COURSE CONTENT
B.Sc PROGRAMME IN FOOD TECHNOLOGY

Course No.	Title of the Course	Marks
F I R S T Y e a r		
BSCFT 1	Mathematics & Statistics	100
BSCFT 2	Food Microbiology	100
BSCFT 3	Communicative English	100
BSCFT 4	Chemistry of foods & Water	100
BSCFT 5	Principles of Biochemistry	100
BSCFT 6	Practicals Related to the above papers	100
	Total Marks	600
S E C O N D Y e a r		
BSCFT 7	Fermentation Technology & Food products	100
BSCFT 8	Food Preservation Technology	100
BSCFT 9	Food safety & Food Laws	100
BSCFT 10	Dairy Microbiology	100
BSCFT 11	Seafood Processing & Analysis	100
BSCFT 12	Practicals Related to the above papers	100
	Total Marks	600
T H I R D Y e a r		
BSCFT 13	Marketing Management	100
BSCFT 14	Food Packaging Technology	100
BSCFT 15	Food analysis & Quality control	100
BSCFT 16	Project	100
BSCFT 17	Seminar & Viva voce	100
	Total Marks	500

FIRST YEAR

Mathematics & Statistics

UNIT I
Matrix, Integration & Derivation, Numerical methods, Probability, Types of probability, Poison ratio,

UNIT II
Introduction to statistics, Graphical representation, Tabulation of Numerical data, methods of disperson, measures of central tendency, standard deviation, standard error, quartile deviation.

UNIT III
Bisectional method, Newton raphson method, regular falsi method, Iteration method, Gouse Jordan method, Gauss elimination method,

UNIT IV
Factorial design, ANOVA, ANCOVA, Pearson correlation, Regression, F test, T test, Z test, Sample design, Chi square test,

Suggested Reading
Engineering Mathematics B.S.Gravel, Tata Mc Grahill
Biostatistics, S.N.Prasad, New age publishers
Research methodology, D.S.Kothari, New age publishers

Food Microbiology

UNIT I
History of microbiology of food, Types of micro-organism normally associated with food-mold, yeast, and bacteria. Foods as ecological niches, Relevant microbial groups, Microbes found in raw materials and foods that are detrimental to quality, Factors that influence the development of microbes in food, newer and rapid methods for qualitative and quantitative assay demonstrating the presence and characterization of microbes, Stress, damage, adaptation, reparation, death.

UNIT II
Microbial growth in food: intrinsic, extrinsic and implicit factors, Microbial interactions, Inorganic, organic and antibiotic additives. Effects of enzymes and other proteins, Combination systems, Adaptation phenomena and stress phenomena, Effect of injury on growth or survival, Commercial available databases.

UNIT III
Microbial behaviour against the newer methods of food processing, Adoption and resistance development, Microbes as test organisms, as sensors and as tools for future applications in energy production and food and non food industrial products.
Modern methods of cell culture: synchronous and co- cell culture, continuous cell culture in liquid and solid media, Cell immobilization and applications, Pre and probiotics cultures

UNIT IV

Contaminants of foods-stuffs, vegetables, cereals, pulses, oilseeds, milk and meat during handling and processing. Biochemical changes caused by micro-organisms, deterioration of various types of food product. Food poisoning and microbial toxins, microbial food fermentation, standards for different foods. Food borne intoxicants and mycotoxins.

Suggested Reading

1. Branen A.L. and Davidson, P.M. 1983. Antimicrobials in Foods. Marcel Dekker, Newyork.
2. Jay J.M. 1986. Modern Food Microbiology. 3rd Edn. VNR, New York.
3. Robinson, R.K. Ed. 1983. Dairy Microbiology. Applied Science, London.
4. Banawart GJ. 1989. *Basic Food Microbiology*. 2nd Ed. AVI Publ.
5. Frazier J & Westhoff DC. 1988. *Food Microbiology*. 4th Ed. McGraw Hill.
6. Garbutt J. 1997. *Essentials of Food Microbiology*. Arnold Heinemann.
7. Jay JM, Loessner MJ & Golden DA. 2005. *Modern Food Microbiology*. 7th Ed. Springer.
8. Ray B. 2004. *Fundamentals of Food Microbiology*.3rd Ed. CRC.
9. Robinson RK. (Ed.). 1983. *Dairy Microbiology*. Applied Science.
10. Steinkraus KS. 1996. *Handbook of Indigenous Fermented Foods*. Marcel Dekker.

Communicative English

UNIT 1 – Introduction

1. What is communication? Definition of communication as a transference of sounds and symbols between the sender and receiver by which an understanding is reached.
2. Verbal and non-verbal modes of communication.
3. Function and Role of effective communication.
4. The process of communication – the four skills of listening, speaking, reading and writing. (LSRW)

UNIT 2 – Active Listening

1. Definition of Active Listening. Difference between listening and hearing.
2. Understanding other viewpoints; suspending judgment; listening for hidden meaning; using verbal and non-verbal signals.
3. Barriers and Filters in listening.
4. The Feedback process.
5. Activities and Tasks: Listening Comprehension, Quizzes, Case Studies.

UNIT 3 – Speaking

1. Elements of Phonology – diction, pitch, intonation, clarity, articulation.
2. Pronunciation, stress, accent. Activities/exercises based on phonology.
3. Grammar for effective speaking – accuracy focused and fluency focused activities. Fillers, turntaking, pauses, phatic.
4. Appropriate use of register, lexis, style and body language.
5. Case Studies, Role Play – understanding aggressive, assertive and passive behavior.
6. Confidence and Personality building activities – extempore exercises/ just a minute (JAM) exercises, debates, group discussions.

UNIT 4 – Reading and Writing

1. Methods of effective reading and writing – skimming and scanning, gists, topic sentences, summaries.
2. Reading Comprehension (passages with focus on business, current affairs, travel and tourism, environment.)
3. Letter Writing – invitations and regrets, enquiries and replies, making reservations, lodging complaints.
4. Report Writing – official and business reports.
5. Grammar in Context –
    a) Correct use of tense, adverbs and prepositions
    b) Phrasal verbs
    c) Study of affixes – prefixes and suffixes
    d) Study of synonyms, antonyms, homonyms, hyponyms, hyponyms
    e) Word pairs. Accuracy focused exercises in context.

Suggested Reading

Objective English, OUP
Further Ahead – Sarah Jones and Greg White, CUP
Company to Company – Andrew Littlejohn, CUP
Communicative English – Meenakshi Raman and Sangeeta Sharma, OUP
Communicative Skills for Professionals – Nira Konar, PHI

Chemistry of foods & waters

UNIT-I
Food chemistry- definition and importance, Shelf life of food. Water relationships in foods: water activity and its relevance to deteriorative processes in foods (chemical, enzymic, physical and microbial changes). Food Carbohydrates: structural, analytical, physicochemical, nutritional and functional aspects of small mol. wt. carbohydrates and polysaccharides of plant and microbial origin. Lipids: classification, and use of lipids in foods, physical and chemical properties, effects of processing on functional properties and nutritive value.

UNIT-II
Protein and amino acids: physical and chemical properties, distribution, amount and functions of proteins in foods, functional properties, effect of processing.-Losses of vitamins and minerals due to processing. Pigments in food, food flavours, browning reaction in foods. Enzymes in foods, and food industry, bio-deterioration of foods, food contaminants, additives and toxicants.

UNIT-III
Sampling techniques; Water activity, its measurements and significance in food quality; Calibration and standardization of different instruments. Spectroscopic techniques using UV/Vis, fluorescence, IR, FTIR, NIR, NMR, atomic absorption, ICP, polarimetry, refractometry, microscopic techniques in food analysis (light microscopy, SEM, TEM, XRD, particle size analysis, image analysis etc.). Techniques for dough rheology and starch characterization, Surface tension and its significance in food analysis.

UNIT-IV

Chromatographic techniques: Adsorption, column, partition, affinity, ion exchange, size exclusion, GC, GLC, HPLC, HPTLC, GCMS, LCMS. Separation techniques: Gel filtration, dialysis, electrophoresis, sedimentation, ultrafiltration and ultracentrifugation, solid phase extraction, supercritical fluid extraction, isoelectric focusing, isotopic techniques, manometric techniques. Special techniques: Immunoassay techniques; Isotopic, non-isotopic and enzyme immunoassays; surface tension; enzymatic methods of food analysis; thermal methods in food analysis (Differential scanning colorimetry and others).

Suggested Readings

1. Aurand, L.W. and Woods, A.E. 1973. Food Chemistry. AVI, Westport.
2. Birch, G.G., Cameron, A.G. and Spencer, M. 1986. Food Science, 3rd Ed. PergamonPress, New York.
3 .Fennema, O.R. Ed. 1976. Principles of Food Science: Part-I Food Chemistry. Marcel Dekker, New York.
4. Meyer, L.H. 1973. Food Chemistry. East-West Press Pvt. Ltd., New Delhi.
   Potter, N.N. 1978. Food Science. 3rd Ed. AVI, Westport.
5. Bamji MS, Rao NA & Reddy V. 2003. *Textbook of Human Nutrition*.Oxford & IBH.
6. Belitz HD.1999. *Food Chemistry*. Springer Verlag.
   DeMan JM. 1976. *Principles of Food Chemistry*. AVI.
7. Fennema OR.1996. *Food Chemistry*. Marcel Dekker.
8. Meyer LH. 1987. *Food Chemistry*. CBS.
9. Swaminathan M. 1974. *Essentials of Foods and Nutrition*. Vol. II. Ganesh& Co.
10. Joslyn, M.A. Ed. 1970. Methods in Food Analysis. Academic Press, New York.
11. King, R.D. Ed. 1978. Developments in Food Analysis Techniques-1. Applied Science Publishers Ltd., London.
12. Morris, C.J. and Morris, P. 1976. Separation Methods in Biochemistry 2nd Ed. PitmanPub., London.
13. Plummer, D.T. 1971. An Introduction to Practical Biochemistry. Mc-Graw Hill Pub. Co., New York.
14. Raghuramulu, N., Madhavan Nair, K., and Kalyanasundaram, S. Ed. 1983. A Manual of Laboratory Techniques. National Institute of Nutrition, ICMR, Hyderabad.
15. AOAC International. 2003. *Official methods of analysis of AOACInternational*. 17th Ed. Gaithersburg, MD, USA, Association ofAnalytical Communities.
16. Kirk RS & Sawyer R. 1991. *Pearson's Chemical Analysis of Foods*. 9th Ed. Longman Scientific & Technical.
17. Leo ML. 2004. *Handbook of Food Analysis*. 2nd Ed. Vols. I-III.
18. Linden G. 1996. *Analytical Techniques for Foods and Agricultural Products*. VCH.
19. Macleod AJ. 1973. *Instrumental Methods of Food Analysis*. Elek Sci.Marcel Dekker.
20. Nielsen S. (Eds.). 1994. *Introduction to Chemical Analysis of Foods*. Jones & Bartlett.
21. Pomrenz Y & Meloan CE. 1996. *Food Analysis - Theory and Practice*. 3rdEd. CBS.
22. Ranganna S. 2001. *Handbook of Analysis and Quality Control for Fruit and Vegetable Products*. 2nd Ed. Tata-McGraw-Hill.
23. Robinson JW. 1970. *Undergraduate Instrumental Analysis*. Marcel Dekke

Principles of Biochemistry

UNIT 1

Amino acids – classification, structure and physiochemical properties, chemical synthesis of peptides – solid phase peptide synthesis. Proteins – classification, purification, and criteria of

homogeneneity. Structural organization, sequence determination and characterization of proteins. Conformation of proteins – Ramachandran plots. Denaturation of proteins.

UNIT 2
Classification, chemical properties of carbohydrates, Chemistry and biological roles of homo and heteropolysaccharides, peptidoglycan, glycosaminoglycans, glycoconjugates, glycoproteins, Structural elucidation of polysaccharides; Oligosaccharides – lectin interaction in biochemical processes.

UNIT 3
Classification of Lipids, Fatty acids and their physiochemical properties. Structure and properties of Prostaglandins. Fats and waces, physicochemical properties and characterization of fats and oil. Structure, properties and biological roles of phospholipids and Sphingolipids. Chemistry and properties of Sterols and Steroids. Salient features of bacterial and plant lipids.

UNIT 4
Tissue homogenization. Disruption of tissues and cells, Centrifuges – Principle, applications and types. Differential and density gradient centrifugation. Preparative and analytical ultracentrifuge. Principles and applications of manometry and oxygen electrode, Principle and applications of microscopy, types of microscopes, phase contrast, fluorescent and electron microscopes.

UNIT 5
Basic Principles of spectroscopy, basic laws of light absorption; instrumentation and applications of UV_visible, IR,ESR,NMR, aatomic absorption and Mass spectroscopy, flourimetry, flame photometry, bephelometry, ORD, CD, X-ray diffraction.

Suggested Reading

Principles of Biochemistry, A.Lehenger Kalayani publishers
Biochemistry, Judith Voet, Academic Publishers
Biochemistry, Harper

SECOND YEAR

Fermentation Technology and Food products

UNIT-I
Introduction to fermentation : Modern methods of cell culture: synchronous and co- cell culture, continuous cell culture in liquid and solid media, Cell immobilization and applications, Pre and probiotics cultures. Rate of microbial growth and death. Fermentation kinetics, mass transfer diffusion, membrane transport, dialysis, nutrient uptake.

UNIT-II
Fermenter design, operation, measurement and control in fermentation. Aeration and agitation in fermentation: Oxygen requirement, measurement of adsorption coefficients, bubble aeration, mechanical agitation, correlation between mass-transfer coefficient and operating variables. Types of fermentation: sub-merged and solid state. Batch and continuous fermentation, scale up in fermentation. Product recovery. Biological waste treatment and in plant sanitation.

UNIT-III
Principle and use of biosensor in fermentator. Production of vitamins, amino acids, organic acids, enzymes (amylase, pectinase, proteases), antibiotics, alcohols and single cell proteins.

UNIT-IV
Fermented food: origin, scope and development, sourkraut, youghurt, cheese, miso, tempeh, idli, dosa. Regulatory and social aspects of biotechnology of foods, application of enzymes in food industry, production of food flavour, colour, enzymes, Immobilised enzymes.

Suggested Readings

1. Stanburry P.P. and Whitaker, A. 1984. Principles of Fermentation Technology. Pergamon Press, Oxford UK.
2. Steinkraus, K.H. 1983. Handbook of Indigenous Fermented Foods. Marcel Dekker, New York.
3. Food, Fermentation, and Micro-Organisms by Charles W. Bamforth
4. Food Fermentation edited by Rob Nout, Willem de Vos and Marcel Zwietering
5. Fermented Beverage Productionedited by A.G.H. Lea
6. Handbook of Fermented Functional Foods Second edition edited by Edward R. Farnworth C.H.I.P.S.
7. Practical Fermentation Technology edited by Brian McNeil
8. Microbiology of Fermented Foods Two-Volume Set Second Edition edited by Brian J. B. Wood

Food Preservation Technology

UNIT 1
Freezing: Structure of water and ice, Influence of solutes on the structure of water and ice, phase equlibria and freezing curves of pure water and binary solutions, freezing curve for fish. Determination of freezing points from time- temperature plots, calculation of freezing time,

UNIT 2
Crystallization, homogeneous and heterogeneous nucleation, super cooling, crystal growth, eutectic point, location of ice crystals in tissue, physical changes during freezing.

UNIT 3
Technological aspects of freezing: Slow and rapid freezing, Methods of freezing, comparison of various freezing methods, selection of a freezing method, product processing, packaging and different types of freezers.

UNIT 4
Chemical treatment prior to freezing: antioxidants, cryoprotectants and other additives, theories of cryopreservation, glazing.

UNIT 5
Canning plant location: Practical considerations, canning plant facilities, layout design.

Suggested Reading

1. Balachandran, K.K., Fish Canning Principles and Practices. CIFT, Cochin.
2. Gopakumar K., 2002. Text Book of Fish Processing Technology. ICAR, New Delhi .
3. Hall, G.M., 1992. Fish Processing Technology (Ed), Blackie Academic and Professional, London.
4. Hersom, A. C and Hulland, E. D, 1980. Canned Foods. Chemical Publishing Company, Inc., New York
5. Larousse, J and Brown, B. E, 1997. Food Canning Technology. Willey VCH New York
6. Stumbo, 1973.Thermo Bacteriology in Food Processing. C.RC ,Academic Press, New York
7. Thorne, S. 1991. Food Irradiation. Elsevier Applied Science, London.
8. Venugopal, V. 2006. Seafood Processing. Taylor & Francis Group, London.
9. Warne, D., 1988.Manual on Fish Canning. FAO Fisheries Technical paper 285.
10. Zeathen, P. 1984. Thermal processing and quality of foods. Elsevier Applied Science Publishers. London.

Food safety and Food Laws

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UNIT I

Concept and functions of marketing of food products; Concepts and elements of marketing mix. Concept of market structure, micro and macro environments; Consumer behaviour; Marketing opportunities- Analysis, marketing research and marketing information systems. Market measurement- present and future demand; Market forecasting; market segmentation, targeting and positioning, Allocation and marketing resources, Marketing Planning Process, Product policy and planning: Product-mix; product line; product life cycle, New product development process. Product brand, packaging, services decisions. Marketing channel decisions, Retailing, wholesaling and distribution, Pricing Decisions, Price determination and pricing policy of milk products in organized and unorganized sectors of dairy industry, Promotion-mix decisions.

UNIT II

Advertising; Deciding advertising objectives, advertising budget and advertising message, Media Planning, Personal Selling, Publicity; Sales Promotion, Food and Dairy Products Marketing. International Marketing and International Trade, Salient features of International Marketing, Composition & direction of Indian exports;International marketing environment; Deciding which & how to enter international market; Exports- Direct exports, indirect exports, Licensing, Joint Ventures, Direct investment & internationalization process, Deciding marketing Programme; Product, Promotion, Price, Distribution Channels.Deciding the Market Organization; World Trade Organization (WTO).

UNIT III

Concept of quality: Quality attributes- physical, chemical, nutritional, microbial, and sensory; their measurement and evaluation; Sensory *vis-à-vis* instrumental methods for testing quality. Concepts of quality management: Objectives, importance and functions of quality control; Quality management systems in India; Sampling procedures and plans; Food Safety and Standards Act, 2006; Domestic regulations; Global Food safety Initiative; Various organizations dealing with inspection, traceability and authentication, certification and

quality assurance (PFA, FPO, MMPO, MPO, AGMARK, BIS); Labeling issues; International scenario, International food standards.

UNIT IV

Quality assurance, Total Quality Management; GMP/GHP; GLP, GAP; Sanitary and hygienic practices; HACCP; Quality manuals, documentation and audits; Indian & International quality systems and standards like ISO and Food Codex; Export import policy, export documentation; Laboratory quality procedures and assessment of laboratory performance; Applications in different food industries; Food adulteration and food safety. IPR and Patent.

Suggested Readings

1. Amerine MA, Pangborn RM & Rosslos EB. 1965. *Principles of Sensory Evaluation of Food*. Academic Press.
2. Early R.1995.*Guide to Quality Management Systems for Food Industries*. Blackie Academic.
3. Furia TE.1980. *Regulatory status of Direct Food Additives*. CRC Press. Florida.
4. Jellinek G. 1985. *Sensory Evaluation of Food - Theory and Practice*. EllisHorwoood.
5. Krammer A & Twigg BA.1973. *Quality Control in Food Industry*. Vol. I,II. AVI Publ. Westport.
6. Macrae R, Roloson R & Sadlu MJ. 1994. *Encyclopedia of Food Science &Technology & Nutrition*. Vol. XVI. Academic Press.
7. Piggot J.R. 1984. *Sensory Evaluation of Foods*. Elbview Applied Science.
8. Ranganna S. 2001. *Handbook of Analysis and Quality Control for Fruit and Vegetable Products*. 2nd Ed. Tata-McGraw-Hill. New Delhi
9. Export/Import policy by Govt. of India.
10. Birk, G.G., Herman, J.G. and Parker, K.J. Ed. -1977. Sensory Properties of Foods. Applied Science, London.
11. Charalambous, G. and Inglett, G. 1981. The Quality of Foods and Beverages. (2 vol. set). Academic Press, New York.
12. Pattee, H.E. Ed. 1985. Evaluation of Quality of Fruits and Vegetables. AVI, Westport.
13. Tannenbaum, S.R. Ed. 1979. Nutritional and Safety Aspects of Food Processing, marcel Dekker, New York.
14. Branson, R.E. and Norvell, D.G. 1983. Introduction to Agricultural Marketing McGrawHill Book Comp., New York.
15. Chowdhry, N.K. and Aggarwal, J.C. 1994. Dunkel Proposals. Vol. III. Shipra Pub., New Delhi.
16. Darrah, L.B. 1971. Food Marketing. The Ronald Press Comp. New York.
17. Kacker, M. Ed. 1982. Marketing and Economic Development, Deep and Deep Pub., New Delhi.
18. Rich, S.U. 1970. Marketing of Forest Products: Text and Cases, McGraw Hill Book Comp., New York.
19. Shepherd, G.S. 1947. Marketing of Farm Products. The Lows State College Press, Ames, Lowa.
20. Painy, F.A. and Painy, H.Y. 1983. A Handbook of Food Packaging. Leonard Hill, Glasgow, UK.
21. Scicharow, S. and Griffin, R.C. 1970. Food Packaging. AVI, Westport.

Dairy Microbiology

UNIT I

Present status of milk & milk products in India and Abroad; market milk- Composition of milk of various species, quality evaluation and testing of milk, procurement, transportation and processing of market milk, cleaning & sanitization of dairy equipments. Special milks such as flavoured, sterilized, recombined & reconstituted toned & double toned.

UNIT II

Condensed milk- Definition, methods of manufacture, evaluation of condensed & evaporated milk; dried milk- Definition, methods of manufacture of skim & whole milk powder, instantiation, physiochemical properties, evaluation, defects in dried milk powder.

UNIT III

Cream- Definition, classification, composition, cream separation, sampling, neutralization, sterilization, pasteurization & cooling of cream, evaluation, defects in cream; Butter- Definition, composition, classification, methods of manufacture, theories of churning, evaluation, defects in butter. Ice cream- Definition, composition and standards, nutritive value, classification, methods of manufacture, evaluation, defects in ice cream, and technology aspects of softy manufacture.

UNIT IV

Cheese: Definition, composition, classification, methods of manufacture, cheddar, Gouda, cottage and processed cheese, evaluation, defects in cheese.Indigenous milk products - Present status, method of manufacture of *yoghurt, dahi, khoa, burfi, kalakand, gulabjamun, rosogolla, srikhand, chhana, paneer, ghee, lassi* etc; probiotic milk products.

Suggested Readings

1. Aneja RP, Mathur BN, Chandan RC & Banerjee AK. 2002. *Technology of Indian Milk Products*. Dairy India Publ.
2. Dey. S.1980. *Outlines of Dairy Technology*. Oxford Univ. Press. New Delhi
3. Henderson JL. 1971. *Fluid Milk Industry*. AVI Publ.
4. Rathore NS *et al.* 2008. *Fundamentals of Dairy Technology - Theory & Practices*. Himanshu Publ
5. Spreer E. 1993. *Milk and Dairy Products*. Marcel Dekker.
6. Walstra P. 1999. *Dairy Technology*. Marcel Dekker.
7. Walstra P. (Ed.). 2006. *Dairy Science and Technology*. 2nd Ed. Taylor & Francis.
8. Web BH, Johnson AH & Lford JA. 1987. *Fundamental of DairyChemistry*. 3rd Ed. AVI Publ.
9. Considine, D.M. Ed. 1982. Foods and Food Production Encyclopaedia, VNR, New York.
10. MaCrae, R., Robinson, R.K. and Sadler, M.J. Ed. 1993. Encyclopedia of Food Science, Food Technology and Nutrition Academic Press, London.
11. Robinson, R.K. (2 vol. set). 1986. Modern Dairy Technology Elsevier Applied Science,UK.
12. Rosenthal, I. 1991. Milk and Milk Products. VCH, New York.
13. Warner, J.M. 1976. Principles of Dairy Processing. Wiley Eastern Ltd. New Delhi.
14. Yarpar, WJ. and Hall, C.W. 1975. Dairy Technology and Engineering AVI, Westport.

Seafood Analysis

UNIT 1
Classification of foods: low acid, medium acid and acidic foods, absolute sterility, statistical sterility, commercial sterility, pasteurisation and sterilisation.

UNIT 2
Canning process, steps involved, process flow, additives, HTST processing and aseptic canning, principles and process details, canning machinery and equipment, canning process for fish/shellfish, value added and ready to use canned products.

UNIT 3
HACCP and Safety of canned foods and unreliability of post process sampling of canned foods to ensure sterilization. Status of a batch of canned foods identifying CCPs and their monitoring by specially trained personnel.

UNIT 4
Spoilage of canned food, physical, chemical and microbial, Thermobacteriology, death of bacteria, autosterilisation bacteriology of canned/heat processed fishery products, examination of cans and seams.

Suggested Reading

1. Balachandran, K.K., Fish Canning Principles and Practices. CIFT, Cochin.
2. Gopakumar K., 2002. Text Book of Fish Processing Technology. ICAR, New Delhi .
3. Hall, G.M., 1992. Fish Processing Technology (Ed), Blackie Academic and Professional, London.
4. Hersom, A. C and Hulland, E. D, 1980. Canned Foods. Chemical Publishing Company, Inc., New York
5. Larousse, J and Brown, B. E, 1997. Food Canning Technology. Willey VCH New York
6. Stumbo, 1973.Thermo Bacteriology in Food Processing. C.RC ,Academic Press, New York

THIRD YEAR

Marketing Management

UNIT 1
Marketing Concepts – Approaches to Marketing –Core concepts of marketing - Marketing Process – Functions of Marketing

UNIT 2
Marketing Environment– The changing marketing environment – Analyzing needs and trends in Macro Environment and Micro Environment

UNIT 3
Market Segmentation – Bases for market segmentation of consumer goods, industrial goods and services – Market Targeting and positioning strategies

UNIT 4
Cost Accounting – Relationship with Financial Accounting -Cost Concept & Classification -Basic Terms: Revenue, Expense, Cost, Cost Centre, Cost Unit– Preparation of Cost Sheet

UNIT 5
Materials Cost – Materials purchasing, receiving, storing, issuing including pricing of issues (LIFO, FIFO, Average method) -ABC Analysis –JIT Meaning and determinants of demand, Demand function, Law of Demand, Market Demand, Elasticity of demand, Types of elasticity, Measurement of elasticity, Significance and uses of the elasticity, Methods of demand estimation, Demand forecasting, Meaning and significance of forecasting, Methods of demand forecasting, Forecasting of an established product, Forecasting of a new.

Suggested Reading

1. Managerial Economics - Analysis, Problems and Cases, P. L. Mehta, Sultan Chand and Sons, New Delhi.
2. Managerial Economics - Varshney and Maheshwari, Sultan Chand and Sons, New Delhi.
3. Managerial Economics - D. Salvatore, McGraw Hill, New Delhi.
4. Management Accounting – Dr. Mahesh Kulkarni
5. Cost Accounting - Khan & Jain
6. Management Accounting 3rd Ed. - Khan & Jain
7. Marketing Management Text And Cases in Indian Context-Dr.K.Karunakaran
8. Marketing Management Text and Cases-Biplab Bose

Food Packing technology

UNIT-I
Types of beverages and their importance; status of beverage industry in India; Manufacturing technology for juice-based beverages; synthetic beverages; technology of still, carbonated, low-calorie and dry beverages; isotonic and sports drinks; role of various ingredients of soft drinks, carbonation of soft drinks. Specialty beverages based on tea, coffee, cocoa, spices, plant extracts, herbs, nuts, dairy and imitation dairy-based beverages.

UNIT II
Alcoholic beverages- types, manufacture and quality evaluation; the role of yeast in beer and other alcoholic beverages, ale type beer, lager type beer, technology of brewing process, equipments used for brewing and distillation, wine and related beverages, distilled spirits.
Packaged drinking water- definition, types, manufacturing processes, quality evaluation and raw and processed water, methods of water treatment, BIS quality standards of bottled water; mineral water, natural spring water, flavoured water, carbonated water.

UNIT III
Technology for grain-based snacks: whole grains – roasted, toasted, puffed, popped and flakes, coated grains-salted, spiced and sweetened; flour based – batter and dough based products; *savoury* and *farsans*; formulated chips and wafers, papads, instant premixes of traditional Indian snack foods.

UNIT IV

Technology for fruit and vegetable based snacks: Chips, wafers; Technology for coated nuts – salted, spiced and sweetened; *chikkis*. Extruded snack foods: Formulation and processing technology, colouring, flavouring and packaging.Equipments for frying, Baking and drying, toasting, roasting and flaking, popping, blending, Coating, chipping.

Suggested Readings

1. Edmund WL. *Snack Foods Processing*. AVI Publ.
2. Frame ND .1994.*The Technology of Extrusion Cooking*. Blackie Academic.
3. Gordon BR.1997 *Snack Food*.AVI Publ
4. Samuel AM.1976. *Snack Food Technology*. AVI Publ.
5. Hardwick WA. 1995. *Handbook of Brewing*. Marcel Dekker.
6. Hui YH. *et al* 2004. *Handbook of Food and Beverage Fermentation Technology*. Marcel Dekker.
7. Priest FG & Stewart GG. 2006. *Handbook of Brewing*. 2nd Ed. CRC.
8. Richard P Vine. 1981. *Commercial Wine Making - Processing and Controls*. AVI Publ.
9. Varnam AH & Sutherland JP. 1994. *Beverages: Technology, Chemistry and Microbiology*. Chapman & Hall.
10. Woodroof JG & Phillips GF.1974. *Beverages: Carbonated and NonCarbonated*. AVI Publ.

Food Processing & Quality Control

UNIT – A

Units and Dimensions: Concept of Unit operation, Mass Energy balance, Dimensions and Units, Unit Conversion, Dimensional Analysis

Psychrometric chart: Dry and wet bulb temperature, specific saturation, adiabatic saturation temperature, Dew point, Information about psychometric chart

Refrigeration: Reverse Carnot's cycle, Pressure enthalpy chart, temperature entropy chart, vapor compression refrigeration system, equipment's C.O.P., Refrigeration load calculation, Application of refrigeration in food processing operations

UNIT -B

Freezing: Principles and methods, Different types of Freezers, Industrial problems associated of frozen storage food products

Introduction to Heat Transfer: Heat Transfer, modes of heat transfer, conduction through a flat wall,conduction through hollow cylinder, convective heat transfer, radiation heat transfer

Heat transfer Equipments and Design: Heat Transfer equipments, parallel and counter current flow heat exchangers, Logarithmic mean temperature difference, heat transfer coefficient, heat exchanger design (preliminary), concept of black body, Emissivity and Absorptivity

UNIT - C

Mass Transfer: Principles of mass transfer and Diffusion process, diffusivity

Evaporation: Mechanisms of vaporization, Boiling Point elevation, Different types of evaporators, Evaporation of heat sensitive materials

Size Reduction: Principles of size reduction, methods of size reduction.

UNIT-D

Mixing: Principles, mixing equipment, mixing index

Separation processes: Principles and methods of gas absorption, Distillation, Extraction and washing,
Filtration, sedimentation, sieving, centrifugation
Membrane Separation Processes: Reverse Osmosis, Nano filtration and Ultra filtration

Suggested Reading

Toledo 2000, Fundamentals of Food Process Engineering, CBS Publishers, New Delhi.
Pandey, 2000, Experiments in Food Process Engineering, CBS Publishers, New Delhi.
Gean Koplis, 1993, Transport processes & Unit operations, Prentice Hall of India, New Delhi.
Mcab Smith, Unit Operations in Chemical Analysis, Tata McGraw Hill, New Delhi.
P G Smith, 2009, Introduction to Food Process Engineering, Kluver Academic, Plenum Publishers.
Zeki Berk, 2008, Food Process Engineering & Technology, Academic Press.