

M.Sc. NUTRITION AND FOOD TECHNOLOGY

(UNDER NON-SEMESTER PATTERN)

(This will come into effect from the academic year 2013 – 14)

NAME OF THE COURSE : M.Sc. (NUTRITION & FOOD TECHNOLOGY)

DURATION OF THE COURSE : TWO YEARS

ELIGIBILITY FOR ADMISSION

Graduation in any branch of Home Science, Microbiology, Bio-Chemistry, Bio-Technology and any other degree with chemistry as major or ancillary subject.

COURSE CONTENT & SCHEME OF EXAMINATION

Sl. No.	PAPERS	Max. Marks	Duration of Exam
FIRST YEAR			
1.	Advanced Nutrition	100	3
2.	Advanced Food Science & Chemistry	100	3
3.	Food Safety & Quality Control	100	3
4.	Food Technology - I	100	3
5.	Analytical Instrumentation	100	3
SECOND YEAR			
1.	Research Methodology & Biostatistics	100	3

2.	Food Product Development and Marketing	100	3
3.	Food Technology – II	100	3
4.	Food Analysis Practical	100	3
5.	Food Processing	100	3
	Grand Total (I + II Year)	1000	

PATTERN OF THEORY QUESTION PAPER

Max. Marks: 100

Time: 3 hours

PART – A

(5x5 = 25 Marks)

Atleast two questions from each unit.

Answer any five questions out of seven questions.

PART – B

(5 x 15 = 75 Marks)

Atleast one question from each unit.

Answer any five questions out of seven questions.

DECLARATION OF RESULT

Passing Minimum - 50 marks out of 100

Class will be awarded as below.

50 – 59 - II Class

60 & Above - I Class

75 % Above - Distinction

ADVANCED NUTRITION

Objectives

Develop approaches to identify food safety hazards in Food processing

- Apply preventive measures and control methods to minimize microbiological hazards and maintain quality of foods

- Develop quality control strategies.

Unit – I

- **Energy:** Definition, units of energy, Energy content of foods. Physiological fuel value, Measurement of energy expenditure, BMR, Thermic effect of food, SDA, Methods of measurement, Factorial methods of estimating energy requirement of individuals, Regulation of energy metabolism.
- **Carbohydrates:** Types, Classification, functions, absorption, metabolism, digestion and transport. Dietary fibre- Classification and its role. Glycemic index of foods. Sweeteners-nutritive and non-nutritive.

Unit – II

- **Proteins:** Classification, digestion, absorption and transport. Protein quality, methods of evaluating protein quality. Protein requirements.
- **Lipids:** Classification, digestion, absorption and transport. Functions of fat and EFA. Role of n-3, n-6 fatty acids in health and disease. Requirements of total fats.

Unit – III

Minerals: Functions, metabolism, deficiency and toxicity and food sources of:

- Macro minerals: Calcium, Phosphorous, Magnesium, Sodium and Potassium.
- Micro minerals: Iron, Copper, Zinc, Iodine, Fluoride, and Selenium.

Unit – IV

Vitamins: Nomenclature, Food sources, functions, metabolism, deficiency and toxicity of:

- Fat soluble: Vitamin A, D, E and K.
- Water soluble: Thiamine, Riboflavin, Niacin, Pyridoxine, Folic acid, Cyanocobalamin and Vitamin C.

Unit – V

- **Water:** Functions, sources, composition of intra and extracellular fluids. Water balance and its regulation, Acid – base balance, Deficiency and Excess of water.

References

1. Catodo CB, Sharon RR and Eleanor NW (1988) Understanding Clinical Nutrition, Second edition (Belmont CA: West/ Wadsworth- An International Thomson Publishing Company)
2. Passmore R Eastwood MA(1990) Human Nutrition and Dietetics (Edinburgh: Churchill Livingstone).
3. Robinson Corinne H, Marilyn RL, Wanda La and Ann EG (1990) Normal and Therapeutic Nutrition, Seventeenth edition (Scotland: Macmillan Publishing Company).

ADVANCED FOOD SCIENCE AND CHEMISTRY

Objectives

- Gain knowledge on the nutritive value of different foods to understand the concepts in food
- Develop skills to prepare acceptable foods with regard to appearance, palatability and nutritive value

Unit – I

- **Properties of Foods:** Physico-Chemical properties of foods – Organic food components, colloids, osmotic pressure, food dispersions (sols, gels, emulsion, foam), Hydrogen ion concentration.

Unit – II

- **Carbohydrates:** Functional properties of sugars and polysaccharides in foods. Principles of sugar crystallization.
- **Starch–Hydrocolloids and gums:** Functions in food systems, properties, gelatinization, retrogradation and modified starches.

Unit – III

- **Proteins:** Functional properties of proteins, modified proteins, denaturation of proteins and maillard browning.
- **Lipids:** Physical and chemical properties, Rancidity of fats, uses of fat replacers

Unit – IV

- **Natural food flavours** – Flavours in food and their industrial application.
- **Water-** Role of water in foods, free water and bound water, functional properties, water activity.
- **Enzymes** -Importance of Enzymes in food processing – Amylases, Proteases, Lipases, Oxidoreductases, hydrolases.

Unit – V

- **Food additives:** Definition, Types, Role in food industry.
- **Leavening agents:** Definition, Classifications and its role in food processing.
- **Colour of foods:** Natural colours, certified artificial colours, Non-certified colors.

References

1. Food chemistry by H.D.Belitz.,
2. Food Additives – R.J.Taylor
3. Enzymes in food processing by G.G. Birch, N.Blakebrough & K.J.Parker
4. Potter, N.N.1978, Food Science 3rd Ed. AVI, Westport.
5. Food science, chemistry and experimental foods by M.Swaminathan.
6. Food Science by Sri Lakshmi.B.

FOOD SAFETY AND QUALITY CONTROL

Objectives

To enable the students

1. To standardize food products through sensory evaluation.
2. To understand the fundamental food quality control procedures.
3. To know about Food standards and Laws

Unit – I

Introduction to sensory evaluation: Sensory quality parameters-size and shape, texture, aroma, taste, colour and gloss. Types of sensory tests: subjective & objective test.

Unit – II

Selection of sensory panelists, general testing conditions - factors influencing sensory measurements; designing of questionnaire and/or evaluation of scorecard; consumer acceptability using sensory evaluation.

Unit – III

Food Adulteration – Definition, classification of adulterants, List of foods commonly adulterated, harmful effects of adulterants and methods of detecting adulterants.

Unit – IV

Introduction to quality control and quality assurance. Food safety measures. Current concepts of quality control. Quality assurance programme: Quality plan, documentation of records, product standards, product and purchase specifications and process control. HACCP – Definition – Principles - Benefits of HACCP.

Unit – V

Food Standards and Regulations - The prevention of Food Adulteration Act, Compulsory National legislation Act - Essential Commodities Act, SWMA and Export Quality Control and Inspection Act. Voluntary Based Product Certifications - BIS, AGMARK and Consumer protection Act. International Standards- Codex Alimentarius, WTO, ISO, WHO and FAO, FSSA.

References

1. Lyon, D.H.; Francombe, M.A.; Hasdell, T.A.; Lawson, K. (eds) (1992): Guidelines for Sensory Analysis in Food Products Development and Quality Control. Chapman and Hall, London.
2. Lawless, H.T. and Klein, B.P. (1991): Sensory Science Theory and Applications in Foods. Marcel Dekker Inc. New York.
3. Piggott, J.R. (ed) (1988): Sensory Analysis of Foods. Elsevier Applied Science, London.
4. Early, R. (1995): Guide to Quality Management Systems for the Food Industry,
5. Blackie, Academic and professional, London.
6. Gould, W.A and Gould, R.W. (1998). Total Quality Assurance for the Food Industries, CTI Publications Inc. Baltimore.
7. Pomeranz, Y. and MeLoan, C.E. (1996): Food Analysis: Theory and Practice, CBS Publishers and Distributor, New Delhi.
8. Bryan, F.L. (1992): Hazard Analysis Critical Control Point Evaluations A Guide to Identifying Hazards and Assessing Risks Associated with Food Preparation and Storage. World Health Organisation, Geneva.

FOOD TECHNOLOGY – I

Objectives

To enable students

1. To know the principles and methods involved in the processing of Agricultural and Horticultural foods
2. To develop skills in the preparation of Agricultural and Horticultural food products.

Unit – I

- **Rice:** Classification, physicochemical characteristics; Drying, rice milling technology; by-products of rice milling and their utilization; Parboiling of rice- technology and effect on quality characteristics.
- **Wheat:** Types and physicochemical characteristics; wheat milling, products and their byproducts;
- **Minor Millets:** Corn - Types and nutritive value; dry and wet milling process, processing of barley, oats and sorghum.

Unit – II

- **Physiochemical Characteristics:** processing and storage; Extraction of edible oils - Mechanical and solvent extraction, byproducts of oil extraction, meal, flour, oil seeds, protein concentrates and isolates.

Unit – III

- **Fresh fruits and vegetables:** Handling, grading, cleaning, pretreatments, transportation, pre cooling, chilling, packaging and transportation.
- **Freezing of Fruits and Vegetables:** Different freezing methods and equipments, problems associated with specific fruits and vegetables;
- **Dehydration of Fruits and Vegetables:** Different methods and its effect on quality.

Unit – IV

- **Fruit and vegetable Processing:** Juices, Squashes, Syrups, RTS, Jam, Jellies, Preserves, Candies, Pickles, Sauces and Ketchup.

Unit – V

- **Spices:** Pepper, onion, ginger, cardamom and garlic processing, physiochemical Characteristics processing of extraction of essential oils.

References

1. Alzamora, S.M., Tapia, M.S. and Lopez Malo, A. Minimally Processed Fruits and
2. Vegetables: Fundamental Aspects and Applications, Springer, 2005.
3. Chakrabarty MM. 2003. Chemistry and Technology of Oils and Fats. Prentice Hall.
4. Chakraverty.A1995.Post Harves Technology of Cereals, Pulses and Oilseeds, Oxford & IBH Publishing Co.Pvt.Ltd.
5. Dendy DAV & Dobraszczyk BJ. 2001. Cereal and Cereal Products. Aspen.
6. Hamilton RJ & Bhatia. 1980. Fats and Oils - Chemistry and Technology. App. Sci. Publ.
7. Hosoney RS. 1994. Principles of Cereal Science and Technology. 2nd Ed.AACC.
8. Kay DE. 1979. Food Legumes. Tropical Products Institute.
9. Kent NL. 1983. Technology of Cereals. 4th Ed. Pergamon Pre
10. Salunkhe, D.K. and Kadam, S.S. Handbook of Fruit Science and Technology: Production, Composition, Storage, and Processing, Marcel Dekker, 2005.
11. Agro Food Processing: Technology Vision 2020 Fruits & Vegetables Current Status and Vision, TIFAC, 1996.

ANALYTICAL INSTRUMENTATION

Objectives

To enable the students to

Understand the principle, instrumentation and applications in Foods and Nutrition.

Unit – I

- **Chromatography:** Meaning – Types of Chromatography – Principles, Components and Applications of (i) Paper Chromatography – Ascending and Descending – One dimensional and two dimensional (ii) Thin Layer Chromatography – (iii) Gas Chromatography (iv) Ion Exchange (v) Gel Filtration (vi) High Performance Liquid Chromatography.

Unit – II

- **Electrophoresis:** Meaning – Types – Paper, Starch, Gel, Agar-gel, Polyacrylamide gel, Moving boundary Electrophoresis, Immuno electrophoresis – Principles - Components – Applications.

Unit – III

- **Colorimetry, Fluorimetry :** Photoelectric Colorimeters, Fluorimetry – Principle , Applications.
- **Centrifugation:** Types of Centrifuge – Ordinary and Ultracentrifuge – Principle and Applications.
- **Microbiological Assays:** Types of Assays – Principle – Requirements for the conduct of Microbiological Assays – Applications.

Unit – IV

- **Spectroscopy:** Spectrophotometer types– Principle, Applications of Atomic Absorption Spectrophotometer and UV Spectrophotometer.
- **NMR and NIR**
Nuclear Magnetic Resonance – Application and Principle
Near Infrared – Principle and Application

Unit – V

- **Isotopes:** Types – Stable and Radioactive, Units of radioactivity – Uses in biological investigation – Geiger Muller Counter and Scintillation Counter – Effects of ionizing radiation – hazards and prevention – Applications.
- **pH and Buffer:** pH meter – measurement of pH, Buffer – Definition – Types – Buffer system with special reference to living body.

References

1. Mahinder Singh, 2003, Analytical Chemistry – Instrumental Techniques, Dominant Publishers and Distributors, New Delhi.
2. M.S. Yadav, 2001, Instrumental Methods of Chemical Analysis, Campus Books Internationals, New Delhi.
3. Nike Lal, 1973, Experimental Methods in Biophysical Chemistry, John Wiley Publishers.
4. W.W. Ewing, 1970, Instrumental Methods of Chemical Analysis, McGraw Hill Book Company, New Delhi.

RESEARCH METHODOLOGY AND STATISTICS

Objectives

To enable the students

To enrich the knowledge in research and to design research.

Unit – I

Meaning of research, role of statistics & research in Nutrition & Food technology discipline, objectives of research, types of research and their application, selection and formulation of research problem

Hypothesis, designing research-different types- Completely randomized design, Randomized block design, Latin square design, Factorial design, and Trend analysis

Sampling methods-random sampling methods and non-random sampling methods, size of sample, sampling and non-sampling errors

Unit – II

Techniques of data collection. Methods of collecting primary data interview method, case-study method, scaling methods, case study, home visits, experimentation method.

Unit – III

Representation of data-diagrammatic and graphic representation-significance of diagrams and graphs, general rules for constructing diagrams, types of diagrams, graphs of frequency distribution

Unit – IV

Measures of central tendency-mean, median, mode their relative advantages and disadvantages, measures of dispersion-mean deviation, standard deviation, quartile deviation, co-efficient of variation, correlation, coefficient of correlation, rank, correlation regression equations and prediction

Unit – V

Probability-rules of probability and its application distribution-normal, binomial, their properties, importance of these distributions in statistical studies. Tests of significance, large and small samples, "t" and f test, chi-square test, analysis of variance one-way and two way classification. Testing of hypothesis. Levels of significance.

References:

1. Kothari, C.R. (2002), Research Methodology.
2. Gupta, S.P. (2002), statistical methods, Sultan Chand and Sons, 31st Revised Edition.
3. Devadas, R.P. (1989), a handbook on methodology of research, Sri Ramakrishna Vidyalaya, Coimbatore.
4. Ramakrishnan, P. (2001), biostatistics, Saras publication.
5. Donald, H.M.C. Bumey (2002), research methods, fifth edition. Thomson and Wadsworth publications.

FOOD PRODUCT DEVELOPMENT AND MARKETING

Objectives

- To enable the students :
- To know the different concepts of product development and formulation.
- To know the market trends, market testing methods, launching and commercialization

Unit – I

New food product - Definition – Concept and general characteristics of new food product - Classes of New Food products, Need for Product development, Factors affecting food product development, causes of product failure/ success.

Unit – II

Phases in Food Product Development- Company objectives - Perceived needs of Market - Ideas - Screening - Feasibility studies - Consumer research - Financial review Development - Production - Consumer trials -Test market.

Unit – III

Difference between market and market -places; Customers and Consumers; Marketing Characteristics of the product, Product Life cycle .Generation of Food product Ideas - Sources of new product ideas - The market –places, types of market- places - Within the company - Outside the market place.

Unit – IV

Organizing for new product development - Concepts of research and development Creativity. Criteria of screening - general criteria for screening - Constraints - financial and technical constraints. Standardization of product formulation and product design; Adaptable suitable technology role of Engineering in the development process.

Unit – V

Process design, Scale - up and in - process specifications, Manufacturing plant and Technical aspects and-production trials. Market testing - methods of testing – Evaluation Quality assessment of new developed products. Costing/pricing and economic evaluation of the product . Product launch and commercialization of the product.

References:

1. Brody Aaron. L, Lord and John B, Developing new food products for a changing market place (2nd edition) - Economic Publishing Co. Inc, Lancaster.
2. Gordon W. Fuller. New Food Product Development – From concept to market place, Second Edition. CRC Press.
3. Crawford .I.M. Agricultural and Food Marketing Management.FAO/UN, Rome.
4. Graf and Saguy, Food product development (From concept to Market Place). CBS Publishers, New Delhi.
5. Olikle, J.K. (1990) New Product Development and Value Added Food, Development Division, Agriculture, Canada.

FOOD TECHNOLOGY - II

Objectives

To enable students

- **To impart knowledge of basic and applied aspects of Milk, Meat, Poultry and fish processing and technology.**
- **To provide necessary knowledge of basic principles and procedures in the production of Milk, Meat, Poultry and fish products.**
- **To orient the students to potential use of various by-products of Meat and Poultry and fish.**

Unit – I

Milk-Composition of milk of various species, quality evaluation and testing of milk, procurement, transportation and processing of milk, cleaning & sanitization of dairy equipments. Special milk flavoured, sterilized, recombined & reconstituted , toned & double toned, Fermented milk products.

Unit – II

Fish – Biochemical composition and quality of fish and shellfish, Microbiological quality of fresh fish ,Fresh fish handling and chilling, Preservation by curing-drying, salting and smoking. Freezing technology and canning preservation of fish. Fish by-products and waste utilization.

Unit – III

Meat- Chemical composition and microscopic structure of meat. Factors affecting post-mortem changes, properties and shelf-life of meat. Slaughtering of animals, inspection and grading of meat. Meat quality evaluation. Mechanical deboning, meat tenderization. Aging, pickling and smoking of meat. Meat plant sanitation and safety, By-product utilization.

Unit – IV

Poultry- classification, composition, preservation methods and processing of poultry. Slaughtering of poultry, inspection and grading.

Unit – V

Egg- Structure, composition, nutritive value and functional properties of eggs and its preservation by different methods. Processing of egg products. Factor affecting egg quality and measures of egg quality.

References

1. Considine, D.M. Ed. 1982. Foods and Food Production Encyclopedia, VNR, New York.
2. Dey, S. 1994. Outlines of Dairy Technology. Oxford Univ. Press, New Delhi.
3. MaCrae, R., Robinson, R.K. and Sadler, M.J. Ed. 1993. Encyclopedia of Food Science,
4. Food Technology and Nutrition Academic Press, London.
5. Robinson, R.K. (2 vol. set). 1986. Modern Dairy Technology Elsevier Applied Science, UK.
6. Rosenthal, I. 1991. Milk and Milk Products. VCH, New York.
7. Warner, J.M. 1976. Principles of Dairy Processing. Wiley Eastern Ltd. New Delhi.
8. Harper, WJ. and Hall, C.W. 1975. Dairy Technology and Engineering AVI, Westport.
9. Lawrie, R.A. 1975. Meat Science, 2nd Edn. Pergamon Press, Oxford UK.
10. Lavie A. 1980. Meat Handbook. 4th Edn. AVI, Westport.
11. Portsmouth, J.I. 1979, Commercial Rabbit Meat Production. 2nd Edn. Saiga Survey, England.
12. Stadelman, W.J. and Cotterill, O.J., 1977. Egg. Science and Technology. 2nd Edn. AVI, Westport.

FOOD TECHNOLOGY PRACTICAL

1. Determination of gluten content in wheat flour.
2. Parboiling of rice.
3. Malting, puffing and popping of grains
4. Blanching and browning control of fruits and vegetables.
5. Preparation of Jam and Jellies.
6. Preparation of fruit preserves (Candies, Glassed candies and crystallized candies).
7. Preparation of pickles.
8. Dehydrated products --- vegetables dices tray drying, osmotic dehydration of seasonal fruit.
9. Tomato processing-Juice, sauces, ketchup and puree
10. Fruit pulping / juice / beverage preparation.
11. Preparation of special milks.
12. Preparation and evaluation of indigenous milk product such as khoa, channa, paneer, ghee, rasgulla, gulab jamun, shrikhand, lassi, burfi.
13. Slaughtering and dressing of meat animals; study of post-mortem changes; meat cutting and handling;
14. Preservation by dehydration, freezing, canning, curing, smoking and pickling of fish
15. Preparation of meat products- barbecued sausages, loaves, burger,
16. Evaluation of fish and other marine products preparation of fish fingers and others.
17. Preparation of partially hydrolysed and deodorized fish powder.(PHD)
18. Preparation of extruded fish products.
19. Storage and packaging of marine products.
20. Evaluation of quality of eggs

FOOD ANALYSIS PRACTICAL

1. Estimation of Calorific value of food
2. Estimation of Moisture content
3. Estimation of Ash content
4. Estimation of Protein
5. Estimation of Fat
6. Estimation of Carbohydrate
7. Estimation of Calcium
8. Estimation of Phosphorus
9. Estimation of Iron
10. Estimation of Vitamin C
11. Estimation of Thiamine
12. Estimation of Riboflavin
13. Estimation of Vitamin A and carotene
14. Estimation of Antioxidants
15. Estimation of Iodine number
16. Estimation of Saponification number.