour measurement using different techniques – primitive to recent techniques. Merits and demerits of each method. Olfactory abnormalities

UNIT 3 Colour (DeMan, Rao)  
(12 Lectures)

Introduction and importance of colour.
- Dimensions of colour and attributes of colour, appearance factors, gloss etc.
- Perception of colour. Colour abnormalities
- Measurement of colour; Munsell colour system, CIE colour system, Hunter colour system, spectrophotometry and colorimetry etc.

UNIT 4 Texture (DeMan, Rao)  
(12 Lectures)

Introduction, definition and importance of texture
- Phases of oral processing
PRACTICAL

1. Training of sensory panel.
2. To perform recognition and sensitivity tests for four basic tastes.
3. To perform analytical tests of sensory evaluation.
4. Recognition tests for various food flavours, flavor defects in milk.
5. Sensory evaluation of milk and milk products.
6. Texture evaluation of various food samples - crisps/cookies/biscuits/snack foods
7. Measurement of colour by using Tintometer/Hunter Colour Lab etc.
8. Qualitative tests for hydrogenated fats, butter, ghee
9. Platform tests for milk
10. Quality evaluation of various food stuffs - cereals, pulses, honey, jaggery, sugar, tea, coffee etc.

Recommended Readings


GE 4: FOOD MICROBIOLOGY AND FOOD SAFETY
(CREDITS: THEORY – 4 PRACTICAL – 2)

THEORY

Objectives:

- To know the important genera of microorganisms associated with food and their characteristics.
- To understand the role of microbes in fermentation, spoilage and food borne diseases.
- To understand Food safety and hygiene, types of hazards associated with food.
- To understand current Food regulations and Food Safety Management Systems.

UNIT 1. Introduction to Food Microbiology (Ch-1, Garbutt) (2 Lectures)
History and Development of Food Microbiology, Definition and Scope of food microbiology

UNIT 2. Types of Microorganisms in Food (Ch-3,5,17,18,19,20 Pelczar et al) (6 Lectures)
Classification and Nomenclature, Morphology and Structure Importance in food (bacteria, fungi and viruses ) Significance of spores

UNIT 3. Microbial Growth in Food (Ch-4,Banwart) (4 Lectures)
Bacterial growth curve, Factors affecting the growth of microorganisms in food

UNIT 4. Microbial Food Spoilage (Ch 4-9,Jay,Ch-12,13,14,17,18, Frazier and westhoff) (6 Lectures)
Sources of Microorganisms in foods, Some important food spoilage bacteria, Spoilage of some specific food groups

UNIT 5. Food Fermentations (6 Lectures)
Fermentation – definition and types, Microorganisms used in food fermentations, Fermented Foods-types, methods of manufacture for vinegar, sauerkraut, yoghurt, soya sauce, wine and traditional Indian foods

UNIT 6. Food borne Diseases (Ch-23,24,25,Frazier and Westhoff) (4 Lectures)
Types – food borne infections, food borne intoxications and toxin infections, Origin, symptoms and prevention of some commonly occurring food borne diseases

UNIT 7. Enumeration techniques & control of microorganisms in foods (6 lectures)
Qualitative and quantitative methods-conventional as well as rapid, Principles and methods of preservation (thermal and non thermal), Introduction to Hurdle Technology

UNIT 8. Introduction to Food Safety (Ch-1,Forsythe) (4 Lectures)
Definition, Types of hazards, biological, chemical, physical hazards, Factors affecting Food Safety

UNIT 9. Hygiene and Sanitation in Food Service Establishments (Ch- 1,Marriot) (6 Lectures)
Introduction, Sources of contamination, Control methods using physical and chemical agents, Waste Disposal, Pest and Rodent Control, Personnel Hygiene

UNIT 10. Food Safety Management Tools (Ch-7,Forsythe) (4 Lectures)
Basic concept, Prerequisites, HACCP, ISO series, TQM and Risk Analysis

PRACTICAL

1. Introduction to the Basic Microbiology Laboratory Practices and Equipments
2. Preparation and sterilization of nutrient broth and media
3. Morphological study of bacteria and fungi using permanent slides
4. Simple staining and Gram’s staining
5. Standard Plate Count Method
6. Bacteriological Analysis of Water
7. Assessment of surface sanitation by swab/rinse method
8. Assessment of personal hygiene
9. Scheme for the detection of food borne pathogens
10. Implementation of FSMS – HACCP, ISO : 22000

Recommended Readings:
1. Frazier William C and Westhoff, Dennis C. 2004 Food Microbiology, TMH, New Delhi,
2. Jay, James M. 2000 Modern Food Microbiology, CBS Publication, New Delhi,
6. De Vries, 1997, Food Safety and Toxicity, CRC, New York,
7. Marriott, Norman G. , 1985, Principles of Food Sanitation, AVI, New York,

GE 5: FOOD ENGINEERING AND PACKAGING
(CREDITS: THEORY – 4 PRACTICAL - 2)

THEORY

Objectives:
- To understand the principles of Unit operation
- To acquaint with fundamentals of food engineering and its process
- To develop an understanding of different food packaging materials and packaging design and techniques used for various foods

Unit 1. Unit Operations and Processes (Singh and Heldman) (20 lectures)

Unit 2. Separation and Size Reduction Processes (9 lectures)

Principles and equipments used in separation Extraction, sedimentation, filtration, centrifugation, Size reduction – Milling, grinding and mixing of foods

Unit 3. Introduction to Food Packaging (Paine and Paine, Robertson) (10 lectures)

Objectives and functions of food packaging, Requirements for effective food packaging, Types of packaging Materials, General properties of packaging materials

Unit 4. Packaging of Foods (Paine and Paine) (9 lectures)

Packaging of fresh produce and processed foods, Aseptic packaging, Advances in food packaging

PRACTICAL

CONTENTS:
1. Study the dehydration process
2. Study the freezing characteristics of foods
3. Study the process of evaporation
4. To design layout of a food plant
5. Determination of viscosity of foods
6. Identification of packaging materials
7. Testing of packaging materials
8. Demonstration of vacuum/gas packaging of foods

Recommended Readings:
1. Paine FA and Paine HY, 1992 A Handbook of Food Packaging, Blackie Academic Professional,

GE 6: TECHNOLOGY OF PLANT AND ANIMAL FOODS
(CREDITS: THEORY – 4 PRACTICAL - 2)

THEORY

Objectives:
UNIT 1. Technology of Fruits and Vegetables (14 lectures)

Introduction and importance of fruit and 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. Fruits beverages: Introduction, process and preservation of fruit juices. Jams, jellies and marmalades: Processing and technology, defects in jelly. Pickles, chutneys and sauces: Processing, types, causes of spoilage in pickling. Tomato products: Selection of tomatoes, processing of tomato juice, tomato puree, paste, ketchup, sauce and soup, Dehydration of Fruits and Vegetables. (Chapter 1, 2, 7, 9, 11, 13, 14, 16 – Girdharilal).

UNIT 2. Technology of cereals, legumes and oilseeds: (7 lectures)


UNIT 3. Spices & Plantation Products (3 lectures)

Spices - Processing and properties of important spices. Tea and Coffee: Processing (Chapter 12 & 20 – Manay)

UNIT 4. Dairy and Fish Technology (12 lectures)

Dairy – FSSA Definition of Milk, Types of Market Milk, Physico-chemical properties of milk, processing of Milk, Concept of Filtration, Clarification, Homogenization, Pasteurization, Introduction to various Milk Products: Butter, ghee, flavored milk, yoghurt, dahi, shrikhand, icecream, condensed milk, milk powder, channa, paneer, cheese (cheddar). (Chapter 1-11, Sukumar De) Fish – Classification of fish (fresh water and marine), composition of fish, characteristics of fresh fish, spoilage of fish- microbiological, physiological, biochemical, Methods of Fish Preservation- chilling, freezing, Drying, salting, smoking. (Chapter 25, Manay, Chapter 2, Hall)

UNIT 5. Meat, Poultry and Egg Technology (12 lectures)

Meat and Poultry – Definition of carcass, composition of meat, marbling, post-mortem changes in meat- rigor mortis, tenderization of meat, ageing of meat, Concept of an abattoir, Process of slaughtering in an abattoir. (Chapter 23, Manay, Chapter 4,12 Shai Barbut) Egg – Structure and composition of hen’s egg, egg proteins, characteristics of fresh egg, deterioration of egg quality.
Preservation of eggs, Refrigeration and freezing, thermal processing, egg powder. (Chapter 3, 4, 11 and 14, Stadelman)

PRACTICAL

1 Physical Characteristics of Wheat
2 Estimation of gluten content of flour
3 Estimation of degree Brix: Acid ratio
4. Estimation of percent Ascorbic acid
5. Platform tests in milk. (Acidity, COB, specific gravity)
6. Evaluation of eggs for quality parameters (market eggs, branded eggs)
7. Cut out examination of canned fish (Sardine, Mackerel, Tuna)/Meat.
8 To prepare casein and calculate its yield.

Recommended Readings: