SNDT Women's University

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Syllabus
Post Graduate Diploma in Nutrition, Food Processing and Technology

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

Revised – 2015

POST GRADUATE DIPLOMA IN NUTRITION, FOOD PROCESSING AND TECHNOLOGY

Objectives:

This programme will enable:

1. Students to develop as professionals for the Food Industry specifically in the areas of Quality Control and Assurance, Food Quality Audits and Food Product Development.

2. Development of capability for entrepreneurship to meet the nutrition and health needs in the current scenario.

Eligibility:

Students with minimum 50% marks or B grade who have BSc Foods and Nutrition, Food Science and Nutrition, Clinical Nutrition and Dietetics, Biochemistry, Life sciences, Microbiology, Applied Nutrition, Food Technology, Nutrition and Dietetics, Chemistry, Biotechnology, Food Science and Quality Control, Public Health and Nutrition, Physiology.

Semester I

Code No	**Courses**	**Total credits**	**Th Cr**	**Pr Cr**	**Int Cr/ Marks**	**Ext Cr/ Marks**	**Total Marks**	**U/C**
102001	Human Nutrition and Metabolism Th	4	4	-	2/50	2/50	100	U
102002	Human Nutrition Pr	4	-	4	2/50	2/50	100	U
102003	Food Processing and Technology Th	4	4	-	2/50	2/50	100	U
102004	Instrumentation and Methods of Investigation	4	-	4	2/50	2/50	100	C
102005	Food Microbiology and Safety Th	4	4	-	2/50	2/50	100	U
102006	Food Microbiology and Safety Pr	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/Marks**	**Ext Cr/Marks**	**Total Marks**	**U/C**
202001	Nutrition in Health and Disease	4	4	-	2/50	2/50	100	U
202002	Food Analysis, Safety and Quality Control	4	-	4	2/50	2/50	100	U
202003	Food Science and Chemistry	4	4	-	2/50	2/50	100	U
202004	Food Processing Pr	4	-	4	2/50	2/50	100	U
202005	Food Product Development and Sensory Evaluation	4	-	4	2/50	2/50	100	U
202006	Food Laws, Standards and Food Audit	4	2	2	2/50	2/50	100	C
	Total	**24**	**8**	**16**	**12/300**	**12/300**	**600**	

Industrial Placement
Duration 4 months: May/June to September

HUMAN NUTRITION AND METABOLISM

4 Credits Theory

Objectives:
The course will enable the students to:
(i) Impart knowledge regarding the principles of human-nutrition and metabolism of nutrients
(ii) Familiarize with basic concepts nutrient requirements and meal planning throughout the life cycle

Module No	Topics and Details	Number of credits
1	**Nutrition and its relation to health** **Food Acceptance and Food Behaviour** Internal factors influencing the intake of food External factors influencing the intake of food **Digestion of Food-** Role of gastrointestinal tract, hepatobiliary system and pancreas Absorption- mechanisms of transport **Digestion, Absorption and metabolic conversions (in brief), functions, sources, requirements effects of deficiencies and excess of** Carbohydrates : sugar, starches, fibre Metabolic conversions to include utilization of glucose(postabsorptive), conversion to glycogen and fat Glucose homeostasis and role of hormones(in brief)	1
2	**Digestion, Absorption, Transport (in brief), functions, sources, requirements, effects of deficiencies and excess of** Lipids : fatty acids, fat, cholesterol Role of lipoproteins and implications for health (in brief) **Digestion, Absorption and metabolic conversions (in brief), functions, sources, requirements during different stages of life cycle, effects of deficiencies and excess of** Protein and amino acids- essential and non-essential amino acids Disposal of nitrogenous wastes – role of liver and kidney Protein synthesis and breakdown vis-à-vis the intake	1
3	**Absorption and transport, functions(physiological and biochemical), sources, requirements during different stages of life cycle,effects of deficiencies and excess of** : Fat soluble vitamins - Vitamin A - Vitamin D - Vitamin E	1

	- Vitamin K Water soluble vitamins - Vitamin C - Thiamin - Riboflavin - Niacin - Pyridoxine - Folic acid - Vitamin B12 - Pantothenic acid - Biotin	
4	**Absorption and transport, functions(physiological and biochemical), sources, requirements during different stages of life cycle, effects of deficiencies and excess of** **Minerals and trace elements** - Calcium and phosphorus - Iron - Zinc - Fluoride - Iodine - Selenium - Copper Sodium, Potassium and Chloride	**1**

References:

1. Groff, James L & Gropper, Sareen S: Advanced nutrition and human metabolism. 3rd ed. Stamford : Wadsworth Publ, 1999.
2. Barasi, Mary E : Human nutrition : a health perspective. London : Arnold, c1997.
3. Present Knowledge in Nutrition. International Life Sciences Institute.
4. Eastwood, Martin & Edwards, Christine & Parry, Doreen : Human nutrition : a continuing debate. London : Chapman & Hall, c1992.
5. The Role of Fats in Human Nutrition/edited by F B Padley and Podmore. Chichester : Ellis Horwood, c1985.(Ellis Horwood Series in Food Science and Techology, edited by I D Morton)
6. Guthrie Helen (1986) Introductory Nutrition. Times Mirror/ Mosby College Publishing.
7. Mudambi, S.R., Rajgopal, M.V.(1990) Fundamentals of Foods and Nutrition, New Age International Pvt. Ltd.
8. Nutrient Requirements and Recommended Dietary Allowances for Indians- I.C.M.R. Publication 1999.
9. Robinsson, and Lawler. (1986) Normal and Therapeutic Nutrition. Mac Millan Pub.Co.
10. Elenaor N., Whitney S., Rady R. (1993): Understanding Nutrition, West Publishing Company, Minneapolis.
11. Wardlaw (1993): Perspectives in Nutrition, Paul Insel Mosby.
12. Bhatia Arti: Nutrition & Dietetics- Anmol Publication Pvt. Ltd.- New Delhi.
13. C. Gopalan, B.V. Ramasastri and S.C. Balasubramanian (1989)- Nutritive Value of Indian Foods. NINICMR Hyderabad 500 007

HUMAN NUTRITION Practicals
4 credits

Module No	Topics and Details	Number of credits
1	**Basic five food groups, dietary guidelines and food pyramid Standardization of common recipes**	1
2	**Meal Planning and Preparation**: (a) Principles of meal planning (b) Planning and preparation of nutritionally adequate diets for - Adult man - Adult woman - Adolescent - School going child - Preschooler - Pregnant woman - Lactating woman	2
3	**Planning and preparation of:** - Energy dense recipes - High fibre recipes - Low fat recipes - Low sodium recipes - Micronutrient dense recipes	1

References :

1 Basic Nutrition and Diet Therapy 7 ed Corinne H. Robinson, Emma S. Weigley Donna H. Mueller Macmillon Publishing Company

2 Nutition in Health and Disease 17th ed L. Anderson Dibble P. R. Turkki H. S. Michael H. J. Ryribergen J. B. Lippincott Company, Philadelphia

3 Introductory Nutrition 6th ed Guthie Helon A St. Louis C. V. Mosby

4 Fundamentals of Food & Nutrition Sumati R. Mudamb M. V. Rajagopal New Age International (P) Ltd. Bombay

FOOD PROCESSING AND TECHNOLOGY

4 credits Theory

Objectives :

This course will enable students to:

1. Be knowledgeable about basic and applied aspects of food processing and technology.
2. Apply the theoretical knowledge in food processing and food product development
3. Know the principles of cleaning and sanitation
4. Be familiar with laws and regulations that govern the food industry

Module No	Topics and Details	No of credits
1.	**Introduction to process operations, principles, good manufacturing practices** **General principles of food processing and preservation** 1. *Physical principles in food processing operations* Asepsis, removal of microorganisms, maintenance of anaerobic conditions 2 : Thermal processing – Degree of processing or preservation, selecting heat treatment, heat resistance of microorganisms, nature of heat transfer, protective effects of food constituents, types of thermal treatments 3 : *Ionising radiations* – Forms of radiants energy; ionizing radiations, sources and properties; radiation units; radiation effects; limiting indirect effects; dose fixing factors; objectives in food irradiation; safety and quality of irradiated food; irradiation of various foods and comparison with other methods of preservation 4 : *Refrigeration* – Refrigeration, cool storage and shelf life extension; cool storages with air circulation, humidity control and gas modifications (i.e. CA, MA & SA) 5 : *Freezing* : changes during freezing, rate of freezing, choice for final temperature for frozen foods, freezing methods, freezing effects. 6 : *Dehydration* – Dehydration, water activity and food safety / quality; methods of dehydration **Chemical principles in food processing** : Preservation / processing by sugar, salt, curing, smoke, acid and chemicals; chemical changes in foods that affect texture, flavour, colour, nutritive value and safety during handling, storage and processing; Chemical and biochemical reactions affecting food quality and safety. **Enrichment and fortification technology**, high protein food technology **Waste disposal and sanitation**	**2**

	Waste characteristics, treatments and technologies, food plant sanitation.	
2	**Cereal and Pulse Processing** : 1. Wheat grain characteristics and products; wheat milling process; milling of durum or semolina; macaroni or pasta products, noodles, wheat starch and gluten fractionation 2. Corn wet milling; zein separation; corn starch products; 3. Barley malting; dry milling and air classification; wet fractionation of barley 4. Storage and quality of cereals grains 5. Rice processing, fractionation, quick-cooking rice, parboiled rice 6 : Pulses – processing, elimination of toxic factors, quick-cooking dals **Processing technology of oilseeds** Oilseeds pressing, solvent extraction, purification (degumming, refining, bleaching, deodorization), hydrogenation, plasticizing and tempering; products – butter, margarine, shortening, mayonnaise and salad dressing **Additives and preservatives** : Definition of food additives; acids, bases, buffer systems and salts, chelating agents, antimicrobial agents, sweeteners, stabilizers and thickeners, fat replacers, firming texturizers, appearance control and clarifying agents. **Extruded foods** Extrusion cooking, advantages and disadvantages, extruded products **Fermentation technology and functional foods**: yeast, milk products, fermented vegetables, beer, vinegar, fermented soy products	**1**
3	**Processing Technology of fruit and vegetables** *Structure, composition, physiological and biochemical changes during ripening, handling storage* 1 : Varietal, harvesting and pre-processing considerations for vegetables; post harvest processing practices 2 : Potato processing – Raw material handling and storage, raw matetial quality and suitability for chips, French fries, dehydrated granules and boiled / canned potatoes; processing for chips, French fries and dehydrated granules 3 : Fruit processing – Citrus juices, apple juices, slices and dehydrated products, grape juice and raisins **Processing technology of milk and milk products** composition and characteristics of components **Milk processing** – classification, separation and	**1**

	standardization. Pasteurization, off-flavour removal, homogemnization, packaging, UHT sterile milk **Processing technology of meat, fish and eggs** Muscle structure and composition. Biochemical changes in muscle post mortem and their effects on meat quality Chemistry of processed meats. Aging and tenderization, curing, smoking and freezing of meat, fresh storage of meat; fish preservation and processing; egg quality and storage; effect of heat on egg proteins; egg foams	

References

1 Food Science 5th ed N. N. Potter and J. H. Hotchkiss, CBS Publishers and distributors, 1997, New Delhi

2 Food Facts and Principles, N. S. Manay and M. Shadaksharaswamy, New Age International Publishers, New Delhi (1997 print)

3 Food Chemistry 3rd ed O. R. Fennema, Marcel Dekker, Inc., NewYork, 1996

4 Fundamentals of Dairy Chemistry 3rd ed. N. P. Wong et Al. Van Nostrand Reinhold Co., New York 1988

5 Elements of Food Technology, N. W. Desrosier, AVI Publishing Co. Inc., Westport, Connecticut, 1984 printing

6 The Technology of Food Preservation, 4th ed., N. W. Desrosier and J. N. Desrosier, CBS Publishers and Distributors, New Delhi, 1987

7 The Chemistry and Technology of Cereals as Food and Feed, S. A. Matz, AVI Publishing Co., Westport Conn., 1969

8 Guide to quality Management Systems for the food Industry R. Early, Blackie Academic and Professional London, 1995

9 Food Microbiology M. R. Adams and M. Q. Moss, New Agw International (P), Ltd., New Delhi, 1996 (Indian edn.)

10 Fruit and Vegetable Juice Processing Technology, D. K. Tressler and M. A. Joslyn, AVI Publishing Co. Westport, Conn. 1971

11 Radiation Technology, N. W. Destrosier and H. M. Rosenstock, AVI Publishing Co., Westport, Conn, 1960

INSTRUMENTATION AND METHODS OF INVESTIGATION

4 CREDITS Practical

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	Electrolytic dissociation – Acids, bases, salts, buffers, Hendersen-Hasselbach equation. Theory of indicators and principles of measurement of pH. Acid and Alkalis: Preparation of dilute solutions of common acids and alkalis and determining their exact normalities. 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. Bioassays – Animal studies, Human Studies, Microbiological assays. **Radiochemical Methods** Use of Isotopes – Radioactive and stable isotopes.	1
2	**Basics of Instrumentation**– Physico-chemical principles and methodology – 1:Colorimetry, Spectrometry: Beer Lambert law, absorption maximum, Preparation of standard curve and nutrient estimations in UV and visible range 2:Photometry 3:Fluorimetry 4: flame photometry 5: Atomic absorptiometry. AAS, AES 6: Infrared spectrometry	1
3	**Separation Techniques** Chromatography – Principles and application in chromatographic techniques: 1:Paper (circular, ascending and descending) 2:Ion-exchange 3: column 4:Thin layer 5:Gas liquid 6:high performance liquid chromatography	1

	7: Supercritical fluid extraction Electrophoresis and Centrifugation Principle and applications in paper and gel electrophoresis. NMR and its applications Immunological Methods – RIA, ELISA.	
4	**Viscosity and Consistency Measurements of Food.** Unit 1. Measurements of Rheological properties **Measurement of specific gravity, freezing point, melting point, refractive index, gel strength, Brix, Densitometry, Refractometry, Polarimetry, Measurement of Colour.** **Instrumental Measurement of Texture of Foods** Dough, Pasta, Baked Products, Fruits and Vegetables, Dairy Products, Meat, Starch. **Relative Humidity and Water Activity** **Aeration / Over run Measurement**	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.

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	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

4 credits

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.

NUTRITION IN HEALTH AND DISEASE

4 credits Theory

Objectives:

This course will enable students to:

1. Understand regulation of fluid, electrolyte and acid-base balance
2. Understand energy metabolism and regulation of weight
3. Understand the nutritional implications of various diseases
4. Know the principles of diet management for selected disease conditions

Module No	Topics and Details	No of Credits
1	**Fluid balance, electrolyte balance and acid-base balance** **Body composition**-changes through the lifecycle **Diarrhoea and dehydration**	**1**
2	**Energy Metabolism** : 1.Energy : Metabolic Concept and Measurements (i) Body's need of energy (ii) Metabolic processes to yield energy (in brief) (iii) Units of Energy 2.Energy Needs of the Body :BMR, REE, Voluntary activities, Influence of food, Energy requirements across the life span, Meeting energy needs (in brief) **Energy Balance-** Maintaining body weight Undernutrition and Obesity – causes and consequences Basic Principles of nutritional care	**1**
3	**Diabetes Mellitus** Definition, Classification and indicators, etiological factors, basic principles of nutritional care **Dyslipidemias, Hypertension and Heart disease** Definition and indicators, etiological factors, principles of nutritional care	**1**
4	**Introduction to renal diseases** **Nomenclature, definition, indicators and basic principles of nutritional care** **Nutrition and Bone health(preventive aspects)** **Nutrition and Cancer(preventive aspects)**	**1**

References:

1. Mahan, L.K. and Escott-Stump, S. (2000): Krause's Food Nutrition and Diet Therapy, 10th Edition, W.B. Saunders Ltd.
2. Shils, M.E., Olson, J.A., Shike, M. and Ross, A.C. (1999): Modern Nutrition in Health and Disease, 9th Edition, Williams and Wilkins.
3. Escott-Stump, S. (1998): Nutrition and Diagnosis Related Care, 4th Edition, Williams and Wilkins.
4. Garrow, J.S., James, W.P.T. and Ralph, A. (2000): Human Nutrition and Dietetics, 10th Edition, Churchill Livingstone.
5. Williams, S.R. (1993): Nutrition and Diet Therapy, 7th Edition, Times Mirror/Mosby College Publishing.
6. Davis, J. and Sherer, K. (1994): Applied Nutrition and Diet Therapy for Nurses, 2nd Edition, W.B. Saunders Co.
7. Walker, W.A. and Watkins, J.B. (Ed) (1985): Nutrition in Pediatrics, Boston, Little, Brown & Co.
8. Guyton, A.C. and Hall, J.E. (1999): Textbook of Medical Physiology, 9th Edition, W.B. Saunders Co.
9. Ritchie, A.C. (1990): Boyd's Textbook of Pathology, 9th Edition, Lea and Febiger, Philadelphia.
10. Fauci, S.A. et al (1998): Harrison's Principles of Internal Medicine, 14th Edition, McGraw Hill.
11. World Cancer Research Fund (1997). Food, Nutrition and the Prevention of Cancer- A Global perspective, Washington E.D. WCRF.

Journals and Other Reference Series

1. Nutrition Update Series
2. World Review of Nutrition and Dietetics
3. Journal of the American Dietetic Association
4. American Journal of Clinical Nutrition
5. European Journal of Clinical Nutrition
6. Nutrition Reviews

FOOD ANALYSIS, SAFETY AND QUALITY CONTROL

4 Credits Practicals

Objectives:

This course will enable students to:

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

Contents:

Module No	Topics and Details	No of Credits
1	**Estimation of the following in foods** *1.Moisture content and total solids* Drying methods Distillation procedures Water activity *2.Ash* : Total ash Water Soluble ash Acid insoluble ash Sulphated ash Alkalinity of ash Titrable acidity and pH *3.Nitrogen and crude protein* Protein : Formal titration Colorimetric methods Spectroscopic methods *4.Fat* : Solvent extraction methods Physical methods GLC *5.Sugars* : Refractometry Polarimetric methods Copper reduction methods *6.Starch* : Microbiological examination Polarimetric methods Quantitative estimation	**1**

	7.Fibre : crude and dietary fibre	
1	**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.	
2	**Assessment of purity and quality using appropriate standard tests and Detection / Estimation of Food Additives and Contaminants- qualitative** **and quantitative methods for**: – Water including mineral water. – Cereals and cereal products – Pulses and legumes – Flesh foods	**1**
3	**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. **Assessment of purity and quality using appropriate standard tests and Detection / Estimation of Food Additives and Contaminants- qualitative** **and quantitative methods for**: – Milk and milk products – Ice creams and sherbets – Confectionery	**1**
	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.	**1**

	Assessment of purity and quality using appropriate standard tests and Detection / Estimation of Food Additives and Contaminants- qualitative and quantitative methods for: – Fats and oils including butter, ghee and hydrogenated fat. – Fried snacks and high fat foods	
	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. **Assessment of purity and quality using appropriate standard tests and Detection / Estimation of Food Additives and Contaminants- qualitative and quantitative methods for**: – Spices and condiments and salt, pickles, sauces and chutneys. – Tea and coffee – Canned, dehydrated, frozen and bottled fruit/vegetable products – Specific food ingredients such as glycerine, vinegar. – Fruit juices, concentrates and beverages.	**1**

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.
3. Pomeranz, Y. and MeLoan, C.E. (1996): Food Analysis: Theory and Practice, CBS Publishers and Distributor, New Delhi.
4. Askar, A. and Treptow, H. (1993): Quality Assurance in Tropical Fruit Processing, Springer – Verlag, Berlin.
5. World Health Organisation (1998): Guidelines for Drinking Water Quality, 2nd edition, Vols. 1, 2, and 3, Geneva.
6. Marth, E.H. (1978): Standard Methods for the Examination of Dairy Products 14th ed or edition. Interdisciplinary Books and Periodicals, Washington, D.C.
7. Ranganna, S. (1986): Handbook of Analysis and Quality Control for Fruit and Vegetable Products, 2nd edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
8. Hagstad, H.V. and Hubbert, W.T. (1986): Food Quality Control, Foods of Animal Origin, Iowa State University Press, AMES.
9. Nielsen, S.S. (1994): Introduction to the Chemical Analysis of Foods, Jones and Bartlet Publishers, Boston.
10. James, C.S. (1995): Analytical Chemistry of Foods, Blackie Academic and Professional (Chapman and Hall), Madras.
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13. Food and Agricultural Organisation (1980): Manuals of Food Quality Control. 2. Additives Contaminants Techniques, Rome.
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FOOD SCIENCE AND CHEMISTRY

4 Credits Theory

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,	**1**

	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. **a.** Confectionery, chocolates, jams and jellies,synthetic and natural beverages	
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.	**1.5**

	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. **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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21.Charalambour, G. (1990) Flavours and Off-Flavours' 89, Elsevier Science Publishers Ltd., P.O. Box 211, 1000 AE Amsterdam, The Netherlands.
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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

FOOD PROCESSING

4 credits Practicals

Objectives:

This course will enable students to:

1, Measure water activity in foods
2. Develop skills for processing of foods using various methods and technologies
3.Use different preservatives for processing and preservation for a variety of food products

Module No	Topics and Details	No of credits
1	**Water Activity** – Measurement of water activity in • Fresh fruits / dehydrated fruits – Raisins, figs (dry), dried vegetable, milk powder/instant coffee powder **Dehydration** • Cereal / Pulse based products • Banana powder, Potato and Sweet Potato powder, Fruit and vegetable powder • Cabinet Drying • Osmo - Vac Drying • Vacuum Drying • Freeze Drying **Tomato Products :**Ketchup, Sauce, Paste **Wafer Technology** • Potato, Tomato, Tomato and sago • Sweet potato, Banana wafers	**1**

2	**Low Temperature processing** • Studies on low temperature and ambient storage • Processed food / fruits / vegetables, Leafy Vegetables • Processing of fruits and vegetables and storage at low temperature using various packaging material (after giving appropriate pre-treatment) **Frozen food Processing** • Fruit pulp processing, packaging and freezing (using various packaging material and methods) • Peas(pulav mixture / vegetable mixture) • Fish / fish products / chicken products **High Temperature processing** • Experiments on Blanching, sterilization, pasteurization, concentration (paste) • Experiments on Milk products, fruits, vegetable products	**1**
3	**Sugar based products** Jam making process Marmalade Jellies / synthetic jelly candies Concentrates, Murabbas, Dairy products Intermediate moisture foods / glazed fruits/ candies - Effect of chemical preservatives- Benzoate, So2, salts (KMS, NaMs) Acetic Acid, Lactic Acid, Propionate, Sorbates Salting • Salting of fish, salting of vegetables • Brining / preservation of vegetables in brine using various containers Pickling • Fruits and vegetables • Fish products • Sauerkraut • Fish pickle • Traditional meat pickles	**1**

4	**Canning** • Commercial canning – sweet corn, baby corn, pineapple, strawberry, mushroom (button), fruit pulp • Home scale canning / bottling of - pulp, vegetables gulab jamun, dairy products **Dairy products** (visit) • Separated milk • Reconstitution of cream (toned milk) • Yoghurt, butter,ghee gulab jamun, ice-cream • Utilization of whey **Juice Technology** (visit) Preservation of fresh fruit and vegetable juices, herbal juices, wheat grass juice **Milling Technology (visit)** Wheat milling (roller mill), Rice milling, Dal milling, Pasta making	**1**

FOOD PRODUCT DEVELOPMENT AND SENSORY EVALUATION

4 Credits Practicals

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	**A. Introduction to sensory analysis and uses of sensory tests.** General testing conditions. **B. Establishing sensory panels:** a. Selecting and recruiting panelists, orienting, screening for trained panels, training panelists, monitoring performance. C. b. **Recognition tests** for 4 basic tastes, odour and aroma. c. Tests with other senses. d. Threshold tests. **Analytical tests**: (i) Difference, (ii) Ranking, (iii) Descriptive, (iv) Scoring and (v) Rating **D. Planning an Experiment for Sensory Evaluation:** (i) Designing the questionnaire and score card, (ii) Identifying descriptors. Designing Sensory Testing Facilities: Permanent and Temporary **E. Conducting the Test:** a. Preparing samples - Presenting samples - Using reference samples - Reducing panel response error b. Consumer oriented tests - Product oriented tests c. Shelf life studies d. Product matching - Product mapping Taint Investigation and Prevention **F. Collecting and analysing sensory data, statistical analysis, interpretations. Report Writing**	2

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** - 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.** - Minimizing post harvest losses. - 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

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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

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	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	1

• 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	Management Systems, Auditing and Accreditation- **Introduction to Management Systems and Auditing, Standard and Accreditation** 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 **Food Audits** • 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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