

MS FOOD TECHNOLOGY

SRI VENKATESWARA UNIVERSITY COLLEGE OF SCIENCES: TIRUPATI
DEPARTMENT OF HOME SCIENCE
CHOICE BASED CREDIT SYSTEM (C.B.C.S), SYLLABUS AND
SCHEME OF EXAMINATION
(WITH EFFECT FROM THE ACADEMIC YEAR 2015-16)
MS FOOD TECHNOLOGY

Sem	Course Code	Title of the course	Core / Elective	No. of Credits	IA	SEE	Total Marks
I	FT-101	Essentials of Food and Community Nutrition	Core	4	30	70	100
	FT-102	Research Methodology	Core	4	30	70	100
	FT-103	Food Science and Experimental Foods	Core	4	30	70	100
	FT-104	Cereal grains, Legumes and Oilseed Technology	Core	4	30	70	100
		Practical -I : Community Nutrition and Research methodology	--	4	--	100	100
		Practical -II :Food science, Cereal and seed Technology	--	4	--	100	100
II	FT-201	Food Chemistry and Analysis	Core	4	30	70	100
	FT-202	Dairy Technology	Core	4	30	70	100
	FT-203	Technology of Horticulture Produce	Core	4	30	70	100
	FT-204	Food Microbiology and Safety	Core	4	30	70	100
	FT-205	Human Values and Professional Ethics - I	--		30	70	100
		Practical -I :Food and Dairy Analysis	--	4	--	100	100
		Practical -II :Food Safety and Technology of Horticulture produce	--	4	--	100	100
III	FT-301	Statistics and Computer Applications	Core	4	30	70	100
	FT-302	Live Stock and Seafood Technology	Core	4	30	70	100
	FT-303	Unit operations in Food Industry	Core	4	30	70	100
	FT-304	Choose ONE of the following A) Food Packaging B) Nutritional Management in Emergencies and Disasters C) Nutrition for Health and Fitness	IE/EE IE IE/EE	4	30	70	100
		Practical - I -Unit operations in Food Industry	--	4	--	100	100
		Practical -II - In plant Training	--	4	--	100	100
IV	FT-401	Food Quality Standards and Control	Core	4	30	70	100
	FT-402	Spices, condiments and Plantation Crops (or) Project work	--	4	30 50	70 50	100 100
	FT-403	Food Product Development & Marketing	Core	4	30	70	100
	FT-404	Choose ONE of the following A) Food Processing and Preservation Technology B) Institutional Food Service Management	IE/EE IE/EE	4	30	70	100
	FT-405	Human Values and Professional Ethics - II	--		30	70	100
		Practical -I : Food quality and plantation crops/viva	--	4	--	100	100
		Practical -II : Food Processing and product development	--	4	--	100	100

Total credits 96

SEMESTER I

FT 101: ESSENTIALS OF FOOD AND COMMUNITY NUTRITION (Common to all Branches of MSc Home Science and MS Food Technology Course)

THEORY:

UNIT-I: Food Composition - Grouping and menu planning:

- Food groups – Classification – food composition, properties, characteristics culinary aspects and nutritive values of different foods, Functions of foods and nutrients – cereal grains, millets, pulses, nuts and oil seeds fruits and vegetables, milk and milk products, meat, egg, poultry and fish, spices and condiments.
- Nutrition through life span – Infancy, Pre-school children, childhood, Adolescence, Adulthood and Ageing – Nutritional requirements and Recommended Dietary Allowances (RDA)– Justification for special needs during periods of growth and development, pregnancy and lactation – significance of breast feeding – Principles of menu planning appropriate to age and stage of life span.

Unit – II: Assessment of Nutritional Status of the community:

Need - Methods of Assessment - (a) Direct Methods - (i) Diet Surveys (ii) Anthropometric Assessment - (iii) clinical and (iv) Biochemical Assessment (b) Indirect Methods - Vital Statistics - Merits and Demerits of methods - Nutrition surveys - longitudinal and cross sectional - Family, individual and institutional surveys - Techniques for assessment of age - use of reference standards for the assessment of nutritional status.

Unit – III: Major Nutrition Problems of the Community:

Malnutrition and under nutrition-PEM/CED, obesity- deficiencies vit-A, iron /iodine – Aetiology –Symptoms - government programmes to eradicate PEM, vitamin-A, Iron and Iodine deficiencies – principles of planning diets for different conditions of malnutrition

Unit – IV: Strategies to combat malnutrition:

- i. Food security – Definition – Management of food insecurity - Food Production, Processing and Preservation-Food Fortification and enrichment- New Foods -Formulation of Food Mixtures.
- ii. Food Assistance and Food Supplementation - Policies and Programmes of the Government - Governmental Policies and Programmes - Food Assistance and Food Supplementation Programmes - Public Distribution System (PDS) - Food For Work (FFW), Special Nutrition Programme (SNP), School Lunch Programme (SLP), Mid Day Meal Programme (MMP), Balawadi Nutrition Programme (BNP), Integrated Child Development Services (ICDS) - MCH Services - Immunization- Universal Immunization Programme (UIP).
- iii. Nutrition Education - Importance - Approaches Media and Methods

PRACTICALS:

1. Planning and Preparation of Cereal and Pulse Products.
2. Planning and Preparation of Milk and Meat Products
3. Planning and Preparation of Fruits and Vegetable Products.
4. Assessment of Nutritional Status using Anthropometry, Dietary and Clinical methods.
5. Planning of Diets for Different Age Groups and Physiological Conditions.
6. Planning Diets for Different Nutritional Deficiency like PEM, Iron Vit-A, Obesity.
7. Planning and Preparation of Programmes for Significant Days like Breast Feeding Week Nutrition Week, World Food Day.
8. Study of the following through visits
 - Govt School Lunch Programme
 - ICDS Programme
 - Anganwadi Training Centers.
9. School Lunch Programme at Sri Venkateswara University Laboratory Nursery School.
10. Preparation of Visual Aids for Nutrition Education, and Method Demonstration on a Nutrition Recipe.

REFERENCES - TEXT BOOKS

1. Davidson and Passmore R., Brock, J.F., and Truswell A.S. "Human Nutrition and Dietetics". 7th ed. New York. Churchill Living stone. 1979.
2. Gopalan, C (Editor) - Basic Issues in Combating Malnutrition - NFI Publication.
3. Gopalan, C (Editor) - Women Nutrition in India. NFI Publication.
4. Jelliffe, D.B."Assessment of Nutritional Status of the Community", WHO Monograph. Series No. 53. WHO Geneva 1966.
5. Mehtab S. Bamji, "Text book of Human Nutrition", Oxford & IBH Co.PVT.LTD, New Delhi, 1996.
6. Measuring change in nutritional status - WHO 1981 (NCHS Standards)
7. Monograph on Integrated Training on National Programmes for Mother and Child Development of Women and Child Department, Government of India, New Delhi.
8. Seymour L. Harpen M.D: Quick reference to clinical nutrition 1979.
9. Suitor C.W Hunter M.F. Nutrition principles and Application in Health Promotion. J.B. Lippincot Company Philadelphia 1980.
10. Swaminathan, M. Essentials of Food and Nutrition, Vol. I and Vol. II Ganesh and co. Madras

JOURNALS AND PROCEEDINGS

- World review of Nutrition and Dietetics. S. Karger New York and Sydney 1959 onwards.
- Proceedings of Nutrition society of India. ICMR. NIN Hyderabad, India 1969 onwards.
- Nutrition Quarterly Journal (ICMR) NIN, Hyderabad.
- The Indian Journal of pediatrics.
- The American Journal of clinical nutrition.
- Journal of Human Nutrition / Applied Nutrition.
- Future' quarterly journal / UNICEF.
- Monographs and other publications by ICMR, WHO, FAO, UNICEF and UNESCO, Nutrition Foundation of India.
- Indian Journal of Nutrition and dietetics, Coimbatore, India.

FT 102: RESEARCH METHODOLOGY

(Common to all Branches of MSc Home Science and MS Food Technology Course)

THEORY:

UNIT – I : Research Purpose And Process

- i. Research – Significance, meaning, objectives, Approaches, Research process, Criteria of good research, Problems encountered by Researchers in India
- ii. Variable-types – Concepts, Theory-Inductive and Deductive
- iii. Types of Research : Historical, descriptive, experimental, case study, survey research, participatory research, Fundamental, applied and action, exploratory ex-post facto
 - Longitudinal and cross sectional, co-relational.
- iv. Basic Principles of Research Design: Meaning, Need and features of a good design - Purposes of research design.
- v. Steps in Research Design

UNIT –II: Research Problem and Methods of Sampling:

- i. Definition and Identification of a Research Problem
 - Selection of research problem
 - Justification
 - Theory, hypothesis, basic assumptions, limitations and delimitations of the Problem.
- ii. Probability and Non-probability Techniques
 - Population and sample
 - Probability sampling : simple random, systematic random sampling, two stages and multi stage sampling, cluster sampling.
 - Non-probability sampling : purposive, quota and volunteer sampling/Snowball Sampling.

UNIT –III: Qualitative Research Methods and methods of data collection

- i. Qualitative Research.
 - Definition and types of qualitative research.
- ii. Methods and techniques of data collection.
 - Group discussions
 - Interviews : key informants, in-depth interviews
 - Observations
 - Social mapping
 - Participatory rapid assessment
 - Participatory learning assessment
- iii. Data Gathering Instruments:
 - Observation, questionnaire, interview, case study, home visits.

UNIT – IV: Measurement, Data Processing and Interpretation

- i. Measurement Scales – Nominal, Ordinal, Interval and Ratio
- ii. Tests of Sound Measurement-Validity and Reliability and Practicality.
- iii. Important scaling Techniques
- iv. Analysis of data and research report.
- v. Project Proposal – Preparation.

PRACTICALS :

1. Identification of different variables in specialization of study.
2. Framing of hypothesis-Null and alternate Hypothesis
3. Selection of Random sample, using tippets random number tables.
4. Preparation of schedule/questionnaire.
5. Development of a Rating scale.
6. Tabulation of data
7. Preparation of research proposal

REFERENCES

1. Bandarkar, P.L. and Wilkinson T.S. (2000) : “*Methodology and Techniques of Social Research*”, Himalaya Publishing House, Mumbai.
2. Batnagar, G.L. (1990) : “*Research Methods and Measurements in Behaviouraland Social Sciences*”, Agri. Cole publishing Academy, New Delhi.
3. Kothari, C.R. (2004) : “*Research Methodology (Methods and Techniques)*”. New Age International (p) Ltd., New Delhi.
4. Black, T.R. (1999) : “*Doing Quantitative Research in the Social Sciences*”, Sage Publications, New Delhi.
5. Goode J.W. and Hatt P.K. “*Methods in Social Science Research*” Mc. Graw hill-Co. New York.
6. BajPai S.M. (1987) “*Methods of Social Survey and Research*” KitabGhat, Kanpur-3.
7. Kerlinger F.N.(1983) “*Foundations of Behaviouring Research*”, Subject Publications, Delhi,
8. Dev Doss R.P. and Kulandavel K (1985) – “*Hand book of methodology of research*” Oxford Press,
9. Garett. (1986) “*Statistics in Psychology and Education*” 10th Indian Re-print ValeitsFefer and Simons Co., Bombay.
10. Sharma S.R. (1994) “*Statistical methods in Educational Research*”, Anmol Publications Pvt. Ltd., New Delhi.

FT 103: FOOD SCIENCE AND EXPERIMENTAL FOODS

(Common to MSc Food Science Nutrition & Dietetics and MS Food Technology Course)

THEORY:

UNIT I: Foods of plant origin

- Cereals and cereal products: Starch: Structure, Characteristics of some food starches. Gelatinization, Factors effecting gelatinization. Modified food starches-Applications.
- Pectin and Gums-Functional roles in food products.
- Baking process - Cereal flours, flour mixes, dough and batter, Leavening agents-Applications
- Pulses and Legumes: Composition, Toxic constituents, processing, effect of cooking.
- Vegetables and Fruits: Classification, composition, Pigments and Flavors constituents - cooking effect, Browning reaction.

UNIT II:Foods of animal origin

- Milk: Composition, kinds of milk, milk products and Functional properties of Milk-Cooking applications.
- Egg: Structure, grading, quality and Functional properties of eggs, use in cookery-its effect.
- Meat and Poultry: Structure, Muscle composition, postmortem changes, Heat-induced changes in meat, tenderness – tenderizers. : Poultry classification.
- Fish and Marine foods: Classification and Composition, Selection and cooking.

UNIT III: Sugars and Fats

- Sugars, sugar crystals and Confections – Types of sugars and sugar syrups, Sugar cookery, Crystallization of sugars, Confectionery-Types and confections raw materials and their role, chocolate processing, Indian confectionery, sugar substitutes.
- Fats and oils -Sources, composition, Absorption, Functional properties of fat and uses in food Preparations, Rancidity, Fat substitutes or replacements.

UNIT IV: Food Evaluation –Attributes of food quality-Subjective and objective evaluation.

- Sensory evaluation-Requirements-panel-sensory testing procedures and tests.
- Objective evaluation-Food Rheology-objective methods of food evaluation.

PRACTICALS:

1. Standardization of weights and measures of various foods
2. Starch cookery- Structure, gelatinization and factors affecting gelatinization
3. Baking –Determination of gluten content, Preparation of plain cake, Bread and evaluation by subjective and objective methods.
4. Pulse cookery – effect of different processing methods-Soaking, germination, malting-effect of factors.
5. Vegetable cookery – Effect of time, temperature, media and cooking methods on pigments.
6. Fruit - Enzymatic Browning- Effect
7. Sugars and confections: Factors affecting crystallization in candies like fondant, experiments on applying scientific methods to Indian confectionary, preparation of confections – role of ingredients and processing of confectionary.
8. Fats and oils – Smoke points, oil absorption and stability of emulsion – mayonnaise.
9. Milk cookery: preparation of milk products-Effect of cooking.
10. Egg cookery: Egg white foams: preparation of the eggs acting as binding, emulsifying and thickening agent.
11. Meat cookery : Effect of different cooking methods and tenderizers
12. Fish cookery, and other marine foods.
13. Sensory evaluation of food
14. Objective evaluation of food

TEXT BOOKS & REFERENCE BOOKS:

1. Food. Theory and Application. ed.Paul. P.C. and Palmer A.H. John Wiley & Sons, Inc. New York, 2002.
2. Belle Lowe: Experimental Cookery, John Wiley & Sons, INC, New York, 1998.
3. Norman N Potter, Food Science, Fifth edition, An Aspen Publication, Maryland- 2007.
4. Griswold. R.M.: The Experimental Study of Foods. Houghton and Mifflin company, Boston, New York, 1962.
5. Sethi Mohini, Food Science: Experiments and Application, second edition, Jain book Agency, New Delhi-2011.
6. Vijayakshar, Text book of food science and Technology, ICAR, New Delhi- 2001.
7. G. Subbulakshmi &Shobha A. Udipi. Food processing and preservation. New Age International (P) Ltd., Publishers Bangalore, Chennai.Hyderabad.2001.
8. B. Srilakshmi. Food Science, 2nd edition New Age International (P) Ltd., Publishers, Bangalore, Chennai & Hyderabad. 2001.
9. Swaminathan, M. Food science and Experimental foods. Ganesh & Co., Madras, 1979.
10. N.Shakuntala Manay & M. Shadaksharswamy, Foods- Facts and Principles, second edition, New Age International Publishers, New Delhi-2001.
11. Marjorie P. Penfield & Adamarie Campbell, Experimental Food Science, Third Edition, Academic Press, New York-1990.

JOURNALS:

1. Journal of Food Technology.
2. Journal of Food Science and Technology (CFTRI Publication)
3. Journal of American Dietetic Association.
4. Indian Journal of Nutrition and Dietetics.

FT 104: CEREAL GRAINS, LEGUMES AND OILSEED TECHNOLOGY

THEORY:

UNIT-I

Cereal grains and millets: Composition, Structure of rice, wheat, maize, corn, jowar, bajra, ragi and Italian millet, etc.

- Post-Harvest Technology – storage, transport handling – prevention of insects, spoilage and post-harvest losses - fumigation.

UNIT-II

Milling Technology :Large scale and small scale milling, turbo milling- classification, conventional wet and dry milling – unit operations in milling industry, flouring, value addition to flours, enrichment, fortification of products - use of biproducts.

- Breakfast cereals: products with rice, wheat, corn, corn sugars, barley and oats etc.
- Baking Technology: yeast fermentation baking powders – baking unit operations and baked products.
- Processing Methods: soaking, parboiling, germination, fermentation and malting.

UNIT-III

Legumes, pulses and oil seeds:

- Processing of commonly used legumes - Bengal gram, red gram, green gram, black gram, chick peas, horse gram etc. - soaking, germination, fermentation – flouring – value addition – protein isolates and concentrates.
- Soybean Technology, Soya products, protein isolates and concentrates and by products.
- Processing of nuts and oilseeds: Extraction of oils, expelling – peanuts, coconuts and other oilseeds – rendering, solvent extraction – refining and hydrogenation etc – local method.
- Convenience and Ready to Eat foods.

UNIT-IV

- Equipment, machinery and tools required for unit operations of processing of cereals, legumes, oils and fats for large scale and small scale units.
- Quality control and standards for different cereal, millet, legume and oilseed based products.

PRACTICALS:

1. Market survey on Cereal, Legumes, Oil Seed grains and their products
2. Soaking, Germination and Malting
3. Fermentation processing in Cereals and Pulses
4. Flouring, Popping & Flaking
5. Processing of Soy based Products
6. Baking- Varieties of Cakes, Cookies, Biscuits, Pizza, doughnuts
7. Traditional and Commercial Processed foods of Grains
8. Preparation & Evaluation of Ready to Eat breakfast foods
9. Visits to Food Industries

REFERENCE BOOKS:

1. Subba Lakshmi G, and Shobha A. Udipi, "Food Processing and preservation", New Age International (P) Ltd Publishers, New Delhi, 2001.
2. VijayaKhader, "Text Book of Food science and Technology" Directorate of Information and publications of Agriculture, Indian Council of Agricultural Research, New Delhi, 2001.
3. Norman N Potter, Food Science, Fifth edition, An Aspen Publication, Mariland- 2007.
4. Edwards W P, "The science of Bakery Products", The Royal Society of Chemistry, Thomas Graham House, Cambridge, 2007.
5. Fast R.B. and Caldwell E.F (1990) "Breakfast cereals and how they are made?" American Association of Cereal Chemists" St Paul. MN.
6. Norman N. Potter – Joseph. H.Hotchkirs (1996) "Food Science". CBS Publishers and distributors, New Delhi.
7. NIIR Board, "The complete Technology Book on Bakery Products" National Institute of Industrial Research, Delhi, Website – www.niir.org.
8. Peter C Morris and James H Bryce, "Cereal Biotechnology", First Edition, Wood head publishing limited, Cambridge, England, 2004.
9. Maya Badri "Cakes" First Edition, Gnosis publishers, Delhi, 2008.
10. Panda H, "The Complete Technology Book on Snack Foods" National Institute of Industrial Research, Delhi, Website: www.niir.org.

JOURNALS:

1. Cereal science - today
2. Critical reviews, Food and Nutrition
3. Food Industry
4. Food Technology
5. Indian Journal Food Technology

SEMESTER II

FT 201: FOOD CHEMISTRY AND ANALYSIS

(Common to M.Sc Food Science Nutrition & Dietetics and MS Food Technology Course)

THEORY:

UNIT-I : Water Chemistry and Dispersed Systems:

- i. Water chemistry – Chemistry of Water, Free, Bound And Entrapped Water, Water Activity And Moisture Determination.
- ii. Dispersed systems – Liquid dispersions, Gels, Emulsions, Foams

UNIT-II : Carbohydrates and Lipids

- i. Carbohydrates – classification , structure, physic – chemical properties of monosaccharides
 - pentoses, and hexoses , oligosaccharides – Maltose, Lactose, sucrose and poly sacchharides – starch , cellulose.
- ii. Lipids – Nomenclature, classification – Milk fats, Animal fats , vegetable fats.
 - Physical properties – crystallization , plasticity
 - Chemical properties – Thermal decomposition , hydrogenation, inter esterification

UNIT-III: Proteins and amino acids

- i. Proteins and amino acids – classification, structure, physical properties
- ii. Functional and Chemical properties – protein hydration, solubility, interfacial properties
Emulsification and foaming, Gelation , Dough formation

UNIT-IV: Food Analysis

- i. Methods of sampling, Determination of total ash
- ii. Principles and methods of chemical analysis
 - Carbohydrates – qualitative and quantitative analysis of starch and sugars
 - Proteins – Electrophoresis, mickrojheldhal method
 - Fats – analysis of solid and liquid fats, Rancidity
 - Determination of vitamin and minerals – vitamin-C, Iron, phosphorus , calcium

PRACTICALS:

1. Qualitative analysis of carbohydrates.
2. Qualitative analysis of proteins and amino acids
3. Qualitative analysis of fats and oils
4. Qualitative analysis of hydrolysis of starch
5. Determination of starch and sugars
6. Estimation of crude fiber
7. Estimation of proteins - micro kjeldal method
8. Separation of proteins and amino acids – Electrophoresis
9. Determination of fat in solid and liquid foods.
10. Determination of moisture
11. Determination of Total ash
12. Estimation of calcium
13. Estimation of phosphorus
14. Estimation of Iron
15. Estimation of vitamin C
16. Qualitative analysis of enzymes in plant foods
17. Qualitative analysis of enzymes in animal foods
18. Demonstration of estimation of minerals using atomic absorption spectro photometer (AAS)

REFERENCES :

1. Andrew L.Winton and Katebarber Winto, “Techniques of food analysis”, agrobios,odhpur, (3001).
2. Deman J M, “Principles of Food Chemistry”, AVI Publishing, 1970.
3. Fennema O R, ” Food Chemistry”, Marcel Dekker Publishers, 1996.
4. Lowe B., "Experimental Cookery", John Wiely and Sons Inc, New York, 1965.
5. Mahindru S N, ” Food Additives - Characteristics, Details and Estimation”, Tata Mc.Graw. Hill Publishing Company Ltd., New Delhi – 3000.
6. Meyer L.H, “Food Chemistry”, Affiliated East West press pvt. Ltd. Bombay – 1987.
7. Norman N Potter Joseph H and Hotchkirs, “Food Science”, 5th edition, CBS,Publishers and Distributor, NewDelhi,1996.
8. Oser BL, Hawk's, ” Physiological chemistry”, TATA, Mc.Graw Hill – Publishing Co., Ltd., Bombay – 1965.
9. Fennema Owen R, “Principles of Food science part – I”. "Food, Chemistry", marcel Dekker Inc, New York, 1976.
10. Ranganna S; "Handbook of Analysis and quality control for fruit and vegetable products" 2 nd edition, Tata MC Graw – Hill publishing company Limited, New Delhi – 1986.
11. Shakuntala Manay N and Shadakshara Swamy M, “Foods, facts and principles”, New-Age International Publishers(p) Ltd., New Delhi, 1987.
12. Panda H, “The complete Technology Book on starch and it’s derivaties”, Asia Pacific Business Press Inc. Publishers, Delhi,Website : www.niir.org.
13. Lillian Hoagland Meyer, “Food Chemistry” First Edition, CBS publishers and Distributors, New Delhi, 2004.
14. Yeshajahu Pomeranz and Clifton E. Meloan “Food analysis-Theory and Practice,” Third Edition, CBS publishers and Distributors, New Delhi, 2004.
15. Kanes K. Rajah “Fats in Food Technology”, First Edition, Blackwell publishing,2002.

JOURNALS :

1. Journal of Food Science and Technology
2. Indian Food Industry, A publication of Association of Food Scientists and technologists..
3. Food Chemistry
4. Journal of Food Science
5. IFCON'93 and IFCON'88 proceedings of IFCON 3003 : International food convention, Food technology update, Mysore.

FT- 202: DAIRY TECHNOLOGY

THEORY:

UNIT-I: Milk

- Definition- production- nutritive value of milk; Procurement quality tests, grading of milk.
- Milk - Storage and chilling at procurement site, Transportation.
- Processing: Homogenization-pasteurization - sterilization -aseptic packaging.
- Quality tests.

UNIT-II: Milk products

- A. **Types of milk**- whole milk, low fat milk, toned and double toned milk, skimmed milk, condensed milk, concentrated milk, fortified and double fortified milk, flavored milk.
- B. **Processing and product formulation** - Cream, Butter, Butter oil, ghee, skim milk powder, Dairy whiteners, peda, khova, Milk shakes, kulfees, ice cream.
- C. **Fermented Milk products** - Cheese, Cheese spread, yoghurt, Dahi, shrikhand Lassi and similar products etc.

UNIT-III: Milk Industry - Unit operations of Milk processing

- Advances in fluid milk processing - Application of Ultra filtration - Mono filtration - Micro filtration – Reverse osmosis - Ion exchange and Electro dialysis processes;
- UHT processing of milk - Irradiation of Milk.

UNIT-IV

- Application of immobilized enzymes and developments in Bio-technology;
- Application of Stabilizers and emulsifiers in Dairy products.
- Quality testing - Storage, preservation, packaging, labeling and Marketing.

PRACTICALS:

1. Market survey of different types of milk, products and bi products of milk.
2. Analysis of raw Milk, Market milk, and other milk products.
3. Product development with milk - evaluation.
4. Preparation of low fat, high protein dairy products,
5. Product development with bi-products of milk.
6. Principles of Ultra filtration of milk and Reverse osmosis of Milk.
7. Principles of U.H.T. processing of milk.
8. Visit to Dairy plant.

REFERENCE BOOKS:

1. De Sukumar, Outlines of Dairy Technology, Oxford University Press, Oxford. 2007
2. Fox P.F "Advanced dairy chemistry" Chapman and Hall, London, New York, 1992.
3. KosiKowski F,V "Cheese, and fermented milk foods", 2nded, F.V. KosiKowski, Brooktondale, New York, 1997.
4. Kurmann J.A, Rasic, J.L and Kroger M, "Encyclopedia of fermented fresh milk products; "An international inventory of fermented Milk, Cream, Buttermilk, Whey and related products" Chapman and Hall, London, New York, 1992.
5. Robinson R.K "Modern dairy Technology", 2nd ed: Chapman and Hall, London, New York, 1994.
6. Varnam A.F. "Milk and Milk products - technology, Chemistry and Microbiology - Chapman and Hall, London, New York, 1994.
7. NIIR Board " The complete Technology Book of Daily and Poultry Industries with farming and processing", Asia Pacific Business Press, New Delhi.
8. NIIR Board, "The Complete Technology Book on Flavored Ice Cream", Asia Pacific Business Press, New Delhi, Website:
9. Mahindru SN, "Milk and Milk products", APH publishing corporation, New Delhi.
10. Milk Industry foundations "Analysis of Milk and its products – A Manual", 2nd edition, Biotech Books, Delhi , 2005.
11. Tina Mattila -Sandholm and Marie saarela "Functional daily products", 1st edition, Woodhead publishing limited, Cambridge, England, 2008.

JOURNALS:

1. British Nutrition Foundation Nutrition Bulletin.
2. Dairy Science.
3. Food Additives Contamination
4. Food Industry
5. Food Nutrition News.
6. Food Policy
7. Food Reviews International
8. Food Technology.
9. Journal of Food Technology.
10. Journal of Food Quality.

FT 203: TECHNOLOGY OF HORTICULTURE PRODUCE

THEORY

UNIT-I: Vegetables

Types of vegetables : Green leafy, root and other vegetables - Harvesting Indices - composition - processing and preservation of fresh produce – washing, cutting, trimming, blanching, chilling, Refrigeration, freezing, canning, drying, packaging and Marketing - spoilage and quality control measures.

UNIT-II: Fruits

Types of fruits: Simple fruits: like citrus fruits: oranges, Grape fruits, Lemons, peaches etc - pomes such as apples and pears etc., Aggregate fruits, such as raspberries, strawberries and black berries composition - Harvesting indices – production, transport. Handling, processing - freezing, blanching - Ascorbic acid drip - storage - packaging and marketing - spoilage and quality control measures.

UNIT-III :Fruits and Vegetable based products

Processing methods of preparation and preservation - fruit juices: extraction, classification, Deaeration blends - fruit bars - Jellies, Jams - Ready to serve beverages, dried fruits - fruit pulp, pickles - gravy - powders - sauces – dried vegetables, processed curries, soups - dehydrated products, fruit toffies, fruit concentrate products and powders, etc.

UNIT-IV: Fruit and Vegetable Industry

Equipment of processing and preservation: Unit operations; transport, Machinery for specific products - Maintenance of quality standards - packaging, labeling and Marketing strategies.

PRACTICALS:

1. Vegetable and fruit Maturity Indexes at post harvesting stage.
2. Preparation of vegetable products.
3. Preparation of fruit products.
4. Quality standards measurements of vegetable and fruit products.
5. Visits to fruit and vegetable processing units.

REFERENCE BOOKS:

1. TarianoValpuesta, "Fruit and Vegetable biotechnology, 1st edition, Wood head publishing Ltd, Cambridge, England, 2002..
2. NPCB Board, "Potato and potato products", Delhi, www.niir.org.
3. VijayaKhader, "Preservation of fruits and Vegetables", 2nd edition, Kalyani publishers, Ludhiana, 2004.
4. Shrivastava A K, "Agriculcture and Food", 1st edition, APH publishing corporation, New Delhi, 2004.
5. Woodford RC, "Citrus classification", 1st edition, Biotech Books, Delhi, 2005.
6. Arthey D and Dennis C, "Vegetable processing" Chapman Hall, London, New York, 1991.
7. Arthey D and Shurst. P., "Fruit processing" Chapman and Hall, London, New York, 1995.
8. Gould W.A "Tomato production Processing and Technology" 2nd edition, CTI publication Baltimore M.D.
9. Kader A.A. "Post Harvest Technology of Horticultural Crops", 2nded, University California, Oakland, CA, 1992.
10. Nelson PE and Tresslor D.K, "Fruit and Vegetable Juice Processing, Technology" AVI Publishing company Co., west port. Ct., 1988.

JOURNALS:

- Consumer
- Food reviews International
- Food Industry
- Food Technology
- IFCON Proceedings
- Indian Journal Food Technology
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FT 204: FOOD MICROBIOLOGY AND SAFETY (Common to MSc Food Science Nutrition & Dietetics and MS Food Technology Course)

THEORY :

UNIT-I: Food and microorganisms :

- Food as a substrate for microorganisms, physical, chemical and biological factors affecting microbial growth.
- Bacteria, Molds, Yeasts and Viruses : General characteristics, classification – structure – growth – morphological characteristics – cultural characteristics – Food Bacteriology in Food Industry.

UNIT-II: Food Spoilage

- Microorganisms causing spoilage – principles underlying spoilage – chemical, physical and physiological changes caused by microorganisms.
- Spoilage of different foods

UNIT III:

- Natural and environmental contaminants
- Food contamination : Sources of contamination in :
 - Cereals and cereal products
 - Sugars and sugar products
 - Legumes, nuts and oilseeds
 - Fruits and Vegetables
 - Eggs and poultry
 - Meat and Meat products
 - Fish and Other sea foods
 - Milk and Milk products
 - Spices and condiments
 - Preserved foods – canned, bottled, dehydrated

UNIT-IV

- Food safety – concept, factors affecting food safety - physical , chemical and biological hazards.
- Food hazards of microbial origin – food borne disease, food borne intoxications, food borne infections, food born toxic infections.

PRACTICALS:

- Morphological and cultural characteristics of bacteria, yeast and molds – Identification and testing. Testing of spoilage
- Testing the presence and type of organisms in relation to raw and processed foods and products - Media preparation – Inoculation of organisms.

SELECTED REFERENCES:

1. Michael J, Waites, Neill. Morgan et al, "Industrial Microbiology- An introduction" 1st edition, Black well Science, London , 2000.
2. Mansi El-Mansi and Charlie Bryce "Fermentation Microbiology and biotechnology" 1st edition, Taylor and Francis Group, Kundli, 2004.
3. George J. Banwart "Basic Food Microbiology" Second edition, CBS Publishers and Distributors, New Delhi, 2002.
4. Adams MR and Moss MO, "Food Microbiology" Second edition, Panima Publishing Corporation, New Delhi, 2003.
5. Tauro P, KK Kapoor KK and Yadav KS "An introduction to Microbiology" 1st edition, New age International (P) Ltd. Publishers, New Delhi, 2003.
6. James M Jay, "Modern Food Microbiology," 4th edition, CBS publishers and Distributors, New Delhi, 2005.
7. William C. Frazier and Denni S.C. Westhoff, "Food Microbiology," 4th edition, Tata McGraw-Hill publishing company Ltd, New Delhi, 2004.
8. Narng S.P, "Food Microbiology Method of enumeration" 1st edition, A.P.H. Publishing corporation, New Delhi, 2004.
9. Kalaichelvan PT, "Microbiology and Biotechnology," A laboratory Manual, 1st edition, MJP Publishers, Chennai, 2005.
10. Miller BM and Litsky W, "Industrial Microbiology", McGraw Hill book company, New York, 1996.
11. Robberts, T.A., and Skinner F.A. (Eds) "Food Microbiology advances and prospects" – Academic press Inc, N.York, 1992.

JOURNALS:

1. Advances in Food Research
2. Advances in applied Microbiology
3. Bacteriological Reviews
4. Indian Journal of food technology
5. Journal of Applied Bacteriology
6. Journal of Dairy Science
7. Journal of Food engineering
8. Journal of Food Production

FT 205: HUMAN VALUES AND PROFESSIONAL ETHICS - I (Common to all Branches of MSc Home Science and MS Food Technology Course)

Unit-I:

Definition and Nature of Ethics- Its relation to Religion, Politics, Business, Legal, Medical and Environment. Need and Importance of Professional Ethics - Goals - Ethical Values in various Professions.

Unit-II:

Nature of Values- Good and Bad, Ends and Means, Actual and potential Values, Objective and Subjective Values, Analysis of basic moral concepts- right, ought, duty, obligation, justice, responsibility and freedom. Good behavior and respect for elders, Character and Conduct.

Unit-III:

Ahimsa (Non- Violence), Satya (Truth), Brahmacharya (Celibacy), Asteya (Non-possession) and Aparigraha (Non- stealing). Purusharthas (Cardinal virtues)-Dharma (Righteousness), Artha (Wealth), Kama (Fulfillment Bodily Desires). Moksha (Liberation).

Unit-IV:

Bhagavad Gita- (a) Niskama karma. (b) Buddhism- The Four Noble Truths – Arya Astangamarga, (c) Jainism- mahavratas and anuvratas. Values Embedded in Various Religions, Religious Tolerance, Gandhian Ethics.

Unit-V:

Crime and Theories of punishment- (a) Reformatory, Retributive and Deterrent. (b) Views on Manu and Yajnavalkya.

REFERENCES:

1. John S Mackenzie: A manual of ethics.
2. The Ethics of Management" by Larue Tone Hosmer. Richard D. Irwin Inc.
3. "Management Ethics' integrity at work' by Joseph A. Petrick and John F. Quinn. Response Books: New Delhi.
4. "Ethics in Management" by S.A. Sherlekar, Himalaya Publishing House.
5. Harold H. Titus: Ethics for Today
6. Maitra, S.K: Hindu Ethics William Lilly: Introduction to Ethics
7. Sinha: A Manual of Ethics
8. Manu: Manava Dharma Sastra or the Institute of Manu: Comprising the Indian System of Duties: Religious and Civil (ed.) G.C.Halighton.
9. SusrptaSamhita: Tr.KavirajKunjanlal, KunjalalBrishagratha. Chowkarnba Sanskrit series. VolLII and III, Varnasi, Vol I 00,16'20,21-32 and 74-77 only.
10. CarakaSamhita :Tr.Dr. Ram Karan Sarma and VaidyaBhagavan Dash, Chowkambha Sanskrit Series office. Varanasi I, 11.111 VolIIPP 183-191.
11. Ethics, Theory and Contemporary Issues. Barbara Mackinnon Wadsworth/Thomson Learning, 2001.
12. Analyzing Moral.Issues, Judith A. Boss. May Field Publishing Company - 1999.
13. An Introduction to Applied Ethics (Ed.) John H.Piet and Ayodhya Prasad. Cosmo Publications
14. Text Book for Intermediate First Year Ethics and Human Values. Board of Intermediate Education- Telugu ~ Akademi, Hyderabad.
15. I.C Sharma Ethical Philosophy of India. Nagin& co Julundhar

SEMESTER III

FT 301: STATISTICS and COMPUTER APPLICATIONS (Common to all Branches of MSc Home Science and MS Food Technology Course)

THEORY

PART - A - STATISTICS

UNIT-I

- Statistics:**Meaning, Definition and Scope, limitations.
Role of Statistics in Research.
- Descriptive statistics :**
 - Classification and tabulation of data.
 - Graphic presentation of data.
 - Diagrammatic presentation of data.
 - Measurement of central tendency, variation, and dispersion.
 - Normal distribution, Frequency distribution, histogram, frequency polygons, curve Ogive.
- Testing of hypothesis :**
 - Type I and Type II errors. Levels of significance.
 - Correlation, coefficient of correlation, rank correlation.
 - Regression and prediction.

UNIT-II

Inferential Statistics

- 't' test for Large samples (mean and proportions) small samples
- X^2 - test of significance of association
- Analysis of variance – one way, two way
(The student needs to understand only application and calculation procedures)

PRACTICAL:

1. Graphic presentation of data.
2. Diagrammatic representation of data.
3. Calculation of Averages – Arithmetic mean, mode of median.
4. Calculation of standard deviation, quartile deviation.
5. Calculation of product movement correlation to Rank correlation.
6. Fitting a straight line equation and testing the goodness of fit.
7. Calculating X^2 to find the significance of association.
8. Calculation of 't' statistic to give inference for small sample and large sample.

PART – B - COMPUTER APPLICATIONS

UNIT-III

- i. Introduction of Computer - Block diagram. The P.C and its component, Memory Capacity, Physical storage of data, various devices, Hardware and Software operating - DOS commands for file handling.
- ii. MS Office and its component - Word and its applications / creating documents -Editing spell check, auto correct and print preview, creating tables and sorting data in tables, Mail Merge and its usage.

UNIT-IV

- i. MS Excel for data analysis, Work sheet and its structure - data entry-editing -Sorting filtering and Copying. Statistical functions in Excel - Data analysis park for performing descriptive statistics - t-test, ANOVA Correlation and regression. Graphs in Excel - Various types of graphs, Editing graphs, cut and copy operations.
- ii. Power Point Presentation and Internet Explorer.

PRACTICALS

1. All relevant practical skills regarding usage of Computers.
2. Analysis of data using computers.

TEXT BOOKS

1. Saxena, S. (2000). A first course in Computers, Vikas Publishing House Pvt. Ltd., New Delhi.
2. Rajaraman, V. (1999). Fundamentals of Computers, Printice Hall India Pvt. Ltd., New Delhi.
3. Kirlinger, F.N. (1983). Foundations of behavioural research Surjeeth Publications, New Delhi.
4. Singh (1992). Technique and Method of social survey research and statistics, Prakashan Kendra Publishers, New Delhi.
5. Goode J.W. and Hatt P.K. Methods in Social Science Research Mc. Graw Hill- Co. New York.

FT 302 : LIVE STOCK AND SEA FOOD TECHNOLOGY

THEORY:

UNIT-I : Selection : grading of livestock for Meat, Buffaloes, sheep, goat, pigs, rabbits and avian species – poultry, ducks and quails etc – Quality grades – Economics and Marketing's.

UNIT-II: Meat Industry: Meat production – Structure of Muscle – Composition – Meat Conversion – Storage and preservation and processing of Meat – Meat food products.

UNIT-III: Avian food product processing:

Egg and Poultry Industry – Desi Birds – Classification – Poultry processing – Composition and nutritive value – Grading, Storage and preservation of eggs, - Egg Products. Avian meat products.

UNIT-IV

- a) Sea food processing:
Commonly cultivated fish, prawns and brackish water fish – identification, procurement – shipboard operations – preservation methods – processing plant operations – freezing – cold storage, canning – inspection – grading of Shellfish, marine fish, shrimp, oysters and clams and crabs.
- b) Value addition to byproducts of the above foods.

PRACTICALS:

1. Inspection and grading, of eggs– Study of shelf life.
2. Inspection and grading, of Meat and poultry - Study of shelf life.
3. Inspection and grading, of sea foods– Study of shelf life.\
4. Chemical and Microbiological tests of Meat and other livestock products-Estimation of Sarcomere, water, protein, fat in Meat product
5. Preparation of Low cost meat products.
6. Value addition to by – products of eggs, meat and sea foods
7. Visits to livestock food industries and sea food processing units.

REFERENCE BOOKS :

1. Sen DP, Advances in Fish Processing Technology, Allied Publishers Pvt.Limited 2005
2. Shahidi F and Botta JR, Seafoods: Chemistry, Processing, Technology and Quality, Blackie Academic & Professional,London,1994
3. Aitkeer. A "Fish handling and Processing 3rd, 1990-Aberdeen Ministry of Agriculture, Edinburgh, 1990.
4. Hall G.M, 'Fish Processing Technology, blackie. New York, 1992.
5. Lawrie R A, Lawrie's Meat Science, 5th Ed, Woodhead Publisher, England, 1998
6. Parkhurst & Mountney, Poultry Meat and Egg Production, CBS Publication, New Delhi, 1997
7. Pearson & Gillet Processed Meats,3 Ed, CBS Publication, New Delhi, 1997
8. Shai Barbut,Poultry Products Processing,CRC Press 2005
9. Stadelman WJ, Owen J Cotterill Egg Science and Technology, 4th Ed. CBS Publication New Delhi, 2002

FT 303: UNIT OPERATIONS IN FOOD INDUSTRY

THEORY:

UNIT-I

Principles of food engineering: Food Engineering operations -Unit dimensions and conversions: design of food process equipment's, elements of measuring instruments - machine elements and electrical elements.

UNIT-II

- Plant and machinery for different types of food Industries and processing units of
1.Cereals, 2.Pulses and legumes, 3.Oilseeds 4.Sugars and sugar products, 5.Vegetables and Fruits, 6. Milk and milk products, 7. Eggs, poultry and meat products, 8.Fish and sea Products, 9. Beverages 10.Spices and condiments, etc.,
- Management strategies in food industry at different stages for different components like, power supply electricity – water, procurement of raw material – storage – product production – preservation – packaging materials- Management of Hygiene and sanitation and personnel management.
- Basics of Vapor Compression Cycles
Properties of steam and Moist air - Boilers operation - Pressure vessels, evaporators - Boiler house and workshop.

UNIT-III

- Unit operations – unit operations for individual food processing and equipment material handling – cleaning – separation – pumping – heat exchange – evaporation
- Refrigeration in Food Industry
Types of refrigeration systems - Refrigerants - Properties - Cold Storage - Design and Maintenance / freezers.
- Energy Audit.

UNIT-IV

- Driers, Cleaning equipment - graders and sorters - blending, pelletization and emulsification equipment - Material handling equipment - Maintenance of food processing equipment.
- Agro processing equipments - Pasteurizers, Cream Separators, Spray driers and filling, sealing and packaging equipment.

PRACTICALS:

1. Blue print reading and drawing, layout of an Industry.
2. Design , Drawings and functions of the equipment used in various food industries
3. Working, operation and maintenance of
1)Cleaners, 2) graders, 3) dryers and spray driers, 4)distillers, 5) evaporators, 6) emulsifiers 7) blenders, 8) palletizers, 9) freeze driers, 10) pasteurizers, cream separators in food industries
4. HACCP and quality management systems in food industry
5. Visits to Food Industries.

TEXT BOOK AND REFERENCE BOOKS :

1. Christopher J. Kennedy, "Managing Frozen Foods", 1st Edition, Woodhead publishing Limited, Cambridge, England, 2000.
2. NIIR Board, "Modern Technology of Food Processing and Agro Based Industries", 2nd Edition, National Institute of Industrial Research, Delhi,
3. Hridayesh Pandey et.al "Experiments in Food Processing Engineering", 1st edition, CBS publishers and distributors, New Delhi, 2004.
4. Hosahalli Ramaswamy et.al, "Food Processing Principles and Applications", 1st Edition, Taylor and Francis Group, LLC, 2006.
5. Chandra Gopala Rao, "Essentials of Food process Engineering", 1st edition, BS publications, Hyderabad, 2006.
6. Fryer G.S., *et al.*, "Chemical Engineering for Food Industries", Blackie Academic Professionals, 1997.
7. Heldman D.R. and Lund D.B. "Handbook of Food Engineering", Marcel Dekker, New York, 1992.

JOURNALS

1. Food Industry Manual
2. Food Patents
3. Food Reviews
4. Food Technology
5. Indian Food Industry
6. Indian Food Packer
7. IFCON'93 and IFCON'88, International Food Concentration, Food Technology Update, Mysore.
8. Journal of Food Science
9. Journal of Food Science and Technology

FT 304 A: FOOD PACKAGING

THEORY:

UNIT-I

- Food Packaging – Definition - Need and functions of packaging;
- Principles in the development of protective packaging.
- Deteriorative changes in food stuff and packaging methods for prevention.

UNIT-II

- Packaging Materials – Concepts, Significance and Classification.
- Packaging – Development, Unit/Retail.
- Primary Packaging Media – Properties and applications
 - Paper boards, metals, plastics, wood and plywood, glass, flexible etc.
 - Labels, caps and closures and wards, adhesives, inks and lacquers, cushioning materials, wooden Boxes, strapping and Reinforcements.

UNIT-III

- Testing and evaluation of packing media – retail packs (including shelf life evaluation) and transport packages – quality control.
- Packaging systems and methods for food products – vacuum packaging, gas flush.
- Packaging, CAP and MAP, Aseptic and retort packing, Bag-in Box etc.
- Food products – General classification and packing types, varieties and trends.
- Storage, handling and distribution of packages (foods) – including palletisation and Containerization – Shelf life evaluation of packet products

UNIT IV

- Food Marketing and role of packaging
- Packaging Aesthetic and graphic design.
- Packaging – Laws and Regulations – FDA, FSSA, Packaging Commodity Rules, Weight and Measures Act etc.
- Coding and Marking Including bar coding.
Environmental and Eco issues and waste disposal.

PRACTICALS:

1. Collection and study of packaging materials from market for different food products.
2. Study of different packaging materials for strength, viscosity, Special needs etc.,
3. Shelf life evaluation of foods using different packaging materials.

REFERENCES

1. Sacharow and Griffin, Food Packing – AVI Publications.
2. Hotchikess Food and Packaging Interaction – American Chemical Society.
3. Stanley and Sacharow Food Packaging.
4. Darry, R.andT, Blackle: Principles and Application MAP – Academic and Professions.
5. Bhatia S.C. Canning and Preservations of Fruits and Vegetables – New Delhi, India
6. Dalzett J.M. Food Industry and The Environment – Chapman and Hall, London.
7. Robertson G.L. Food Packaging – New York, Marcell Dekker, Inc.
8. Bureau of G and Multon J.K Food Packaging Technology (vol. 1 and 2) – VCH, publishers, INC, New York
9. Madhavaiah M and RV Goramma; “ Food Packaging Materials – Tata Mcoraw – Hill publishing company limited: New Delhi – 1996
10. Sood. S.K. and MridulaSaxena “Food Packaging” – NLERT – Booklet – New Delhi, 2002.

JOURNALS:

1. Food Industry
2. Food Packer
3. Journal of Food Science and Technology.

FT 304 B: NUTRITION IN EMERGENCIES and DISASTERS

THEORY :

UNIT-I

- i. Natural/Manmade disasters resulting in emergency situations:
 - Famine, drought, flood, earthquake, cyclone, war, civil and political emergencies.
 - Factors giving rise to emergency situation in these disasters.
 - Illustration using case studies from Indian subcontinent
- ii. Nutritional problems in emergencies in vulnerable groups
 - Causes of malnutrition in emergency situations
 - Major deficiency diseases in emergencies
 - Protein – Energy Malnutrition
 - Specific deficiencies
- iii. Communicable disease: Surveillance and treatment.
 - Control of communicable diseases in emergencies – Role of immunization and sanitation.

UNIT-II

- Assessment and surveillance of Nutritional status in emergency affected populations.
- Scope of assessment of malnutrition in emergencies
 - Indicators of malnutrition. Clinical signs for screening acute malnutrition
 - Anthropometric assessment of nutritional status. Indicators and cut-offs indicating seriously abnormal nutrition situation: Weight for height based indices, MUAC, social indicators.
 - Organisation of nutritional surveillance and individual screening.

UNIT-III

- i. Nutritional Relief and Rehabilitation
 - Assessment of food needs in emergency situations
 - Food distribution strategy – Identifying and reaching the vulnerable group – Targeting Food Aid.
 - Mass and Supplementary Feeding
 - Therapeutic Feeding
 - Special foods/rations for nutritional relief
 - Local production of special foods
 - Local foods in rehabilitation
 - Organisation of mass feeding/general food distribution
 - Feeding centers
 - Transportation and food storage
 - Sanitation and hygiene,
 - Evaluation of feeding programmes
 - Household food security and nutrition in emergencies
- ii. Public nutrition approach to tackle nutritional problems in emergencies

UNIT-IV

- i. Introduction to Epidemiology – types of epidemiology, collection of epidemiological data, secondary routine data, Descriptive epidemiology, Cross sectional Analysis, prevalence and incidence, risk factors, risks and odds, relative and attributable risks
- ii. Principles of Nutritional Epidemiology, Measurement issues, Measurement of diseases, Occurrence and Measurement of association, Exposure and outcome, Socio demographic and Psycho social variables.
- iii. Design and Planning of Nutritional Epidemiological studies – assessing and supplying and Evaluating Epidemiological studies – Discussion of selected case studies

PRACTICALS:

1. Training in rapid assessment of Nutritional status
2. Assessment of needs, Nutrition, Health. Collection of epidemiological data hand an experiences.
3. Planning and preparation of Nutrient Dense Foods to be used in
 - Famine
 - Drought and
 - specific Nutrient Deficiency states
4. Simulating exercises – Planning, execution and evaluation of emergency programmes.
5. Survey of causative factors of communicable diseases – Case study Experiences on the Management of the same
6. Study of drought and famine relief programmes available with Governmental and Non-Governmental agencies

REFERENCES :

1. Goyet, Fish. V.; Seaman, J. and Geijer, U. (1978): The Management of Nutritional Emergencies in Large populations, World Health Organisation, Geneva.
2. Field Exchange, Newsletters by Emergency Nutrition Network, Dept. of Community Health and General Practice, Ireland.
3. World Disasters Report – Focus on Public Health, International Federation of Red Cross and Red Crescent Societies.
4. The Management of Nutrition in Major Emergencies WHO – in Collaboration with UNCHCR, International Federation of Red Cross and Red Crescent Societies and EFP
5. Disasters – International Public Nutrition and Emergencies: The Potential for improving practice. Special Issue – Vol.23/4, Dec. 1999
6. Guidelines and Research publications of OXFAM, Oxford, UK ((1998-1977)(1991,1999) WFP, Rome, WFP/UNCHCR Rome and Geneva, FAO, Rome. WHO, Geneva (1997)

FT 304 C: NUTRITION FOR HEALTH AND FITNESS

UNIT-I

Definitions- Nutrition, Health, Physical activity, Physical Fitness Benefits of exercise on Health and fitness, Physical activity Recommendations, components of physical fitness, Assessment criteria of age specific fitness and health status- Evaluation of physical fitness- FITT Principles.

UNIT-II

Energy metabolism in physical activity- Aerobic and Anaerobic metabolic pathways, energy requirements and assessment of energy expenditure based on physical activity.

UNIT-III

Nutritional and physical performance- carbohydrate, fat, protein and exercise, vitamins, minerals and fluid needs during exercise, nutrition in post exercise recovery.

UNIT-IV

Sports nutrition, classification of sports events, RDA for sports person, Nutritional requirements and special needs of sports person, pre, during , post sports events, water and electrolyte balance, ergogenic aids, Endurance and fatigue in sports performance- Assessment-strategies, Role of National agencies towards improvements of sports performance

PRACTICALS:

1. Assessment of physical fitness in different age groups/sex.
2. Assessment of Energy expenditure based on physical activity record
3. Physiological parameters like heart rate and blood pressure
4. Assessment of coronary risk profile-RISKO factor
5. Planning diets and formulating dietary guidelines for Fitness and health
6. Planning diets and formulating dietary guidelines for Obesity management
7. Study of life styles and Physical Activity patterns
8. Assessment of Nutritional status of sports person.
9. Field visits to sports camps, Sports organizations.
10. Visits to weight management on fitness centers.

REFERENCES:

1. Shils, M.E., Olson, J.A., Shike, N. and Ross, A.C.(Ed)(1999): “Modern Nutrition in Health and Disease”, 9th Edition, Williams and Wilkins.
2. Whitney, E.N. and Rolfes, S.R.(1999): “Understanding Nutrition”, 8th Edition, West/Wadsworth, An International Thomson Publishing Co.
3. Prizkova, J, Nutrition, “Physical activity and health in early life”, Ed. Wolinsky, I., CRC Press.
4. McArdle, W.Katch, F. and Katch, V. (1996) “Exercise Physiology, Energy, Nutrition and Human Performance”, 4th edition, Williams and Wilkins, Philadelphia.
5. Ira Wolinsky(ed) (1998): “Nutrition in Exercise and Sports”, 3rd Edition, CRC Press.
- 6.Sizer, F. andWhitney, E.(2000): “Nutrition – Concepts and Controversies”, 8th Edition, Wadsworth Thomson Learning.
7. Mahan, I.K. and Ecott-Stump, S.(2000): Krause’s “Food, Nutrition and Diet Therapy”, 10th Edition, W.B. Saunders Ltd.

JOURNALS

1. Medicine and science in Sports and Exercise International Journal of Sports Nutrition

FT: In-plant Training

The students will undergo training for six weeks in Food Industries and submit a detailed report and present a seminar at the end of the placement period

List of Industries where students can be placed:

- Dairy Industries
- Fruit Pulp Industries
- Beverage Production Industries
- Baking and confectionary industries
- Other Food Processing Industries

An evaluation report for 100 marks along with a certificate of internship is issued by the Institution. A copy of the certificate is enclosed along with report.

SEMESTER IV

FT401: FOOD QUALITY STANDARDS AND CONTROL (Common to M.Sc Food Science Nutrition & Dietetics and MS Food Technology Course)

THEORY:

UNIT-I - Food Quality, Assessment and evaluation.

- Definition and Physico Chemical attributes.
- Sensory perception; subjective/ organoleptic evaluation.
- Objective methods of evaluation.
- Chemical methods of evaluation.
- Microbial methods of evaluation.

UNIT-II - Food safety : Food Safety Standards Authority of India (FSSAI)

- Current rules and regulations
- Definitions of standards of identity and quality
- Food licensing and registration system
- International food safety measures

UNIT-III - Food safety

- Definitions
- Undesirable constituents-Naturally occurring contaminants.Heavy metals, pesticide residues,products of microbial growth etc .,Health hazards.
- Desirable constituents-chelating agents,acids,bases,buffer systems and salts; stabilizers,thickeners,polyhydrocalcinols,anticaking,firming,clarifying and bleaching agents;antioxidants,non-nutritional sweetness,antimicrobial agents.
- Gases and propellants.

UNIT IV - Food contaminants and Standards of Quality-

- Contaminants in milk and milk products
- Contaminants in fruit and vegetable products
- Contaminants in meat, poultry, eggs and fish
- Contaminants in fats and oils
- Contaminants in spices and condiments.
- Contaminants in Water and Beverages.
- Contaminants in Food grains and flours
- Contaminants in sugars

PRACTICALS:

Assessment of quality parameters in different foods

1. Survey of different foods in market
2. Cereals and pulses – label information, adulterants
3. Fats and oils – saturation , Rancidity
4. Fruit and vegetable products – Maturity , acidity , TSS, sugars
5. Coffee and tea , spices , Honey – Adulterants
6. Milk and milk products
7. Meat products
8. Determination of different preservatives
9. Determination of different colors
10. Document preparation for the approval of FSSAI

REFERENCES :

1. S.N.Mahindru ,”Food Safety –Concept and Reality” ,APH Publishing corporation, 5 ansari road ,Darya ganj, New delhi-2004
2. Rajesh Mehta and J.George –“Food Safety Regulation concerns and Trade –The developing country perspective ,Mac millan India Ltd ,2005.
3. Vanisha Nambiar, A Text book on “Food Contamination and Safety “ ANMOL Publications Pvt.Ltd. New Delhi -2004.
4. Amerine, M.A., Pangborn RM, and Roessler BB,” Principles of Sensory evaluation of foods”, Academic press New York, 1965.
5. The prevention of food adulteration Act, 1954 and Prevention of food adulteration Rules, 1955. (1998). Federation of Indian Industry, New Delhi.
6. Swaminathan.M., “Food Science and Eperimental foods” (1979) Ganesh and Company – Chennai.
7. Development in Milling and baking Technology (1991) Association of food scientists and Technologists, Mysore.
8. The prevention of food Adulteration Act 1954 (1997) Eastern Book Company, Lucknow.
9. Dr. Ramesh V. Bhat and R. Nageswar Rao (1992) “Food Safety in Public catering”. NIN, ICMR, Hyderabad.
10. Blank.F.C., “Hand book of food and nutrition” (1999). AGRO Botanical Publishers, India.
11. Norman N. Potter, Joseph H. Hotchkiss (1996) “Food Science” 5th Edition. CBS Publishers and Distributors, New Delhi.
12. Ramesh V. Bhat and B.S. Narasinga Rao, “National Strategy for food quality control”(1985), National Institute of Nutrition, ICMR, Hyderabad.
13. Perpinstrum - Anderson, “World food trends and future food security”(1994) Food Policy Report, The International Food Policy Research Institute, Washington, D.C.,

JOURNALS

1. Journal of Food Science and Technology
2. Indian Food Industry, A publication of Association of Food Sciences and Technologists
3. Food Chemistry
4. Journal of Food Science
5. IFCON' 93 and IFCON'98 International food convention, Food technology update,Mysore.

FT - 402: SPICES, CONDIMENTS AND PLANTATION CROPS

THEORY

UNIT I: Spices and condiments

- Introduction and History of Spices and condiments, Classification, composition, nutritive value.
- Definition of types of Major and Minor spices, post-harvest technology, processed products and their marketing in trade
- Production and processing of spices and condiments and its scope, Value addition of spices and spice products with different processing methods
- Different technologies involved in the preparation of spice powders, spice oils, oleoresins and products
- Flavoring agents and extracts ,Flavoring components and concentrates
- Herbs and Greens as Spices and condiments

UNIT II: Plantation crops – A

- Definition of plantation crops and Classification.
- **Coffee:** Bean processing – Grading, blending, roasting of seeds, grinding, brewing; Coffee varieties & processing - Decaffeinated Coffee, Instant Coffee, extraction, Dehydration, Aromatization; Plant and machinery for coffee processing.
- **Tea:** Tea processing- leaves gathering, Grading, leaf processing; Types of tea & processing - dust tea, black tea, green tea, Oolong tea, Instant tea; Plant layout and machinery for tea processing.

. UNIT III: Plantation crops - B

- **Cocoa:** Production, composition, grading, processing; cocoa products processing- cocoa mass, cocoa powder, cocoa butter, cocoa based beverages, malted milks and cocoa liquor.
- **Coconut** - Production, composition, Grading, post-harvest technology and treatments; processing of coconut, coconut milk and its applications.

. UNIT IV: Quality control and commercial value

- Standards, specifications and Quality control measures of spices, condiments and plantation crops.
- Packaging of spices, spice products and plantation products.
- Commercial value of Spices, Condiments, plantation crops and their products in global market.

PRACTICALS:

1. Market survey of Spices, Condiments and their products.
2. Market survey of plantation crops and their products.
3. Survey of herbs and Greens used as Spices and condiments.
4. Preparation of Spice powders and products.
5. Preparation of products from coffee, tea, cocoa and coconut and quality evaluation.
6. Grading and evaluation of commercially marketed products.
7. Study of standard specifications of spices, Condiments and plantation crops.
8. Visit to Spice processing industry.

REFERENCE BOOKS

1. Alikonis, J.J. "Candy technology" AVI publishing West Port, CT, 1998.
2. Shanmugavelu K.G. Spices and Plantation Crops. Oxford & IBH Publishing Co. New Delhi
4. Purselave J.W., Brown E.G., Green C.L., and Robins. Spices Vol.1 and Vol.II SRJ Academic Press. New Delhi.
4. Thampan P.K. Hand Book of Coconut Palm. IBA Publishing Company, New Delhi
5. Gupta S. Hand Book of Spices and Packaging with Formulae. Engineers India Research Institute, New Delhi
6. Minifie, B.W. "Chocolate, Cocoa and confectionery" Science and Technology, 3rd edition, Chapman and Hall, London, NY, 1986.
7. Vijayakheder, "Text Book of Food science and Technology" ICAR, New Delhi, 2001.

JOURNALS

1. British Nutrition foundation Nutrition Bulletin
2. Consumer
3. Food Nutrition News.
4. Food additives contamination
5. Food Technology
6. Food Industry
7. Food Policy

FT 403: FOOD PRODUCT DEVELOPMENT AND MARKETING

THEORY:

UNIT I: Innovations in product Development

- Introduction to the Product development and formulation - Need for Product development
- New Food Products - Definition, Classification, General characteristics of New food product - Classes of new Food products - Line extensions - Repositioning of existing products - New form of existing product - Reformulation - New packaging - Innovative products and Creative products and Value added products
- Factors affecting food product development - Corporate factors - Market place factors, technological pressures - Governmental issues and legislations

UNIT II: Food product development Process

Stages/Phases of new product development : Idea generation- Screening, Feasibility studies, Consumer research , Financial review, Product design and Formulation, Process development – Recipe development and scale up, Consumer trials ,Test market, Quality assessment of new developed products -Sensory Evaluation, Shelf life Testing, packaging and labeling protocols. Costing/pricing and economic evaluation of the product, Product launch – product life cycle.

UNIT III: Speciality food products

Product development with reference to nutritional and health needs: Health foods, Medical foods, Therapeutic foods, Infant foods, Geriatric foods, Functional foods, Nutraceuticals, prebiotics and probiotics, Herbal foods, Sports drinks.

UNIT IV: Product Commercialization and Marketing

- Entrepreneurship, Test Marketing; evaluating results and analyzing.
- Ethics in food product development
- Intellectual property/ Patents

PRACTICALS

1. Market Survey to identify new products in terms of
 - Line Extension, Repositioning Existing Products, New form/Reformulation, New packaging of existing products, Innovative products and Creative Products.
2. Market Survey to identify
 - Nutrition products, Therapeutic products, Specialty products, Technology Driven products.
3. Identification of product for development
 - Idea generation, Screening of Ideas, Concept, Market research concerned product development.
4. Development of the product.
 - Formulation, Standardization, Scaling up.
5. Sensory evaluation
 - Designing of score card, Sensory Evaluation.
6. Food and Nutrition labeling and packaging.
7. Costing and Pricing.
8. Test Marketing.
9. Shelflife Studies.

REFERENCES

1. Proc. Food Processors Institute: A key to Sharpening your Competitive Edge. Food Processors Institute, Washington, DC.
2. Mike Stringer and Colin Dennis, "Chilled foods A comprehensive guide" 2nd edition :Woodhead publishing limited, Cambridge, England, 2000.
3. Andrew J.Taylor, "Food Flavour Technology", Sheffield Academic Press, 2002.
4. Debashri Ray "Nutritional Challenge and Total Quality Management" 1st edition; Sarup and Sons, New Delhi, 2002.
5. Rita Singh "Food Biotechnology" Volume 1, 1st edition, Global Vision publishing house, Delhi, 2004.
6. Rita Singh "Food Biotechnology" volume 2, 1st edition, Global vision publishing house, Delhi, 2004.
7. Fuller, G.W.(1994) New Food Product Development: From Concept to Market place CRC, Press, New York.
8. Man, C.M.D. and James A.A.(1994) Shelf life Evaluation of Foods. Blackie Academic and Professional, London.
9. Shapton, D.A. and Shapton, N.F. (1991) Principles and Practices for the Safe Processing of Foods, Butterworth Heinemann Ltd, Oxford.
10. Graf, E. and Saguy, I.S. (1991), Food Product Development: From Concept to the Market Place, Van Nostrand Reinhold New York.
11. Oickle, J.G. (1990) New Product Development and Value Added. Food Development Division Agriculture, Canada.

JOURNALS

1. International Journal of Food Science and Technology
2. Food Technology
3. Journal of Food Science and Technology (IAFST), CFTRI, Mysore.
4. Trends in Food Science and Technology
5. Critical Reviews in Food Science and Nutrition
6. Food Packer
7. Food Industry (IAFST) Mysore: CFTRI.

FT 404 A: FOOD PROCESSING AND PRESERVATION TECHNOLOGY (Common to MSc Food Science Nutrition & Dietetics and MS Food Technology Course)

THEORY

UNIT I: Scope and significance of food processing and preservation

- Need and Purpose, Principles and Methods of food processing and preservation.
- Traditional Methods of food processing and preservation
- Preservatives and Additives - Classification, applications, permissible limits and safety aspects.

UNIT II : Modern Methods of food processing and preservation

- Processing and preservation by Heat - Principles of thermal processing, blanching, pasteurization, UHT processing, thermal sterilization, canning, extrusion, Different time-temperature- combinations, Thermal Death Curves , Margin of safety.
- Processing and preservation by Cold- Refrigeration and freezing, freezing time and rate, methods of freezing, effect on quality of foods.
- Processing and preservation by Dehydration and concentration – Types, Methods and their suitability for different food products, effect of dehydration and concentration on quality of foods- Low, High, and Intermediate Moisture foods.

UNIT III: Processing and preservation by Fermentation

- Definition, types, Importance, Technology, Benefits and Limitations.
- Processing and preservation of fermented foods - Cereal and pulse products Vegetables, Milk products, Beverages, meat products

UNIT IV: Processing and preservation by Novel methods

Irradiation, high Pressure and ultrasonic, high intensity light, pulse electric field, ohmic heating, inductive heating and pulsed X-rays, Microwave and radio frequency, Minimal Processing, membrane processing, hurdle technology, Nanotechnology and applications in foods

PRACTICALS

1. Market survey of processed and preserved foods and to study the methods of processing, preservation, Additives and preservatives used, shelf life, cost and form of availability.
2. Preservation of food by traditional methods using sugar, salt and turmeric powder etc.
3. Preservation by using Chemical preservatives.
4. Preparation of Jams, Jellies, fruit Juices, Squashes, Sauces and bottling – Shelf life study.
5. Pickling with a variety of foods - Shelf life study.
6. Drying and dehydration of foods.
7. Refrigeration, Freezing and freeze drying of foods.
8. Extrusion processing.
9. Processing and preservation of fermented products.
10. Visits to different commercial food processing units and Industries.

REFERENCE BOOKS & TEXT BOOKS

1. Anuradha Subramanian, "Concise Food Science", Soundariya Publication, Erode, Tamil Nadu. 1998.
3. Harry. W. Von Loesecke, "Drying and dehydration of Foods", Allied Scientific Publishers, 1998.
4. Fellows, P. and Ellis H. 1990. Food Processing Technology: Principles and Practice, New York.
5. Norman, N. Potter, Joseph H. Hotchkiss "Food Science", 5th edition, CBS Publishers & Distributors, New Delhi. 1996.
6. Jelen, P. 1985. Introduction to Food Processing. Prentice Hall, Reston Virginia, USA.
7. Lewis, M.J. 1990. Physical Properties of Food and Food Processing Systems. Woodhead, UK.
8. Rama swamy, H and Marcote, M, 2005. Food processing- principals and applications, Taylor and francis.
9. Vijayakhader, "Text book on food storage and preservation", Kalyani Publishers, New Delhi. 2000.

JOURNALS

1. Advances in food research, yearly volumes.
2. British food journal.
3. Food Science.
4. Food Technology.
5. Journal of Food Science and Technology.
6. Indian journal of Nutrition and dietetics.
7. Scientific American.

FT 404-B: INSTITUTIONAL FOOD SERVICE MANAGEMENT

THEORY:

UNIT-I: Introduction to food service Industry, management and types of Food service establishments.

- Principles and functions of food service management.
- Need and importance
- Tools of Management.
- Management of resources.
- Types: Hotels and Restaurants - Hotels/Motels, restaurants, cafes, clubs public houses, winebars, speciality restaurants, fast foods, take-aways, street foods.
- Welfare and Industrial - Residential establishments - School, colleges, hostels, old people House, Hospitals, nursing homes, Industrial canteens, Temple feeding and Marriage feeding.
- Transport - Railway, Airlines and Sea.

UNIT-II: Infrastructure and Equipment in Food Science Institutions

- Building plans, outlays of work places - kitchen spaces, storage spaces and service areas.
- Equipment - Classification of equipment, selection of equipment, Design, installation, operation and maintenance.
- Menu – types of menu in Food service institutions, principles and planning
- Food service operation and types of food services - systems of service, mechanics of waiter service, self-service, vending and mobile catering.
 - Food services systems - Introduction, Standards of hygiene.
 - Cook-chill system and benefits.
 - Cook-freeze system and benefits.
 - sous-vide.
- Computers in service - Introduction, catering controls.

UNIT-III: Food safety in public catering.

- Health and Hygiene of personnel.
- Laws governing food service in public catering.
- Sanitation of food service establishments.
- Food safety in hotels, restaurants, street foods, industry and canteens, hospitals, hostels, airlines , railways, temple and mass feeding programmes.
- Laboratory support services in food safety.
- Food borne diseases and importance of surveillance
- Food safety awareness programmes to food handlers and consumers.
- Role of media in food safety education.

UNIT IV: Financial and Personnel Management

- Definition and scope of financial management.
- Cost concept, cost control and pricing.
- Book keeping and accounting.
- Personnel Management - Recruitment, selection and Induction, Job analysis, description Monitoring work employee facilities and benefits, Inservice Training. Skills required to operate and manage food service system.

PRACTICALS:

1. Survey of different types of food service establishments.
2. Standardization of recipes suitable for different food service establishment.
3. Portioning, costing and multiplication of the recipes.
4. Practice in preparation of volume meals at different costs suitable for different service systems.
5. Meal planning exercise for various food service systems
5. Exercise on preparation of work schedule
7. Visit to the following types of
 - Hotels / restaurant.
 - Welfare and industrial - transport.and writing report with regard to outlays, equipment, personnel etc. organizational set up.
8. Carrying out an evaluation study project on any aspect unit of food service.

REFERENCES

1. Ronald Kinton and victor cesarani (1992), "The theory of catering", Butler and Tanner Ltd. France and London.
2. Mohinisethi and Surjeet Mohan (1993), "Catering management - An integrated approach", second edition, Wiley eastem limited, New Delhi.
3. Ramesh V. Bhat and R. Nageswara Rao (1996), "Food safety", Bappco (Ltd). Mysore, Bangalore.
4. Ramesh V. Bhat and R. Nageswar Rao (1992), "Food safety in public catering", NIN, ICMR, Hyderabad.

JOURNALS

1. Journal of Food Science and Technology
2. Indian Food Industry, A publication of Association of Food Sciences and technologists
3. IFCON' 93 and IFCON'98 International food convention, Food technology update, Mysore.

FT 405: HUMAN VALUES AND PROFESSIONAL ETHICS - II **(Common to all Branches of MSc Home Science and MS Food Technology Course)**

Unit-I:

Value Education- Definition - relevance to present day - Concept of Human Values - self introspection – Self-esteem - Family values-Components, structure and responsibilities of family- Neutralization of anger - Adjustability - Threats of family life - Status of women in family and society - Caring for needy and elderly - Time allotment for sharing ideas and concerns.

Unit-II:

Medical ethics- Views of Charaka, Sushruta and Hippocrates on moral responsibility of medical practitioners. Code of ethics for medical and healthcare professionals. Euthanasia, Ethical obligation to animals, Ethical issues in relation to health care professionals and patients. Social justice in health care, human cloning, problems of abortion. Ethical issues in genetic engineering and Ethical issues raised by new biological technology or knowledge.

Unit-III:

Business ethics- Ethical standards of business-Immoral and illegal practices and their solutions. Characteristics of ethical problems in management, ethical theories, causes of unethical behavior, ethical abuses and work ethics.

Unit-IV:

Environmental ethics- Ethical theory, man and nature- Ecological crisis, Pest control, Pollution and waste, Climate change, Energy and population, Justice and environmental health.

Unit-V:

Social ethics- Organ trade. Human trafficking .Human rights violation and social disparities, Feminist ethics. Surrogacy/pregnancy. Ethics of media- Impact of Newspapers, Television, Movies and Internet.

REFERENCES:

1. John S Mackenjie: A manual of ethics.
2. The Ethics of Management" by Larue Tone Hosmer. Richard D. Irwin Inc.
3. "Management Ethics' integrity at work' by Joseph A. Petrick and John F. Quinn. Response Books: New Delhi.
4. "Ethics in Management" by S.A. Sherlekar, Himalaya Publishing House.
5. Harold H. Titus: Ethics for Today
6. Maitra, S.K: Hindu Ethics
7. William Lilly: Introduction to Ethics
8. Sinha: A Manual of Ethics
9. Manu: Manava Dharma Sastra or the Institute of Manu: Comprising the Indian System of Duties: Religious and Civil (ed.) G.C.Halighton.
10. SusrptaSamhita: Tr.KavirajKunjanlal, KunjalalBrishagratha. Chowkarnba Sanskrit series. VolLII and III, Varnasi, Vol I 00,16'20,21-32 and 74-77 only.
11. CarakaSamhita :Tr.Dr. Ram Karan Sarma and VaidyaBhagavan Dash, Chowkambha Sanskrit Series office. Varanasi I, 11.111 VolIPP 183-191.
12. Ethics, Theory and Contemporary Issues. Barbara Mackinnon Wadsworth/Thomson Learning, 2001.
13. Analyzing Moral.Issues, Judith A. Boss. May Field Publishing Company - 1999.
14. An Introduction to Applied Ethics (Ed.) John H.Piet and Ayodhya Prasad. Cosmo Publications
15. Text Book for Intermediate First Year Ethics and Human Values. Board of Intermediate Education- Telugu ~ Akademi, Hyderabad.
16. I.C Sharma Ethical Philosophy of India. Nagin& co Julundhar

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