SINGHANIA UNIVERSITY

Master of Science in Food Technology (MSCFT)

SYLLABUS & SCHEME

Subject Code	Subject Name	Year	Scheme			IA	ESE	Total Marks
			L	T	P			
MSCFT~101	FOOD AND FOOD PRODUCTS	Year 1	4			30	70	100
MSCFT~102	FOOD MICROBIOLOGY	Year 1	3	1		30	70	100
MSCFT~103	FOOD CHEMISTRY	Year 1	4			30	70	100
MSCFT~104	BASIC CONCEPTS OF NUTRITION	Year 1	4			30	70	100
MSCFT~105	STATISTICAL METHODS IN FOOD SCIENCE	Year 1	3	1		30	70	100
MSCFT~106	PRACITCAL Based on 101&102	Year 1			4	30	70	100
MSCFT~107	PRACITCAL Based on 103&104	Year 1			4	30	70	100
	TOTAL :		**18**	**2**	**8**	**210**	**490**	**700**
MSCFT~201	FOOD PROCESSING AND PRESERVATION	Year 2	4			30	70	100
MSCFT~202	FOOD INGREDIENTS ,ADDITIVES AND NEUTRACEUTICALS	Year 2	3	1		30	70	100
MSCFT~203	FOOD PACKAGING AND POST HARVEST TECHNOLOGY	Year 2	3	1		30	70	100
MSCFT~204	FOOD BIOTECHNOLOGY & BY-PRODUCT UTILIZATION	Year 2	4			30	70	100
MSCFT~205	PRACITCAL Based on 201	Year 2	4			30	70	100
MSCFT~206	PRACITCAL Based on 202	Year 2	4			30	70	100
MSCFT~207	FINAL DISSERTATION & VIVA-VOICE	Year 2	4			30	70	100
	TOTAL :		**26**	**2**	**0**	**210**	**490**	**700**
	GRAND TOTAL :							**1400**

M.Sc. (Food Technology)

1st Year

MSCFT~101 : Food and Food Products

UNIT-I

Cereals: Structure of cereal grains, composition, processing and storage of some common cereals (Rice, Wheat, Maize, Oats) ; Pulses: composition, nutritive value, processing and storage of some common pulses(Bengal gram, Black gram, Horse gram, Green gram); Nuts & plantation crop: processing, nutritional value of some common nuts(Coconut, Ground nut, Almond, Cashewnut), tea, coffee and cocoa.

UNIT-II

Fruits: Composition, Processing, nutritive value, fruit ripening and storage of fruits, processing of juices, candy, preserve, dried powder, ketch up, sauce, jam and jellies; Beverages: Composition, classification and Processing of Carbonated Beverages Vegetables: Classification, composition, processing of some common vegetables like pickles, potato chips; Spices: Composition, flavoring compounds, processing, nutritive value, adulteration of some common spices of India.

UNIT-III

Meat: Structure, composition, Slaughtering types, post-mortem changes and grading of meat, tenderization and curing of meat; Poultry: composition, classification, nutritive value and processing; Egg: Structure, composition, classification, nutritive value and processing; Fish: composition, classification, nutritive value and processing.

UNIT-IV

Milk and milk products: composition, physic-chemical properties of milk and nutritional importance of milk, processing of milk, Classification and study of milk products- Cream, Butter, Ghee, Khoa, Chhanna, Paneer, Cheese, Ice-cream, Fermented milk products. Various defects in milk products.

References:

1. Food Facts and Principles -N. ShakuntalaManay& M. Shadaksharaswamy, New Age International (P) Limited, New Delhi.
2. Food Science – B.Srilakshmi, New Age international (P) Limited, New Delhi.
3. Essentials of Food & Nutrition-M.Swaminathan-vol I &vol II.
4. Nutrition: An Integrated Approach- Pike & Brown
5. Principles of Nutrition E.D Wilson,K.H.Fisher&M.C.Faqua
6. Food Science- N.Potter&J.H.Hotchkiss- CBS Publishers & Distributors, New Delhi.
7. Encyclopedia of Food Science(1-3 volume) Anmol Publications.

MSCFT~102 : Food Microbiology

UNIT-I

Introduction to food Microbiology: Growth and survival of microorganisms in foods (Yeast, Mould, Bacteria); Factors affecting growth of microorganism: Intrinsic, Extrinsic; Physical and chemical methods to control microorganisms, General principles of spoilage, Biochemical changes caused by microorganisms; microbes in food fermentation, putrefaction, lipolysis; Antagonism and synergism in microorganism; General concept of Prebiotics, probiotics and symbiotic; Principle of food preservation by controlling growth of microorganism (asepsis, high temp., low temp.,)

UNIT-II

Contamination, Preservation and Spoilage of different kind of foods-cereal, Pulses, Fruit and Vegetable, Meat, fish egg, poultry and their processed products, Milk and milk Products, Canned foods and Beverages.

UNIT-III

Food toxicology & food borne illness: Food hazards microbiological, nutritional, environmental, natural toxicants, pesticides, food additives, preservatives, food borne illness: (Clostridium, botulinum, Escherichia coli, Brucella, Bacillus, Salmonella, Staphylococcus) Non bacterial agent & food borne illness, (Helminths & Nematodes, protozoa, toxic algae, fungi & food borne viruses

UNIT-IV

Microbial Food hygiene and sanitation: Method for microbial examination of food: indicator organisms, direct examination, cultural techniques, Rapid methods in detection of microorganisms. Contamination during handling, processing and its control.

References:

1. Food Microbiology – M.R.Adams&M.O.Moss, New Age International (P) Limited, New Delhi.
2. Food Facts and Principles -N. ShakuntalaManay& M. Shadaksharaswamy, New Age International (P) Limited, New Delhi.
3. Food Microbiology – William C.Frazier, Tata McGraw Hill publishing Company limited, New Delhi.
4. General Microbiology – Power &Daginawala, Himalaya Publishing House, Mumbai. (vol-II)
5. Basic Food Microbiology – G. Banwart, CBS Publishing & Distributors.
6. Modern Food Microbiology – Jay, James, Aspen publishers.
7. Microbiology- M.I.Pelezar&R.D.Reid McGraw Hill Book Company, New York.
8. Food Hygiene & Sanitation – S.Roday- Tata McGraw Hill, New Delhi.
9. Modern Food Microbiology: J.M.Hay, CBS Publications & Distributions..

MSCFT~103 : Food Chemistry

UNIT-I

Carbohydrates: classification and chemical structure of carbohydrate; chemical properties, nutritive roles of carbohydrate, important carbohydrates in food (glucose, sucrose, starch, agar, glycogen, cellulose, pectin, Gums and resins); Carbohydrates: digestion, absorption, metabolism (glycolysis, citric acid cycle, glycogenesis, Glycogenolysis, Gluconeogenesis, hexose monophosphate pathway), Blood sugar level and equilibrium.& effect of deficiency.

UNIT-II

Amino acids and its classification, essential amino acids; Proteins: properties, classification, structure of proteins (primary, secondary, tertiary, quaternary), protein denaturation, Protein: Digestion, absorption, transportation and metabolism of Protein (Nitrogen balance, transamination & deamination of protein, urea cycle and biosynthesis of protein), Functional properties of protein & effect of deficiency.

UNIT-III

Lipid: role of lipid in body, structure, classification and physiochemical properties of Lipids, Chemical aspects of lipolysis-rancidity, Lipids: Digestion, absorption, transport and Metabolism of lipids, importance of lipo -protein, oxidation of fatty acids, fatty acid synthesis, metabolism of cholesterol, triacylglycerol and phospholipids- their role in health & diseases.

UNIT-IV

Water: physical properties, structure of water molecule, Role and types of water in Food, water activity and sorptionisotherm, Importance of dietary fiber in body, Enzymes: properties, classification, kinetics and mechanism ofenzyme inhibition. Terpenoids and alkaloids: Definition, Classification, Structure, Biosynthesis, Properties, Extraction, Biological Role. Naturally occurring phenolic compounds: Definition, Classification, Structure, Biosynthesis, Properties and Biological Role.

References:

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. Belitz HD.1999. *Food Chemistry*. Springer Verlag.DeMan JM. 1976. *Principles of Food Chemistry*. AVI.
6. Fennema OR.1996. *Food Chemistry*. Marcel Dekker.
7. Meyer LH. 1987. *Food Chemistry*. CBS.

MSCFT~104 : Basic Concept Of Nutrition

UNIT-I

Food as a source of nutrients: classification of nutrients; functions, recommended dietary allowances, BMR, SDA. Vitamins: (A, B complex, C,D, E & K)& all major and minor mineral elements with their role in body , importance of Roughages in the diet.Water& electrolytes balance.

UNIT-II

Nutritional Needs: Nutrition during infancy, childhood, adolescence and adult, nutrition during pregnancy& lactation, nutrition in later maturity period, nutrition and infection, nutrition and immunity, nutrition & stress.

UNIT-III

Nutritional Assessment: Assessment of nutritional status by direct & indirect methods, use of various methods for the assessment of nutritional status, anthropometric assessment, clinical examination, bio-physical or radiological measurement, functional assessment, laboratory &biochemical assessment, dietary assessment, vital health statistics.

UNIT-IV

Nutritional problems: food intake and its regulation, food pattern, population and food production, malnutrition, background problem of malnutrition in India ecology of malnutrition, effect of malnutritionon vulnerable society, impact of malnutrition on national development, major to combat malnutrition, national nutrition policy and programmes, National and International agencies in combating malnutrition.

References:

1. Human Nutrition and Dietetics – S. Davidson & R. Passmars.
2. Essentials of Food and Nutrition – M. Swaminathan, vol. I & II, The Bangalore printing and Publishing Co. Ltd.
3. Human Nutrition and Dietetics – Davidson, Passmore, East wood, English Language Book Society (ELBS).
4. Dietetics – B.Srilakshmi; New age International (P) Limited, New Delhi.
5. Nutrient Requirements and Recommended Dietary Allowances for Indians – Indian Council of Medical Research, National Institute of Nutrition, Hyderabad.
6. Text Book of Human Nutrition – Mahtab. S. Bamji; N.Pralhadrao&Vinodini Reddy, Oxford & IBH Publishing Co. Pvt.Ltd
7. Principles of Nutrition – Fisher and Fuqua, wiley eastern Private Limited, New Delhi.

MSCFT~105 : Statistical Methods In Food Science

UNIT-I

Research Methodology: Meaning, aim & objective of research, significance of research, Research types, Different types of research design. Fundamentals of statistics: Research process, Population, Variables, Primary and secondary data, Collection of data, Classification and tabulation of data, Need and usefulness of Diagrams & Graphs, Different types of diagrams and graphs. Frequency distribution*:* Discrete and continuous frequency distribution, population & sample, sampling methods and its types, sampling errors.

UNIT-III

Descriptive statistics: Measure of central tendency: (Arithmetic mean, mean ,median, mode), relation between mean, median and mode ;Measure of dispersion: Range, Mean deviation & Standard deviation; Skewness and Kurtosis .

UNIT-IV

Theoretical Probability Distribution: Binomial, Poisson and normal distribution; Testing of Hypothesis: Null and Alternative Hypothesis, level of significance, Student't' distribution and its application, Chi-square(x^2) test & its application, 'f' test and its application.

UNIT-V

Correlation, Regression and ANOVA analysis: Types of correlation; simple, partial and multiple correlation, Method of study & testing the significance of correlation coefficient, Rank Correlation, Regression analysis: regression equations and regression lines, Properties of regression lines, regression coefficient, testing the significance of regression coefficient. Analysis of variance (ANOVA): One way and two way classification and their applications.

References:

1. Statistical Methods – S.P.Gupta, Sultan Chand & Sons Publisher- New Delhi
2. Research Methodology, Methods and Techniques – C.R. Kothari Wiley Eastern Limited – New Delhi
3. Elements of Statistics, Theory & Practice – M.Singhal. Lakshmi Narain Agarwal, Educational Publisher – Agra
4. An Introduction to Statistical Methods – C.B.Gupta & V.Gupta- Vikas Publishing House PVT Ltd. New Delhi.
5. Research Methods & Measurements in Behavioural & Social Sciences – G.L.Bhatnagar – Agri. Cole. Publishing Academy, New Delhi.
6. Statistical Methods – S.P.Gupta, Sultan Chand & Sons Publisher- New Delhi
7. Research Methodology, Methods and Techniques – C.R. Kothari Wiley Eastern Limited – New Delhi
8. An Introduction to Statistical Methods – C.B.Gupta&V.Gupta- Vikas Publishing House PVT Ltd. New Delhi.

MSCFT~106 Practical based on 101 & 102
MSCFT~107 Practical based on 103 & 104

SECOND SEMESTER

MSCFT~201 : Food Processing and Preservation

UNIT-I

Basic concept of food processing and preservation: Reason of food Spoilage and Scope of food processing preservation; principles of food processing and preservation. Principle and preservation by low temperature: (refrigeration, freezing, and dehydro freezing; cold storage, frozen food), changes during freezing-physical and chemical changes. Processing and preservation by drying: factors affecting drying rate, types of dryer – (kiln, tray, drum, spray, tunnel, fluidized bed drying), types of drying technique (freeze drying, vaccum drying),

UNIT-II

Processing and preservation by heat: (blanching, pasteurization, sterilization, UHT processing, heating, dehydration, canning, Microwave cooking-(principle, changes during microwave cooking, advantages),difference between microwave and conventional heating, Use of Nano technology in food. Concentration and evaporation-(flash evaporator, falling film evaporator and multiple effect evaporators), changes during Concentration

UNIT-III

Processing and preservation by non-thermal method: irradiation, high pressure, pulsed electric field, high hydrostatic pressure, Hurdle technology: concept of hurdle technology and its application, Ultrasonic processing: Properties of ultrasonic, application of ultrasonic as processing techniques, ohmic heating, IR heating;

UNIT-IV

Food processing equipments: material handling, cleaning and grading, conveyors, size reduction, food grain storage, milling, Separation Technique: filtration, agitation and mixing. Baking, Roasting, Frying. Extrusion Technology-(principle, types of extruders).

References

1. Arsdel WB, Copley MJ & Morgan AI. 1973. *Food Dehydration*. 2nd Ed. Vols.I, II.AVI Publ.
2. Desrosier NW & James N.1977. *Technology of Food Preservation*.4th Ed. AVI.Publ.

3. Fellows PJ. 2005. *Food Processing Technology: Principle and Practice*. 2nd Ed. CRC.
4. Jelen P. 1985. *Introduction to Food Processing*.Prentice Hall.

MSCFT~202 : Food Ingredients, Additives and Neutraceuticals

UNIT-I

Properties of solid and liquid foods: Physical properties(solutions, vapor pressure, boiling point, freezing point, osmotic pressure, viscosity, surface and interfacial tensions, specific gravity), Dispersion systems in of foods-Sol, Gel, Foam, Emulsion; Food preparation: Objective and method of cooking, cooking media, changes during cooking,

UNIT-II

Food pigments and colors: Some common pigments used in food industry (chlorophylls, myoglobin, anthocyanin, betalain, carotenoids, synthetic colors & lake /dye colors and other colourants); Flavors: types of flavor, flavor compounds, extraction principles of flavor, Sensation- smell sensation, texture sensation, visual appearance and sensation of taste.

UNIT-III

Food additives: definition, need and classification of food additives, preservatives-Natural and Artificial, antioxidants, chelating agents, coloring agents, curing agents, Emulsions, flavors and flavor enhancers, leavening agents, nutritional supplements, non-nutritive sweeteners, pH control agents, stabilizer and thickeners, humectants, anti-caking agents, firming agent, clarifying agent, flour bleaching agents.

UNIT-IV

Nutraceuticals and phytochemicals: definition, Classification. Dietary supplements, Functional foods- their legislation and health claims, Natural occurrence of certain photo-chemicals. Antioxidants and flavonoids: omega – 3 fatty acids, carotenoids, dietary fiber, phytoestrogens; Neutraceuticals for effective control of disease or health benefit with adequate safety. Role of neutraceuticals against- skin health/ageing, bone health, eye health, mental health, cardiovascular health, cancer prevention etc. Safety, adverse effect and interactions of neutraceuticals.

References:

1. Food Facts and Principles -N. ShakuntalaManay& M. Shadaksharaswamy, New Age International (P) Limited, New Delhi.
2. Branen AL, Davidson PM &Salminen S. 2001. *Food Additives*. 2nd Ed.Marcel Dekker.
3. Gerorge AB. 1996. *Encyclopedia of Food and Color Additives*. Vol. III.CRC Press.
4. Gerorge AB. 2004. *Fenaroli's Handbook of Flavor Ingredients*. 5th Ed.CRC Press.
5. Madhavi DL, Deshpande SS &Salunkhe DK. 1996. *Food Antioxidants:*
6. *Technological, Toxicological and Health Perspective*. MarcelDekker.
7. Morton ID & Macleod AJ .1990. *Food Flavours*. Part A, BC. Elsevier.
8. Nakai S &Modler HW. 2000. *Food Proteins. Processing Applications*.Wiley VCH.
9. Stephen AM. (Ed.). 2006. *Food Polysaccharides and Their Applications*.Marcel Dekker.

MSCFT~203 : Food Packaging and Post Harvest Technology

UNIT-I

Post harvest Technology: Importance, principles & scope of post harvest treatments, value-addition, and traceability; Post harvest technology for cereals, legumes, oilseeds and spices (cleaning, grading, milling), Hydrothermal treatment & conditioning of grains, Modern paddy and wheat parboiling-systems, equipment, Advances in heat transfer and fluid flow in grain processing operations. Crop drying methods/systems and Crop dryers-selection

UNIT-II

Post-harvest of fruits & Vegetables: physiological and biochemical changes in fruits and vegetables; ripening of climacteric and non-climacteric fruits. Physiological post harvest disorders - chilling injury and disease; prevention of post harvest diseases and infestation; Handling and packaging of fruits and vegetables; factors affecting post harvest losses; Standards and specifications for fresh fruits and vegetable.

UNIT-III

Packaging Fresh and Processed Food: Packaging requirement for different foods and processing methods- Types (paper, glass, metal container and plastic), varieties, and trends; protective packaging of foods; packaging of food products sensitive to oxygen, light, moisture; special problems in canned foods. Permeability – theoretical consideration permeability of gases and vapours, permeability of multilayer packages, permeability in relation to products.

UNIT-IV

Food packaging: Packaging material, packaging system and methods- vacuum packaging, gas flush packaging, aseptic packaging, modified atmosphere packaging (MAP), controlled atmosphere packaging (CAP), active packaging ,retort pouch technology Packages of radiation stabilized foods, microwave packaging, bio-degradable packages, aseptic and edible package. Food Labelling and barcode technology. Packaging of convenience foods; packaging of food products-fruits and vegetables; packaging requirements of fresh fruits and vegetables; packaging of fruit juices, spices, meat & poultry, fish, seafood; criteria for selection of proper packaging based on the shelf life desired, diary product, beverages, cake and snacks food.

References:

1. Kadar AA.1992. *Post-harvest Technology of Horticultural Crops*.2nd Ed. Universiity of California.
2. Lal G, Siddapa GS &Tandon GL.1986. *Preservation of Fruits and Vegetables*.ICAR.

3. Pantastico B. 1975. *Post Harvest Physiology, Handling and Utilization of Tropical and Subtropical Fruits and Vegetables*. AVI Publ.

4. Salunkhe DK, Bolia HR & Reddy NR. 1991. *Storage, Processing and Nutritional Quality of Fruits and Vegetables*. Vol. I. *Fruits and Vegetables*.CRC.

5. Thompson AK. 1995. *Post Harvest Technology of Fruits and Vegetables*. Blackwell Sci.
6. Verma LR. & Joshi VK. 2000. *Post Harvest Technology of Fruits and Vegetables*. Indus Publ.
7.Robertson, G.L. Food Packaging: Principles and Practice (2nd ed.), Taylor & Francis 2006
8.Parry R. T. and Blakistone B. A. Principles & Applications of MAP –Springer, New York, 1999
9.Food Packaging Technology Handbook. NIIR Board, National Institute of Industrial Research, 2003
10.Ahvenainen, R. (Ed.) Novel Food Packaging Techniques, CRC Press, 2003
11.Han, J.H. (Ed.) Innovations in Food Packaging, Elsevier Academic Press, 2005
12.Coles, R., McDowell, D. and Kirwan, M.J. (Eds.) Food Packaging Technology, CRC Press, 2003

MSCFT~204 : Food Biotechnology & By-Product Utilization

UNIT-1

Basic tools of r-DNA technology: Restriction endonuclease and DNA ligase, cloning vectors,cloning of foreign DNA, screening of recombinant clone, DNA fingerprinting, PCR technology, DNA sequencing technique, Cell/ tissue-culture. Transgenic for food production: Development and current status of transgenic crops for crop improvement and enhanced agronomic performance; molecular farming, GM foods: Ethical issues concerning GM foods; testing for GMOs; IPR.GMO Act 2004.

UNIT-II

Fermentation and Industrial Microbiology: Microbes in food process operations and production, microbes in food fermentation: lactic acid bacteria , yeast and mould. Fermentation as a method of processing and preserving foods; fermented foods and beverages; citric acid production, vinegar, Yoghurt, tofu, miso, tempeh, Soya sauce(shoyu); microbes used in pickling and sauerkraut, producing colors-*angkak*,beta-carotene, production of microbial enzymes, baker's yeast, amino acids and anti-biotics; bacteriocins from lactic acid bacteria-production and application in food preservation, nisin, SCP.

UNIT-III

Basic concepts of Bioprocess Technology: Up stream processing, Bioreactor and its operation, optimization of process, scale-up; downstream processing, separation and purification.Application of enzymes in food processing: enzyme catalyzed bioprocess, enzymatic bioconversions e.g- starch and sugar conversion processes, hydrolysed protein etc. and their downstream processing; baking by amylases; de-oxygenation and de-sugaring by glucose oxidase; beer mashing and chill proofing, Cheese production and processing.

UNIT-IV

Industrial by-products and waste, utilization of-agricultural waste (cereal, legume and oil seed based waste), dairy waste, fruit and vegetable waste, meat, poultry, egg and fish wastes, by-products of fermentation industries, Sugar and bakery industry. New product development- need, importance and objectives of formulation, ideas and strategy of new product, market testing and plan, cost evaluation and commercialization of product.

References:

1- Bains W.1993.Biotechnology from A to z. Oxford Univ.Press
2- Joshi VK and Pandey A.1999.Biotechnology: Food fermentation.vol.1,2.Eduction publ.
3- Knorr D.1982.Food Biotechnology. Marcel Dekker.
4- Lee BH.1996.Fundamentals of Food Biotechnology.VCH
5- Perlman D.1977-1979.Annual Reports of fermentation processes.
6- Percott SC and Dunn CG.1959.Industrial Microbiology.McGraw Hill.
7- Ward.OP.1989.Fermentaion Biotechnology.Prentice Hall.

MSCFT~205 : Practical based on 201

MSCFT~206 : Practical based on 202

MSCFT~207 : Final Dissertation & Viva-Voice