

SNDT Women's University

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Syllabus

MSc FOOD SCIENCE AND NUTRITION



SNDT Women's University
1, Nathibai Thackersey Road,
Mumbai 400 020
Revised – 2015

M.Sc. Food Science and Nutrition 2015

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 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 and Human Nutrition*

Eligibility:

Students who have BSc Foods and Nutrition, Food Science and Nutrition, Clinical Nutrition and Dietetics, Food Science and Quality Control, Applied Nutrition, Food Technology, Nutrition and Dietetics, Public Health and Nutrition with minimum 50% marks or B grade are eligible to apply.

Students having pure Science Degree in Life Science, Biotechnology, Bio Chemistry, Physiology and Microbiology are eligible provided they have secured a minimum of 60% or 'A' grade in their Undergraduate degree and they have obtained minimum of 40 credits from amongst the subjects / courses listed below: 200 marks/8 credits courses in Nutrition related subjects and/or Diet Therapy/Dietetics. 100 Marks/4 Credits courses in Physiology, Biochemistry, Advanced Chemistry, Food Science / Food Chemistry, Microbiology, Clinical Nutrition, Sports Science, Public Health and Nutrition, Functional Foods, Nutraceuticals, Food Service Management, Food Safety and Quality Control, Food Preservation, Food Processing and Technology.

SEMESTER-I

Code No	Courses	Total Credits	Th-Cr	Pr-Cr	Int Cr/M	Ext Cr/M	Total Marks	U/C	Component
16101	Nutritional Biochemistry	4	4	-	2/50	2/50	100	U	CC
16102	Macronutrients	4	4	-	2/50	2/50	100	U	CC
16103	Food Microbiology and Safety- Th	4	4	-	2/50	2/50	100	U	CC
16104	Food Microbiology and Safety- Pr	4	4	-	2/50	2/50	100	U	CC
16105	Instrumentation and Methods of Investigation	4	-	4	2/50	2/50	100	C	AC
16191	Advanced Nutrition Pr	4	-	4	2/50	2/50	100	C	IC
	Total	24	16	8	12/300	12/300	600		

CC: Core component AC: Applied Component IDC: Interdisciplinary Component

SEMESTER-II

Code No	Courses	Total Credits	Th-Cr	Pr-Cr	Int Cr/M	Ext Cr/M	Total Marks	U/C	Component
00201	Research Methodology	4	4	-	2/50	2/50	100	U	CC
16202	Food Science and Chemistry	4	4	-	2/50	2/50	100	U	CC
16203	Vitamins	4	4		2/50	2/50	100	U	CC
16204	Food Safety and Quality Control	4		4	2/50	2/50	100	U	CC
16205	Food Product Development & Sensory Evaluation	4	-	4	2/50	2/50	100	C	AC
16291 Or 16292	Clinical Nutrition Or Nutrition for Sports and exercise	4	4	-	2/50	2/50	100	C	IC
	Total	24	16	8	12/300	12/300	600		

SEMESTER-III

Code No	Courses	Total Credits	Th-Cr	Pr-Cr	Int Cr/M	Ext Cr/M	Total Marks	U/C	Component
16301	Minerals	4	4	-	2/50	2/50	100	U	CC
16302	Maternal and Child Nutrition	4	4	-	2/50	2/50	100	U	CC
16303	Nutrition in Society	4	-	4	2/50	2/50	100	U	AC
16304	Food Product Development and Packaging	4	-	4	2/50	2/50	100	U	AC
00301 17	Statistical Applications in Research	4	-	4	2/50	2/50	100	C	AC
16391	Functional Foods, Biodynamic Principles and Nutraceuticals	4	4	-	2/50	2/50	100	C	IC
16392	or Research Methodology in Nutrition								
16393	Or Public Nutrition and Health								
16394	Or Management of Severe Acute Malnutrition								
	Total	24	12	12	12/300	12/300	600		

SEMESTER-IV

Code No	Courses	Total Credits	Th-Cr	Pr-Cr	Int Cr/M	Ext Cr/M	Total Marks	U/C	Component
00401	Dissertation	8	-	8	4/100	4/100	200	U & C	CC
16491	Scientific Writing	4	-	4	2/50	2/50	100	C	IC
00402	Internship	8	-	8	4/100	4/100	200	C	AC
16492 16493	Recent Methods in Food Processing, Preservation and Packaging or Food Laws, Standards and Food Audit	4	4		2/50	2/50	100	U	IC
	Total	24	4	20	12/300	12/300	600		

1. Core Component

Semester	Course	Credits
I	Nutritional Biochemistry	4
	Macronutrients	4
	Food Microbiology Th	4
	Food microbiology Pr	4
II	Research Methodology	4
	Food Science and Chemistry	4
	Vitamins	4
	Food Safety and Quality Control	4
III	Minerals	4
	Maternal and Child Nutrition	4
IV	Research	8
	Total	48

2. Applied Component

Sem	Course	Credits
I	Instrumentation and Methods of Investigation	4
II	Food Product Development & Sensory Evaluation	4
III	Nutrition in Society	4
	Food Product Development and Packaging	4
IV	Statistical Applications in Research	4
	Internship	8
	Total	28

3. Intra / Inter Disciplinary component

Sem	Course	Credits
I	Advanced Nutrition Pr	4
II	Clinical Nutrition / Nutrition for Sports and Exercise	4
III	Functional Foods, Biodynamic Principles and Nutraceuticals / Recent Methodology in Nutrition/ Public Nutrition and Health / Management of Severe Acute Malnutrition	4
IV	Scientific Writing	4
V	Recent Methods in Food Processing, Preservation and Packaging / Food Laws, Standards and Food Audit	4
	Total	20

NUTRITIONAL BIOCHEMISTRY

4 Cr (Th)

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	<ul style="list-style-type: none">a. Membrane structure, composition and Transport of metabolites across membranesb. Acid base balance and its regulationc. Enzymes<ul style="list-style-type: none">- Kinetics of monosubstrate and bisubstrate catalysed reactions (including inhibition)- Enzyme specificity, regulation of enzyme activity and synthesis- Enzymes in clinical diagnosisd. 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 pathwaysf. Free radicals, ROS and oxidative damage	2
2	<p>Review of :</p> <ul style="list-style-type: none">a. Carbohydrate Metabolism : Intestinal transport of carbohydrates, Transport of glucose across various cells, Cellular	1

	<p>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 proteoglycans</p> <p>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</p> <p>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</p> <p>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</p> <p>e. Biological Oxidation : Electron transport chain and oxidative phosphorylation</p>	
3	<p>Biochemical aspects of purine and pyrimidines</p> <ol style="list-style-type: none"> Metabolism of purines Metabolism of pyrimidines Role of purine and pyrimidine nucleotides in metabolism. <p>Biochemistry of Nucleic Acids</p> <ol style="list-style-type: none"> Metabolism of DNA Metabolism of RNAs 	1

	<p>c. DNA replication, mutation, repair and recombination concepts</p> <p>d. Disorders of nucleic acid metabolism</p> <p>Protein Biosynthesis</p> <p>a. Gene expression and its regulation, transcription, translation, post-translational modification</p> <p>b. Inhibitors of protein biosynthesis</p> <p>c. Gene expression in mitochondria</p> <p>d. Systems Biology including Metabolomics and Proteomics</p>	
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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.

MACRONUTRIENTS

4 Credits (Th)

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 No	Topics and Details	No of Credits
1	Human Nutritional Requirements – Development and Recent Concepts. a.Methods of determining human nutrient needs b.Description of basic terms and concepts in relation to human nutritional requirements. c.Guidelines and Recommendations - Development of International and National Nutritional Requirements - Translation of nutritional requirements into Dietary Guidelines Body Composition a. Significance of body composition and changes through the life cycle b. Methods for assessing body composition (both classical and recent) and their applications. Nutrition in Special Conditions: Space Travel, High Altitudes, Low Temperature, Submarines. Energy a.Components of energy requirements: BMR, RMR, thermic effect of feeding, physical activity. Factors affecting energy requirements, methods of measuring energy expenditure. b.Estimating energy requirements of individuals and groups. c.Regulation of energy metabolism and body weight: Control of food intake – role of leptin and other hormones.	1
2	Carbohydrates	2

	<p>a. Review of nutritional significance of carbohydrates and changing trends in dietary intake of different types of carbohydrates and their implications</p> <p>b. Dietary fibre: Types, sources, role and mechanism of action</p> <p>c. Resistant starch, fructo-oligosaccharides, other oligosaccharides: Chemical composition and physiological significance</p> <p>d. Glycemic Index and glycemic load</p> <p>e. Carbohydrates and gene expression</p> <p>Proteins</p> <p>a. Overview of role of muscle, liver and G.I. tract in protein metabolism</p> <p>b. Amino acid and peptide transporters</p> <p>c. Therapeutic applications of specific amino acids</p> <p>d. Peptides of physiological significance</p> <p>e. Proteins, amino acids and gene expression</p>	
3	<p>Lipids</p> <p>a. Nutritional significance of fatty acids – SFA, MUFA, PUFA: functions and deficiency</p> <p>b. Role of n-3 and n-6 fatty acids</p> <p>c. Prostaglandins</p> <p>d. Trans Fatty Acids</p> <p>e. Conjugated linoleic acid</p> <p>f. Nutritional Requirements and dietary guidelines (International & National) for visible and invisible fats in diets.</p> <p>g. Lipids and gene expression</p>	1

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. Annals of Nutrition and Metabolism

FOOD MICROBIOLOGY AND SAFETY THEORY

4 Credits

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	<p>History, scope and importance of food microbiology Food spoilage, preservation, fermentation, QA/QC</p> <p>Micro-organisms and food:</p> <ul style="list-style-type: none">- 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 <p>Factors affecting the survival and growth of microorganisms in food.</p> <ul style="list-style-type: none">- 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 <p>Food Preservation and application to different types of foods:</p> <ol style="list-style-type: none">a. Physical methods – Drying, freeze-drying cold storage, heat treatments(pasteurization), TDT, TDP Irradiation (UV, microwave, ionization), high pressure processing, Aseptic packaging, modified atmosphereb. Chemical preservatives and Natural antimicrobial compounds.c. Biologically based preservation systems and Probiotic bacteria. <p>Uses of Microorganisms: Fermented foods, (Yeast, lactobacillus)</p>	1

	Fermented milk, Cheese, vegetables, beer, vinegar Genetically modified foods, marine foods .	
2	<p>Microbiological examination-Methods of Isolation and detection of microorganisms or their products in food.</p> <ul style="list-style-type: none"> - 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. <p>Spoilage of different groups of foods:</p> <ol style="list-style-type: none"> 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 <p>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. <i>Bacillus, Campylobacter, Brucella, Staphylococcus, Clostridium, E.coli, Aeromonas, Vibrio cholerae, Listeria, Mycobacterium, Salmonella, Shigella</i></p>	2
3	<p>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.</p>	1

FOOD MICROBIOLOGY AND SAFETY PRACTICALS 4 Credits (Pr)

Module No	Topics and Details	No of Credits
1	<p>Preparation of common laboratory media and special media for cultivation of bacteria, yeast & molds.</p> <p>Staining of Bacteria: Gram's staining, acid-fast, spore, capsule and flagellar staining, Motility of bacteria, Staining of yeast and molds.</p> <p>Cultivation and Identification of important molds and yeasts. (slides and mold culture).</p> <p>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.</p> <p>Isolation of microorganisms: Different methods and maintenance of cultures of microorganisms.</p>	0.5
2	<p>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.</p> <p>Bacteriological analysis of water and milk, Total count, MPN Coliform (Count) and MBRT, IMVIC etc.</p>	1.5
3	<p>Various biochemical tests used in identification of commonly found bacteria in foods: IMVIC urease, H₂S, Catalase, coagulase, gelatin and fermentation (Acid/gas)</p> <p>Demonstration of available rapid methods and diagnostic kits used in identification of microorganisms or their products.</p> <p>HACCP</p>	1.5
4	<p>Visits (at least two) to food processing unit or any other organization dealing with advanced methods in food microbiology.</p> <p>Project</p>	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.

INSTRUMENTATION AND METHODS OF INVESTIGATION PRACTICALS

4 credits

Objectives:

This course is designed to:

1. Understand the principles involved in different methods of investigation
2. Understand the principles of various analytical techniques available for research in food science and nutrition.
3. Understand the applications, strengths and limitations of different methods.
4. Be familiar with the applications of the above techniques.
5. Become efficient in the use of some of the most commonly used techniques and instruments in High quality research.

Contents:

Module No	Topics and Details	No of Credits
1	<p>Electrolytic dissociation – Acids, bases, salts, buffers, Hendersen-Hasselbach equation.</p> <p>Theory of indicators and principles of measurement of pH.</p> <p>Acid and Alkalis: Preparation of dilute solutions of common acids and alkalis and determining their exact normalities.</p> <p>Buffers: Preparation of phosphate, carbonate-bicarbonate, boric acid, acetate, chloride and pthalate buffers and determination of their pH by the use of indicators and pH meters.</p> <p>Bioassays –</p> <p>Animal studies, Human Studies, Microbiological assays.</p> <p>Radiochemical Methods Use of Isotopes –</p>	1

	Radioactive and stable isotopes.	
2	<p>Basics of Instrumentation– Physico-chemical principles and methodology –</p> <p>1:Colorimetry, Spectrometry: Beer Lambert law, absorption maximum, Preparation of standard curve and nutrient estimations in UV and visible range</p> <p>2:Photometry</p> <p>3:Fluorimetry</p> <p>4: flame photometry</p> <p>5: Atomic absorptiometry. AAS, AES</p> <p>6: Infrared spectrometry</p>	1
3	<p>Separation Techniques</p> <p>Chromatography –</p> <p>Principles and application in chromatographic techniques:</p> <p>1:Paper (circular, ascending and descending)</p> <p>2:Ion-exchange</p> <p>3: column</p> <p>4:Thin layer</p> <p>5:Gas liquid</p> <p>6:high performance liquid chromatography</p> <p>7: Supercritical fluid extraction</p> <p>Electrophoresis and Centrifugation</p> <p>Principle and applications in paper and gel electrophoresis.</p>	1

	NMR and its applications Immunological Methods – RIA, ELISA.	
4	<p>Viscosity and Consistency Measurements of Food.</p> <p>Unit 1. Measurements of Rheological properties</p> <p>Measurement of specific gravity, freezing point, melting point, refractive index, gel strength, Brix, Densitometry, Refractometry, Polarimetry, Measurement of Colour.</p> <p>Instrumental Measurement of Texture of Foods</p> <p>Dough, Pasta, Baked Products, Fruits and Vegetables, Dairy Products, Meat, Starch.</p> <p>Relative Humidity and Water Activity</p> <p>Aeration / Over run Measurement</p>	1

References:

1. Boyer, R. (2000). 3rd Ed. Modern Experimental Biochemistry. Person Education, Asia.
2. Dawes, E.A. (1980) 6th Ed. Quantitative Problems in Biochemistry. Longman Group Ltd.
3. Khosla, B.D., Garg, V.C. and Khosla, A. (1987). 5th Ed. Senior Practical Physical Chemistry. R. Chand & Co. New Delhi.
4. Oser, B.L. (1965). 14th ed. Hawk's Physiological Chemistry. Tata McGraw-Hill Publishing Co. Ltd.
5. Raghuramulu N.; Madhavan Nair and K. Kalyanasundaram, S. (1983). A Manual of Laboratory Technique. NIN. ICMR.
6. Sharma, B.K. (1999). 8th Ed. Instrumental Methods of Chemical Analysis. Gel Publishing House.
7. Srivastava, A.K and Jain, P.C. (1986). 2nd Ed. Chemical Analysis: An Instrumental Approach. S Chand and Company Ltd.

8. Varley, H.; Gowenlock, A.H. and Bell, M. (1980). 5th ed. Practical Clinical Biochemistry. Heinemann Medical Books Ltd.
9. Vogel, A.I. (1962) 3rd Ed. A Textbook of Quantitative Inorganic Analysis by The English Language Book Society and Longman.
10. Fung, D.Y.C. and Matthews, R. (1991): Instrumental Methods for Quality Assurance in Foods, Marcel Dekker, Inc. New York.
11. 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.
12. Skoog, D.A., Holler, F.H. and Nieman (1998): Principles of Instrumental Analysis Saunders College Publishing, Philadelphia.
13. Gruenwedel, D.W.; Whitaker, J.R. (editors) (1984): Food Analysis Principles and techniques, Volumes 1 to 8, Marcel Dekker, Inc., New York.
14. Herschdoerfer, S.M. (ed) (1968 – 1987): Quality Control in the Food Industry, Vols. 1 to 4, Academic Press, London.
15. Moskowitz, H. R. (ed) (1987): Food Texture: Instrumental and Sensory Measurement: Marcel Dekker, Inc., New York.
16. Pomeranz, Y. and MeLoan, C.E. (1996): Food Analysis: Theory and Practice; 3rd Edition, CBS Publishers and Distributors, New Delhi.

ADVANCED NUTRITION PRACTICALS 4 Cr (Pr)

Objectives:

This course will enable students to use, apply and interpret various methods for assessment of nutritional status, assessment of dietary/nutrient intakes, physical activity and energy expenditure, and interpret tests used for lipid profile and glycemic control.

Contents:

Module No	Topics and Details	No of Credits
1	<p>A. Assessment of Nutritional Status- reliability, validity accuracy, precision</p> <p>Measurement of weight and height – assessment of nutritional status for adults, young and older children</p> <p>Calculation of BMI, interpretation</p> <p>Use of WHO reference standards</p> <p>Wasting, stunting, underweight, severe and moderate malnutrition</p> <p>Calculation of z-scores and use of software</p> <p>Circumference Measurements – chest, head, mid arm. Waist, hip and ratios wherever applicable</p> <p>Applications to children and adults</p> <p>B. Body Composition: Use of skinfold, bioelectric impedance, DEXA</p> <p>Calculation of body fat</p> <p>C. Dietary Protein Evaluation and Assessment of Protein Status:</p> <ul style="list-style-type: none"> ---- Assessment of protein quality - Chemical Score, PDCAAS - In vitro protein digestibility - Estimation of serum albumin, globulin and albumin:globulin ratio 	2
2	<p>Dietary assessment and Assessment of Energy Expenditure</p> <ul style="list-style-type: none"> - Food frequency questionnaire - 24-diet recall, 24-hour diet record - Weighment method <p>Assessment of energy expenditure –</p> <ul style="list-style-type: none"> - Indirect calorimetry : use of ergometer, treadmill, heart rate monitoring - Recording physical activities - Factorial estimation of energy expenditure: MET, PAL - Study of food labels- calculation of DV - In vitro starch digestibility 	1
3	<p>Biomarkers of Carbohydrate and Protein Metabolism</p> <ul style="list-style-type: none"> - Fasting and Postprandial Blood Glucose estimation, OGTT, Glycosylated Hemoglobin, - Glycemic index and glycemic load - Insulin index 	1

	- Measurement of lipid levels in serum, Interpretation	
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RESEARCH METHODOLOGY

4 credits (Th)

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	<p>The Research Process</p> <p>a. Scientific approach to enquiry in comparison to native, common sense approach</p> <p>b. Knowledge, theory and research</p> <p>c. Role, need and scope of research in the discipline of Home Science</p> <p><i>Assignment : Differentiate between investigative reporting and research report (with examples to be brought by students as exercise)</i></p> <p>Steps in Research Process and Elements of Research</p> <p>a. Identifying interest areas and prioritizing Selection of topic and considerations in selection</p> <p>b. Review of related literature and research</p> <p>c. Variables- types of variables including discrete and continuous variables Conceptual definitions and operational definitions</p> <p>d. Concepts, hypotheses and theories</p> <p>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</p> <p>f. Research Design Research questions, objectives and assumptions</p>

	<p>Assignment: <i>Types of variables</i> <i>Hypothesis formations and research questions from Research readings – students identify hypothesis/research questions – Discussion</i></p> <p>Ethics in Research</p>
2	<p>Types of Research</p> <p>a. Basic and Applied research, Qualitative and Quantitative research (brief review of differences)</p> <p>b. Historical research</p> <p>c. Descriptive research methods – survey, case study, correlational study, content analysis, causal-comparative research</p> <p>d. Analytic studies- pre-experimental, experimental research, quasi experimental research</p> <p>e. Qualitative research, Ethnography</p> <p>f. Evaluative research- general characteristics, use of qualitative methods in enquiry</p> <p>Scope and importance in Home Science</p> <p>Assignment: <i>Differentiate between (a) basic and applied research (Exercise to be based on actual research papers published in accredited journals)</i> <i>(b) qualitative and quantitative research</i> <i>Based on Journal contents undertake a critical appraisal of studies/research papers and discuss types of Research with examples</i></p>
3	<p>Sampling</p> <p>a. Rationale, characteristics- meaning, concept of population and sample, and utility</p> <p>b. Types of sampling and generalizability of results</p> <p>c. Probability sampling - simple random sample, systematic random sample, stratified random sampling etc - random and non-random samples, random numbers and use</p> <p>d.. Non-probability sampling - purposive samples, incidental samples, quota samples, snowball samples</p> <p>e.. General consideration in determination of sample size</p>
4	<p>Tools for Data Collection</p> <p>a. Primary and secondary methods of data collection</p> <p>b. Different types of questionnaires, rating scales, check lists, schedules, attitude scales, inventories, standardized tests, interviews, observation</p> <p>c. Development of tools, estimation of reliability and validity of tools</p> <p>d. Procedure for preparation of the tool, administration of tools for data collection</p> <p>e. Procedure for data collection</p> <p>f. Planning for data analysis-coding of responses</p> <p>Assignment : <i>Construction of tools for data collection a) types of questions b) Questionnaire c) interview schedule d) observation d) scales</i></p>

<i>For a given topic students to frame and discuss the different possibilities of methods and tools</i>

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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.
3. Bulmer, M.C. (1984): *Sociological Research Methods: An Introduction*, Macmillan, Hong Kong.
4. Festinger, L. and Katz, D. (ed.) (1977): *Research Methods in the Behavioral Sciences*, Amerind Publishing, New Delhi.
5. Holloway, I. (1997): *Basic Concepts of Qualitative Research*, Blackwell Science, London.
6. Jain, G. (1998): *Research Methodology: Methods and Techniques*, Mangal Deep, Jaipur.
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9. Kumar, A. (2002): *Research Methodology in Social Sciences*, Sarup and Sons, New Delhi.
10. McBurney, D.H. (2001): *Research Methodology*, Thomson-Wadsworth, Australia.
11. Pande, G.C. (1999): *Research Methodology in Social Sciences*, Anmol Publication, New Delhi.

FOOD SCIENCE AND CHEMISTRY

4 Credits

(Th)

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	<p>A. Water, Ice and Food Dispersions</p> <p>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</p> <p>2: Colloidal salts, stabilization of colloidal systems, Rheology of food dispersions</p> <p>3: Gels: Structure, formation, strength, types and permanence</p> <p>4: Foams: Structure, formation and stabilization</p> <p>B. Carbohydrates: Polysaccharides, Sugars and Sweeteners</p> <p>a. Reactions of mono and oligosaccharides</p> <p>b. Use of Polysaccharides in foods: Non-starch Polysaccharides: Cellulose, hemicelluloses, pectins, gums(gum Arabic, guar gum, xanthan gum) , animal polysaccharides, agar, alginates, carageenan .</p> <p>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</p> <p>d: Polysaccharide hydrolysis</p> <p>e: Modified food starches: mechanically damaged starches, extruded starches, pregelatinized, thin boiling starch, cross-linked starches, starch ethers and esters, oxidized starches</p> <p>f: Sugars and Sweeteners: Sugars, syrups, sugar alcohols, potent sweeteners, sugar products, Caramellization.</p>	1

	<p>f. Confectionery, chocolates, jams and jellies, synthetic and natural beverages</p>	
2	<p>Chemistry of Amino acids, peptides, proteins and Science of Protein Foods</p> <p>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,</p> <p>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</p> <p>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.</p> <p>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.</p> <p>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.</p>	1.5

	<p>F.Fish and Sea Food:</p> <p>a. Types and Composition b. Storage and changes during storage. Changes during processing. c. By-products and newer products.</p> <p>G.Pulses and Legumes:</p> <p>a. Structure, composition b. Processing. c. Toxic constituents.</p>	
3	<p>A. Lipids: Fats, Oils and Related Products</p> <p>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</p> <p>B. Nuts and Oilseeds: Composition, Oil extraction and by-products</p> <p>C. Flavors:</p> <p>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</p>	1
4	<p>Fruits , Vegetables and Processed Products</p> <p>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</p> <p>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.</p>	0.5

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- 19..Mahindru, S.N.(2000) Food Additives- Characteristics – Detection and Estimation Tata McGraw Hill Publishing Co. Ltd.
- 20..Borwankar, R.P. and Shoemaker, C.E. (1992) Rheology of Foods. Elsevier Science Publishers Ltd., England
- 21.Charalambour, G. (1990) Flavours and Off-Flavours' 89, Elsevier Science Publishers Ltd., P.O. Box 211, 1000 AE Amsterdam, The Netherlands.
- 22.Salunke, D.K. and Kodam, S.S. (2001): Handbook of Vegetable Science and Technology, Marcel Dekker, Inc., 270, Madison Avenue, New York, NY, 10016.

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

VITAMINS

4 Credits

(Th)

Objectives:

This course will enable the students to:

1. Gain in-depth knowledge of the physiological and metabolic role of vitamins 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, 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.

Block No	Topics and Details	No of credits
1	Fat Soluble Vitamins Vitamin A and Beta Carotene Vitamin D Vitamin E Vitamin K	1.5
2	Water Soluble Vitamins Ascorbic acid Thiamin Riboflavin Niacin Pyridoxine Folic acid Vitamin B ₁₂ Biotin	2
3	Quasi vitamins (in brief) Choline/Betaine Myo Inositol Carnitine Bioflavinoids	0.5

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1. Annual Reviews of Nutrition. Annual Review Inc, California, USA.
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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.
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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.

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 SAFETY AND QUALITY CONTROL PRACTICALS

4 Credits

Objectives:

This course will enable students to:

1. Know the importance of quality assurance in food industry.
2. Be able to conduct various tests and assess quality, using standards for quality assessment and food safety.
3. Be able to conduct the various tests used to detect food adulterants.
4. Be familiar with the fundamentals that should be considered for successful quality control programme.

Contents:

Module No	Topics and Details	No of Credits
1	<p>Introduction to quality assurance and food safety. Current concepts of quality control.</p> <p>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.</p>	
2	<p>Product Evaluation:</p> <ul style="list-style-type: none">- Sampling for product evaluation and line control.- Statistical quality and process control- Specifications and food standards. International, National – Mandatory, Voluntary.- Sample preparation <p>Reporting results and reliability of analysis.</p> <p>Assessment of purity and quality using appropriate standard tests and Detection / Estimation of Food Additives and Contaminants-qualitative and quantitative methods for:</p> <ul style="list-style-type: none">– Water including mineral water.– Cereals and cereal products	1

	<ul style="list-style-type: none"> - Pulses and legumes - Flesh foods 	
3	<p>Product Evaluation:</p> <ul style="list-style-type: none"> - Sampling for product evaluation and line control. - Statistical quality and process control - Specifications and food standards. International, National – Mandatory, Voluntary. - Sample preparation <p>Reporting results and reliability of analysis.</p> <p>Assessment of purity and quality using appropriate standard tests and Detection / Estimation of Food Additives and Contaminants-qualitative and quantitative methods for:</p> <ul style="list-style-type: none"> - Milk and milk products - Ice creams and sherbets - Confectionery 	1
	<p>Product Evaluation:</p> <ul style="list-style-type: none"> - Sampling for product evaluation and line control. - Statistical quality and process control - Specifications and food standards. International, National – Mandatory, Voluntary. - Sample preparation <p>Reporting results and reliability of analysis.</p> <p>Assessment of purity and quality using appropriate standard tests and Detection / Estimation of Food Additives and Contaminants-qualitative and quantitative methods for:</p> <ul style="list-style-type: none"> - Fats and oils including butter, ghee and hydrogenated fat. - Fried snacks and high fat foods 	1
	<p>Product Evaluation:</p> <ul style="list-style-type: none"> - Sampling for product evaluation and line control. - Statistical quality and process control - Specifications and food standards. International, National – Mandatory, Voluntary. - Sample preparation <p>Reporting results and reliability of analysis.</p> <p>Assessment of purity and quality using appropriate standard tests and Detection / Estimation of Food Additives and Contaminants-qualitative and quantitative methods for:</p> <ul style="list-style-type: none"> - Spices and condiments and salt, pickles, sauces and chutneys. 	1

	<ul style="list-style-type: none"> – Tea and coffee – Canned, dehydrated, frozen and bottled fruit/vegetable products – Specific food ingredients such as glycerine, vinegar. – Fruit juices, concentrates and beverages. 	
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References:

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2. Gould, W.A. and Gould, R.W. (1988): Total Quality Assurance for the Food Industries, CTI Publications Inc. Baltimore.
3. Pomeranz, Y. and MeLoan, C.E. (1996): Food Analysis: Theory and Practice, CBS Publishers and Distributor, New Delhi.
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FOOD PRODUCT DEVELOPMENT AND SENSORY EVALUATION PRACTICALS

4 Credits

Objectives:

This course will enable students to:

1. Understand concepts about sensory evaluation of food.
2. Use different sensory methods for evaluating variety of foods.
3. Analyze and interpret sensory evaluation data.
4. Understand the requirements for product development

Contents:

Module No	Topics and Details	No of credits
1	<p>A. Introduction to sensory analysis and uses of sensory tests. General testing conditions.</p> <p>B. Establishing sensory panels: a. Selecting and recruiting panelists, orienting, screening for trained panels, training panelists, monitoring performance.</p> <p>C. b. Recognition tests for 4 basic tastes, odour and aroma. c. Tests with other senses. d. Threshold tests.</p> <p>Analytical tests: (i) Difference, (ii) Ranking, (iii) Descriptive, (iv) Scoring and (v) Rating</p> <p>D. Planning an Experiment for Sensory Evaluation: (i) Designing the questionnaire and score card, (ii) Identifying descriptors. Designing Sensory Testing Facilities: Permanent and Temporary</p> <p>E. Conducting the Test: a. Preparing samples - Presenting samples - Using reference samples - Reducing panel response error</p> <p>b. Consumer oriented tests - Product oriented tests</p> <p>c. Shelf life studies</p> <p>d. Product matching - Product mapping</p>	2

	Taint Investigation and Prevention F. Collecting and analysing sensory data, statistical analysis, interpretations. Report Writing	
2	A New Food Products a. Definition, Classification b. Characterization Factors shaping new product development- Social concerns, health concerns impact of technology and market place influence. B. Market Survey, Consumer survey to identify new products in terms of <ul style="list-style-type: none"> - Line Extension - Repositioning Existing Products - New form/Reformulation - New packaging of existing products - Innovative products - Creative Products. C.Tapping traditional foods and unconventional sources of foods. a. Minimizing post harvest losses. b. Identification of concept & product for development c. Market research for the concept and selected product	1
3	Identification of product, selection of one product and its standardization	1

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.
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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

CLINICAL NUTRITION THEORY

4 Credits

Objectives:

The course will enable the students to:

- Understand the etiology, physiologic and metabolic anomalies of acute and chronic diseases and patient needs.
- To assess nutritional status of patients.
- Be familiar with recent advances in the medical nutritional management of various diseases.

Module No	Topic and Details
1	<p>A. Cellular adaptations to stress.</p> <p>a. Types of stress</p> <p>b. Changes in hormonal secretion, CNS and immune system. Cellular changes</p> <p>c. Effects on cells and tissues</p> <p>B. Diet, nutrient and drug interactions.</p> <p>a. Effect of drugs on ingestion, digestion, absorption and metabolism of food and nutrients.</p> <p>C. Nutrition and Immune response</p> <p>a: Role of individual nutrients in immune response and function</p> <p>b: Effect of undernutrition and overnutrition on immune function</p> <p>c: Immunoenhancers, immunosuppressants, conditionally essential nutrients. d. Effect of food, nutrients and nutritional status on drug dosage and efficacy.</p> <p>D. Ageing</p> <p>Physiological changes with ageing</p> <p>Bone health</p> <p>Osteoporosis</p> <p>Rheumatoid arthritis</p>
2	<p>A. Nutrition and the gastro intestinal tract</p> <p>a. Malabsorption and its patho-physiology, Carbohydrate intolerance.</p> <p>b. Parasitic infections</p> <p>c. Acute and chronic infections</p> <p>d. Diarrhea</p> <p>e. Recent advances in gastroenterology and nutrition</p> <p>f. Diet and gut microflora</p> <p>B. Nutrition and oral health</p> <p>a. Structure, development and maturation</p>

	<p>b.Dental caries c.Recent advances in role of nutrition in dental health</p>
3	<p>A. Nutrition and cardiovascular diseases a.Role of lipids, carbohydrates, protein, and other nutrients b. Bile acid metabolism c.Prostaglandins B. Diabetes mellitus and complications-Recent advances C. Nutrition and Renal Disease a.Nephrotic syndrome b.Nephritis c.ESRD d.Renal Transplant e.Nephrolithiasis Recent advances</p>
4	<p>Nutrition and Cancer Carcinogenesis and Mutagenesis- Carcinogens in Food Epidemiology Investigations of Diet-Cancer relationship Development of cancer Types of cancer and effect on metabolism and nutritional status Nutrients and their relationship with cancer Recent developments in nutrition and cancer. Nutrition and HIV/AIDS</p>

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9. Ritchie, A.C. (1990): Boyd's Textbook of Pathology, 9th Edition, Lea and Febiger, Philadelphia.
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11. World Cancer Research Fund (1997). Food, Nutrition and the Prevention of Cancer- A Global perspective, Washington E.D. WCRF

NUTRITION FOR SPORTS AND EXERCISE THEORY

4 credits

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

Module No	Topics and Details	No of Credits
1	Introduction: Nutritional considerations for sports / exercising person as compare to normal active person. Energy substrate for activities of different intensity and duration, aerobic and anaerobic activities. Fluid balance in sports and exercise, importance, symptoms and prevention of dehydration, Sports drinks	1
2	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.	1
3	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 Protein and amino acid requirements: Factors affecting Protein turnover, Protein requirement and metabolism during endurance exercise, resistance exercise and recovery process. Protein supplement.	1
4	Important micronutrients for exercise. B complex vitamin and specific minerals. Exercise induced oxidative stress and role of antioxidants Chronic dieting and eating disorder. Female athletic triad, sports anemia	1

	Dietary supplements and ergogenic aids (nutritional, pharmacological and physiological)	
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References

1. Bucci, L., 1993 Nutrients as Ergogenic Aids for Sports and Exercise. Boca Raton, FL.:CRC Press.
2. Advances in Sport and Exercise Science : Nutrition and Sport , Edited by Don MacLaren. , ChPublished by Churchill 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.
7. Bucci, L., 1993 Nutrients as Ergogenic Aids for Sports and Exercise. Boca Raton, FL.:CRC Press.
8. Advances in Sport and Exercise Science : Nutrition and Sport , Edited by Don MacLaren. , ChPublished by Churchill Livingstone, Elsevier. 2007
9. Sports Medicine: The school age athlete by Bruce Reider. 1996. Published by W.B. Saunders.
10. Nutrition for Serious Athletes. Dan Banardot. 2000; Human Kinetics.
11. Energy-Yielding Macronutrients and Energy Metabolism in Sports Nutrition. Edited by Judy A Driskell , Ira Wolinsky, CRC Press 2000.
12. 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.

MINERALS

4 Credits (Th)

Objectives:

This course will enable the students to:

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

Contents:

For each of the minerals/elements, 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 No	Topics and Details	No of Credits
1	Macrominerals a. Calcium and Phosphorus b. Magnesium c. Sodium, Potassium, Chloride	1
2	Microminerals a. Iron b. Copper c. Manganese d. Iodine e. Fluoride f. Zinc g. Selenium h. Cobalt i. Chromium	2

	j Molybdneum	
3	Ultra Trace Elements a. Vanadium b. Silicon c. Boron d. Nickel e:Lithium, Lead ,Cadmium, Sulphur,Arsenic	1

References:

11. Annual Reviews of Nutrition. Annual Review Inc, California, USA.
12. 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.
13. Bodwell, C.E. and Erdman, J.W. (1988) Nutrient Interactions. Marcel Dekker Inc. New York
14. World Reviews of Nutrition and Dietetics.
15. WHO Technical Report Series.
16. Indian Council of Medical Research. Recommended Dietary Intakes for Indians - Latest Recommendations.
17. Indian Council of Medical Research. Nutritive Value of Indian Foods - Latest Publication.
18. Berdanier, C.D. and Haargrove, J.L.(ed) (1996): Nutrients and Gene Expression: Clinical Aspects. Boca Raton, FL CRC Press.
19. Baeurle, P.A. (ed) (1994) Inducible Gene Expression. Part I: Environmental Stresses and Nutrients. Boston: Birkhauser.
20. Chandra, R.K. (ed) (1992): Nutrition and Immunology. ARTS Biomedical. St. John's Newfoundland.

Journals:

10. Nutrition Reviews
11. Journal of Nutrition
12. American Journal of Clinical Nutrition
13. British Journal of Nutrition
14. European Journal of Clinical Nutrition
15. International Journal of Vitamin and Nutrition Research
16. International Journal of Food Science and Nutrition
17. Nutrition Research
18. Ann Nutr Metab

MATERNAL AND CHILD NUTRITION

4 Credits (Th)

Objectives:

This course will enable the students to:

- Be familiar with physiological changes in pregnancy and lactation.
- Be familiar with growth and developmental changes from conception till adolescence.
- Understand the inter-relationship between nutrition and growth and development during life cycle.
- Apply their knowledge in community and public nutrition/health programmes.

Contents:

Module No	Topics and Details	No of Credits
1	<p>Changing concepts and controversies in Maternal and Child Nutrition.</p> <p>Importance of Maternal Nutrition during Pregnancy :</p> <p>Unit 1. Importance of nutrition prior to and during pregnancy.</p> <p>Unit 2. Pre-requisites for successful outcome. Effect of undernutrition on mother-child dyad including pregnancy outcome and Maternal and Child Health – Short term and Long term.</p> <p>Unit 3. Physiology and endocrinology of pregnancy and embryonic and fetal growth and development</p> <p>Unit 4. Nutritional requirements during pregnancy</p> <p>Unit 5. Adolescent Pregnancy</p> <p>Unit 6. Pregnancy and AIDS, Pregnancy and TB</p> <p>Unit 7. Intra-uterine growth retardation critical windows of development and programming concepts</p> <p>Unit 8. Complications of pregnancy and management and importance of antenatal care.</p> <p>Unit 9. Congenital malformations, fetal alcohol syndrome and gestational diabetes mellitus.</p>	1
2	<p>Lactation and Infant feeding</p> <p>Unit 1. Development of mammary tissue and role of hormones</p> <p>Unit 2. Physiology and endocrinology of lactation – Synthesis of milk components, let down reflex, role of hormones, lactational amenorrhea, effect of breast feeding on maternal health</p> <p>Unit 3. Human milk composition and factors affecting breastfeeding and fertility, maternal nutritional status and milk composition.</p>	1

	<p>Unit 4. Management of lactation – Prenatal breastfeeding skills education. Rooming in, problems – sore nipples, engorged breast, inverted nipples</p> <p>Unit 5. Exclusive breastfeeding Baby friendly Hospitals Initiative</p> <p>Unit 6. Breast feeding in the age of AIDS</p> <p>Feeding of infants and children and dietary management, key issues in infant Feeding</p>	
3	<p>Infant physiology and the preterm and LBW infants: Implications for feeding and management. Growth and development during infancy, childhood and adolescence.</p> <p>a. Normal pattern of growth and development b.: Norms/standards for growth c: Growth monitoring and promotion, growth faltering, Failure to thrive</p>	1
4	<p>Malnutrition in mothers and children: etiology and management (in brief), Consequences of malnutrition on physical development, mental development, cognitive development. Effect of deficiencies of specific nutrients</p> <p>Current Nutrition and Health Status of Women and Children in India.</p> <p>Policies and programmes for promoting maternal and child nutrition & health. International, national and state level Concept of small family, methods of family planning, merits and demerits.</p>	1

References:

1. International Food Policy Research Institute (1997). Care and Nutrition: Concepts and Measurement. International Food Policy Research Institute Washington DC., USA
2. International Child Health: A Digest of Current Information
3. Barker, D.J.P. (1998). Mothers, Babies and Health in Later Life. Edinburgh, Churchill Livingstone
4. Ward, R.H.T; Smith, S.K.; Donnai, D. (eds) (1994) Early Fetal Growth and Development. London, RCOG Press
5. Sachdev, H.P.S. and Choudhary, P. (1995). Nutrition in Children-Developing Country Concerns. Cambridge Press, New Delhi
6. King, F.S. (1992). Helping Mothers to Breastfeed. Association for Consumers Action on Safety and Health, Mumbai

7. Wallace, H.M. and Giri, K. (1990) Health Care of Women and Children in Developing Countries. Third Party Publishing Co, Oakland.
8. Tanner, J.M. (1988) Foetus into Man: Physical Growth from Conception to Maturity. Wheaton and Co Ltd. Great Britain
9. Luke, B. Johnson, T.R.B.; Petrie, R.H. (1993). Clinical Maternal-Fetal Nutrition. Little Brown and Co, Boston
10. ACC/SCN Reports
11. WHO (1999) Nutrition for Health and Development: Progress and Prospects on the Eve of the 21st century. WHO/NHD/99.9. Geneva
12. Alderman, H.; Behrman, J.; Lavy, V.; Menon, R. (1997) Child Nutrition, Child Health and School Enrollment. Policy Research Working Paper 1700. Washington DC. World Bank
13. Haggerty, PA; Rustein SO (1999) Breastfeeding and Complementary Infant Feeding and the Postpartum Effects of Breastfeeding. Demographic and Health Surveys Comparative Studies Calverton, MA., Macro International.
14. Koletzko, B.; Hernell, O.; Michaelson, K. (2000) Short and Long Term Effects of Breastfeeding on Infant Health. Plenum Press, New York
15. Huffman, S.L.; Baker, J.; Schumann, J.; Zehner, E.R. (1998) The Case for Promoting Multiple Vitamin/Mineral Supplements for Women of Reproductive Age in Developing Countries. LINKAGES Project. Washington DE. AED.
16. WHO/ University of California, Davis (1998) Complementary Feeding of Young Children in Developing Countries. Review of Current Scientific Knowledge. Geneva, WHO.
17. Lusty T., Diskett, P. (1977) OXFAM's Practical Guide to Selective Feeding Programmes. OXFAM Practical Guide No. 1, Oxford, OXFAM Health Unit
18. UNICEF (1997). The Care Initiative: Assessment, Analysis and Action to improve care for Nutrition. New York, UNICEF
19. WHO (1999) Management of severe malnutrition. A manual for physicians and other senior health workers. Geneva, WHO.

NUTRITION IN SOCIETY

4 Credits (Pr)

Objectives:

The course will enable the students to:

- Familiarize with the problems related to food and nutrition security among various communities / socio-economic groups / rural, tribal, urban slums.
- Enable to assess nutritional status of individuals/group.
- Enable to plan, implement, monitor and evaluate intervention programmes
- Familiarize with the various strategies / approaches used to combat malnutrition.

Contents:

Block No	Topics and Details	No of credits
1.	Food and nutrition security of different segments of the society vis-à-vis food production and consumption patterns in different states of India Epidemiologic and socio-demographic indicators – current situation	1
2	Strategies and approaches to combat malnutrition – short term and long term <i>For each unit field visits should be undertaken by students. Case studies are to be done and report prepared</i> a. Food supplementation b. Nutrient supplementation c. Fortification and enrichment d. Food-based approaches, dietary diversification, IEC Cost Analysis Cost benefits, cost effectiveness and cost efficiency	1
3	Development and preparation of food supplements for various target groups and programmes e.g. preschoolers, pregnant/lactating women, mid-day meal programme, emergency situations, Nutritional rehabilitation centres.	1
4	Appraisal of existing programmes: Planning and implementation of an intervention programme 1.Situation analysis and needs identification 2.Intervention planning and intervention	1

	3. Plan for monitoring and evaluation	
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FOOD PRODUCT DEVELOPMENT AND PACKAGING

4 credits (Pr)

Objectives:

This course will enable students to

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

Contents:

Module No	Topics and Details	No of Credits
1	Nutritional evaluation (estimation of relevant parameters) Packaging and Labelling of the product - Packaging design, graphics and labeling	1
2	Bulk preparation of product Shelf life testing of the product (testing for appropriate quality parameters- chemical, microbiological and nutrient content, acceptability studies) Product integrity and conformance to standard	2
3	Costing the product and determining the sales price Advertising and test marketing the product	1
4	Report preparation	

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.
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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 Jones 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

STATISTICAL APPLICATIONS IN RESEARCH

4 credits (Pr)

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	<p>Introduction to Statistics Definition, conceptual understanding of statistical measures, popular concepts and misuse of statistics</p> <p>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</p> <p>Data Management Planning for data analysis – coding of responses, preparation of code book Coding of data Use of statistical programs - MS Excel - SPSS</p>
2	<p>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</p> <p>e. Large and Small Sample tests and interpretation</p>

	<ul style="list-style-type: none"> - . 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	<p>Chi square test and its interpretation</p> <ul style="list-style-type: none"> a. General features, goodness of fit b. Independence of Attributes <p>Correlation and Regression and its interpretation</p> <ul style="list-style-type: none"> a. Basic concepts b Linear regression and correlation coefficient <p>Regression and prediction</p> <ul style="list-style-type: none"> c. Rank correlation, Product-moment method <p>Analysis of Variance and its interpretation</p> <ul style="list-style-type: none"> a. One-factor analysis of variance b. Two-factor analysis of variance <p>Design of Experiments</p> <ul style="list-style-type: none"> a. Completely randomized design b. Randomized block design c. Latin square design d. Factorial design
4	<p>Presentation of Data</p> <ul style="list-style-type: none"> 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, <p>Graphs for nominal and ordinal data- pie diagram, bar graphs of different types, graphs for relation between two variables, line diagram.</p> <p>Use of illustrations</p> <p>Cautions in visual display of data</p> <p>The Research Report</p> <p>Basic components of a research report- prefatory material, introduction and Review of Related Literature, Methodology, Results, Discussion, Conclusion, Summary, Abstract, Bibliography and Appendices</p> <p>Students to design a research study on a topic-</p> <ul style="list-style-type: none"> - specify type of research - sample selection - protocol/operationalization - tools - tests for statistical analysis <p>Preparation of a Research Proposal</p>

FUNCTIONAL FOODS, BIODYNAMIC PRINCIPLES AND NUTRACEUTICALS

4 Credits (Th)

Objectives:

This course is designed to enable students to:

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

Contents:

Module No	Topics and Details	No of Credits
1.	<p>Introduction: Definition, history, classification – Type of classification (Probiotics, probiotics and synbiotics; Nutrient vs. Non-nutrient; according to target organ; according to source or origin). Metabolism of xenobiotics (review)</p> <p>Probiotics</p> <ol style="list-style-type: none">a. Taxonomy and important features of probiotic micro- organisms.b. Health effects of probiotics including mechanism of action.c. Probiotics in various foods: fermented milk products, non-milk products etc.d. Quality Assurance of probiotics and safety. <p>Prebiotics</p> <p>Unit 1. 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:</p> <ul style="list-style-type: none">• Non-digestible carbohydrates/oligosaccharides:• Dietary fibre• Resistant starch• Gums	1
2	<p>Potential health benefits of the following biodynamic principles: 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:</p> <ul style="list-style-type: none">• Polyphenols: Flavonoids, catechins, isoflavones, tannins Curcumin, Resveratrol• Phytoestrogens/ Isoflavones• Phytosterols	2

	<ul style="list-style-type: none"> • Glucosinolates • Pigments : Lycopene, Carotenoids • Organo sulphur compounds • Other components – Phytates, Protease inhibitors, saponins, Amylase inhibitors, haemagglutinins 	
3.	<p>Non- nutrient effect of specific nutrients : Proteins, Peptides and nucleotides, Conjugated linoleic acid and n-3 fatty acids, Vitamins and Minerals.</p> <p>Active biodynamic principles in spices, condiments and other plant materials and their evidence based effects</p>	1

References:

1. Cho S. S. and Dreher, M.L. (2001): Handbook Dietary Fibre, Marcel Dekker Inc., New York.
2. Yurawecz, M.P., M.M. Mossoba, J.K.G. Kramer, M.W. Pariza and G.J. Nelson eds (1999) Advances in Conjugated Linoleic Acid Research, Vol. 1. AOCS Press, Champaign.
3. Wildman, R.E.C. ed. (2000) Handbook of Nutraceuticals and Functional Foods, CRC Press, Boca Raton.
4. Fuller, R. ed. (1992) Probiotics the scientific basis, London: Chapman and Hall, New York.
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7. Goldberg, I. Ed (1994): Functional Foods: Designer Foods, Pharma Foods, Nutraceuticals, Chapman & Hall, New York.
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10. Young, J. (1996): Functional Foods: Strategies for successful product development. FT Management Report Pearson Professional Publishers, London.
11. Frei, B. (1994): Natural antioxidants in human health and disease. Academic Press, San Diego.
12. Tannock, G.W. (1999): Probiotics: A critical review, Horizon Scientific Press, UK.

**RECENT METHODS IN FOOD PROCESSING,
PRESERVATION AND PACKAGING**

4 Credits (Th)

Objectives:

This course will enable students to:

- Acquire systematic knowledge of basic and applied aspects of recent methods of food processing.
- Know the basic principles in the production of important food products.
- Understand the potential and use of various by-products of food industry.
- Gain knowledge about various packaging materials and importance of packaging
- Be familiar with packaging laws/regulations and tests used for evaluation
- 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	No of Credits
1.	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	1
2	Physical Methods <ul style="list-style-type: none">- 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	
3	Chemical Methods and Hurdle Technology <ul style="list-style-type: none"> - Use of antimicrobials from plants, animals and micro-organisms. - Use of chemicals: Antioxidants, nitrates, salt, sugar, acid etc. - Surface treatment and edible coatings - Encapsulation and controlled release - Use of hurdle technology 	
4	Packaging, its significance, classification, unit. <ul style="list-style-type: none"> - 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.
2. Gould, G.W. (1995): New Methods of Food Preservation, Blackie Academic and Professional, London.
3. Singh, R.P. and Oliveira, F. (1994): Minimal Processing of Foods and Process Optimisation An Interface, CRC Press, London.
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18. Kalp, K. Lorenz, K. and Brummer, J. (1995), Frozen and Refrigerated Doughs and Batters, American Association of Cereal Chemists INC. St. Paul, Minnesota.
19. Von Loesecke, H.W. (1998), Food Technology Series: Drying and Dehydration of Foods, Allied Scientific Publishers.
20. Matz, S.A. (1996), Bakery Technology and Engineering, Third Edition, CBS Publishers, New Delhi.
21. Fellows, P.J. (2000), Food Processing Technology: Principles and Practice, Second Edition, CRC Woodhead Publishing Ltd, Cambridge.
22. Hosney, R.C. (1996), Principles of Cereal science and Technology, Second Edition, American Association of Cereal Chemists, St. Paul, Minnesota.
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28. Fabriani, G. and Lintas, C. (1988), Durum Wheat-Chemistry and Technology, American Association of Cereal Chemists, Inc.
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.
31. Van Beynum, G.M.A. and Roels, J.A., , Starch Conversion Technology, Marcel Dekker INC. New York
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 Methodology in Nutrition

4 credits

Objectives:

This course is designed to enable students to:

1. Understand the scientific approaches used in accumulating knowledge in the field.
2. Understand the various designs used vis-à-vis the research problem.
3. Be able to identify sources of variability and uncertainty in research in this field.
4. Be able to design and carry out research studies in these fields of Foods and Nutrition

Contents

Module No	Topics and Details	No of credits
1	Quantitative and Qualitative Research in Foods and Nutrition – an overview Quantitative Research: Unit 1. Design Strategies in Research – Descriptive Studies Brief overview of types of descriptive studies <ul style="list-style-type: none">- correlational studies (Populations/individuals)- case reports and case studies- cross sectional surveys- Use of descriptive studies in research- Hypothesis formulation from descriptive studies- Issues in the design and conduct of descriptive studies Unit 2. Design Strategies in Research – Analytic Studies I Analytic studies <ul style="list-style-type: none">- Observational studies- Case-control studies- Cohort studies – retrospective and prospective- Intervention trials (Clinical trials)	2.5

	<p>Use of analytic studies Issues in the design and conduct of case control studies, definition and selection of cases, selection of control, ascertainment of disease and exposure status Issues in Analysis and Interpretation of case-control studies Unit 3. Design Strategies in Research – Analytic Studies II</p> <ul style="list-style-type: none"> - Overview of types of Cohort studies and Intervention Studies - Issues in the design of Cohort studies (selection of the exposed population, selection of comparison groups, sources of data, sources of exposure information, sources of outcome data) - Issues in the design & conduct of clinical trials (selection of study population, allocation of study regimens, maintenance and assessment of compliance, issues of factorial design, sample size considerations: statistical power etc.) - Issues in Analysis and Interpretation of Cohort studies (role of bias, effect of loss to follow-up effect of nonparticipation) - Strengths and limitations of intervention studies - Unique problems of intervention studies - Issues in analysis and interpretation of clinical and community trials 	
2	<p>Qualitative Research in Foods and Nutrition:</p> <ul style="list-style-type: none"> - Types of qualitative research - Tools, techniques and methodologies, RRA, PRA, PLA - Data Analysis and Interpretation - Rapid Assessment Procedures: Use of rapid assessment procedures for Nutrition programme planning, design, training, assessment - Project reorientation and evaluation 	1

3	Study design issues, sample size and power Summarizing Data, Analyzing Trend data Criteria for evaluation of research problem/programme Introduction to meta-analysis Application of non-parametric tests Ethics in research	0.5
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PUBLIC NUTRITION AND HEALTH

4 Credits (Th)

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:

Module No	Topics and Details	No of Credits
1	<p>Concept of public nutrition</p> <p>a. Relationship between health and nutrition</p> <p>b. Role of public nutritionists in the health care delivery</p> <p>Sectors and Public Policies relevant to nutrition and health.</p> <p>Primary Health Care of the Community</p>	1

	<p>a. National Health Care Delivery System b. Determinants of Health Status c. Indicators of Health</p> <p>Population Dynamics</p> <p>a. Demographic transition b. Population structure c. Fertility behavior d. Population policy e. Fertility f. Interrelationship between Nutrition and Quality of Life</p> <p>Food and Nutrition Security</p> <p>a. Food production</p> <ul style="list-style-type: none"> ❖ Access ❖ Distribution ❖ Availability ❖ Losses ❖ Consumption <p>b. Food Security c. Socio-cultural aspects and Dietary Patterns: Their implications for Nutrition and Health</p>	
2	<p>Nutritional Status</p> <p>a. Determinants of nutritional status of individual and populations b. Nutrition and Non-nutritional indicators</p> <ul style="list-style-type: none"> ❖ Socio-cultural ❖ Biologic ❖ Environmental ❖ Economic <p>c: 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</p> <p>Major Nutritional Problems – etiology, prevalence, clinical manifestations, preventive and therapeutic measures for:</p> <p>a. Macro and micro nutrient deficiencies b. Other nutritional problems like lathyrism, dropsy, aflatoxicosis, alcoholism and fluorosis. c. Overweight, obesity and chronic degenerative diseases</p>	1

3	<p>Approaches and Strategies for improving nutritional status and health:</p> <p>a. National Food , Nutrition and Health Policies - Plan of action and programmes</p> <p>b. Programmatic options- their advantages and demerits. Feasibility Political support Available resources (human, financial, infrastructural)</p> <p>c. Case studies of selected strategies and programmes: their rationale and context, how to select interventions from a range of possible options:</p> <p>d.. Health-based interventions, Food-based interventions including fortification and genetic improvement of foods, supplementary feeding, Nutrition education for behaviour change.</p> <p>Health economics and economics of malnutrition</p> <p>a. Its impact on productivity and national development</p> <p>b. Cost-Benefit</p> <ul style="list-style-type: none"> ❖ Cost effectiveness ❖ Cost efficiency 	2
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References:

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**RECENT METHODS IN FOOD PROCESSING,
PRESERVATION AND PACKAGING**

4 Credits (Th)

Objectives:

This course will enable students to:

- Acquire systematic knowledge of basic and applied aspects of recent methods of food processing.
- Know the basic principles in the production of important food products.
- Understand the potential and use of various by-products of food industry.
- Gain knowledge about various packaging materials and importance of packaging
- Be familiar with packaging laws/regulations and tests used for evaluation
- 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	No of Credits
1.	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, electrical diffusion, surface, optical and sensory. Reduction in water content and water activity by various methods	1
2	Physical Methods <ul style="list-style-type: none">- 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	
3	Chemical Methods and Hurdle Technology <ul style="list-style-type: none"> - Use of antimicrobials from plants, animals and micro-organisms. - Use of chemicals: Antioxidants, nitrates, salt, sugar, acid etc. - Surface treatment and edible coatings - Encapsulation and controlled release - Use of hurdle technology 	
4	Packaging, its significance, classification. <ul style="list-style-type: none"> - 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:

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68. Ting, S.V. and Rouseff, R.L., Citrus Fruits and Their Products: Analysis and Technology.
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70. Kokini, J.L., Ho, C.T. and Karwe, M.V., Food Extension Science and Technology, Marcel Dekker INC. New York.
71. Akoh, C.C. and Swanson, B.G., Carbohydrate Polyesters as Fat Substitutes, Marcel Dekker INC. New York.
72. Stephen, A.M., Food Polysaccharides and Their Application, Marcel Dekker INC. New York.

SCIENTIFIC WRITING

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.

Contents:

Module No	Topic and Details	Number of credits
1	Literature search and use of databases Styles and formats for writing references Writing a Book review	1
2	Writing review of literature on an upcoming area Review paper including bibliography	1
3	1 Writing a scientific paper including abstract and identification of key words	1
4	Writing a research proposal for various funding agencies	1

FOOD LAWS FOOD STANDARDS AND FOOD AUDIT

4 Credits Theory

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

<ul style="list-style-type: none"> • Describe the fundamental purpose of a food safety management system as well as the principles, processes and techniques used for the assessment and management of food safety hazards, • Explain the purpose, content and interrelationship of the following: management system standards; ISO 22000:2005, the ISO 9000:2000 series; guidance documents (ISO 15161:2002); industry practice; standard operating procedures; and the legislative framework relevant to a FSMS. • Explain the role of an auditor to plan, conduct, report and follow up a food safety management systems audit • Plan, conduct, report and follow up a food safety management system audit 	<p>Other Food Safety Practices-Good Manufacturing Practices/ GHP</p> <p>Management Systems, Auditing and Accreditation-</p> <p>Introduction to Management Systems and Auditing, Standard and Accreditation</p> <p>ISO 9001:2000: An overview and structure, Case Studies</p> <p>ISO 22000: 2005: An overview, Case Studies</p> <p>Lab Quality Management System- ISO 17025: An Overview and Requirements</p> <p>Food Audits</p> <ul style="list-style-type: none"> • Process approach; • Standards, principles, definitions: national/international food safety legislation • Accreditation, certification and types of audit-principles, practices, • compliance with legal requirements in the area of food safety; • ISO 22000:2005 requirements review and their practical implementation in the organization's activities; • HACCP principles, steps for its adoption and implementation; • Techniques for carrying out an audit; • Plan, conduct and report an audit; • Techniques for continuous improvement. 	
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