SNDT Women's University

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Syllabus for
M.Sc. Nutrition and Food Processing
(Home Science)

With effect from
Academic Year 2012-13

Shreemati Nathibai Damodar Thackersey Women's University
1, Nathibai Thackersey Road, Mumbai – 400 020.

M. SC. NUTRITION AND FOOD PROCESSING

Eligibility: B. Sc Food Science and Nutrition, Clinical Nutrition and Dietetics, Food Science and Quality Control, Applied Nutrition, Food Technology, Biochemistry, Microbiology and Biotechnology.
Student should have obtained minimum 50% marks in the undergraduate degree or B grade from any recognized University
Science Graduates with, Food Technology, Biochemistry, Microbiology and Biotechnology must successfully complete a course in Human Nutrition and Metabolism with a minimum of 50% marks.
Prerequisites:

Courses	Prerequisites
I. B.Sc. Food Technology	**1. Human Nutrition and Metabolism**
II. B.Sc. Biochemistry **Biotechnology** **Microbiology**	**1. Human Nutrition and Metabolism** **2. Basic Food Science**

Objectives:

1. *To impart knowledge and develop capacities of the students through state of the art higher education in the areas of Human Nutrition and Food Science, Food Safety and Quality, Food Processing and Food Product Development.*

2. *To develop students to become professionals in these and related areas who can work effectively and efficiently in academics, research, food industry, training, extension and community service.*

3. *To develop capacities and abilities and enable them to*
   Pursue higher education and research in Food Science, Nutrition and Food Processing.

SEMESTER-I

Code No	Courses	Total Credits	Th-Cr	Pr-Cr	Int Cr/M	Ext Cr/M	Total Marks	Exam U/C
CC1	Nutritional Biochemistry	4	4	-	2/50	2/50	100	U
CC2	Advanced Nutrition I	4	4	-	2/50	2/50	100	U
CC3	Analytical Instrumentation	4	-	4	2/50	2/50	100	C
CC4	Food Microbiology and Safety – Th	4	4	-	2/50	2/50	100	U
CC5	Food Microbiology and Safety - Pr	4	-	4	2/50	2/50	100	U
CC6	Sensory Evaluation	4	-	4	2/50	2/50	100	C
	Total	24	12	12	12/300	12/300	600	

SEMESTER-II

Code No	Courses	Total Credits	Th-Cr	Pr-Cr	Int Cr/M	Ext Cr/M	Total Marks	Exam U/C
CC 7	Research Methodology	4	4	-	2/50	2/50	100	U
CC8	Food Science and Chemistry	4	4	-	2/50	2/50	100	U
CC9	Advanced Nutrition II	4	4	-	2/50	2/50	100	U
CC10	Food Science Pr	4	-	4	2/50	2/50	100	C
CC11	Principles of Food Preservation and Processing	4	4	-	2/50	2/50	100	U
E-I	Elective I	4	4	-	2/50	2/50	100	C
	Total	24	20	4	12/300	12/300	600	

SEMESTER-III

Code No	Courses	Total Credits	Th-Cr	Pr-Cr	Int Cr/M	Ext Cr/M	Total Marks	Exam U/C
CC 13	Research and Statistical Applications	4	-	4	2/50	2/50	100	U
CC14	Food Analysis and Quality Control	4	-	4	2/50	2/50	100	U
CC15	Food Processing	4	-	4	2/50	2/50	100	C
CC16	Food Product Development and Packaging	4	-	4	2/50	2/50	100	U
CC17	Functional Foods and Nutraceuticals	4	4	-	2/50	2/50	100	U
CC18	Elective II	4	4	-	2/50	2/50	100	C
	Total	24	8	16	12/300	12/300	600	

SEMESTER-IV

Code No	Courses	Total Credits	Th-Cr	Pr-Cr	Int Cr/M	Ext Cr/M	Total Marks	Exam U/C
CC19	Dissertation	8	-	8	4/100	4/100	200	U
CC20	Internship	8	-	8	4/100	4/100	200	C
CC21	Research Applications in Nutrition and Food Processing	4	-	4	4/100	-	100	C
CC22	Recent Methods in Food Processing, Preservation and Packaging	4	4	-	2/50	2/50	100	U
	Total	24	4	20	14/350	10/250	600	

Note:

1) CC-Core Courses

2) Elective -I Elective within Home Science

3) Elective -II Elective outside Home Science faculty

Elective I

1. Public Nutrition and Health
2. Food Advertising and communication
3. Nutrition and Health Communication
4. Food Photography
5. Food Laws
6. Nutrition for Sports and Exercise

SEMESTER I

NUTRITIONAL BIOCHEMISTRY

Objectives:

This course will enable the students to:

1. Augment the knowledge of biochemistry acquired at the undergraduate level
2. Understand the mechanisms adopted by the human body for regulation of metabolic pathways
3. Develop an insight into interrelationships between various metabolic pathways
4. Understand integration of cellular level metabolic events to nutritional disorders and imbalances.
5. Become proficient for specialization in nutrition

Contents:

Module No	Topics and Details	Number of credits
1	a. Membrane structure, composition and Transport of metabolites across membranes **b. Acid base balance and its regulation** c. Enzymes - Kinetics of monosubstrate and bisubstrate catalysed reactions (including inhibition) - Enzyme specificity, regulation of enzyme activity and synthesis - Enzymes in clinical diagnosis **d. Detoxification in the body-metabolism of xenobiotics (Phase I and Phase II enzymes)** e. **Cell Signaling** : Overview of extracellular cell signaling, G protein couple receptors and their effectors, enzyme linked receptors and their effectors, second messengers, map kinase pathways f. **Free radicals, ROS and oxidative damage**	**2**
2	**Review of** : **a. Carbohydrate Metabolism** : Intestinal transport of carbohydrates, Transport of glucose across various cells, Cellular metabolism of carbohydrates Glycogen metabolism Regulation of carbohydrate metabolism at substrate level, enzyme level, hormonal level and organ level, Disorders of carbohydrate metabolism. Definition, classification, structure and properties of glycoproteins and	**1**

	proteoglycans **b. Metabolism of Lipids** : Metabolism is to be discussed with reference to:Intestinal transport of lipids, Cellular uptake and metabolism of lipids (beta-oxidation, denovo synthesis of fatty acids, synthesis and breakdown of unsaturated fatty acids, cholesterol, phospholipids and triacylglycerol) Lipoprotein metabolism, VLDL and LDL ('Forward' Cholesterol transport)VLDL and LDL (Endogenous TAG transport),HDL ('Reverse' Cholesterol transport), Regulation of lipid metabolism at substrate level, enzyme level, hormonal level and organ level, Disorders of lipid metabolism, Dyslipidemias, Lipid storage diseases **c. Protein Metabolism**: Metabolism of amino acids- biosynthesis and catabolism - energy, glucose and ketone bodies, protein amino acids, non-protein amino acids (including urea cycle, transamination, one-carbon metabolism), Creatine and creatinine, Plasma proteins – Nature, properties and functions, Biologically active peptides, polypeptides and transport proteins, Inborn errors of amino acid metabolism **d. Intermediary Metabolism:** Review of regulation of intermediary metabolism- equilibrium and non-equilibrium reactions, committed steps, allosteric modifications, covalent modulation, hormonal induction and repression, cross-over theorem, starve-feed cycle, caloric homeostasis and futile cycles, Tricarboxylic acid cycle **e. Biological Oxidation :** Electron transport chain and oxidative phosphorylation	
3	Biochemical aspects of purine and pyrimidines a. Metabolism of purines b. Metabolism of pyrimidines **c.** Role of purine and pyrimidine nucleotides in metabolism. Biochemistry of Nucleic Acids a. Metabolism of DNA b. Metabolism of RNAs c. DNA replication, mutation, repair and recombination concepts d. Disorders of nucleic acid metabolism Protein Biosynthesis a. Gene expression and its regulation, transcription, translation, post-translational modification b. Inhibitors of protein biosynthesis	**1**

	c. Gene expression in mitochondria d. Systems Biology including Metobolomics and Proteomics	

References:

1. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2000): 25th Ed. Harpers Biochemistry. Macmillan Worth Publishers.
2. Nelson, D.L. and Cox, M.M. (2000): 3rd Ed. Lehninger's Principles of Biochemistry, Macmillan Worth Publishers.
3. Devlin, T.M. (1997): 4th Ed. Text book of Biochemistry with Clinical Correlations, Wiley Liss Inc
4. Stryer, L. (1998): 4th Ed. Biochemistry, WH Freeman and Co.
5. Conn, E.E., Stumpf, P.K., Bruening, G. and Doi, R.H. (2001): 5th Ed. Outlines of Biochemistry, John Wiley and Sons.
6. Voet, D. Voet, J.G. and Pratt, C.W. (1999). Fundamentals of Biochemistry.
7. Tietz, N.W. (1976) Fundamentals of Clinical Chemistry. WB Saunders Co.
8. King, E.J. and Wootton, I.D.P. (1956). 3rd ed. Micro-Analysis in Medical Biochemistry. J and A Churchill Ltd.
9. Plummer, D.T. (1987). 3rd ed. An Introduction to Practical Biochemistry. McGraw-Hill Book Co.

ADVANCED NUTRITION – I

Objectives:

This course will enable the students to:

1. Gain in-depth knowledge of the physiological and metabolic role of macronutrients, fat soluble vitamins and electrolytes and their importance in human nutrition.
2. Enable the understanding of basis of human nutritional requirements and recommendations through the life cycle and translate the knowledge into practical guidelines for dietary needs.
3. Familiarize with the recent advances in nutrition and apply this knowledge in planning for public health programmes.

Contents:

Module	Contents
Module – 1 This module will enable the students to – • Summarize the nutrient requirements in health. • Computation of energy requirements of individuals. • Learn the importance of body composition. • Get acquainted with the methods for assessing the body composition	**Human Nutritional Requirements – Development and Recent Concepts.** • Methods of determining human nutrient needs • Description of basic terms and concepts in relation to human nutritional requirements. • Guidelines and Recommendations • Development of International and National Nutritional Requirements • Translation of nutritional requirements into Dietary Guidelines **Body Composition** • Significance of body composition and changes through the life cycle. • Methods for assessing body composition (both classical and recent) and their applications.
Module – 2 This module will enable the students to – • Understand the measurement of energy expenditure and regulation of energy metabolism,	**Energy** • Components of energy requirements: BMR, RMR, thermic effect of feeding, physical activity. Factors affecting energy requirements, methods of measuring energy expenditure. • Estimating energy requirements of individuals and groups. • Regulation of energy metabolism and body weight: Control of food intake – role of leptin

	and other hormones.
Module – 3 This module will enable the students to – • Have in depth knowledge and understanding of the physiology and metabolism of macro nutrients • Learn the role of Nutrients in gene expression • Understand the role of non-nutritive components of food in health and disease.	**Carbohydrates** • Review of nutritional significance of carbohydrates and changing trends in dietary intake of different types of carbohydrates and their implications • Dietary fibre: Types, sources, role and mechanism of action • Resistant starch, fructo-oligosaccharides, other oligosaccharides: Chemical composition and physiological significance • Glycemic Index and glycemic load • Carbohydrates and gene expression ***Proteins*** • Overview of role of muscle, liver and g.i. tract in protein metabolism • Amino acid and peptide transporters • Therapeutic applications of specific amino acids • Peptides of physiological significance • Proteins, amino acids and gene expression ***Lipids*** • Nutritional significance of fatty acids – SFA, MUFA, PUFA: functions and deficiency • Role of n-3 and n-6 fatty acids • Prostaglandins • Trans Fatty Acids • Conjugated linoleic acid • Nutritional Requirements and dietary guidelines (International and National) for visible and

	invisible fats in diets. • Lipids and gene expression
Module – 4 This module will enable the students to – • Learn about the fat soluble vitamins, their functions in the body, deficiency, toxicity symptoms and therapeutic effects. • Understand about the nutrition in special conditions.	For each of the vitamins, the following should be focused on: ❖ Historical background ❖ Structure and chemistry ❖ Food sources ❖ Metabolism (digestion, absorption, transport, storage and elimination), Bioavailability and factors affecting bioavailability. ❖ Biochemical and physiological functions ❖ Assessment of status ❖ Interaction with other nutrients, regulation of gene expression (wherever applicable) ❖ Pharmacological and therapeutic effects Vitamin A and Carotenoids Vitamin D Vitamin E Vitamin K Nutrition in Special Conditions: Space Travel, High Altitudes, Low Temperature and Submarines.

References:

1. Annual Reviews of Nutrition. Annual Review Inc, California, USA.
2. Shils, M.E.; Olson, J.; Shike, M. and Roos, C. (1998): Modern Nutrition in Health and Disease. 9th edition. Williams and Williams. A Beverly Co. London.
3. Bodwell, C.E. and Erdman, J.W. (1988) Nutrient Interactions. Marcel Dekker Inc. New York
4. World Reviews of Nutrition and Dietetics.
5. WHO Technical Report Series.
6. Indian Council of Medical Research. Recommended Dietary Intakes for Indians - Latest Recommendations.
7. Indian Council of Medical Research. Nutritive Value of Indian Foods - Latest Publication.
8. Berdanier, C.D. and Haargrove, J.L. (ed) (1996): Nutrients and Gene Expression: Clinical Aspects. Boca Raton, FL CRC Press.
9. Baeurle, P.A. (ed) (1994) Inducible Gene Expression. Part I: Environmental Stresses and Nutrients. Boston: Birkhauser.
10. Chandra, R.K. (ed) (1992): Nutrition and Immunology. ARTS Biomedical. St. John's Newfoundland.

11. International Life Sciences Institute Present Knowledge in Nutrition – latest edition

Journals:

1. Nutrition Reviews
2. Journal of Nutrition
3. American Journal of Clinical Nutrition
4. British Journal of Nutrition
5. European Journal of Clinical Nutrition
6. International Journal of Vitamin and Nutrition Research
7. International Journal of Food Science and Nutrition
8. Nutrition Research
9. Ann Nutrition Metabolism

ANALYTICAL INSTRUMENTATION

PRACTICALS

Objectives:

This course will enable the students to:

1. Learn various modern instrumental techniques in food analysis.
2. Understand the applications, strengths and limitations of different methods.

Contents:

Module	**Topics and Details**
Module1 This module will enable the students to- • Study the basic principles involved and applications of advanced techniques available for food analysis. • Apply the principles of laboratory techniques and acquire proficiency in laboratory techniques.	**1) Colorimetry** **2) Photometry** **3) Flourimetry** **4) Flame photometry** **5) Spectrometric Methods**: 1. UV and visible molecular absorption spectrometry. 2. Atomic Absorption Spectrometry, Atomic Emission Spectrometry, ICP. 3. Fluorescence Spectrometry 4. Atomic Mass Spectrometry 5. Infrared Spectrometry
Module 2 This module will enable the students to- • Understand the basic chromatographic techniques used in the food analysis, their Principles and application in food analysis	**1) Paper chromatography** **2) Ion Exchange Chromatography** **3) Thin Layer Chromatography** **4) Column Chromatography** **5) Gas Liquid Chromatography** **6) High Performance Liquid Chromatography** **7) Super critical fluid extraction chromatography**

Module 3 This module will enable the students to- • Gain knowledge of advanced analytical techniques and applications in food analysis	**1) Electrophoresis and Centrifugation-** Principles and applications in paper and gel electrophoresis **2) Radiochemical Methods-** Use of radio isotopes. **3)Viscosity and Consistency-** 1. Measurements of Food. 2. Measurements of Rheological properties. **4)Instrumental Measurement of Texture of Foods-** Dough, Pasta, Baked Products, Fruits and Vegetables, Dairy Products, Meat, Starch.
Module 4 This module will enable the students to- • Understand the significance of calibration of instruments. • Learn the possible errors and their control. • Use statistical methods in food analysis.	**1) Specific gravity, freezing point, melting point, refractive index, gel strength, Brix, Densitometry, Refractometry, Polarimetry, Measurement of Colour.** **2) Relative Humidity and Water Activity** **3)Aeration / Over run Measurement** **4) Calibration of Instruments, Basic Analytical Chemistry errors, Statistical analysis**

References:

1. Fung, D.Y.C. and Matthews, R. (1991): Instrumental Methods for Quality Assurance in Foods, Marcel Dekker, Inc. New York.
2. DeMan, J.M., Voisey, P.W. Rasper, V.F. and Stanley, D.W. (1976): Rheology and Texture in Food Quality, The AVI Publishing Co. Inc, West Port.
3. Skoog, D.A., Holler, F.H. and Nieman (1998): Principles of Instrumental Analysis Saunders College Publishing, Philadelphia.
4. Gruenwedel, D.W.; Whitaker, J.R. (editors) (1984): Food Analysis Principles and techniques, Volumes 1 to 8, Marcel Dekker, Inc., New York.
5. Herschdoerfer, S.M. (ed) (1968 – 1987): Quality Control in the Food Industry, Vols. 1 to 4, Academic Press, London.
6. Moskowitz, H. R. (ed) (1987): Food Texture: Instrumental and Sensory Measurement: Marcel Dekker, Inc., New York.
7. Pomeranz, Y. and MeLoan, C.E. (1996): Food Analysis: Theory and Practice; 3rd Edition, CBS Publishers and Distributors, New Delhi.

FOOD MICROBIOLOGY AND SAFETY

Objectives:

This course will enable the students to:

1. Gain deeper knowledge of role of micro-organisms in humans and environment.
2. Understand the importance of micro-organisms in food spoilage and to learn advanced, techniques used in food preservation.
3. Understand the recent procedures adopted in various food operations to prevent food- borne disorders and legal aspects involved in these areas.

Contents:

Module No	Topics and Details	No of credits
1	History, scope and importance of food microbiology Food spoilage, preservation, fermentation, QA/QC **Micro-organisms and food**: - Their primary sources in foods, morphology, cultural characteristics and biochemical activities. - Airborne bacteria, fungi - Microorganisms found in soil - Microorganisms in water - Normal flora of skin, nose, throat, GI tract **Factors affecting the survival and growth of microorganisms in food.** - Intrinsic and Extrinsic parameters that affect microbial growth. - Intrinsic factors for growth- Generalized, nutrient effect, pH, buffer, anaerobic/aerobic conditions, moisture content, temperature, gaseous atmosphere - Implicit factors- properties of microorganisms-response **Food Preservation and application to different types of foods:** a. Physical methods – Drying, freeze-drying cold storage, heat treatments(pasteurization), TDT, TDP Irradiation (UV, microwave, ionization), high pressure processing, Aseptic packaging, modified atmosphere b. Chemical preservatives and Natural antimicrobial compounds. c. Biologically based preservation systems and Probiotic bacteria. **Uses of Microorganisms**: Fermented foods, (Yeast, lactobacillus) Fermented milk, Cheese, vegetables, beer, vinegar Genetically modified foods, marine foods .	1

2	**Microbiological examination-Methods of Isolation and detection of microorganisms or their products in food.** - Conventional methods - Rapid methods (Newer techniques) - Immunological methods: Fluorescent, antibody, Radio immunoassay, ELISA etc. - Chemical methods: Thermostable nuclear, ATP measurement and PCR (Polymers chain reactions) - only principles in brief. **Spoilage of different groups of foods:** a. Cereal and cereal products b. Vegetables & fruits c. Meat & meat products d. Eggs and poultry e. Fish and other seafoods f. Milk and milk products g. Canned food **Food borne infections and diseases:** Significance to public health Food hazards and risk factors Bacterial, and viral food-borne disorders, Food-borne important animal parasites, Mycotoxins. *Bacillus, Campylobacter, Brucella, Staphylococcus, Clostridium, E.coli, Aeromonas, Vibrio cholerae, Listeria, Mycobacterium,Salmonella, Shigella*	2
3	**Quality Control/Quality Assurance** Legislation for food safety – national and international Criteria, sampling schemes, records, risk analysis QC- microbial source, code Indicators of food safety and quality: Microbiological criteria of foods and their significance. The HACCP system and food safety used in controlling microbiological hazards.	1

FOOD MICROBIOLOGY AND SAFETY
PRACTICALS

Module No	Topics and Details	No of Credits
1	**Preparation of common laboratory media and special media for cultivation of bacteria, yeast & molds.** **Staining of Bacteria**: Gram's staining, acid-fast, spore, capsule and flagellar staining, Motility of bacteria, Staining of yeast and molds. **Cultivation and Identification of important molds and yeasts.** (slides and mold culture). **Study of environment around us as sources of transmission of microorganisms in foods. Assessment of surface sanitation of food preparation units - swab and rinse techniques**. **Isolation of microorganisms:** Different methods and maintenance of cultures of microorganisms.	0.5
2	**Bacteriological analysis of Foods**: Both processed and unprocessed like vegetables and fruits, cereals, spices and canned foods, using conventional methods, yeast and mold count in foods. Bacteriological analysis of water and milk, Total count, MPN Coliform (Count) and MBRT, IMVIC etc.	1.5
3	Various biochemical tests used in identification of commonly found bacteria in foods: IMVIC urease, H_2S, Catalase, coagulase, gelatin and fermentation (Acid/gas) Demonstration of available rapid methods and diagnostic kits used in identification of microorganisms or their products. HACCP	1.5
4	Visits (at least two) to food processing unit or any other organization dealing with advanced methods in food microbiology. Project	1.5

References:

1. Pelezar, M.I. and Reid, R.D. (1993) Microbiology McGraw Hill Book Company, New York, 5th Edition.
2. Atlas, M. Ronald (1995) Principles of Microbiology, 1st Edition, Mosby-Year Book, Inc, Missouri, U.S.A.
3. Topley and Wilson's (1983) Principles of Bacteriology, Virology and Immunity, Edited by S.G. Wilson, A. Miles and M.T. Parkar, Vol. I: General Microbiology and Immunity, II: Systematic Bacteriology. 7th Edition. Edward Arnold Publisher.
4. Block, J.G. (1999) Microbiology Principles and Explorations, 4th Edition John Wiley and Sons Inc,
5. Frazier, W.C. (1988) Food Microbiology, Mc Graw Hill Inc. 4th Edition,
6. Jay, James, M. (2000) Modern Food Microbiology, 6th Edition. Aspen publishers, Inc., Maryland.
7. Banwart, G. (1989) Basic Food Microbiology, 2nd Edition. CBS Publisher.

8. Garbutt, J. (1997) Essentials of Food Microbiology, 1st Edition, Arnold International Students Edition.
9. Doyle, P. Benehat, L.R. and Mantville, T.J. (1997): Food Microbiology, Fundamentals and Frontiers, ASM Press, Washington DC.
10. Adams, M.R and M.G. Moss (1995): Food Microbiology, 1st Edition, New Age International (P) Ltd.
11. Bensaon, H.J. (1990) Microbiological applications, C. Brown Publishers U.S.A.
12. Roday, S. (1999) Food Hygiene and sanitation, 1st Edition. Tata McGraw Hill, New Delhi.
13. Venderzant, C. and D.F. Splitts Toesser (1992): Compendium of Methods for the Microbiological Examination of Foods 3rd Edition. American Public Health Association, Washington D.C.

Journals:

1. Journal of Food Science Published by the Institute of Food Technologists, Chicago, U.S.A.
2. Journal of Food Science and Technology published by Association of Food Scientists and Technologists (India) CFTRI – MYSORE.
3. Food Technology published by the Institute of Food Technologists, Chicago, U.S.A.

SENSORY EVALUATION

PRACTICALS

Objectives:

This course will enable students to:

1. Understand concepts about sensory evaluation of food.
2. Use different sensory methods for evaluating the quality of foods.

Contents:

No	Topics and Details
Module1 This module will enable the students to- • Learn the basic principles and techniques in sensory analysis of food • Apply sensory evaluation principles.	**1) Introduction to sensory analysis and uses of sensory tests.** **2) General testing conditions.** **3) Establishing sensory panels-** 1. Selecting and recruiting panelists, orienting, screen for trained panels, training panelists, monitoring performance. 2. Recognition tests for 4 basic tastes, odour and aroma. 3. Tests with other senses. 4. Threshold tests.
Module 2 This module will enable the students to- • Learn about types of different sensory tests used in sensory analysis of food.	**1) Analytical tests-** 1. Difference 2. Ranking 3. Descriptive 4. Scoring 5. Rating **2) Planning an Experiment for Sensory Evaluation-** 1. Designing the questionnaire and score card 2. Identifying descriptors. **3) Designing Sensory Testing Facilities-** Permanent and Temporary
Module 3 This module will enable students to understand and practice-	**1) Conducting the Test** 1. Preparing samples 2. Presenting samples

• Basic techniques • Design and conduct sensory tests required for different food products	3. Using reference samples 4. Reducing panel response error **2) Consumer oriented tests** **3) Product oriented tests** **4) Shelf life studies** **5) Product matching** **6) Product mapping** **7) Taint Investigation and Prevention**
Module 4 This module will enable the students to- • Process and analyze the data • Learn analytical and effective methods of assessing sensory properties of food utilizing statistical methods. • Interpretation and report writing	**1) Collecting and analyzing sensory data generated in above tests.** **2) Application of appropriate statistical methods for analysis** **3) Interpretation of data results.** **4) Report Writing**

References:

1. Lyon, D.H.; Francombe, M.A.; Hasdell, T.A.; Lawson, K. (eds) (1992): Guidelines for Sensory Analysis in Food Product Development and Quality Control. Chapman and Hall, London.
2. Amerine, M.A.; Pangborn, R.M.; Roessler, E.B. (1965): Principles of Sensory Evaluation. Academic Press, New York.
3. Kapsalis, J.G. (1987): Objective Methods in Food Quality Assessment. CRC Press, Florida.
4. Martens, M.; Dalen, G.A.; Russwurm, H. (eds) (1987): Flavour Science and Technology. John Wiley and Sons, Chichester.
5. Moskowitz, H.R. (eds) (1987): Food Texture: Instrumental and Sensory Measurement. Marcel Dekker Inc. New York.
6. Lawless, H.T. and Klein, B.P. (1991): Sensory Science Theory and Applications in Foods. Marcel Dekker Inc.
7. Jellinek, G. (1985): Sensory Evaluation of Food Theory and Practice. Ellis Horwood, Chichester.
8. Piggott, J.R. (ed) (1988): Sensory Analysis of Foods. Elsevier Applied Science, London.

9. Meilgaard, M.; Civille, G.V.; Carr, B.T. (1987): Sensory Evaluation Techniques, Vols. I and II, CRC Press, Florida.
10. Moskowitz, H.R. (1983): Product Testing and Sensory Evaluation of Foods: Marketing and R & D approaches. Food and Nutrition Press, Connecticut.
11. Moskowitz, H.R. (1985): New Directions for Product Testing and Sensory Analysis of Foods. Food and Nutrition Press, Connecticut.
12. O'Mahony, M. (1986): Sensory Evaluation Practices. Academic Press, London.
13. Thomson, D.M.H. (1988): Food Acceptability. Elsevier Applied Science, London.
14. Watts, B.M., Ylimaki, G.L., Jeffery, L.E. and Elias, L.G. (1989): Basic Sensory Methods for Food Evaluation. The International Development Research Centre, Ottawa, Canada.
15. Askar, A. and Treptow (1993): Quality Assurance in Tropical Fruit Processing. Springer-Verlag, New York.
16. ASTM (1968 to 1981): Special Technical Publications, American Society for Testing and Materials, Philadelphia.
17. Ball, A.D. and Buckwell, G.D. (1986): Work Out Statistics: 'A' level. MacMillan, London.
18. BSI (1975 to 1989) BS 5098 & BS 5929: Publications of British Standards Institution, London.
19. Resurrecion, A.V.A. (1998). Consumer Sensory Testing for Product Development. Aspen Publishers Inc., Guthersburg, Maryland USA.
20. BIS 6273 (1972) Guide for Sensory Evaluation of foods. Optimum Requirement. Part I. Bureau, Of Indian Standards, Manate Bhavan, New Delhi.
21. Fuller, G.W.(1994) New Food Product Development : From Concept to Market place CRC Press, New York.
22. Man, C.M.D. and Jomes A.A. (1994) Shelf life Evaluation of Foods. Blackie Academic and Professional, London.
23. Shapton, D.A. and Shapton, N.F.(1991) Principles and Practices for the Safe Processing of Foods. Butterworth Heinemann Ltd , Oxford.
24. Graf, E. and Saguy, I. S. (1991). Food Product Development : From concept to the Market place, Van Nostrand Reinhold New York.
25. Oickle, J.G.(1990) New Product Development and Value Added. Food Development Division Agriculture, Canada.
26. Proc. Food Processors Institute: A key to Sharpening your Competitive Edge. Food Processors Institute, Washington, DC.

Journals:

1. International Journal of Food Science and Technology
2. Food Technology
3. Journal of Food Technology
4. Trends in Food Science and Technology
5. Critical Reviews in Food Science and Nutrition

SEMESTER II

RESEARCH METHODOLOGY

Objectives:

This course will enable students to:

1. develop a scientific approach and know the processes of research
2. develop the competence for selecting methods and tools appropriate for research topics
3. understand concepts of statistical measures of central tendency, dispersion, variability and probability

Contents:

Module No	**Topics**
1	**The Research Process** a. Scientific approach to enquiry in comparison to native, common sense approach b. Knowledge, theory and research c. Role, need and scope of research in the discipline of Home Science **Assignment** : Differentiate between investigative reporting and research report (with examples to be brought by students as exercise) **Steps in Research Process and Elements of Research** a. Identifying interest areas and prioritizing Selection of topic and considerations in selection b. Review of related literature and research c. Variables- types of variables including discrete and continuous variables Conceptual definitions and operational definitions d. Concepts, hypotheses and theories e Hypothesis- meaning, attributes of a sound hypothesis, Stating the hypothesis and types of hypothesis Hypothesis testing- null hypothesis, sample distribution, level of significance, critical regions, Type I and Type II errors f. Research Design Research questions, objectives and assumptions **Assignment:** Types of variables Hypothesis formations and research questions from Research readings – students identify hypothesis/research questions – Discussion **Ethics in Research**
2	**Types of Research** a. Basic and Applied research, Qualitative and Quantitative research (brief review of differences) b. Historical research c. Descriptive research methods – survey, case study, correlational study, content

	analysis, causal-comparative research d. Analytic studies- pre-experimental, experimental research, quasi experimental research e. Qualitative research, Ethnography f. Evaluative research- general characteristics, use of qualitative methods in enquiry Scope and importance in Home Science **Assignment:** Differentiate between (a) basic and applied research (Exercise to be based on actual research papers published in accredited journals) (b) qualitative and quantitative research Based on Journal contents undertake a critical appraisal of studies/research papers and discuss types of Research with examples
3	**Sampling** a. Rationale, characteristics- meaning, concept of population and sample, and utility b. Types of sampling and generalizability of results c. Probability sampling - simple random sample, systematic random sample, stratified random sampling etc - random and non-random samples, random numbers and use d.. Non-probability sampling - purposive samples, incidental samples, quota samples, snowball samples e.. General consideration in determination of sample size
4	**Tools for Data Collection** a.Primary and secondary methods of data collection b.Different types of questionnaires, rating scales, check lists, schedules, attitude scales, inventories, standardized tests, interviews, observation c. Development of tools, estimation of reliability and validity of tools d. Procedure for preparation of the tool, administration of tools for data collection e. Procedure for data collection f. Planning for data analysis-coding of responses **Assignment :** Construction of tools for data collection a) types of questions b) Questionnaire c) interview schedule d) observation d) scales For a given topic students to frame and discuss the different possibilities of methods and tools

References

Research Methods
1. Bell, J. (1997): Doing Your Research Project: A Guide for First-time Researchers in Education and Social Science, Viva Books, New Delhi

2. Bell, J. (1997): How to Complete Your Research Project Successfully: A Guide for First-time Researchers, UBSPD, New Delhi.
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4. Festinger, L. and Katz, D. (ed.) (1977): Research Methods in the Behavioral Sciences, Amerind Publishing, New Delhi.
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6. Jain, G. (1998): Research Methodology: Methods and Techniques, Mangal Deep, Jaipur.
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11. Pande, G.C. (1999): Research Methodology in Social Sciences, Anmol Publication, New Delhi.

FOOD SCIENCE AND CHEMISTRY

Objectives:

This course will enable students to:

1. Be familiar with composition of food stuffs
2. Understand the properties and significance of various food constituents.
3. Understand changes occurring in various food stuffs after harvest, during storage and transportation, as a result of processing and cooking.
4. Apply this knowledge for food product development.

Contents:

Module No	Topics and Details	No of Credits
1	**A. Water, Ice and Food Dispersions** 1.Structure and properties of water and ice - types of water , solutions and colligative properties - Water activity and Food spoilage, Sorption phenomena - Phase transition of foods containing water - Relation between viscosity and temperature _ WLF equation - Water – solute interactions -Heat transfer during processing 2: Colloidal salts, stabilization of colloidal systems, Rheology of food dispersions 3: Gels: Structure, formation, strength, types and permanence 4: Foams: Structure, formation and stabilization **B. Carbohydrates: Polysaccharides, Sugars and Sweeteners** a. Reactions of mono and oligosaccharides b. Use of Polysaccharides in foods: Non-starch Polysaccharides: Cellulose, hemicelluloses, pectins, gums(gum Arabic, guar gum, xanthan gum) , animal polysaccharides, agar, alginates, carageenan . c. Starch: Structure, Properties of amylose and amylopectin, effect of processing -gelatinization, methods for following gelatinization. Characteristics of some food starches. Effects of ingredients and conditions on gelatinization. - Retrogradation d: Polysaccharide hydrolysis e: Modified food starches: mechanically damaged starches, extruded starches, pregelatinized, thin boiling starch, cross-linked starches, starch ethers and esters, oxidized starches f: Sugars and Sweeteners: Sugars, syrups, sugar alcohols, potent sweeteners, sugar products, Caramellization. **f.** Confectionery, chocolates, jams and jellies,synthetic and natural beverages	**1**

2	**Chemistry of Amino acids, peptides, proteins and Science of Protein Foods** A. a: Review of structure, physicochemical properties, functional properties of amino acids, peptides and proteins b: Chemical and enzymatic modifications- denaturation, non-enzymatic browning, and other chemical changes c: Processing induced physical, chemical and nutritional changes d: Texturized proteins e: Protein isolates, concentrates f: Protein hydrolysate, **B. Enzymes:** a. Review of nomenclature, properties and isolation Nature of enzymes, stability and action. b: Factors influencing enzymes- enzyme inactivation and control c: Enzymes in food processing and modification- Proteolytic enzymes, oxidases, lipases, enzymes decomposing carbohydrates and applications d: Immobilised enzymes in food processing. e. Enzymes in waste management f Enzymes and health/nutrition/food issues C. **Milk and Milk Products:** a. Composition. Physical and functional properties. b. Denaturation c. Effects of processing and storage. d. Cultured milk, yogurt, butter, whey, cheese, concentrated and dried products, frozen desserts, dairy product substitutes. **D. Meat and Poultry:** a. Muscle composition, characteristics and structure. b. Post mortem changes. c. Processing, preservation and their effects. Heat-induced changes in meat. d Variables in meat preparation. Tenderizers. e.Meat Products. **E. Eggs:** a. Structure and Composition. Changes during storage. b. Functional properties of eggs, use in cookery. c. Egg processing. d. Low cholesterol egg substitutes. **F.Fish and Sea Food:** a. Types and Composition b. Storage and changes during storage. Changes during processing. c. By-products and newer products.	**1.5**

	G.Pulses and Legumes: a. Structure, composition b. Processing. c. Toxic constituents.	
3	**A. Lipids: Fats, Oils and Related Products** a. Review of nomenclature, classification, sources, composition, and properties b. Role of lipids in food flavour. Effects of processing on chemical structure and physical properties- Precursors of aroma compounds c: Functional properties of fat and uses in food preparations, inter-esterification of fats. d: Lipids exposed to frying conditions, hydrogenated fat and irradiated foods e: Lipid-protein complexes, emulsions: formation, stability, surfactants and emulsifiers f. Fat deterioration and antioxidants g. Fat substitutes **B. Nuts and Oilseeds:** Composition, Oil extraction and by-products **C. Flavors:** a: Individual aroma compounds- vegetable, fruit and spice/condiment flavors, flavors from lactic acid/ethanol fermentation, flavors volatiles from fats and oils, flavor volatiles in muscle foods and milk b. Composition, flavorings extracts – natural and synthetic c: Thermally induced process flavors d: Natural and synthetic flavors d: Interactions with other constituents	**1**
4	**Fruits , Vegetables and Processed Products** a. Plant anatomy, gross composition, structural features and activities of living systems. b. Enzymes in fruits and vegetables. Flavour constituents. Plant phenolics. Pigments. c. Post harvest changes. Texture of fruits and vegetables. d. Effects of storage, processing and preservation **Processed Foods:** Squashes, Pickles, fruit/vegetable–based, vinegar, pickles. b. Beverages: Synthetic and natural, alcoholic and non-alcoholic, carbonated and non-carbonated, coffee, tea, cocoa. Malted drinks. c., bakery products, dehydrated products.	**0.5**

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1. Charley, H. (1982): Food Science (2nd edition), John Wiley & Sons, New York.
2. Potter, N. and Hotchkiss, J.H. (1996): Food Science, Fifth edition, CBS Publishers and Distributors, New Delhi.
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19..Mahindru, S.N.(2000) Food Additives- Characteristics – Detection and Estimation Tata McGraw Hill Publishing Co. Ltd.
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Journals:

1. Journal of Food Science
2. Advances in Food Research
3. Journal of Food Science and Technology
4. Journal of Agricultural and Food Chemistry
5. Cereal Science
6. Journal of Dairy Science
7. Journal of the Oil Chemists' Society

ADVANCED NUTRITION II

Objectives:
This course will enable the students to:

1. Gain in-depth knowledge of the physiological and metabolic role of vitamins and minerals and their role in human nutrition.
2. Understand the basis of human nutritional requirements and recommendations through the life cycle and translate the knowledge into practical guidelines for dietary needs.
3. Be familiar with the recent advances in nutrition and apply this knowledge in planning for public health programmes.
4. Understand the pharmacological actions of various vitamins and their implications.

Contents:
For each of the vitamins and minerals the following will be discussed:

- Historical background
- Structure and chemistry
- Food sources
- Metabolism (digestion, absorption, transport, storage and elimination), Bioavailability and factors affecting bioavailability.
- Biochemical and physiological functions
- Assessment of status
- Interaction with other nutrients, regulation of gene expression (wherever applicable)
- Pharmacological and therapeutic effects
- Requirements, methods for estimating requirements and recommended daily allowance.
- Deficiency, overload and toxicity.

Module	**Topics and Details**
Module 1	**Water Soluble Vitamins** Ascorbic acid Thiamin Riboflavin Niacin Pyridoxine Folic acid Vitamin B_{12} Biotin
Module 2	**Quasi vitamins (in brief)** Choline/Betaine Myo Inositol Carnitine

	Bioflavinoids
Module 3	**Macro minerals** Calcium and Phosphorus Magnesium Sodium, Potassium and Chloride
Module 4	**Micro minerals and Trace Minerals** Iron Copper Manganese Iodine Fluoride Zinc Selenium Cobalt Chromium Molybdenum **Trace Minerals** Vanadium Silicon Boron Nickel Lithium, Lead, Cadmium, Sulphur

References:

1. Annual Reviews of Nutrition. Annual Review Inc, California, USA.
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4. World Reviews of Nutrition and Dietetics.
5. WHO Technical Report Series.
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Journals:

1. Nutrition Reviews
2. Journal of Nutrition
3. American Journal of Clinical Nutrition
4. British Journal of Nutrition
5. European Journal of Clinical Nutrition
6. International Journal of Vitamin and Nutrition Research
7. International Journal of Food Science and Nutrition
8. Nutrition Research
9. Annals of Nutrition & Metabolism

FOOD SCIENCE PRACTICALS

Objectives:

This course is designed to enable students to:

1. Be familiar with changes occurring in various foods as a result of processing and cooking.
2. Apply theoretical knowledge in various food preparations.

Contents:

No	Topics and Details
Module 1 This module will enable students to • Understand practical aspects of basic scientific techniques • Learn the changes occurring in various food stuffs due to processing and cooking	**1) Effect of solutes on boiling point and freezing point of water** **2) Effect of types of water on characteristics of cooked vegetables, pulses and cereals.** **3) Sugar and Jaggery Cookery-** Relative sweetness, solubility and sizes of sugars, stages of sugar cookery, caramelization, crystallization, factors affecting crystal formation. **4) Starches, Vegetable Gums and Cereals-** 1. Microscopic examination of structure of starch from different sources. 2. Dextrinization, gelatinization, retrogradation, thickening power. Factors affecting gels and gluten formation Starch hydrolysis, viscosity measurement. **5) Jams and Jellies-** Pectin content of fruits, role of acid, pectin and sugar in jam and jelly preparation. Use of gums as emulsifiers/stabilizers.
Module 2 This module will enable students to understand- • Importance of basic ingredients used in preparation of food products. • Their significance in processing and changes in their overall quality aspects	**1) Fats and Oils-** 1. Flash point, melting point and smoking point. 2. Role of fats and oils in cookery as: shortening agent, frying medium. 3. Factors affecting fat absorption. Fat crystals. Plasticity of fats. Permanent and semi-permanent emulsions. **2) Milk and Milk Products: Scalding, denaturation.** Effect of acid, salt, alkali, sugar, heat, enzymes, polyphenols on milk. Khoa, curd, paneer, cheese (ripened and unripened).

	3) Eggs- 1. Structure, assessing egg quality. Use of egg in cookery:- Emulsions, air incorporation, thickening, binding, gelling. 2. Method of egg cookery and effect of heat. 3. Egg white foams and factors affecting foams. **4) Pulses-** 1. Effect of various cooking and processing methods on various characteristics. 2. Functional properties of pulses and their products. **5) Meat and Poultry-** Methods affecting tenderness of meat, effect of various ingredients and methods of cooking on colour, volume, texture, flavour, aroma and water holding capacity.
Module 3 This module will enable students to- • Understand the basic aspects of various foods while processing, cooking and storage. • Learn the effect of various food additives on processing products used during preparation	**1) Fish and Sea Food-** Effects of different cooking methods on various fish and seafoods. **2) Gelatin-** Gelation, gel strength and factors affecting gelation and ability to foam. **3) Fruits and Vegetables-** 1. Pigments: Effects of cooking, metal ions, pH on pigments. 2. Effect of various cooking processes on different characteristics of vegetables. 3. Prevention of enzymatic browning. **4) Leavened Products-** Leavening power of different leavening agents:- Use of microorganisms (bacteria, lactic acid, yeast), steam, egg and, chemical agents.
Module 4 This module will enable students to- • Understand and effect of various additives in food products while processing new product. • Apply the knowledge in food processing • Study their quality aspects by using various parameters	**1) Beverages-** Factors affecting quality of beverages. **2) Frozen Desserts-** Factors affecting ice crystal formation. Quality characteristics of frozen desserts. **3) Emulsions-** Water-in-oil and oil-in-water. **4) Surface tension-** Measurement in hydrophilic and hydrophobic liquids and emulsions. **5) Measurement of browning in a food system.**

References:

1. Charley, H. (1982): Food Science (2nd edition), John Wiley & Sons, New York.
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3. Belitz, H.D. and Grosch, W. (1999): Food Chemistry, (2nd edition), Springer, New York.
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Journals:

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5. Cereal Science
6. Journal of Dairy Science
7. Journal of the Oil Chemists' Society

PRINCIPLES OF FOOD PRESERVATION AND PROCESSING

Objectives:

This course is designed to enable students to:

1. Know the principles of preservation
2. Understand the principles of food processing techniques and apply the principles to specific food commodities
3. Know the principles of cleaning and sanitation
4. Be familiar with laws and regulations that govern the Food Industry
5. Be aware of current issues and trends in the Food Industry

Contents:

No	Topics and Details
Module 1 This module will enable students to- • Learn about the spoilage and deterioration mechanisms in foods and methods to control deterioration and spoilage. • Understand the principles that make a food product safe for consumption. • Understand the principles of food processing techniques and their application in food	**1) Introduction to process operations** 1. Principles, good manufacturing practices 2. Food Laws and Regulations **2) General principles of food preservation** 1. Principles of food preservation 2. Asepsis, removal of microorganisms 3. Maintenance of anaerobic conditions 4. Methods of food preservation **3) Water Activity and Food Preservation** 1. Free and Bound water 2. Effect of water activity on quality of food constituents during storage (proteins, lipids and carbohydrates) 3. Effect on physical and nutritional quality 4. Water activity and food stability 5. Effect of packaging material on water activity **4) Preservation through temperature reduction** 1. Storage of food at chilling temperature behavior 2. Refrigeration 3. Controlled Atmosphere Storage (CAS) 4. Modified Atmosphere Storage (MAS) 5. Chilling defects 6. Freezing –principles, fundamental aspects of freezing a) Freezing process –technological aspects b) Freezing damage - osmotic damage, solute damage c) Structural damage

Module 2 This module will enable students to- • Develop skills for processing and preservation of foods using different techniques • Know the principles and processing technologies and application of high temperature • Dehydration of food, use of food additives for processing and preservation of food	**1) Preservation by use of High Temperatures** Concentration of food, Evaporation, Freeze concentration, Membrane process for concentration **2) Drying or Dehydration of food (Food Preservation through water removal)** 1. Transport of water in foods 2. Different methods of dehydration a. Cabinet drying, sun / solar drying b. Osmo drying, Osmo - vac drying, c. Freeze drying- Introduction, principle, processing, preservation d. Vacuum drying 3. Quality aspects of dehydrated products 4. Physical and chemical changes in food 5. Nutritional changes and recent advances 6. Blanching, sterilization, pasteurization, processing, concentration 7. Milk products, fruit pulp, vegetable packaging and 8. Quality analysis, storage studies. **3)Food Additives** 1. Natural food additives as preservatives a. Sugar b. Acidulants (citric acid, malic acid, tartaric acid, lactic acid, acetic acid c. Thickeners (modified starches and gums) d. Stabilizers e. Emulsifiers (GMS, soya) f. Colours (natural and synthetic) g. Vitamins h. Minearals 2. Salt, gases, spices, smokes, oils, vinegar 3. Chemical Preservatives a. sorbic acid, its potassium salts b. calcium and sodium propionates c. sodium benzoates, parabenes 4. Antioxidants – functions, products and applications, regulatory status, trends, issues and developments 5. Enzymes - applications in fruit and vegetable processing, trends issues and developments

Module 3 This module will enable students to- • Familiar with preservation and processing of high sugar, tomato products, salt preserved products and fermented products • Know their quality, technical aspects, packaging aspects	**1) Preservation using high Sugar, Product technology for-** 1. Jam, Jellies 2. Squashes, syrups, marmalades, cordials, concentrate etc. 3. Intermediate moisture fruits (candies/ *muramba's*, tutti-frutti /glazed fruits) **2) Processing and preservation of Tomato products-** Tomato juice, Ketchup, Sauce, Paste, Soup, concentrate, puree, Chutneys and allied traditional products. **3) Salted products-** 1. Acidified brined fruits and vegetables 2. Fish salting *3.* Salted *amala supari* 4. Processing, packaging, preservation **4) Processing and preservation of different Pickles, quality evaluation and storage.** **5) Fermentation products-** Process, preservation 1. Wine making (grape and others) 2. Beer making 3. Traditional fermented food products- 4. Dhokla, Idli, Curd, Tempe, Soya sauce, vegetable fermented products 5. Various alcohol based products 6. Yeast fermented products
Module 4 This module will enable students to- • Understand the basic principles, preservation and processing of food products by using various methods	**1) Canning and bottling-** 1. Commercial canning operation 2. Containers for canning 3. Canning of vegetables and their products 4. Canning of fruits and their products 5. Machinery and equipments, processing 6. Spoilage of canned food and its quality evaluation 7. Canning of sweet corn, baby corn, pineapple, slices, juice, pulp, strawberry, mushroom 8. Home scale canning and bottling in standy pouches for vegetables, pulp, *gulab jamun*, dairy products. **2) Irradiation** 1. Principle

	2. Commercial applications 3. Quality / Technological aspects 4. UV rays application 5. Microwave technique, its application in food preservation (surface sterilization of food) **3) Food Packaging** – different techniques **4) Food Plant Sanitation** **5) Environmental Aspects of Food Processing (Eco friendly)** **6) Roles and use of water in food processing** **7) Food industry waste management and disposal**

References

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2. Brain J.B. Wood (1985), Microbiology of Fermented Foods, Vol. I, Elsevier Applied Science Publishers.
3. Diane M Barrett, Laszlo Somogyi, Hoshahalli Ramaswamy
   Processing Fruits, II edition, Science and Technology, CRC Press.
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5. IGNOU-2006, Food Processing and Engineering –II, Practical Mannual,
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SEMESTER III

RESEARCH AND STATISTICAL APPLICATIONS PRACTICALS

Objectives

This course will enable students to:

1. Discriminate between parametric and non-parametric tests
2. Learn to apply statistical tests for data analysis for both large and small samples
3. Know how to interpret the results of statistical analysis of data
4. Be able to summarize data and present it using tables and graphs
5. Develop skills for preparation of research proposals
6. Understand the components of a research report

Module No	Topics
1	**Introduction to Statistics** Definition, conceptual understanding of statistical measures, popular concepts and misuse of statistics **Normal Distribution and its Properties** a. Normal distribution b. Binomial distribution c. Probability, use of normal probability tables, area under normal distribution curve d. Parametric and non-parametric tests **Data Management** Planning for data analysis – coding of responses, preparation of code book Coding of data Use of statistical programs - MS Excel - SPSS
2	**Data Analysis** a. Quantitative analysis, descriptive statistics, inferential statistics : Uses and limitations, Summation sign and its properties b. Proportions, percentages, ratios c. Measures of central tendency-mean, median, mode-arithmetic mean and its uses, mid – range, geometric mean, weighted mean d. Measures of dispersion /variability- range, variance, standard deviation, standard error, coefficient of variation, Kurtosis, skewness Grouped data-frequency distribution, histogram, frequency polygons, percentiles, quartiles, tertiles, ogive

	e. Large and Small Sample tests and interpretation -. Z-test for single proportions and difference between proportions -. Large sample test for single mean and difference between means -. Small sample tests- 't'-test, paired 't'-test, 'F' Test
3	**Chi square test and its interpretation** a. General features, goodness of fit b. Independence of Attributes **Correlation and Regression and its interpretation** a. Basic concepts b Linear regression and correlation coefficient Regression and prediction c. Rank correlation, Product-moment method **Analysis of Variance and its interpretation** a. One-factor analysis of variance b. Two-factor analysis of variance **Design of Experiments** a. Completely randomized design b. Randomized block design c. Latin square design d. Factorial design
4	**Presentation of Data** a. Tabulation and Organization of data- frequency distributions, cumulative frequency distribution, contingency tables b. Graphical presentation of data- histogram, frequency polygon, ogive, stem and leaf plot, box and whiskers plot, Graphs for nominal and ordinal data- pie diagram, bar graphs of different types, graphs for relation between two variables, line diagram. Use of illustrations Cautions in visual display of data **The Research Report** Basic components of a research report- prefatory material, introduction and Review of Related Literature, Methodology, Results, Discussion, Conclusion, Summary, Abstract, Bibliography and Appendices **Students to design a research study on a topic-** - specify type of research - sample selection - protocol/operationalization - tools - tests for statistical analysis **Preparation of a Research Proposal**

Note: * Evaluation: External written Exam at university level = 50 marks

FOOD ANALYSIS AND QUALITY CONTROL
PRACTICALS

Objectives:

This course will enable students to:

1. Gain knowledge about different methods of analysis in food systems
2. Determine nutrients in foods
3. Apply newer and modern methods in foods
4. Know the importance of quality assurance in food industry.
5. Be able to conduct various tests and assess quality, using standards for quality assessment and food safety.
6. Be able to conduct the various tests used to detect food adulterants.
7. Be familiar with the fundamentals that should be considered for successful quality control programme.

Contents:

No	Topics and Details
Module 1 This module will enable students to- • Describe and apply principles of quality assurance • Demonstrate practical proficiency in food analysis laboratory • Understand government regulations required for the manufacture and sale of food products.	**Introduction to quality assurance and food safety.** **Current concepts of quality control** **Quality Assurance Programme:** Quality plan, documentation of records, product standards, product and purchase specifications, process control and HACCP, hygiene and housekeeping, corrective action, quality and programme and total quality process. **Product Evaluation:** • Sampling for product evaluation and line control. • Statistical quality and process control • Specifications and food standards. International, National – Mandatory, Voluntary. • Sample preparation • Reporting results and reliability of analysis.

Module 2 This module will enable students to- • Learn the analytical methods for Moisture, protein and fat.	**Estimation of the following in foods** Moisture content and total solids • Drying methods • Distillation procedures Water activity Ash : Total ash • Water Soluble ash • Acid insoluble ash • Sulphated ash • Alkalinity of ash • Titrable acidity and pH **Nitrogen and crude protein** **Protein** : • Formal titration • Colorimetric methods • Spectroscopic methods **Fat : Solvent extraction methods** • Physical methods • GLC
Module 3 This module will enable students to- • Learn the analytical methods for carbohydrates and fibre.	**Sugars** : Refractometry • Polarimetric methods • Copper reduction methods **Starch** : Microbiological examination • Polarimetric methods **Fibre** : crude and dietary fibre
Module 4 This module will enable students to- • Learn quality control aspects of water, cereals, pulses, milk and milk products, flesh foods, beverages, canned foods, juices and vinegar.	**Assessment of purity and quality using appropriate standard tests for the following:** • Water including mineral water. • Milk and milk products • Fats and oils including butter, ghee and hydrogenated fat. • Ice creams and sherbets • Cereals and cereal products • Pulses and legumes • Spices and condiments and salt, pickles, sauces and chutneys. • Tea and coffee • Canned, dehydrated, frozen and bottled fruit/vegetable products • Confectionery • Flesh foods • Specific food ingredients such as glycerine, vinegar.

	• Fruit juices, concentrates and beverages. Detection / Estimation of Food Additives and Contaminants- qualitative and quantitative demonstrations

References:

1. Early, R. (1995): Guide to Quality Management Systems for the Food Industry, Blackie, Academic and Professional, London.
2. Gould, W.A. and Gould, R.W. (1988): Total Quality Assurance for the Food Industries, CTI Publications Inc. Baltimore.
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FOOD PROCESSING PRACTICALS

Objectives:

This course is designed to enable students to:

1. To be able to measure water activity in foods.
2. Develop skills for processing of foods using various methods and technologies
3. Be able to use different preservatives for processing and preservation of variety of food products.
4. Develop skills in canning of foods

Contents:

No	Topics and Details
Module 1 This module will enable students to- • Develop skills for commercial processing of foods using various methods and technologies. • Learn about measurement of water activity in food and dehydration of food products.	**1) Water Activity**- Conduct experiments on measurement of water activity in fresh fruits / dehydrated fruits – Raisins, figs (dry), dried vegetable, milk powder/instant coffee powder. **2) Dehydration**- Conduct experiments on- 1. Dehydration of wheat, rice dhal based products, preparation, packaging, quality evaluation and storage study. 2. Preparation of dehydrated Banana powder, Potato and Sweet Potato powder. 3. Dehydration of leafy vegetables like methi, palak 4. Dehydration of other vegetables like karela, carrot, beetroot, pumpkin, okra, cabbage, cauliflower etc. 5. Methods by using- Cabinet Drying, Osmo - Vac Drying, Vacuum Drying, Freeze Drying.
Module 2 This module will enable students to- • Understand the application of low temperature technologies for preservation of perishable commodities	**1) Low Temperature processing-** 1. Experiment on storage of leafy vegetables, fruits, perishable produce at refrigerated temperature, cold storage, and chilling temperature. 2. By using appropriate preprocessing and various packaging material. **2) Frozen food Processing-** 1. Experiments on processing of Fruit pulp, fruits, vegetables, eatables by using appropriate packaging and freezing 2. Quality Evaluation and storage studies.

	3. Freezing of Peas(pulav mixture / vegetable mixture) 4. Fish / fish products / chicken products/ ethenic foods
Module 3 This module will enable students to- • Study the various process technologies and conducting experiments.	**1) High Temperature processing-** Experiments on- 1. Blanching of fruits and vegetables. 2. Sterilization using steam, boiling water, hot dry air. 3. Pasteurization of fruit pulp, milk and milk products, concentration tomato pulp, fruit pulp, paste its quality aspects. 4. Preparation of Milk products by using steam and batch heating method (burfi, khoa etc.) 5. Quality analysis of the products during storage, packaging and storage studies. **2) Processing of high Sugar based products-** Experiments on- 1. Fruit Jam making process 2. Marmalade making process 3. Jellies / synthetic jelly making process 4. Preparation of fruit candies (amala, tutti-frutti) 5. Preparation of chutneys, concentrates, murabbas, 6. Processing Dairy products- *channa*, yoghurt, paneer, *khoa, burfi*. 7. Processing of Intermediate moisture foods / glazed fruits/ orange peels, cherries, *awal kathi*. **3) Use of chemical preservatives in processed foods-** Experiments on- 1. Preparation of fruit juices/ ketchups with and without sodium benzoate, sodium and potassium meta bisulphate, 2. Benzoate, SO_2, salts (KMS, NaMs) 3. Effect of Acetic Acid in bread preparation, pickles (acidified brine, instant) tomato products. 4. Effect of calcium Propionate in bread and cereal products and sorbates in chapattis 5. Evaluation of quality, shelf life, packaging, storage study aspects (chemical, physical, microbial, sensory)
Module 4 This module will enable students to- • Study the practical aspects of application of salt in food	**1) Processing by using Salt-** Experiments on- 1. Salting of fish, salting of vegetables packaging and storage. 2. Preservation of onion, gherkins, flower and

products. • Know the technical process of making pickle and canning using fruits and vegetables, packaging, quality evaluation of processed and fresh products during storage.	vegetables by Brining / preservation in brine using various containers. 3. Quality evaluation of products. **2) Pickling-** 1. Pickling of Fruits and vegetables 2. Fish products, Sauerkraut, Fish pickle, kimchi, Traditional meat pickles, Instant pickles 3. Commercial processing **3) Canning processing of fruits and vegetables and other foods-** 1. Commercial canning – sweet corn, baby corn, pineapple, mango, papaya, strawberry, mushroom (button), fruit juices, cherry tomatoes, okra. 2. Home scale canning in PET, standy pouches and glass bottles / bottling of pulp, vegetables, gulab jamun, dairy products like curd, yoghurt, lassi 3. Retortable pouch technology processing RTE/RTC foods

FOOD PRODUCT DEVELOPMENT AND PACKAGING

PRACTICALS

Objectives:

This course will enable students to:

1. Understand and apply various aspects of food product development including Food Science and Technology, Marketing and Consumer research, finance and communication.
2. Develop products which meet consumer needs and are nutritionally and commercially viable.
3. Be skilled in various aspects of including shelf life assessment, testing of quality parameters and acceptability, packaging and labeling of a product.

Contents:

No	Topics and Details
Module 1 This module will enable to the students for- • Development of new food product and studying its health and social impact	**Development of New food product** • Definition classification • Characterization of factors shaping new product development Social concerns, health concerns, impact of technology and market place influence **1) Bulk preparation of product** **2) Packaging and Labelling of the product - Packaging design, graphics and labeling** **3) Nutritional evaluation (estimation of relevant parameters)** • **4) Shelf life testing of the product (**testing for appropriate quality parameters- chemical, microbiological and nutrient content, acceptability studies**)** Product integrity and conformance to standard

Module 2 This module will enable students to understand- • Market survey, consumer survey, gain knowledge of tapping traditional foods and unconventional sources of food.	**1) Market survey, consumer survey, to identify new product in terms of** • Line Extension • Repositioning Existing Products • New form/Reformulation • New packaging of existing products • Innovative products • Creative Products.
Module 3 This module will enable students to understand- • Study for identification of products selection and standardization	**2) Tapping traditional foods and unconventional sources of foods.** • Minimizing post harvest losses. • Identification of concept & product for development • Market research for the concept and selected product
Module 4 This module will enable the students to- • Be able to develop new food products, calculate the cost, Packaging and labeling.	• Identification of products, selection of one product and its standardization • Costing the product and determining the sales price • Advertising and test marketing of the product

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Journals:

1. International Journal of Food Science and Technology
2. Food Technology
3. Journal of Food Technology
4. Trends in Food Science and Technology
5. Critical Reviews in Food Science and Nutrition

FUNCTIONAL FOODS AND NUTRACEUTICALS

Objectives:

This course is designed to enable students to:

1. Gain knowledge about functional foods and nutraceuticals
2. Have thorough understanding about the health effects
3. Be familiar with applications in industry.

Contents:

Module	**Topics and Details**
Module 1.	**Introduction:** Definition, history, classification – Type of classification (Probiotics, probiotics and synbiotics; Nutrient vs. Non-nutrient; according to target organ; according to source or origin). Probiotics 1. Taxonomy and important features of probiotic micro- organisms. 2. Health effects of probiotics including mechanism of action. 3. robiotics in various foods: fermented milk products, non-milk products etc. 4. Quality Assurance of probiotics and safety.
Module 3.	Prebiotics Definition, chemistry, sources, metabolism and bioavailability, effect of processing, physiological effects, effects on human health and potential applications in risk reduction of diseases, perspective for food applications for the following: • Non-digestible carbohydrates/oligosaccharides • Dietary fibre • Resistant starch • Gums

Module 4.	**1. Other Food Components with potential health benefits:** Definition, chemistry, sources, metabolism and bioavailability, effect of processing, physiological effects, effects on human health and potential applications in risk reduction of diseases, perspective for food applications for the following: • Polyphenols: Flavonoids, catechins, isoflavones, tannins • Phytoesterogens • Phytosterols • Glucosinolates • Pigments : Lycopene, Curcumin etc • Organo sulphur compounds • Other components – Phytates, Protease inhibitors, saponins, Amylase inhibitors, haemagglutinins • Active biodynamic principles in spices, condiments and other plant materials **Non- nutrient effect of specific nutrients :** Proteins, Peptides and nucleotides, Conjugated linoleic acid and n-3 fatty acids, Vitamins and Minerals.

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1. Cho S. S. and Dreher, M.L. (2001): Handbook Dietary Fibre, Marcel Dekker Inc., New York.
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FUNCTIONAL FOODS AND NUTRACEUTICALS

Objectives:

This course is designed to enable students to:

1. Gain knowledge about functional foods and nutraceuticals
2. Have thorough understanding about their health effects
3. Understand the nutraceutical constituents present in various food products.
4. Learn and get awareness about latest research area on nutraceutical and functional food components and their applications in industry.

Contents:

Module	**Topics and Details**
Module 1 This module is designed to enable students to: Understand the role of probiotics In health Know different types of probiotic foods and their applications	**Introduction:** Definition, history, classification – Type of classification (Probiotics, probiotics and synbiotics; Nutrient vs. Non-nutrient; according to target organ; according to source or origin). Probiotics 1. Taxonomy and important features of probiotic micro-organisms. 2. Health effects of probiotics including mechanism of action. 3. Probiotics in various foods: fermented milk products, non-milk products etc. 4. Quality Assurance of probiotics and safety.
Module 2 This module is designed to enable students to: Have thorough knowledge of probiotics, physiological benefits effect of processing on their bioavailability Therapeutic applications	**Prebiotics** Definition, chemistry, sources, metabolism and bioavailability, effect of processing, physiological effects, effects on human health and potential applications in risk reduction of diseases, perspective for food applications for the following: • Non-digestible carbohydrates/oligosaccharides • Dietary fibre • Resistant starch • Gums

Module 3 This module is designed to enable students to: Learn the physiological and functional basis of various phytochemical compounds of natural as well as synthetic compounds.	**Other Food Components with potential health benefits:** Definition, chemistry, sources, metabolism and bioavailability, effect of processing, physiological effects, effects on human health and potential applications in risk reduction of diseases, perspective for food applications for the following: • Polyphenols: Flavonoids, catechins, isoflavones, tannins • Phytoesterogens • Phytosterols • Glucosinolates • Pigments : Lycopene, Curcumin etc • Organo sulphur compounds • Other components – Phytates, Protease inhibitors, saponins, Amylase inhibitors, haemagglutinins • Active biodynamic principles in spices, condiments and other plant materials
Module 4 This module is designed to enable students to: Understand the non nutrient effect and therapeutic applications of specific nutritients.	**Non- nutrient effect of specific nutrients :** Proteins, Peptides and nucleotides, Conjugated linoleic acid and n-3 fatty acids, Vitamins and Minerals.

References:

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22. Young, J. (1996): Functional Foods: Strategies for successful product development. FT Management Report Pearson Professional Publishers, London.
23. Frei, B. (1994): Natural antioxidants in human health and disease. Academic Press, San Diego.
24. Tannock, G.W. (1999): Probiotics: A critical review, Horizon Scientic Press, UK.

SEMESTER IV

RECENT METHODS IN FOOD PROCESSING, PRESERVATION AND PACKAGING

Objectives:

This course will enable students to:

1. Acquire systematic knowledge of basic and applied aspects of recent methods of food processing.
2. Know the basic principles in the production of important food products.
3. Understand the potential and use of various by-products of food industry.
4. Gain knowledge about various packaging materials and importance of packaging
5. Be familiar with packaging laws/regulations and tests used for evaluation
6. Be able to select appropriate packaging material for a variety of food stuffs vis-à-vis the need for preventing environmental degradation.

Contents:

Module No	**Topics and Details**
Module 1 This module will enable students to- Acquire scientific knowledge of basic and applied aspects of recent methods of food processing Know the purpose of food processing, principles of food processing, properties of food use of extreme temperature and water activity in food	Purpose of food processing and post-harvest handling of foods of plant and animal origin. Physical and Chemical Principles of Food Processing Properties of Foods: Physical, thermal, heat transfer, water activity and electrical diffusion, surface, optical and sensory. Reduction in water content and water activity by various methods
Module **2** This module will enable students to- Understand the technology of various advance methods used in food processing and preservation Study the application of some processes used in food processing and their technical knowledge.	**Physical Methods** - Irradiation of food - Microwave processing - Use of pulsed electric fields - Use of electricity – Ohmic heating - Use of light and sound - Use of combination of treatments - Use of extreme temperatures: Thermal processing and use of low temperature - High pressure treatment - Use of modified atmosphere
Module **3** This module will enable students to-	**Chemical Methods and Hurdle Technology** - Use of antimicrobials from plants, animals and micro-

Know the advance methods of preservation using Hurdle technology and chemicals	organisms. - Use of chemicals: Antioxidants, nitrates, salt, sugar, acid etc. - Surface treatment and edible coatings - Encapsulation and controlled release - Use of hurdle technology
Module **4** This module will enable students to- Gain knowledge about various food packaging materials and importance of packaging. Select appropriate packaging method for particular food product.	**Packaging, its significance, classification, unit.** - Types of packaging media – Properties and applications - Packaging of fresh and processed food products: classification, - packaging types, trends - Packaging systems and methods for food products - Laws and Regulations for foods packaging - Environmental and eco-issues and waste disposal

References:

1. Salunkhe, D.K. and Kadam, S.S. (1995): Handbook of Fruit Science and Technology, Production, Composition, Storage and Processing, Marcel Dekker, Inc. New York.
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29. Fennema, O.R., Powrie, W.D., Marth, E.H., Low-Temperature Preservation of Food and Living Matter, Marcel Dekker INC. New York.
30. Tannerbaum, S.R., Nutritional and Safety Aspects of Food Processing, Marcel Dekker INC. New York.
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32. Ting, S.V. and Rouseff, R.L., Citrus Fruits and Their Products: Analysis and Technology.
33. Mathews, R.H., Legumes: Chemistry, Technology and Human Nutrition, Marcel Dekker INC. New York.
34. Kokini, J.L., Ho, C.T. and Karwe, M.V., Food Extension Science and Technology, Marcel Dekker INC. New York.
35. Akoh, C.C. and Swanson, B.G., Carbohydrate Polyesters as Fat Substitutes, Marcel Dekker INC. New York.
36. Stephen, A.M., Food Polysaccharides and Their Application, Marcel Dekker INC. New York.

RESEARCH APPLICATIONS IN NUTRITION AND FOOD PROCESSING PRACTICALS

Objectives:

This course will enable students to:

- Appreciate and understand the importance of different types of scientific writing / documentation.
- Develop competence in writing and abstracting skills.
- Develop competence in oral presentations.

Contents:

Sr No	Topic and Details
1	**Literature search and use of databases**
2	**Styles and formats for writing references**
3	a. Writing review of literature on an upcoming area b. Review paper including bibliography
4	**Oral presentations on the following:** a. Book review b. Research topics in upcoming/recent areas c. Own research
5	**Writing a scientific paper including abstract and identification of key words**
6	**Developing a research proposal for funding**

ELECTIVE

(NFP)

Public Nutrition and Health
4 credits

Objectives:

This course will enable the students to:

1. Develop a holistic knowledge base and understanding of the nature of important nutritional problems and their prevention and control for the disadvantaged and upper socio-economic strata in society

2. Understand the causes /determinants and consequences of nutritional problems in society

3. Be familiar with various approaches to nutrition and health interventions, programmes and policies.

Contents:

Block No	**Topics and Details**
1	Concept of public nutrition Unit 1. Relationship between health and nutrition Unit 2. Role of public nutritionists in the health care delivery
2	Sectors and Public Policies relevant to nutrition and health.
3	Primary Health Care of the Community Unit 1. National Health Care Delivery System Unit 2. Determinants of Health Status Unit 3. Indicators of Health
4	Population Dynamics Unit 1. Demographic transition Unit 2. Population structure Unit 3. Fertility behaviour Unit 4. Population policy Unit 5. Fertility Unit 6. inter-relationship between Nutrition and Quality of Life
5	Food and Nutrition Security Unit 1. Food production ❖ Access ❖ Distribution ❖ Availability ❖ Losses ❖ Consumption Unit 2. Food Security

	Unit 3. Socio-cultural aspects and Dietary Patterns: ❖ Their implications for Nutrition and Health
6	Nutritional Status Unit 1. Determinants of nutritional status of individual and populations Unit 2. Nutrition and Non-nutritional indicators ❖ Socio-cultural ❖ Biologic ❖ Environmental ❖ Economic Unit 3: Assessment of nutritional status of individuals of different ages- MUAC, Wt for age, Ht for age, Wt for ht, Ponderal index, BMI Applications and limitations in different field situations- choice of an indicator
7	Major Nutritional Problems – etiology, prevalence, clinical manifestations, preventive and therapeutic measures for: Unit 1. Macro and micro nutrient deficiencies Unit 2. Other nutritional problems like lathyrism, dropsy, aflatoxicosis, alcoholism and fluorosis. Unit 3. Overweight, obesity and chronic degenerative diseases
8	National Food , Nutrition and Health Policies Unit 1. Plan of action and programmes
9	Approaches and Strategies for improving nutritional status and health: Unit 1. Programmatic options- their advantages and demerits. Feasibility Political support Available resources (human, financial, infrastructural) Unit 2. Case studies of selected strategies and programmes: their rationale and context, how to select interventions from a range of possible options: Unit 3. Health-based interventions, Food-based interventions including fortification and genetic improvement of foods, supplementary feeding, Nutrition education for behaviour change.
10	Health economics and economics of malnutrition Unit 1. Its impact on productivity and national development Unit 2. Cost-Benefit ❖ Cost effectiveness ❖ Cost efficiency

References:

1. Owen, A.Y. and Frankle, R.T. (1986): Nutrition in the Community, The Art of Delivering Services, 2nd Edition Times Mirror/Mosby.
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4. State of the World's Children, UNICEF.
5. Census Reports.
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19. Documents and Reports published by the International Vitamin A Consultative Group

20. Documents and Reports of the International Nutritional Anemia Consultative Group

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FOOD LAWS AND STANDARDS

4 credits

Objectives:

The course will enable the students to

1. Know and understand the various national and international standards for different food articles in detail.
2. Understand the food regulatory mechanism in our country.

Module	**Contents**	**credits**
Module 1	Indian Food Regulatory Regime- (Existing and new) Introduction - What is the need for food standards and their enforcement? Introduction to various Mandatory/Regulatory and Voluntary/Optional Food Laws – PFA Act and Rules, 1954 Food Safety and Standards Act, 2006 Essential Commodities Act, 1955	1
Module 2	Global Scenario- Codex Alimentarious Commission (CAC) Other International Standards Setting Bodies (e.g. ISO, OIE, IPPC) Voluntary National Standards: BIS and AGMARK Export and Import Laws and Regulations Global Gap and India Gap National Agencies for Implementation of International Food Laws and Standards Accreditation System for Conformity Assessment Bodies	1
Module 3	Food Safety and Quality Management Systems- Introduction to Food Safety Food Safety System Total Quality Management HACCP- History, Background and Structure, Pre- requisites, Principles	1
Module 4	Other Food Safety Practices-Good Manufacturing Practices/ GHP Management Systems, Auditing and Accreditation- Introduction to Management Systems and Auditing, Standard and Accreditation	1

	ISO 9001:2000: An overview and structure, Case Studies ISO 22000: 2005: An overview, Case Studies Lab Quality Management System- ISO 17025: An Overview and Requirements	

References:

1. Patricia and Curtis A, An operational Text Book, Guide to Food Laws and Regulations.
2. Marth, E.H. (1978): Standard Methods for the Examination of Dairy Products 14th ed or edition. Interdisciplinary Books and Periodicals, Washington, D.C.
3. Ranganna, S. (1986): Handbook of Analysis and Quality Control for Fruit and Vegetable Products, 2nd edition, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi.
4. Early, R. (1995): Guide to Quality Management Systems for the Food Industry, Blackie, Academic and Professional, London.
5. Gould, W.A. and Gould, R.W. (1988): Total Quality Assurance for the Food Industries, CTI Publications Inc. Baltimore.
6. **Prevention of Food Adulteration Act, 1954, Professional Book Pub.**
7. Food Safety and Standards Act 2006, Rules 2011, Regulations 2011, International Law Book Company.

FOOD PHOTOGRAPHY

4 credits

Objectives:

The course will enable the students to

1. Have the understanding of lighting for still life and food photography.
2. Develop an eye for composition and the arrangement of still life and food elements.
3. Process skills related to food photography.
4. Proper selection of props and how to work with a food and prop stylist.
5. Learn lighting methods and balancing mixed light sources.

Module	**Contents**	**credits**
Module 1	- Introduction to Food Photography. - The principles of shooting food/ products. - Styling/ Dressing /organizing food /products before shoot	1
Module 2	- Camera Settings while taking food images. -Lighting setup for food. -Use of different equipments like- flash, hot lights, strobes and natural light -More setups for food hawker, restaurants, food labels and high class foods.	1
Module 3	- Post-Production work, retouching and image manipulation. -Use of different computer software's. -Asses and analyze trends and other Food /Product Photography.	1
Module 4	- Photo Shoot by students of different foods- raw and processed.	1

	-Design an advert or a magazine using the Food/Product images. - Photo Critics.	

References:

1. Helene Dujardin, (2011)Plate to Pixel: Digital Food Photography and Styling, John Wiley and Sons.
2. Lou Manna, (2005), Digital Food Photography, Thompson Course Technology PTR.
3. Nicole S. Young (2012) Food Photography: From Snapshots to Great Shots, Peachpit Press.
4. John Carafoli, (2007), Food Photography and Styling: How to Prepare, Light, and Photograph Delectable Food and Drinks.

NUTRITION FOR SPORTS AND EXERCISE

4 Credits Th

Objectives:

This course will enable students to:

1. Understand the special nutritional requirements for physical activities related to sports and exercise

2. Apply the knowledge to improve the performance of sportspersons

Contents:

Module No	Topic and Details	No of credits
1	Introduction, Nutritional considerations for sports / exercising person as compare to normal active person. **Energy substrates** for activities of different intensity and duration, aerobic and anaerobic activities. **Macro Nutrients-Carbohydrate as an energy source** for sport and exercise. Carbohydrate stores, Fuel for aerobic and anaerobic metabolism, Glycogen re-synthesis, CHO Loading, CHO composition for pre exercise, during and recovery period. **Role of Fat** as an energy source for sports and exercise. Fat stores, regulation of fat metabolism , factors affecting fat oxidation (intensity, duration , training status, CHO feeding) , effect of fasting and fat ingestion. .	2
5	**Protein and amino acid requirements**, Factors affecting Protein turnover, Protein requirement and metabolism during endurance exercise, resistance exercise and recovery process. Protein supplement. **Important micronutrients for exercise**. B complex vitamin and specific minerals. Exercise induced oxidative stress and role of antioxidants.	1
	Fluid balance in sports and exercise, importance, symptoms and prevention of dehydration, Sports drink, **Dietary supplements and ergogenic aids (nutritional, pharmacological and physiological**) Chronic dieting and eating disorder. Female athletic triad, sports anemia.	1

References

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2. Advances in Sport and Exercise Science : Nutrition and Sport , Edited by Don MacLaren. , ChPublished by Churchhill Livingstone, Elsevier. 2007

3. Sports Medicine: The school age athlete by Bruce Reider. 1996. Published by W.B. Saunders.

4. Nutrition for Serious Athletes. Dan Banardot. 2000; Human Kinetics.

5. Energy-Yielding Macronutrients and Energy Metabolism in Sports Nutrition. Edited by Judy A Driskell , Ira Wolinsky, CRC Press 2000.

6. Recommended Dietary Intakes for Indian Sportsman and Women. Satyanarayan, K; Nageshwar Rao. C; Narsinga Rao,B.S.; Malhotra, M.S. (1985)., Hyderabad, National Institute of Nutrition.