**SWAMI RAMANAND TEERTH MAHARATHWADA UNIVERSITY NANDED**

**Faculty of Science**

**Syllabus for**

# B.Sc. Food Technology SY

# Academic year 2012-13

**Semester – III (3 periods per course work/week)**

| Sr. No. | Course Number | Course Title | Theory/week | Marks |
|---|---|---|---|---|
| 1 | 201 | Fruit & vegetable processing | 03 | 50 |
| 2 | 202 | Wheat milling & baking technology | 03 | 50 |
| 3 | 203 | Meat, poultry & fish technology | 03 | 50 |
| 4 | 204 | Food packaging | 03 | 50 |
| 5 | 205 | Fermentation & industrial microbiology | 03 | 50 |
| 6 | 206 | Techniques in food analysis | 03 | 50 |
| 7 | 207 | Confectionary technology | 03 | 50 |
| 8 | 208 | Food processing equipments - I | 03 | 50 |

Practicals : One practical of three periods/week

| | | |
|---|---|---|
| Lab Course VII- | Based on theory course no. 201 + 204 | 50 Marks |
| Lab Course VIII- | Based on theory course no. 202 + 207 | 50 Marks |
| Lab Course IX- | Based on theory course no. 203 + 208 | 50 Marks |
| Lab Course X- | Based on theory course no. 205 + 206 | 50 Marks |
| | Total Marks | 600 Marks |

**Semester – IV (3 periods per course work/week)**

| Sr. No. | Course Number | Course Title | Theory/week | Marks |
|---|---|---|---|---|
| 1 | 209 | Legumes & oil-seed technology | 03 | 50 |
| 2 | 210 | Processing of milk & milk-products | 03 | 50 |
| 3 | 211 | Spice & flavour technology | 03 | 50 |
| 4 | 212 | Food hygiene & sanitation | 03 | 50 |
| 5 | 213 | Food safety & microbial standards | 03 | 50 |
| 6 | 214 | Food additives | 03 | 50 |
| 7 | 215 | Food processing equipments - II | 03 | 50 |
| 8 | 216 | Instrumentation & process control | 03 | 50 |

Practicals : One practical of three periods/week

| | | |
|---|---|---|
| Lab Course XI- | Based on theory course no. 209 + 210 | 50 Marks |
| Lab Course XII- | Based on theory course no. 211 + 214 | 50 Marks |
| Lab Course XIII- | Based on theory course no. 212 + 213 | 50 Marks |
| Lab Course XIV- | Based on theory course no. 215 + 216 | 50 Marks |
| | Total Marks | 600 arks |

## SEMESTER- III

## 201 -FRUIT AND VEGETABLE PROCESSING

**TOTAL PERIODS -32**

**Theory**

| No. of Units | Topics |
|---|---|
| 1 | Production and processing scenario of fruits and vegetables in India and World |
| 2 | Scope of fruit and vegetable preservation industry in India. present status, constraints and prospects |
| 3 | Overview of principles and preservation methods of fruits and vegetables |
| | Commercial processing technology of following fruits and vegetables |
| 4 | Mango: pulp, RTS, squash, canned pulp. toffee amchur, pickle, powder, bar |
| 5 | Banana: wafers, puree, powder |
| 6 | Papaya: jam, candy, RTS, nectar, squash, papain. |
| 7 | Pomegranate: juice, squash, syrup, anardana, dalimb manuka, anargoli. |
| 8 | Guava; jelly, cheese, juice, canned guava, squash, toffee |
| 9 | Grape: raisin, juice, wine |
| 10 | Fig : pulp, dried fig, toffee, powder, bar |
| 11 | Citrus fruits: jelly, marmalade, RTS, squash, candy |
| 12 | Aonla ; preserve, jam, candy, juice, squash, powder, dried shreds, chavanprash, pickle, chutney, sauce, sweets. |
| 13 | Tamarind: pulp, powder, toffee, bar, RTS, slab |
| 14 | Jamun : jelly, RTS, syrup, wine, flakes, bar, powder |
| 15 | Wood apple: jelly, marmalade |
| 16 | Tomato: ketchup, sauce, puree, soup, chutney, pickle |
| 17 | Ginger: preserve, candy, dried ,ginger pickle, RTS, syrup. |
| 18 | Onion: dried onion, powder |
| 19 | Garlic : dried garlic, powder, |
| 20 | Potato : wafer, starch, papad |
| 21 | Carrot: preserve, candy, pickle, jam |
| 22 | Cauliflower and Cabbage: dried cauliflower and cabbage, sauerkraut, pickle |
| 23 | Leafy vegetables; dried leafy vegetables (spinach, fenugreek, coriander leaves, curry leaves) |
| 24 | Bitter gourd: pickle, dried bitter gourd |

**Practicals**

| No. of Units | Topics |
|---|---|
| 1 | Cannning of mango/guava/papaya |
| 2 | Preparation of fruit jam: apple/mango/guava/ papaya/aonla/strawberry |
| 3 | Preparation of fruit jelly : wood apple/ sweet orange/mandarin/guava/ tamarind. |
| 4 | Preparation of fruit marmalade: |
| 5 | Preparation of fruit squash |
| 6 | Preparation of fruit RTS |
| 7 | Preparation of dried onion and garlic |
| 8 | Preparation of anardana and dalimb manuka |
| 9 | Preparation of grape raisin, dried fig and banana fig. |
| 10 | Preparation of banana and potato wafers |
| 11 | Preparation of dehydrated leafy vegetable |
| 12 | Preparation of pickle, mixed pickle |
| 13 | Preparation of dried ginger |
| 14 | Preparation of amchur |

**REFERENCE BOOKS**


| | | |
|---|---|---|
| 1 | Fruit and Vegetable Preservation Principles and Practices | Srivastava R.P. and Sanjeev Kumar |
| 2 | Post Harvest Technology of Fruits and Vegetables : Handling, Processing, Fermentation and Waste Management vol. I and II | Verma L. R. and Joshi V.K. |
| 3 | Hi Tech Horticulture | Singh D.K. |
| 4 | Preservation of Fruits and Vegetables | Khader |
| 5 | Fruit and Vegetable Preservation | Bhutani R.C. |
| 6 | Principles of Fruit Preservation | Morris, Thomas Norman,. |
| 7 | Preservation of fruits and vegetables | Giridharilal, G.S. Siddappa and G.L. Tandon. |

# 202 - WHEAT MILLING AND BAKING TECHNOLOGY

**Total periods-32**

**Theory**

| No. of Units | Topics |
|---|---|
| 1 | Wheat – importance, production varieties |
| 2 | Types of wheat, grading and quality of wheat |
| 3 | Structure of wheat, chemical constituents, their distribution |
| 4 | Physico-chemical and Rheological properties |
| 5 | Conditioning of wheat – principles and methods of conditioning |
| 6 | Milling of wheat –<br>Roller flour milling process<br>Break rolls, reduction rolls, The design and operation<br>Wheat milling process |
| 7 | Products of wheat milling industry<br>Flour grades, Supplementation, Fortification |
| 8 | Flour additives, flour improvers, Bleaching, Oxidizing agents |
| 9 | Bakery products, role of bakery ingredients (major and minor),<br>from hard wheat: bread processes of bread making using straight and sponge, dough methods role of each ingredient, quality control<br>Testing of raw material testing of final product<br>Bread faults, staleness, roppynes |
| 10 | Baked Products from soft wheat:<br>cookies, crackers, biscuits, cakes:<br>types, ingredients, process, causes, remedy |
| 11 | Other bakery products: using very hard wheat.<br>pizza, pastry and its types. Macaroni products: Including spaghetti, noodles, vermicelli-process. Nutritional improvement of bakery products |
| 12 | Setting of bakery unit, bakery norms, specifications for raw materials<br>Packaging, marketing of products, project report on bakery |

**Practical**

| No. of Units | Topics |
|---|---|
| 1 | Classification of wheat based on physico-chemical properties |
| 2 | Conditioning of wheat |
| 3 | Milling of wheat |
| 4 | Quality Testing of flour.<br>a) - Falling number and α- amylase activity.<br>b) - Sedimentation value.<br>c) – Pelshenke value.<br>d) – Rheological Tests.<br>i) Farinograph.<br>ii) Mixograph<br>iii) Extensiograph.<br>iv) Alveograph. |
| 5 | Manufacture of bread, types, faults, remedies, shelf life bread, quality of bread |
| 6 | Test Baking: biscuits, cookies, crackers, buns:<br>Types and quality |
| 7 | Other baked products- pastry, pizza |

REFERENCE BOOKS


1. Bakery Science and Cereal Technology — Khetarpaul.
2. Technology of Cereals — Kent.
3. Bread — Spensor.
4. Flour Milling Process — Scott.

## 203 - MEAT, POULTRY AND FISH TECHNOLOGY TOTAL PERIODS -32

**Theory**

| No. of Units | Topics |
|---|---|
| 1 | Sources and developments of meat and poultry industries and importance in national economy |
| 2 | Muscle structure, chemical composition and physico-chemical properties of meat muscle |
| 3 | Pre-slaughter transport and care and antimortem inspection |
| 4 | Slaughtering of animals and poultry, post-mortem inspection and grading of meat |
| 5 | Factors affecting post-mortem changes, properties and shelf life of meat |
| 6 | Processing and preservation of meat- mechanical deboning, aging or chilling, freezing, pickling, curing, cooking and smoking of meat. |
| 7 | Technology of manufacture of meat and poultry products |
| 8 | Meat plant sanitation and safety |
| 9 | By-products utilization of abattoir |
| 10 | Egg structure: Composition, quality characteristics, processing and preservation of eggs |
| 11 | Fish types,composition quality characteristics & preservation of fish |

**Practicals**

| No. of Units | Topics |
|---|---|
| 1 | Pre-slaughter operations of meat animals and poultry birds |
| 2 | Slaughtering and dressing of meat animals |
| 3 | Meat cutting and handling |
| 4 | Evaluation of meat quality |
| 5 | Preservation of meat by different methods and preparation of meat and poultry products |
| 6 | Preservation of shell eggs |
| 7 | Evaluation of quality and grading of eggs |

**REFERENCE BOOKS**


| | |
|---|---|
| Principles of Meat Science | F. J. Forrest |
| Meat Hand Book | Albert Levie |
| Developments in Meat Science Vol. I and II | Ralston Lawrie |
| Poultry Production | R. A. Singh |
| Meat Technology | Gerard F. |


## 204 - FOOD PACKAGING

TOTAL PERIODS -30

**Theory**

| No. of Units | Topics |
|---|---|
| 1 | Introduction to food packaging in India, need of packaging, Package requirements, package functions, Hazards acting on package during transportation & Storage, labeling laws |
| 2 | Package Materials: classification packages, paper as package material its manufacture, types, advantages corrugated and paper board boxes etc. Glass as package material, Manufacture, Advantages, disadvantages. Metal as package material-manufacture, Advantages, disadvantages, Aluminum as package material,. Its advantages and disadvantages, |
| 3 | Plastic as package material classification of polymers, properties of each plastics, uses of each plastics, chemistry of each plastic such as polyethylene, polypropylene, polystyrene, polycarbonate, PVC, PVDC, Cellulose acetate, Nylon etc. |
| 4 | Lamination Coating and Aseptic packaging<br>Lamination, need of lamination, types, properties, advantages & disadvantages of each type<br>Coating on paper & films, types of coatings. Need of coating, methods of coatings. Aseptic packaging-Need, Advantages, process, system of aseptic packaging and materials used in aseptic packaging. Machineries used in Packing foods |
| 5 | Packaging of Specific Foods<br>Packaging of specific foods with its properties, Like bread, Biscuits, Coffee, Milk powder, egg powder, carbonated beverages. Snack foods, R.T.S. beverages |
| 6 | Mechanical and functional tests on Package<br>Various mechanical and functional testes performed in laboratories on package boxes and package materials |

**Practicals**

| No. of Units | Topics |
|---|---|
| 1 | Classification of various packages bared on material and rigidity |
| 2 | Measurement of thickness of paper, paper boards |
| 3 | Measurement of water absorption of paper, paper boards |
| 4 | Measurement of puncture resistance of paper and paperboard |
| 5 | Measurement Tear resistance of papers |
| 6 | Determination of WVTR of films |
| 7 | Identification of plastic films |
| 8 | Determination of gas transmission rate of package films |
| 9 | Determination of coating on package materials |
| 10 | Prepackaging practices followed for packing fruits and vegetables |

**REFERENCE BOOKS**


1 Handbook of Package Engineering — Joseph F. Hanlon
2 Fundamentals of Packaging — F.A. Paine
3 Food Packaging — Sacharow and Griffin
4 Principles of Food Packaging — R. Heiss
5 Flexible Packaging of Foods — A.L. Brody
6 Food Packaging and Preservation — M. Mathouthi


## 205- FERMENTATION AND INDUSTRIAL MICROBIOLOGY

**Total periods-32**

**Theory**

| No. of Units | Topics |
|---|---|
| 1 | Beneficial microbes and their primary and secondary metabolites, screening and isolation of microorganisms |
| 2 | Industrially important secondary metabolites, organic acids, antibiotics, probiotics, compounds of therapeutic and medicinal value |
| 3 | Bacteriocins, nisin, biocolours, carotenoids flavours, B-carotene, lycopane, production of microbial enzymes, down stream processing of enzymes and application of microbial enzymes in food and allied industries |

| | |
|---|---|
| 4 | Production and purification of microbial polysaccharides, and their applications production of important amino acids, vitamins |
| 5 | Plant cell cultures and metabolites, production of SCP, fermented dairy products, bakers yeast |
| 6 | Fermented foods and alcoholic beverages, microbial standards |
| 7 | Industrial fermentors and accessories. (instrumentation) |
| 8 | Economic feasibility studies of few products, advances in strain improvements for high yields of metabolites, blue green algae |

**Practicals**

| No. of Units | Topics |
|---|---|
| 1 | Standardization of physical factors for higher yields of citric acid |
| 2 | Production and assay of niacin from lactic acid bacteria |
| 3 | Production and assay of β-carotene |
| 4 | Single cell protein (SCP) production |
| 5 | Production, purification and assay of fungal analyses / proteases |
| 6 | Production of xanthan / pullulan |
| 7 | Production and assay of amino acids |
| 8 | Mushroom production |
| 9 | Preparation of food based fermented product like miso/Idli/Dhokla |

**REFERENCE BOOKS**


1 Microbial Technology Vol-I H.J. Peppler and D. Perlman
2 Microbial Technology Vol-II H.J. Peppler and D. Perlman
3 Industrial Microbiology 4th Ed. Prescott and Dunns


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## 206 - TECHNIQUES IN FOOD ANALYSIS

**Theory** Total periods-32

| No. of Units | Topics |
|---|---|
| 1 | Nature and concepts of food analysis<br>i) Safety in laboratory<br>ii) Sampling techniques |
| | Principles and methodology involved in analytical techniques<br>i) PH Meter and use of ion selective electrodes<br>ii) Spectroscopy & its types<br><br>i) Nuclear magnetic resonance and electron spin resonance<br>ii) Chromatography & its types<br><br>i) Various separation techniques<br>. |
| 3 | Principles and methodology involved in analysis of foods.<br>i) Rheological analysis<br>ii) Textural profile |
| 4 | Immuno assay techniques in food analysis<br>i) Isotopic and Non-isotopic immuno assay<br>ii) Enzyme-immuno assay |
| 5 | Evaluation of analytical data |
| 6 | Sensory analysis of food<br>i) Objective method<br>ii) Subjective method |

**Practicals**

| No. of Units | Topics |
|---|---|
| 1 | Molecular weight determination using sephadox-gel |
| 2 | Estimation of phytic acid using spectrophotometer |
| 3 | Separation of amino acids by two-dimensional paper chromatography |
| 4 | The identification of sugers in fruit juice using TLC |
| 5 | Separation of prolines by Ion-exchange chromatography |
| 6 | Identification of organic acids by paper electrophoresis |
| 7 | Quantitative determination of sugars and fatty acid profile by GLC |
| 8 | Quantitative make-up of water and fat soluble vitamins using HPLC |

# 207- CONFECTIONERY TECHNOLOGY

TOTAL PERIODS-32

**Theory**

| No. of Units | Topics |
|---|---|
| 1 | History, traditional confectionery goods, types of confectionary |
| 2 | Raw materials<br>Sugar, physical, chemical, optical properties. sugar grinding, dextrose, fructose, lactose, caramel, maltose, honey, sorbitol, xylitol, iso malt, soy maltose, polydextrose, lactitol, maltitol. |
| 3 | Additives used in confectionary- whipping, release agent, thickeners, acidulents, milk and milk products, flavours, emulsifiers and other additives, |
| 4 | starch derivatives such as glucose syrup, colours used in confectionary. |
| 5 | Cocoa processing: cocoa bean, processing, roasting, fermentation, production of cocoa butter cocoa powder, its quality |
| 6 | Chocolate processing : Ingredients, mixing, refining, conching, tempering, molding, cooling, coating, fat bloom |
| 7 | High boiled sweets: Introduction, composition, properties of high boiled sweets, preparation of high boiled sweets,. different types of higher boiled sweets, |
| 8 | Caramel: Definition, composition, manufacture & factors affecting quality of caramel |
| 9 | Toffee: Definition, composition, types of toffee ingredient and their role. |
| 10 | Tablets: Definitions, recipe, composition, wet granulation, slugging, manufacture of tablet, and checklist of tablet faults |
| 11 | Panning: Process, types of panning, soft and hard panning. quality of confectionery, standards and regulations, packaging requirements of confectionery, economics and marketing of confectionary goods. |

**Practicals**

| | |
|---|---|
| 1 | Production of invert sugar |
| 2 | Preparation of high boiled sweets |
| 3 | Preparation of toffee |
| 4 | Preparation of groundnut chikki |
| 5 | Preparation of decorative cake |
| 6 | Preparation of chocolate |
| 7 | Preparation of traditional Indian confection |
| 8 | Preparation of Shrikhand wadi |
| 9 | Preparation of milk chocolate |
| 10 | Preparation of fruit toffee |

| | |
|---|---|
| 11 | Preparation of petha |
| 12 | Preparation of Rasgulla |
| 13 | Preparation of fruit candy |

**REFERENCE BOOKS**


1. Sugar Confectionery and Chocolate Manufacture — R. Less and E.B. Jackson.
2. Industrial Chocolate Manufactory and Use — S.T. Beekelt
3. Chocolate, Cocoa & Confectionery Sci and Tech. — Bernared W. Minifie
4. Basic Baking — S.C. Dubey.


**REFERENCE BOOKS**


1 Food Analysis Theory and Practice — Pomeranz & Meloan
2 Methods in Food Analysis — Maynard
3 Food Biochemistry — Eskin, Henderson and Twonsend.
4 Post Harvest Physiology, Handling and Utilization of Tropical and Co-west port cohn. — Pantastico, AVI Publishing
5 Subtropical Fruits and Vegetables. — R.B. Wills, W.B.Mc Glasson,
6 Post harvest : An Introduction to the Physiology and Handling of Fruits and Vegetables. — D.Graham T.H. Lee and E.G. Hall
7 Introduction to practical Biochemistry — Plumer.


## 208- FOOD PROCESSING EQUIPMENTS – I

TOTAL PERIODS-32

**Theory**

| No. of Units | Topics |
|---|---|
| 1 | Material handling : machines and conveyors |
| 2 | Unit operations in food processing: Cleaning, Dehulling, dehusking, Sorting, Grading, Peeling and Forming, Size reduction and separation, Agitation and Mixing |
| 3 | Engineering properties of Food materials: Its significance in equipment design, processing and handling of food products |
| 4 | Hygienic design of Food processing equipment. Sanitary requirement, Sanitary pipes and fittings |
| 5 | Rheology and texture of food materials: Concept of rheology, methods of texture evaluation, subjective and objective measurements of rheological characteristics |
| 6 | Evaporation: Principles of evaporation, types and selection of evaporators, mass and energy balance. Design of single and multiple |

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|---|---|
| | effect evaporators, recompression heat and mass recovery and vacuum creating devices |
| 7 | Drying: Principles of drying, drying rate kinetics, Classification, mass and heat transfer. Different types of dryers and components |
| 8 | Thermal processing: principles & objectives of Blanching, Pasteurization and Sterilization- different methods and equipments. Processing in containers, process time, T-evaluation, Design of batch and continuous sterilization |

**Practicals**

| No. of Units | Topics |
|---|---|
| 1. | Study of Instron and its working |
| 2 | Study of evaporator, dryer, sterilizer |
| 3 | Determine flow parameters of Newtonian, non Newtonian food products by : Capillary tube viscometer, Hakke's viscometer, Rotational viscometer and Falling Ball viscometer |
| 4 | Numerical problem on Thermo bacteriology (D, Z, & F) |
| 5 | Design problems on evaporators |
| 6 | Design problems on Dryers |

**RFERENCE BOOKS**


1 Unit operations of chemical Engineering — Mc Cabe Smith & Harriott
2 Food Engineering operation — Brennan, Butters, Cowell and Lilly
3 Process Heat Transfer — Kern

## SEMESTER-IV

## 209- LEGUME AND OILSEED TECHNOLOGY

TOTAL PERIODS-32

**Theory**

| No. of Units | Topics |
|---|---|
| 1 | Present status and future prospectus of legumes and oil seeds processing industries in India |
| 2 | Classification and types of legumes and pulses. Chemical composition and nutritional value. Antinutritional factors, methods of removal of antinutritional factors |
| 3 | Processing of legumes at home scale, cottage scale and commercial scale |
| 4 | Dal milling – principles, methods, equipments and effect on quality.<br>Principle products, dry and wet milling of pulses, fermented products of legumes |
| 5 | Soaking – principles, methods of soaking - sprouting, puffing, roasting and parboiling of legumes |
| 6 | Cooking quality of dhal – methods, factors affecting quality of dhal and cooking of dhal. quick cooking dhal, instant dhal. |
| 7 | Oil seeds: chemical composition and characters antinutritional factors, elimination methods |
| 8 | Post harvest technology of oil seeds, handling drying, storage, grading, pretreatments, cleaning, dehulling, size reduction and flaking |
| 9 | Oil extraction: traditional methods, ghani, power ghanis, expellers & screw press |
| 10 | Solvent extraction process : principle, pretreatment - breaking, cracking, flaking. extraction principle, factors affecting the extraction process. Desolventization |
| 11 | Refining of oils – degumming, neutralization, bleaching, filtration, deodorization, their principles and process controls. |
| 12 | New technologies in oil seed processing, utilization of oil seed meals of different food uses. high protein product like protein concentrate and isolates |

**Practicals**

| No. of Units | Topics |
|---|---|
| 1 | Physical properties of legumes and oil seeds |
| 2 | Estimation of protein |
| 3 | Estimation of fat |
| 4 | Production of protein rich product. |
| 5 | Dal milling process. |
| 6 | Antinutritional factors, methods of elimination. |
| 7 | Soaking studies. |
| 8 | Sprouting of legumes. |
| 9 | Fermented product of legumes- dosa, idli, wada, dhokala, etc. |

**REFERENCE BOOKS**


1 Post Harvest Biotechnology of Legumes D.K. Salunkhe *et al.*
2 Post Harvest Biotechnology of Oil Seed D.K. Salunkhe *et al.*
3 Processed Protein Food Stuff A.M. Alschule
4 The Chemistry and Technology of Edible Oils and Fat A.E. Baily
Post Harvest


## 210- PROCESSING OF MILK AND MILK PRODUCTS

TOTAL PERIODS-32

**Theory**

| No. of Units | Topics |
|---|---|
| 1 | Milk –Defination, composition of milk from different species, colostrum. |
| 2 | Physico – Chemical properties of milk. |
| 3 | Nutritive value of milk and milk products. |
| 4 | Processing of milk- pasteurization by L T H T and HTST and UHT – filtration, UF and RO, clarification, cream separation, homogenization and heat processing. |
| 5 | Classification of milk products |
| 6 | Manufacture of butter and butter oil (Ghee) |
| 7 | Fermented milks-Asidophilus milk,kefir,kumiss |
| 8 | Preparation of yoghurt and cheese |

| | |
|---|---|
| 9 | Ice-cream – Method of manufacture. |
| 10 | Manufacture of indigenous milk products – ghee, khoa, chhanna, paneer, dahi and shrikand. |
| 11 | Indian milk confectionary – Dahi, Khoa and Chhanna based sweets |
| 12 | By products of dairy Industry and their utilization condensed milk & milk powders |
| 13 | Packaging and storage of milk and milk products – Defects – Standards. |

**Practicals**

| **No. of Units** | **Topics** |
|---|---|
| 1 | Sampling and analysis of milk – physico chemical properties and composition, DMC and DYC reduction tests, presence of adulterants and preservatives. |
| 2 | Standardization of milk for markets |
| 3 | Clarification and separation of milk |
| 4 | Heat processing of milk – Pasteurization |
| 5 | Preparation of butter and ghee |
| 6 | Ice-cream preparation |
| 7 | Preparation of dahi, shrikhand, lassi etc |
| 8 | Preparation of khoa and khoa based sweets |
| 9 | Preparation of channa, paneer and chana based sweets |
| 10 | Visit to Dairy plant |
| | |

**REFERENCE BOOKS**


Outlines of dairy Technology — Sukumar- De , Oxford University Press, New Delhi.

The Fluid Milk Industry — J.L.Henderson. 3rd edition AVI Publishing Co. West port, Conn. USA.

Principles of Dairy Processing — J.N.Warner, Wiley Eastern Ltd, New Delhi.

Indian Dairy Products — K.S.Rangappa and K L Acharya Asia Publishing house, Bombay.

Judging of Dairy Products — J.A.Nelson and Trout, The Olsen publishing Co. Milwankee, Wisconsin, USA.

Milk processing and Dairy Products Industries, — EIRI Board of consultants & Engineers Engineers India Research Institute, Delhi.

Technology of Milk Processing — Q. A. Khan & Padmanabhan

## 211- SPICES AND FLAVOR TECHNOLOGY

Total periods-32

**Theory**

| No. of Units | Topics |
|---|---|
| 1 | Production and processing scenario of spices, flavour & plantation crops and its scope |
| 2 | Major Spices:<br>(1) Post Harvest Technology composition, processed products of following spices (2) Ginger (3) Chilly (4) Turmeric (5) Onion and garlic (6) Pepper (7) Cardamom (8) Cashew nut |
| 3 | Minor spices, herbs and leafy vegetables: processing and utilization, All spice, Annie seed, sweet Basil, Caraway seed, Cassia, Cinnamon, Clove, Coriander, cumin, Dill seed<br>Fern seed nutmeg mint marjoram, Rose merry, saffron, sage |
| 4 | Savory, Thyme, Ajowan, Curry leaves, Asafoctida |
| 5 | Tea, Coffee: Processing |
| 6 | Vanilla and annatto-processing |
| 7 | Spice oil and oleoresins |
| 8 | Chemistry and physiology of taste, flavouring compounds in foods |
| 9 | Separation, purification and identification of natural flavouring materials |
| 10 | Synthetic flavouring agents and their stability |
| 11 | Flavours of soft drinks, Baking and confectionery industry |
| 12 | Standards specification of spices and flavours |
| 13 | Packaging of spices and spice products |

**Practical**

| No. of Units | Topics |
|---|---|
| 1 | Identification and characterization of flavouring compounds of spices |
| 2 | Piperine estimation in pepper oleoresin |
| 3 | Extraction of oil from clove, pepper, cardamom-chili |
| 4 | Determination of curcumin content in turmeric |
| 5 | Packaging study of spices |
| 6 | Steam distillation of spices |
| 7 | Preparation of curry powder |
| 8 | Chemical analysis of spices moisture, Volatile oil, specific gravity, refractive index, acid value |
| 9 | Preparation of Indian Masala for different foods |
| 10 | Study of standard specification of spices |

**REFERENCE BOOKS**


1. Spices – vol. II - Parry J.W.
2. Spice and condiments - Pruthi J.S.
3. Herbs and spices - Rosemery Hemphill
4. The book of spices - Rosen garten, F. and Livington Jr.
5. Spices and herbs for the Food Inudstry - Lewies, Y.S.
6. Spices Vol. I and II; Tropical Agril. Series - Purseglove, J.W. Brown E.G., Green C.L. And Robbins SRJ.
7. Food Flavourings - P.R. Ashust
8. Food Flavouring composition, manafacture and uses. - J.Merrory


## 212- FOOD HYGIENE AND SANITATION

**Theory** **Total periods-32**

| No. of Units | Topics |
|---|---|
| 1 | Principles of food hygiene, hygiene in urban & rural areas with respect to food preparation. |
| 2 | Food handling habits & personal hygiene |
| 3 | Sources of water & impurities in water, hardness of water |
| 4 | Water supply systems & water purification , chlorination |
| 5 | Types of soil (food residues on equipment surfaces)and its properties |
| 6 | Cleaning procedures, types of cleaning agents & their properties |
| 7 | Acid & alkine cleaners |
| 8 | Types of sanitizing agents & their properties |
| 9 | Chlorine, iodine & their compounds as a sanitizers,Quaternaly ammonium compounds, phonolic compounds as sanitizers. Advantages & disadvantages of these sanitizers. |
| 10 | Physical sanitizing agents eg. Hot water steam & UVlight |
| 11 | Cleaning of premises & surroundings. Common pests in food services & their control |
| 12 | Sanitation regulations |
| 13 | Hygiene & sanitation at retail shops |

**Practicals**

| No. of Units | Topics |
|---|---|
| 1 | Water quality parameters |
| 2 | Collection of sample for pollution study |
| 3 | Estimation of dissolved oxygen |
| 4 | Determination of pH/ acidity/alkalinity from sample |

| | |
|---|---|
| 5 | Estimation of nitrates |
| 6 | Estimation of pollutant elements |
| 7 | Estimation of heavy/ toxic elements |
| 8 | Estimation of phosphates |

**REFERENCE BOOKS**


1 Environmental Biology — Dr. K.C. Agrawal.
2 Fundamentals of Environmental Science — G.S. Dhaliwal and G.S. Sanghai


## 213- FOOD SAFETY AND MICROBIAL STANDARDS

TOTAL PERIODS-32

**Theory**

| No. of Units | Topics |
|---|---|
| 1 | Hazards in food chain physical, chemical, biological |
| 2 | Toxins in food, naturally occurring, bacterial and fungal |
| 3 | Intrinsic toxins produced during processing and storage |
| 4 | Metals as toxins – sources, contamination, toxicity and elimination |
| 5 | Pesticide residues as toxin<br>i) chlorinated ii) Non – chlorinated. |
| 6 | Permitted food additives and their permissible limits |
| 7 | Microbial standards of fresh and processed foods. |
| 8 | Risk assessment and management during food preparation. |
| 9 | Food safety management system |

**Practicals**

| No. of Units | Topics |
|---|---|
| 1 | Estimation of *Salmonella /Sshigella/ Stachyphylococcus* from food samples. |
| 2 | Estimation of fungal toxins from food samples. (Different types of foods) |
| 3 | Microbial and chemical analysis of water |
| 4 | Isolation and identification of *Listeria* and *E. Coli* |
| 5 | HACCP for food industries by taking few models |
| 6 | Study of national and international microbial quality standards |

**REFERENCE BOOK**


1 Food Hygiene and Sanitation S. Roday
2 Food Microbiology W.C. Frazier and D.C. Westhoff
3 Food Chemistry (New Edition) Owin R. Fenema
4 Handbook of Food Toxicology S.S. Deshpande
5 Food Microbiology M.R. Adams and M.O. Moss
6 Food Additives Toxicology J.A. Maga and A.T. Tu
7 Safety of Foods (II Edition) H.D. Graham


## 214- FOOD ADDITIVES

Total periods-30

**Theory**

| No. of Units | Topics |
|---|---|
| 1 | Intentional and unintentional food additives their toxicology and evaluation |
| 2 | Naturally occurring food additives |
| 3 | Food colour (natural and artificial) |
| 4 | Pigments their importance and utilization as food colour |
| 5 | Taste and flavour inducer, potentiater |
| 6 | Food preservatives and their chemical action |
| 7 | Role mode of action salt, chelating agents stabilizers and thickners, polyhydric alcohol, anticaking agent, firming and colouring agent, flour bleaching agent, antioxidants, non-nutritional sweetners and antimicrobial agents |

**Practicals**

| No. of Units. | Topics |
|---|---|
| 1 | Evaluation of GRAS aspect of food additives |
| 2 | Identification of food colour by TLC |
| 3 | Isolation and identification of naturally occurring food pigments by paper and TLC |
| 4 | Role mode of action of chelating agent in fruit juice |
| 5 | Determination of diacetyl content of Butter |
| 6 | Role and mode of antioxidant in frozen fish |
| 7 | Role and mode of action of stabilizer and thickener in frozen dairy products. (Ice-cream) |
| 8 | Role of leaving agent in baked food product. |

**REFERENCE BOOKS**


1 Food Chemistry- Vol-I Fennama O.R.
2 Food Chemistry Mayer L.H.


## 215-FOOD PROCESSING EQUIPMENTS- II

TOTAL PERIODS-30

**Theory**

| No. of Units | Topics |
|---|---|
| 1 | Mechanical separations :<br>Centrifugation : liquid-liquid centrifugation, liquid- solid centrifugation, clarifiers, de sludging and decanting machines |
| 2 | Filtration : Principles involved in filtration. Pressure and vacuum filtration |
| 3 | Expression : batch and continuous type |
| 4 | Baking, Roasting and Frying equipment |
| 5 | Extraction and Leaching, Crystallization and Distillation |
| 6 | Membrane processes : Ultra filtration, Reverse osmosis |
| 7 | Electro dialysis, Pre-evaporation and micro filtration |
| 8 | Microwave and Dielectric & Infrared heating : Physical parameters. Heat transfer phenomenon. Equipment and application |
| 9 | Irradiation - Principle and its equipments |
| 10 | Blending and pulverization equipments |

**Practicals**

| No. of Units | Topics |
|---|---|
| 1 | Lab demonstration on state of water |
| 2 | Demonstration of equilibrium sorption isotherms |
| 3 | Study of centrifugal separators |
| 4 | Study of ultra filtration equipments |
| 5 | Study of microwave oven, infrared moisture meter and universal moisture meter |
| 6 | Study of size reduction machineries |
| 8 | Study of size reduction machineries |

**REFERENCE BOOKS**


| | | |
|---|---|---|
| 1 | Food Engineering operation | Brennan, Butters, Cowell and Lilly |
| 2 | Introduction to Food Engineering | Heldman D.R. and Singh R.P. |
| 3 | Fundamentals of Food Engineering | Charm S.E. |


## 216- INSTRUMENTATION AND PROCESS CONTROL

TOTAL PERIODS -30

**Theory**

| No. of Units | Topics |
|---|---|
| 1 | Introduction ,recorders monitors & panel boards |
| 2 | General characteristics of instruments, static & dynamic |
| 3 | Various types of thermometers |
| 4 | Pressure & pressure scales, manometers, pressure elements differential pressure |
| 5 | Liquid level measurement & its different methods |
| 6 | Flow measurement, kinds of flow, rate of flow |
| 7 | Transmission –pneumatic & electrical |
| 8 | Control elements, control actions, pneumatic & electrical control systems |

**Practicals**

| No. of Units | Topics |
|---|---|
| 1 | Sensory evaluation of product |
| 2 | Quality evaluation of raw materials. |
| 3 | Quality evaluation of product for size, shape. |
| 4 | Determination of viscosity of food products. |
| 5 | Determination of texture |
| 6 | Evaluation of food standards |
| 7 | Market testing of products. |

**REFERENCE BOOKS**


1. Principles of Sensory Evaluation of Food — Maynard A –Amerine, Rose Marie Pangborn, Edward B. Roessler.
2. Quality Control for Food Industry — Krammer & Twigg.
3. Quality Control in Food Industry — S.N. Herschdogrfer.
4. Advances in Food Research — Academic Press. Vol I.