

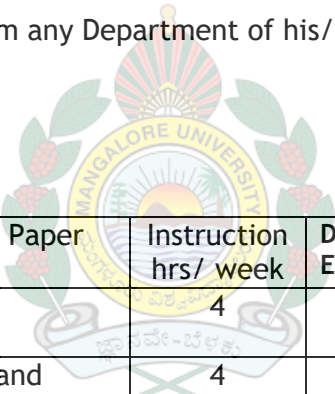
MANGALORE UNIVERSITY
M.Sc., FOOD SCIENCE AND NUTRITION (CBCS)
Course pattern and scheme of Examination

Semester	Course Code	Title of the Paper	Instruction hrs/ week	Duration of Exam (hrs)	Marks			Credits
					IA	Exam	Total	
I Semester	FSN 401	Food Chemistry	4	3	30	70	100	4
	FSN 402	Nutrition and Statistics	4	3	30	70	100	4
	FSN 403	Food Microbiology	4	3	30	70	100	4
	FSN 404	Principles of Food Processing	4	3	30	70	100	4
	FSN 405**	Food Chemistry, Nutrition and Statistics	8	4	30	70	100	4
	FSN 406**	Food Microbiology and Food Processing	8	4	30	70	100	4
	FSN 407	Seminar	1	-	-	-	25	1
		Total		-	180	420	625	25

Semester	Course Code	Title of the Paper	Instruction hrs/ week	Duration of Exam (hrs)	Marks			Credits
					IA	Exam	Total	
II Semester	FSN 451	Analytical Techniques in Food Science	4	3	30	70	100	4
	FSN 452	Nutritional Physiology	4	3	30	70	100	4
	FSN 453	Industrial Microbiology and Biochemistry	4	3	30	70	100	4
	FSN 454	Advances in Food Processing and Technology	4	3	30	70	100	4
	FSN 455**	Analytical Techniques and Nutritional Physiology	8	4	30	70	100	4
	FSN 456**	Industrial Microbiology, Biochemistry and Food Processing	8	4	30	70	100	4
	FSN 457	Seminar	1	-	-	-	25	1
		Total		-	180	420	625	25

Semester	Course Code	Title of the Paper	Instruction hrs/ week	Duration of Exam (hrs)	Marks			Credits
					IA	Exam	Total	
III Semester	FSN 501	Choice based course #	4	3	30	70	100	4
	FSN 502	Fruit and Vegetable Technology	4	3	30	70	100	4
	FSN 503	Clinical Nutrition and Dietetics	4	3	30	70	100	4
	FSN 504	Functional properties of Food and Health Implications	4	3	30	70	100	4
	FSN 505**	Dairy, Fruit and Vegetable Technology	8	4	30	70	100	4
	FSN 506**	Clinical Nutrition, Dietetics and Functional Properties of Foods and Health Implications	8	4	30	70	100	4
	FSN 507	Seminar	1	-	-	-	25	1
		Total		-	180	420	625	25

Students can opt this course from any Department of his/her choice.



Semester	Course Code	Title of the Paper	Instruction hrs/ week	Duration of Exam (hrs)	Marks			Credits
					IA	Exam	Total	
IV Semester	FSN 551	Meat and Fish Technology	4	3	30	70	100	4
	FSN 552	Food Quality and Plant Management	4	3	30	70	100	4
	FSN 553	Marketing, Business Management and Bioinformatics	4	3	30	70	100	4
	FSN 554**	Meat and Fish Technology, Food Quality and Plant Management	8	4	30	70	100	4
	FSN 555***	Field Survey and Report	2	-			25	1
	Project ****							
	FSN 556	Project + Viva		-			200	8
		Total			120	280	625	25

*Internal assessment for theory should be based on two tests/assignment in each paper; for practical, based on records, continuous assessment and one test in each practical

** Practicals based on background of respective theory papers

*** Field survey and report based on visit to different food industries

**** Project report should be evaluated by an internal and an external examiner

Unit I

Concept of food chemistry: Introduction, definition and classification.

Proteins, essential amino acids, supplementary value of proteins, nitrogen balance, dietary proteins, malnutrition. Techniques of protein purification: Cell lysis, dialysis, salting-in, salting-out, centrifugation and density gradient. Factors affecting enzyme function, specificity, mechanism of action and application of enzymes.

Unit II

Carbohydrates: Source, classification, structural study (dextrose, grape sugar cane sugar, Lactose, sucrose, maltose). Deoxy- and amino sugars, phosphate esters of sugars muramic and muraminic acids, glycosides, cellobiose, Gentobiose, polysaccharides (starch, cellulose), Industrial applications of cellulose, dietary fibers. Heterocyclic systems: Occurrence and sources. Chemistry of porphyrins,

Unit III

Lipids: Occurrence, structure, chemistry and properties of fatty acids. Essential fatty acids, chemistry of carotenoids, cholesterol and bile acids.

Nucleotides: Chemistry, properties, isolation, structure and synthesis of nucleosides and nucleotides.

Chemistry of alcoholic beverages: Source, classification, source typical examples (wine).

Chemistry of milk and milk products (e.g. curd or dahi, yoghurt, cheese, lassi)

Food emulsions: Theory of emulsions, properties and types of emulsifying agents.

Unit IV

Vitamins: source, classification, chemistry of vitamin B1, B2 and vitamin A deficiency.

Pigments: Classification, constituents, structural elucidation of flavones and flavonols, natural sources of flavones and flavonols. Food Additives: Bakery food and milk products.

Colouring substances in foods, their constitution, side effects, identification of colouring substance, natural food colours,. Minerals: Essential minerals in our daily life, their source (iodine, calcium, magnesium, zinc) and deficiency diseases.

Reference

An Introduction to the Chemistry of Carbohydrates – Honyman and Guthri, 2000

Biochemistry – Lubert Stryer, Freeman & co, New York, 1988

Biochemistry – Zubay, Mac Millan pub., 1988

Fats and Oils – Hamilton, R.J. and Bharti, A., Applied Science, London, 1980

Food Chemistry – Aurand, L.W. and Woods, A.E., AVI, Westport, 1973

Food Chemistry – Meyer, L.H., East-West Press Pvt. Ltd., New Delhi, 1976

Food Science – Birch, G.G. *et al.*, Pergamon Press, New York, 1986

Food Science – Potter, N.N., AVI, Westport, 1978

Natural Product Chemistry – Chatwal, G.R., Vol. 1 and 2, Himalaya Publishing, Mumbai 1990

Organic Chemistry – Finar, I.L. Vol. 1 and 2, Longman – ELBS, London, 2000

Principle of Biochemistry – A.L. Lehninger, David L. Nelson and M.M. Cox CBS pub., 1993

Principles of Food Science (Part I – Food Chemistry) – Fennema, O.R., Marcel Dekker, USA, 1976

World Oil Seeds: Chemistry, Technology and Utilization – Salunkhe, D.K. et al., VNR, New York, 1982

FSN 402

NUTRITION AND STATISTICS

52 hr (13 hr x 4 units)

Unit I

Concepts and definitions of nutrition: Nutrition, malnutrition and health.

Food groups: Types, classification and contributions of nutrients.

Energy value of foods, energy requirement, adequate nutrition for normal physical development and sound health.

Nutritional requirements of proteins, sources, requirements, qualities, functions and digestion, protein deficiency and related diseases.

Unit II

Nutritional aspects of carbohydrates and dietary allowances.

Fats, sources, requirements, essential fatty acids and their role, nutritional significance of omega fatty acids, Cholesterol.

Vitamins: Nutritional significance, functions, requirements and deficiency (vitamin A, D, C and B).

Unit III

Mineral nutrition, importance of minerals (calcium, iron, iodine and zinc)

Recommended daily allowances for nutrients and balanced diets.

Nutrition for infants, children, adults, pregnant women, lactating women and old age.

Dietary diseases: Causes, symptoms and treatments (obesity, diabetes, cardiovascular diseases, liver diseases and renal diseases).

Unit IV

Application of statistics in food science and technology, Classification, Tabulation, graphical representation of data, frequency polygon, frequency curve.

Exponential growth, logarithmic growth, measures of central tendency and dispersion. Normal, binomial, Poisson's, distribution, Probability, correlation and regression.

Significance of 't' tests and Chi-square test. ANOVA. Statistical packages

Reference

A textbook of foods: Nutrition and Dietetics – Raheena, Begum, Sterling Publishers, New Delhi, 1989

Biostatistical analysis – Zar, J.H., Prentice Hall, New Jersey, 1974

Biostatistics – Alvin E. Lewis, Affiliated Est West, New Delhi, 1971

Clinical Dietetics and Nutrition – Anita F.P., Oxford University Press, New Delhi, 1973

Essentials of Food and Nutrition – Swaminathan, M., Ganesh and Co., Madras, 1985

Evaluation of Protein for Humans – Bodwell, C.E., AVI Publishing, Westport, 1977

Introductory statistics for Biology – Edward Arnold, London 1979

Krause's food, Nutrition and Diet Therapy – Mahan, L.K. and Arlin, M.T., W.B. Saunders Company, London, 1992
 Normal and Therapeutic Nutrition – Robinson, D.H. *et al.*, Mac Millan Publishing Co., 1988
 Nutrient Requirements and Recommended Dietary Allowances for Indians – Indian Council of Medical Research, New Delhi, 1989
 Nutrition and Dietetics – Joshi, S.A., Tata McGraw Hill publishers, New Delhi, 1992
 Nutrition and Diet Therapy – Williams, S.R., Times Mirror/Mosby College Publishing, St. Louis, 1989
 Nutrition in Health and Diseases – Anderson, L. *et al.*, J.B. Lippincott and Co., Philadelphia, 1982
 Nutritive value of Indian foods – Gopalan C *et al.*, Indian council of medical Research, 1991
 Statistics for Biological Sciences – William C. Shefler, Addison Wesley, California, 1969
 WHO Technical Reports Series for different Nutrients

FSN 403

FOOD MICROBIOLOGY

52 hr (13 hr x 4 units)

UNIT I

Historical perspectives of microbiology of foods.
 Microorganisms, taxonomy and principles of classification
 Microbiology, structure and reproduction in archaeobacteria, eubacteria and fungi
 Microbial nutrition, nutritional classification of microorganism.
 Common Microbial inhabitants of food and food products and their characteristics.

UNIT II

Methods of isolation, enumeration, cultivation and preservation of microorganisms
 Growth kinetics, factors affecting growth and death of microorganisms, Basic principles of food Spoilage by microorganisms (impacts of temperature, pH, water activity, OR Potential, nutrients)
 General account of symbiosis, mutualism, antagonism, parasitism, commensalism in microorganisms.
 Microbial metabolism, respiration, aerobic and anaerobic respiration and fermentation

UNIT III

Principles of favourable and unfavourable spoilage of foods.
 Role of microorganisms in unfavourable food spoilages, microbial fermentation, types of food fermentations, alcoholic leverages, organic aids and volatile fatty acids.
 Food borne infections and food-borne diseases (amoebiosis, diarrhea and typhoid)
 Food poisoning by microorganisms (*Salmonella*, *Staphylococcus* and *Clostridium* and mycotoxins, toxins), food-borne disease outbreaks.

UNIT IV

Principles and techniques of food preservation (physical, chemical and radiation)
 Food additives and microbes, microbial flavouring agents.

Microbiology of selected food products (dairy, meat, poultry, sea foods, beverages and flours)
Microbiological and analytical methods of detection and enumeration of food- borne microorganisms.

References

- Microbials in Foods – Branen, A.L. and Davidson, P.M., Marcel Dekker, New York, 1983
of Microorganisms – Brock, T.D. and Madigan, M.T., Prentice Hall, New Jersey, 2000
Microbiology Robinson, R.K., Applied Science, London, 1983
Text Book of Microbiology - Peleazar J. and Chan ECS. Mac Graw Hill New York, 1988
Medical Microbiology – Adams, M.R. and Moss, M.O., Panima Publishing Co., New Delhi, 2000
Medical Microbiology – Frazier, W.C.
Microbiology – Schelegel, H.G., Cambridge University Press, Cambridge, 1995
Introductory Mycology – Alexopolous, C.J., Wiley Eastern Limited, New Delhi, 1988
Medical Microbiology – Crucikshank, R. *et al.* Churchill Livingstone, London, 1975
Medical Biology – Rosenberg E and Chohen I.R., Saunders Coll. Pub., 1983
Microbiology in Agriculture, Fisheries and Food – Skinner, F.A. and Carr, J.G. Academic Press, London, 1976
Food Microbiology – Jay, J.M., CBS Publishing and Distribution, New Delhi, 2000
Microbial World – Stainer, R.Y. *et al.* Prentice Hall, India, New Delhi, 2000

FSN 404

PRINCIPLES OF FOOD PROCESSING

52 hr (13 hr x 4 units)

Unit I

Food processing and its historical perspectives

Basic principles of food processing: thermal processing, canning, materials of canning, types and fabrication (tin, aluminum, glass), heat penetration into containers and corrosion of cans. Determination of heat resistance of microorganisms and enzymes in foods. Determination of process time inoculated pack studies, spoilage of thermally processed foods.

Unit II

Refrigerated storage: Slow and quick freezing, freezing points of foods, cryogenic freezing and frozen food storage. Effects of low temperature on fresh food materials and processed food products. Drying and hehydration: sum and solar dehydration, mechanical drying, types of food dryers.

Unit III

Chemical preservation: SO₂, benzoic acid, sorbic acid, antioxidants and antibiotics and modern preservatives. Food fermentation: Alcoholic, acetic and lactic acid fermentation, traditional food products. Pickling and curing, impact of salt on food preservation, types and properties of slat cured products. Preservation through controlling water activity, high sugar concentration, liquid food concentrates.

Unit IV

Irradiation of foods, types and sources of radiation, dosimetry, mode of action of ionizing radiation, impacts of radiation on food constitutions and regulations. Hurdle technology. Flexible packing materials, types, qualities, selection and application of specific food stuffs for packing. Modified and controlled atmospheric storage and gas storage. Processing of cereals and their products, oil seeds, spices and plantation products.

References

- Food Dehydration – Arsdel, W.B. *et.al.*, AVI, Westport, 1973
Food Processing and Nutrition – Bender, A.E., Academic Press, London, 1978
Food Processing Technology: Principles and Practice – Fellows, P. and Ellis, H., New York, 1990
Introduction to Food Processing – Jelen, P., Prentice Hall, Reston Virginia, USA, 1985
Physical Properties of Food and Food Processing Systems – Lewis, M.J., Woodhead, UK, 1990
Minimally Processed Refrigerated Fruits and Vegetables – Wildey, R.C., Chapman and Hall, London, 1994
Nuclear and Radio Chemistry – Gerhan Fried Lander, John Wiley and sons, 1981

FSN 405*

FOOD CHEMISTRY, NUTRITION AND STATISTICS

Colour reactions for mono-, di- and polysaccharides, proteins, lipids and enzymes
Estimations of glucose, free fatty acids and proteins
Estimation of amino acids
Tests for nitrogen and nonprotein nitrogen (NPN)
Determination of Ascorbic acid
Chromatography: Paper, thin layer, Rf value; ascending and descending chromatography
Estimation of vitamin C
Testing of rancidity in fats and oils
Estimation of minerals (iron and micronutrients)
Estimation of amines (trimethylamine)
Isolation of caffeine from tea powder
Isolation of pigments from natural sources
Colorimetry
Flame photometry
Electrophoresis

Methods of Cooking (boiling, steam cooking, pressure cooking, frying and baking)
Preparing dishes rich in protein, Iron, Calcium, Vitamin A and Thiamine
Determination of crude fibres in food
Determination of antinutritional properties (e.g. phenolics, tannis, trypsin inhibitors and hemagglutinins)
Determination of functional properties (e.g. foaming, emulsifying activities and stabilities)
Determination of cooking properties
Proximate analysis of foods and feeds (moisture, nitrogen, crude fiber, crude lipids and ash)
Calculation of calorific value
Mineral analysis of foods
Vitamin assay (water soluble and fat soluble)
Detection of adulterants in foods

In vivo and *in vitro* protein digestibility
Statistical analysis of data and presentation of reports
Computer applications in statistical data analysis and presentation

*Practical exercises to be conducted with background of respective theory papers (FSN 401 and FSN 402)

FSN 406* FOOD MICROBIOLOGY AND FOOD PROCESSING

Microscopic observations of microorganisms
Microbial staining techniques (simple and differential staining, cell wall, endospores, intracellular lipids, acids-fast, flagella, viability)
Microbial motility tests
Sterilization techniques
Microbial culture media and their preparation
Studies on bacterial, fungi and actinomycetes
Isolation techniques
Maintenance of microorganisms (stock culture and subculture)
Microbial characterization based on biochemical tests
Quantitative and qualitative assessment of microflora in soil, water, air and food
Milk microbiology
Food toxigenic fungi
Food poisoning and contamination

Aseptic handling of food materials
Food Spoilage, storage and disorders of foods
Submerged and solid state fermentation (bacteria and fungi)
Preparation of beer, wine and other fermented beverages
Techniques involved in indigenous food preparation
Solvent extraction of oil seeds
Canning materials and methods of canning
Experiments on freezing preservation, drying and dehydration
Food fermentation, pickling and curing
Preservation of food by chemical preservatives
Estimation of SO₂ and benzoic acid
Preparation of intermediate moisture products
Determination of water activity of food
Storage studies
Impact of electron beam radiation on nutrients
Visits to food processing industries

*Practical exercises to be conducted with background of respective theory papers (FSN 403 and FSN 404)

52 hr (13 hr X 4 units)

UNIT I

And their applications in food technology, Principles of partition coefficient, techniques – paper, TLC, Gel filtration, ion exchange, affinity, HPLC and GLC. Spectroscopy - UV-visible, fluorescent spectroscopy, CD spectroscopy, NMR, X-ray diffraction, scopy.

UNIT II

Radio techniques – nature of radiation sources, radioactive decay, units of radiation, detection and measurements of radioactivity, autoradiography, GM counter, Scintillation counter

Extraction, isolation and purification of soluble and membrane bound enzymes

Enzyme . Study of enzyme kinetics (effect of substrate concentration, pH, temperature and metal Determination of K_m and V_{max} . Mechanism of enzyme inhibition. Immobilization of enzymes and their applications. Isolation of enzymes, extraction of soluble and membrane bound enzymes purification of enzyme- criteria for purification, assay of enzymes

UNIT III

Quantification of organic acids (citric acid, lactic acid, butyric acid)

Proximate analysis of foods and feeds (moisture, nitrogen, crude fiber, crude lipids and ash).

Mineral analysis of foods and feeds. Vitamin assay (water soluble and fat soluble)

Analysis of antinutritional factors (phenolics, tannins, L-DOPA, trypsin inhibitors)

Estimation of secondary metabolites (alkaloids, antibiotics)

UNIT IV

Optimisation of PCR reactions and application in food technology

Antige diagnosis (*in vitro*), immunodot technique, immunodiffusion technique, immunological diagnosis of food adulteration and ELISA technique

References

A manual of Laboratory Techniques – Raghuramulu et al., National Institute of Nutrition, ICMR, Hyderabad, 1983

An introduction to practical Biochemistry – Plummer, D.T. McGraw Hill Pub. Co., New York, 1971

Basic Concepts of Analytical Chemistry (2nd ed), S.N. Khopkar. New Age Pub.

Biophy Chemistry – Principles and techniques – A. Upadhaya Himalaya pub.

Developments in Food Analysis – King R.D., Applied Science Publishers Ltd., London, 1978

Metho Food Analysis – Joslyn, M.A., Academic Press, New York, 1970

Nuclear and Radio Chemistry – 3rd ed. Gerhan Friedlander John Wiley and sons, 1981

Practical Immunology – Hudson *et al.*, Blackwell scientific pub., 1986

Principles of Gene Manipulation – Old and Primrose, Blackwell scientific Pub., 1994

Principles of Instrumental Analysis. Da Skooge Holt-Saunders, 1985

Separation Methods in Biochemistry – Morris, C.J. and Morris, P., Pitman Publ., London, 1976

UNIT I

Movement and Coordination

Organization of Body

Structure of skeletal, cardiac and smooth and Physiology of muscle contraction.

Structure of Brain and Neurons.

Physiology of nerve impulse conduction, excitability of membranes, electrical and chemical transmission between cells.

Sensory organs and their functions.

Hormones: Classification, synthesis, regulatory functions and mechanism of hormone action. Prostaglandin- structure, biosynthesis, metabolism and biological action and their role in pathology.,

UNIT II

Digestion and Respiration

Physiological basis of Nutritional Biochemistry,

Structure of digestive tract, enzymes in digestion, regulators of GI activity, mechanical and biochemical aspects of digestion, absorption and transport of major nutrients.

Liver: Role of liver in processing and distribution of nutrients absorbed from SI, inter relationship of major metabolism in liver, excretory functions and storage.

Structure of Lung, Physiology of respiration

Exchange and transport of gases and its regulation.

UNIT III

Transport and Defence

Blood: Composition- plasma, blood cells, haemoglobin, blood clotting process.

Heart : beat, initiation , conduction and regulation

Physiology of Circulation

Adipose tissue: Structure, composition, deposition of triglycerides in adipose tissue, formation of fat stores from non lipid and dietary lipids, role of brown adipose tissues in thermo genesis.

Immunity: Immune response, antibody, cell mediated and humoral immunity complement system.

UNIT IV

Excretion Detoxification and Reproduction

Internal structure of Kidney and Nephron

Fluid and electrolytes balance, Acid Base balance,

Physiology of Excretion, Roles of kidney in body water regulation.

Detoxication: Definition, xenobiotics, enzyme systems involved mechanism of detoxification.

Metabolic adaptation during starvation, exercise, stress and diabetes mellitus.

Oxidative stress and Antioxidants: Free radicals: definition, formation in biological systems, defense against free radicals. Role of free radicals and antioxidants in health and disease. Determination of free radicals, lipid peroxides and antioxidants.

Reproduction: Female and male reproductive organs – structure and functions;

Reproductive health and nutritional requirements

Unit I

Microbial biomass, primary metabolites, secondary metabolites microbial enzymes, transformed products (glutamic acid, L-lysine), vitamins and hormones (vitamin B 12, vitamin A, riboflavin, gibberellins), organic acids and other industrial chemicals (lactic acid, citric acid, alcohol, glycerol, acetone). Antibiotics (penicillin, streptomycin, tetracycline) and lantibiotics (peptide antibiotics)

UNIT II

Microbial production of enzymes (protease, amylase, invertase, pectinase, xylanase) substrate, production, purification of enzymes, immobilization, their application in food industries. Microbial exopolysaccharides (EPS), classification and applications (g=health, industrial, pharmaceutical and food): Alginate, Cellulose, Hyaluronic acid, Xanthan, Dextran, Gellan, Pullulan, Curdlan, polysaccharides of lactic acid bacteria; Chitin, chitosan and chitin derivatives. Microbial food: Oriental foods, Baker's yeast, cheese, SCP, PUFA, mushroom cultivation, sauerkraut, silage, probiotics, Microbial beverages and food: Production of wine, beer and vinegar

UNIT III

Biochemical engineering, types of fermentation processes and their merits and demerits. Kinetics of microbial growth and death. Bioreactors and their design and analysis. Batch, fed and continuous bioreactors. Scale-up of bioprocesses and bioreactor operation.

UNIT IV

Allosteric enzymes and metabolic regulation, sigmoid kinetics, steady-state metabolic pathway, concerted and sequential models to explain the sigmoid nature of allosteric enzymes. Regulation of metabolic pathway by control of enzyme activity. Enzyme activation –zymogen, substrate analogues and their uses. Mechanism of action of mysozyme, chymotrypsin, DNA polymerases I, EcoRI, aspartate transcarbamylase, alcohol dehydrogenase, RNA as enzyme, Synthetic enzymes, ribozyme, abzyme, industrial application of enzymes, enzymes as reagents in clinical chemistry (analytical tools). Enzyme engineering (protein engineering), Immobilization of enzyme and their applications

References

Biochemical Engineering Fundamentals, Baily & Ollis McGraw-Hill Publishing
Biotechnology: A Text Book of Industrial Microbiology – Crueger, W. and Crueger, A.,
Science Tech., Madison, USA, 1984
Biotechnology of Food Fermentation _ Joshi, V.K. and Pandey, A., Education Publishers, New
Delhi, 1999
Chemical engineering – J.M. Coulson Pregamon Press

UNIT I

Basic principles in food processing. Design of fermenter-criteria for ideal fermenter, aeration, agitation, valves, baffles, heat exchanges. Types of Fermenters- The Waidhof-type fermentor, tower fermenter, cylindroconical vessels, air-lift fermenter, deep-jet fermenter, the cyclone column, the packed tower, rotating disc fermenter, hollow fiber chambers, packed glass bead reactors. Types of fermentation processes: submerged fermentation, surface or solid substrate fermentation, batch fermentation, continuous fermentation.

UNIT II

Kinetics of fermentation processes. Transport phenomenon in bioprocesses- mass transfer, Mass transfer co-efficient for gases and liquids, oxygen transfer co-efficient, biological heat transfer and heat transfer coefficients. Online acquisition: Bioprocess control and monitoring of variables such as temperature, agitation, pressure, pH, PID control, use of computers in bioprocess control systems.

Biosensors- construction and application, fermentation economics.

UNIT III

Fluid foods: Material and energy balance, flow of fluid foods. Hygienic design concepts, sanitary pipe fittings, milk pumps, milking machines, bulk milk coolers, milk collecting and chilling centers, milk tanks, stirrers and mixers, milk reception equipment, pasteurizers, sterilizers and treatment by irradiations, CIP system, corrosion process and their controls. Separators, Centrifugation, cyclone separators, ultra-filtration, reverse osmosis and electrodialysis. Equipments for cheese, butter manufacture and other special milk products.

UNIT IV

Thermal processing, sterilization classification, UHT systems and recent advances, design of thermal processes, Survival curves, thermal death curves, analysis of thermal resistance data, process time evaluation. Design of batch and continuous sterilization cycles in vat. Refrigeration cycles, performance of compressors, refrigeration system balance and multiple evaporation systems. Flash cooling, design of condensers, evaporators, cooling towers, thermo-electric cooling, cryogenics and refrigeration systems for ultra and low refrigeration. Food irradiation.

References

- Biochemical Engineering Fundamentals – Bailly & Ollis, McGraw-Hill Publishing
Principles of Fermentation Technology – P.F. Stanbury & Whitaker, Pergamon Press
Food Dehydration – Arsdell, W.B. et al., AVI, Westport, 1973
Food Processing and Nutrition – Bender, A.E., Academic Press, London, 1978
Food Processing Operations – Magnard Joslyn, AVI Publishing Company, Westport
Handbook of Food Engineering – Heldman, D.R. and Lund, D.B., Marcel Dekker, New York, 1992
Minimally Processed Refrigerated Fruits and Vegetables – Wildey, R.C., Chapman and Hall, London, 1994
Unit Operations in Food Processing – Earle R.L., Pergamon Press
Food Irradiation: Thurme, S., Elsevier Applied Science, London, 1991

FSN 455* ANALYTICAL TECHNIQUES AND NUTRITIONAL PHYSIOLOGY

Instrumentation in bioprocess technology

Enzyme assays

Extraction, isolation and purification of soluble and membrane bound enzymes

Study of enzyme kinetics (effect of substrate concentration, pH, temperature and metal ions)

Determination of K_m and V_{max}

Mechanism of enzyme inhibition

Chromatographic techniques

Immobilization of enzymes and their applications

Cell encapsulation (immobilization) techniques and uses

Downstream processing techniques

Estimation of organic acids

Immunological techniques

Immunological diagnosis of food adulteration

Demonstration of ELISA technique

Methods of cell lysis

Reverse osmosis

Drying processes

Isolation of DNA and RNA from bacteria, plants and yeasts

Southern and Northern blotting techniques

Blotting Techniques

PCR techniques

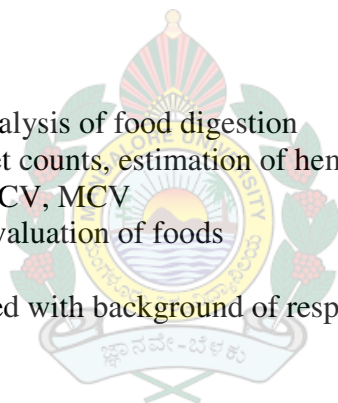
Simulated digestive system and analysis of food digestion

Hematology – RBC, WBC, Platelet counts, estimation of hemoglobin, oxidized hemoglobin

Estimation of hematocrit values, PCV, MCV

Sensory evaluation/organoleptic evaluation of foods

*Practical exercises to be conducted with background of respective theory papers (FSN 451 and FSN 452)



**FSN 456* INDUSTRIAL MICROBIOLOGY, BIOCHEMISTRY AND
FOOD PROCESSING**

Isolation of microbes of industrial importance
Microbial growth and death kinetics
Estimation of microbial biomass
Production of microbial polysaccharides
Production and quantification of organic acids (e.g. citric acid, lactic acid, butyric acid)
Enzyme immobilization
Whole cell immobilization
Production of enzymes by microbial cultures (amylase, pectinase, proteases)
Preparation of starter cultures (bacteria and fungi)
Ethanol fermentation
Production of wine and vinegar
Estimation of amino acids
Determination of antimicrobial activity
Mushroom cultivation and processing
Fermenters and Bioreactors

Determination of thermal process time
Determination of osmotic dehydration of food
Preparation of intermediate moisture foods
Preparation of clarified juice, candy and microwaved foods
Fermentation kinetics
Canning of fruit juices
Solid state and submerged fermentation techniques
Parboiling of rice
Pasteurization techniques
Food irradiation principles and practice
Biosensors
Visits to food processing industries



*Practical exercises to be conducted with background of respective theory papers (FSN 453 and FSN 454)

UNIT I

Sources and composition of milk, standardization and toning of milk

Milk products and processing: Cream, butter oil, cheese, cheese spread, condensed milk, evaporated milk, whole and skimmed milk powders, ice cream, khova, channa, paneer, fermented milk products (yoghurt, dahi, shrikhand)

Principles and advances in dairy technology and engineering. Physico-chemical properties of milk and milk products and its application in processing and equipment design.

UNIT II

Processing and qualities: Processing steps, equipments, quality parameters and selection of equipments.

Homogenization: Principles of homogenization, single and double stage homogenizers, care and maintenance of homogenizers, design principles of homogenizers, application of homogenization in dairy industry

UNIT III

Thermal processing: Pasteurization of milk, batch, flash and continuous pasteurizers, HTST pasteurizer and design, principles and thermal death kinetics, care and maintenance, UHT processing of milk, quality changes during processing of milk.

Concentration of milk: Evaporators, types, machineries, heat and mass balance in single and multiple effect evaporators, performance characteristics of evaporators and their selection criteria. Steam economy.

UNIT IV

Spray and drum drying: Theory of drying, estimation of drying rates and drying time, drying equipments, particle size calculation, design of spray and drum dryer.

Dairy products: Frozen dairy products, cheese, casein and its derivatives, lactose and their composition, standards, manufacturing, process and control and quality control parameters.

References

Dairy Technology and Engineering – Yarpar, W.J. and Hall, C.W., AVI Publishing, Westport, 1975

Microbiology in Agriculture, Fisheries and Food – Skinner, F.A. and Carr. J.G. Academic Press, London, 1976

Modern Food Microbiology – Jay, J.M., CBS Publishing and Distribution, New Delhi, 2000

Modern Dairy Technology – Robinson, R.K., Elsevier Applied Science, UK, 1986

Milk and Milk Products – Rosenthal, I., VCH, New York, 1991

Outlines of Dairy Technology – Dey, S., Oxford University Press, New Delhi, 1994

Principles of Dairy Processing – Warner, J.M., Wiley Eastern Ltd., New Delhi, 1976

UNIT I

Principles and methods of fruit and vegetable preservation, Advances in fruits and vegetable selection, grading, sorting, blanching and other pre-processing steps in automation of processing like, kinetics of quality changes (physical, chemical, sensory and nutritional changes during processing)

UNIT II

Principles of storage: Natural, ventilated low temperature storage.

Preservation of fruits and vegetables by heat, chemicals, sugar, salt, fermentation and drying. Fruit and vegetable juices, syrups, cordials and nectars, juice concentrates, pectin and related compounds, jams, jellies and marmalades.

Theory of gel formation, quality control, pickles, chutneys, vinegar production and tomato products.

UNIT III

Concept of commercial sterilization, heating and cooling of food in container, influence of commercial sterilization on product quality.

Aseptic processing: Concepts of aseptic processing and packaging, quality assurance, machineries and their maintenance, package characteristics.

Concept of drying and drying curves, state of water in fruits and vegetables, drying effect on product quality and nutritive value. Advances in drying of fruits and vegetables.

UNIT IV

Thermal processing: Influence of elevated temperature on microbial population, product quality, process time calculation, balancing purpose, blanching techniques and determination of blanching processes.

Minimally processed fruits and vegetables: Concept hurdle technology, thermal heating approach to minimal processing, high frequency heating, microwave heating and ohmic heating. Fruit product odour and quality control.

References

- Biochemistry of Fruit Ripening – Seymour, G.B. et.al., Chapman and Hall, London, 1993
Commercial Processing of Vegetables – Hamson, L.P., Noyes Data Corporation, New Jersey, 1975
Fruit and Vegetable Preservation: Principles and Practices – Srivastava, R.P. and Kumar, S., International Book Distributing Co., Lucknow, 1998
Fruit and Vegetable Processing – Dauthy, M.E., International Book Distributing Co., Lucknow, 1997
Fruits of India: Tropical and Subtropical – Bose, T.k., Naya Prakash, Calcutta
Hand Book of Fruit Science and Technology – Salunkhe, D.K. and Kadam, S.S., Mareel Dekker, New York
Preservation of Fruits and Vegetables – Lal, G. *et al.*, ICAR, New Delhi, 1986
Postharvest Technology of Horticultural Crops Kada, A.A., University of California, 1992
Tropical Fruit Processing – Jagtiani, J. *et al.*, Academic Press, London, 1988

UNIT I: Introduction to clinical nutrition

Definition and history of dietetics, Dietetics in modern health care management
Principles of planning a normal diet, objectives of diet therapy
Role of dietitian – functions and classification of a dietitian. Team approach in patient care, interpersonal relationship with patients

UNIT II: Dietary management in common disease conditions

Febrile diseases – acute and chronic fever, tuberculosis, poliomyelitis, typhoid, malaria
Gastrointestinal disorder-etiology symptoms and treatment of gastritis, peptic ulcer, diarrhea, constipation, dumping syndrome, malabsorption syndrome, steatorrhea irritable bowel syndrome, ulcerative colitis, diverticulosis, crohn's disease etc.
Liver diseases-Infective hepatitis, cirrhosis, chole cystis, chole lithiasis, hepatic encephalopathy and liver transplant
Renal diseases- nephritis and nephrosis, acute failure, chronic renal failure, urolithiasis, dialysis, renal transplant

UNIT III: Dietary management in degenerative, metabolic and other diseases

Obesity and its clinical manifestation
Cardiovascular diseases- Role of fat in the development of atherosclerosis, risk factors, hypercholesterolemia, dyslipidemia, physical activity and heart disease. Dietary management in short term and long term treatment in coronary diseases
Hypertension- causes, symptoms, implication and prevention
Diabetes mellitus- Hyper and hypoglycemia, symptoms, diagnosis, treatment and prevention, glycemic index and glycemic load. Compliaions and diabetes
Inborn errors of metabolism-phenyl ketonuria, fructosuria, galactosemia, maple syrup urine disease

UNIT IV: Recent trends in nutrition

Principles of dietary management in gout, rheumatism, AIDS/HIV
Cancer-risk factors, symptoms, dietary management, role of food in prevention of Cancer
Role of functional foods, health foods and novel foods, organically grown foods, recent concepts in human nutrition like nutrigenomics, neutraceuticals etc.

Nutritional counseling: Concept, methods and models

UNIT I

Processing, chemical composition, properties, flavouring components, extraction, evaluation, quality control and standards. Flavour technology, isolation and identification of flavouring materials. Synthetic flavours and problems of their incorporation in foods. Evaluation of flavours and carbonated beverages. Terpenoids, flavonoids, sulfur compounds as flavouring compounds. Flavour encapsulation and their application in food industry. Flavours of onion, garlic, cheese, milk, fish, poultry, bread, wine, coffee and pineapple. Microbial flavours: Methyl ketones, diacetyl, acetaldehyde, lactones, terpenes, esters, pyrazines, vanilla and enzymatic flavour generation and utilization.

UNIT II

- Concept of Public health nutrition
- Relationship between health and nutrition, Role of public health nutritionists in the health care delivery.
- Determinants of health status, vital statistics-mortality, morbidity rate and life expectancy.
- Assessment of nutritional status of individuals and population, anthropometry, biomarkers (biochemical and biophysical), clinical measures, dietary assessment and immunization.
- Nutritional problems in the community
- Common nutritional problems in the community: etiology, prevalence, clinical manifestation and assessment of macronutrient malnutrition (PEM), Maternal & Infant Nutrition
- Micronutrient malnutrition-vitamin-A, iron, iodine, and zinc its prevention measures.
- Nutrition and infection.

UNIT III

- Role of national and international organization:
 - National organization – ICMR, ICAR, CSWB, SSWB, NIN, CSIR. Fortification and enrichment of food. Other nutrition intervention programmes for control of 1. Energy Malnutrition 2. Vitamin A Deficiency 3. Anemia Prophylaxis 4. Goiter control 5. Fluorosis 6. Epidemic Dropsy 7. Lathyrism
 - International organization- FAO,WHO,UNICEF,AFPRO,WORLD BANK CARE
- Their role in combating malnutrition, Food and nutrition security

UNIT IV

- Food safety and Food Laws
- Food safety and quality control in food industries, physical,biological,and chemical hazards to food supply,bioterrorism a threat to food safetyss
- Regulation of food safety, food labeling, food laws and food adulteration with respect to India
- Waste disposal in food industries.

References

Food Packaging – Seicharow S. and Griffin, R.C. AVI Publishing, Westport, 1970
Handbook of Vegetable Science and Technology – Salunkhe. D.K. and Kadam, S.S., Mareel Dekker, New York, 1998
Handbook of Food Packaging – Painy, F.A. and Painy, H.Y., Leonard Hill, Glasgow, UK, 1983
Postharvest: An Introduction to the Physiology and Handling of Fruits and Vegetables – Wills et al., BSP Profesional Books, Oxford, 1989
Postharvest Biology and Handling of Fruits and Vegetables – Haard, N.F. and Salunkhe, D.K., AVI Publishing, Westport, 1975

Postharvest Technology of Cereals, Pulses and Oilseeds – Chakravary, A., Oxford and IBH, New Delhi, 1988

Postharvest Technology of Horticultural Crops – Kader, A.A., Division of Agriculture and National Resources, California, 1992

FSN 505*

DAIRY, FRUIT AND VEGETABLE TECHNOLOGY

Experiments on platform test of milk and Milk quality analysis

Chemical analysis of milk and milk products

Milk pasteurization and sterilization

Sparry and drum drying

Preparation of cream, butter, cheese paneer and ice cream

Milk homogenization techniques

Concentration of milk

Visit to dairy industries

Processing equipment for fruits and vegetable

Preparation of fruit juices, squashes, syrups and ready-to-serve beverages

Canning of fruits and vegetables

Preparation of jams, jellies, marmalade, pickles, preserves, and candies

Drying of fruits and vegetables and quality control of processed products

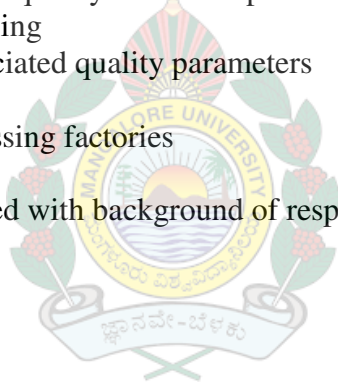
Mushroom production and processing

Preparation of beverages and associated quality parameters

Sensory evaluation

Visit to fruit and vegetables processing factories

*Practical exercises to be conducted with background of respective theory papers (FSN 501 and FSN 502)



FSN 506* CLINICAL NUTRITION, DIETETICS AND FUNCTIONAL PROPERTIES OF FOODS AND HEALTH IMPLICATIONS

Basic principles in planning diets for individual, families and institution – Review of existing situations- hospitals, hostels, hotel, boarding home and industrial canteen

Separation Techniques- Chromatography-paper and column. Centrifugation, Electrophoresis and Dialysis. (One example for each may be demonstrated)

Analysis of Urine for-

- a. Creatinine
- b. Sugar
- c. Urea
- d. Total Nitrogen
- e. Calcium

Estimation of oxidative stress (lipid peroxides, protein oxidation)

Extraction and Estimation of natural antioxidants – DPPH assay, FRAP, Total polyphenols etc

Protection of oxidative damage to biomolecules by natural antioxidants

*Practical exercises to be conducted with background of respective theory papers (FSN 503 and FSN 504)



UNIT I

Scope of meat, fish and poultry industry in India

Sources of meat and meat products and their importance. Structure and chemical composition of meat. Impact of feed, breed and management on meat quality and production. Slaughtering of animals and poultry, inspection of grading of meat. Factors influence of post-mortem changes (colour, rigor mortis, properties and shelf life of meat.

Meat quality evaluation.

UNIT II

Mechanical deboning, meat tenderization. Ageing, pickling and smoking and curing of meat.

Meat plant sanitation and safety. Byproduct of meat industry and utilization. Radiation processing and meat safety.

Types of fish, composition, structure, post-mortem changes in fish. Handling of freshwater fish.

Canning, smoking, freezing and dehydration of fish. Fish sausage and home making.

UNIT III

Structure, composition, nutritive value and functional properties of eggs and its preservation by different methods. Measures of egg quality and factors influencing egg quality. Inspection of poultry, slaughtering, defeathering, sigeing, evisceration and dressing of poultry. Quality assessment and assurance of dressed poultry meat.

UNIT IV

Thermal processing of meat, fish and poultry: freezing, drying, pressing, centrifugation, evaporation, salting and pelletization. Sausages, fish fillets, salted fish, smoked fish, dehydrated fish, frozen and canned fish, fish oil, fish sauce, fish protein concentrate, fish pickle, frozen chicken and egg powder. By products of meat, fish and poultry industry and utilization.

References

Commercial Rabbit Meat Production – Portsmouth, J.I., Saiga Survey, England, 1979

Egg Science and Technology – Stadelmen, W.J. and Cotterill, O.J., AVI Publishing, Westport, 1977

Engineering Science and Technology – Stadelmen, W.J. and Cotterill, O.J., AVI Publishing, Westport, 1977

Meat Handbook – Lavie, A., AVI Publishing, Westport, 1080

Meat Science – Laurie, R.A., Pergamon Press, Oxford, UK, 1975

UNIT I

Quality control, grades and standards, production of food quality, statistical approaches in quality control and quality assurance. Objectives of production, planning and concept and total quality control (TQM). Requirement of good manufacturing process (GMP) use of hazard analysis critical control point (HACCP) and its implication in food industries. Procedure of production control, project planning network, PERT and CPM network.

UNIT II

Industrial legislation and laws, acts and disputes. Industrial disputes act 1947

WTO, GAAT, CAC and intellectual property rights

Patent laws, patents, national and international patents, patenting procedures, patent applications, rules governing patenting. Patent-related litigations and controversies (neem, Basmathi, turmeric and coffee), biopiracy

Food laws, regulation, standards and specification. Ag-Mark 1937, FPO 1955, PFA 1954, BIS 1952.

Consumer protection act 1986. Vanaspathi control order 1978. Export control and inspection act 1963, ISO-9000 series: 9001 and 2000.

UNIT III

Types of organization structure: Principles of development of organization structure, forms of business organization. Division of industries, industrial sectors (private and public), problems associated to public sector industries, social obligations of industries towards society.

UNIT IV

Food adulteration and food safety. Sensory evaluation: panel of screening, selection methods, sensory and instrumental analysis in quality control. Food industrial waste management: Causes of wastages, waste within the unit, wastage controlling techniques. Waste control programme measures. Waste utilization practices. Traditional knowledge and food, traditional knowledge digital library (TKDL). GM foods and health.

References

Evaluation of Quality of Fruits and Vegetables – Patee, H.E., AVI Publishing, Westport, 1985

Handbook of Analysis of Quality Control for Fruits and Vegetable Products – Ranganna, S., Tata McGraw Hill, New Delhi, 1986

Principles of Sensory Evaluation of Food – Amerine, M.A. *et al.*, Academic Press, New York, 1965

Quality Control for the Food Industry – Krammer, A. and Twigg, B.A., AVI Publishing, Westport, 1970

Nutritional and Safety Aspects of Food Processing - Tannenbaum, S.R., Marcel Dekker, New York

Regulatory Status of Direct Foods Additives – Furia, T.E., CRC Press, Florida, 1980

Sensory Properties of Foods – Birk G.G. *et al.*, Applied Science, London, 1977

The Quality of Foods and Beverages – Charalambous, G. and Inglett, G., Academic Press, New York, 1981

Unit I

Food processing industry: Structure, various types, Features, Investments, costs

Major components and food processing: Assets, raw materials, Labour, environmental aspects, waste management, recycling, Financial arrangement: Bank facilities

Indian scenario of food industries. Product manufacturing technology. Food processing technology, processing, preservation, packing technology, ingredients. Food patents (process and products).

Indian scenario of food technology. Food legislation and prevention of food adulteration Act. Essential commodities Act.

Unit II

Marketing of processed foods: Transport, advertisement, aspects of processed food materials.

Handling perishable, semi-perishable and stable food items. Competition, internal food processing and marketing (export and import). Indian scenario of food marketing. World Trade Organization (WTO) and foods. Consumers psychology and attitudes on foods. Quality and product management. Concepts of quality management

Quality management and food processing. Quality management in Indian foods.

UNIT III

Introduction to Bioinformatics. Biological databases – online databases and tools for bioinformatics, The nucleotide and protein sequence databases, primary and secondary databases, format Vs content, file formats for sequence database, Structural databases, Protein Data Bank, Molecular Modeling Database at NCBI, Structure file formats, visualizing structural information, Molecular visualization software. Major web resources for bioinformatics.

UNIT IV

Predictive Methods for Nucleotides – tools and methods, prediction of genes and protein coding regions, conserved sequence pattern discovery, whole genome analysis.

Predictive Methods for Proteins – structure prediction methods. Prediction of trans-membrane Regions, Molecular modeling, online modeling servers (e.g. SWISSNOD).

Biological databases, use of databases (e.g. BLAST, FASTA)

Microarray techniques. Distributed Computing approach, genomics, genome@home, proteomics, folding@home, protein structure based targeted drug design – small molecular interactions and docking

References

Beginning Perl for Bioinformatics – James D. Tisdall

Bioinformatics – Methods and protocols – Stephen A., Krawetz, Humana Press

Bioinformatics: Sequence and genome analysis By David W. Mount

Dunkel Proposals – Chowdhary, N.K. and Aggarwal, J.C., Shipra Publishing, New Delhi, 1994

Fundamental Concepts of Bioinformatics – Krane *et al.*

Introduction to Agricultural Marketing – Branson, R.E. and Norvell, D.G., McGraw Hill, New York, 1983

Marketing and Economic Development – Kacker, M., Deep and Deep Pub., New Delhi, 1982

Mercantile Law including Industrial Law – Daver, S.R., Progressive Corporation Pvt. Ltd., Mumbai

FSN 554 MEAT AND FISH TECHNOLOGY AND FOOD QUALITY AND PLANT MANAGEMENT

Study of post-mortem changes
Meat cutting, handling and dressing
Nutritional evaluation of meat quality
Experiments on dehydration, freezing, canning, curing, smoking and pickling
Shelf-life studies of processed meat
Evaluation of quality and grading of eggs
Preservation of shell eggs
Estimation of meat/bone ratios
Preparation of meat products (e.g. dehydrated, barbecued sausages, burger, fish finger)
Salting and smoking of fish
Preparation of fish protein concentrate
Frozen chicken and egg powder
Cryopreservation techniques
Preparation of meal products and storage
Studies on the byproducts of meat, fish and poultry
Visits to meat/fish/poultry processing industries

Experiments on aseptic packaging
Wastewater treatment methods
Solid waste treatment methods
Experiments on industrial waste treatment methods (e.g. distillery, whey)
Waste management and recycling
Quality management strategies

*Practical exercises to be conducted with background of respective theory papers (FSN 501 and FSN 502)



FSN 555 FIELD SURVEY AND REPORT

Food-based institutions and industries in Karnataka and India
Food processing (e.g. Fish, Dairy, Bakery, Beverage, Fruit, Vegetable)
Breweries and Distilleries, Plantation products (e.g. Cashew, cocoa)
Technological approach for commercial exploitation of food materials/wastes
Utilization of food processing byproducts (e.g. Plantation crops, fishery, Shellfish waste, slaughter house waste and poultry waste)
Project Planning and Design: Aims and Scope, Objectives, Requirements and Methodology, Planning waste and poultry waste)
Project Planning and Design: Aims and Scope, Objectives, Requirements and Methodology, Planning, Economics, Management and Execution, Documentation and Report preparation

FSN 556 PROJECT