

UNIVERSITY OF MUMBAI



Syllabus

SEMESTER I & SEMESTER II

Program: M.Sc.

Course: Home Science

Branch IB: Food Processing & Preservation

(Credit Based Semester and Grading System
with effect from the academic year 2016–2017)

M.Sc. (HOME SCIENCE) BRANCH IB : FOODS PROCESSING AND PRESERVATION**SEMESTER I**

Course Code	Title	Theory/ Practical	Internal Marks	Semester End Exam	Total Marks	Periods/ week	Credits
PSHSI101	Research Methods and Biostatistics - Paper I	Theory	40	60	100	3	4
PSHSIB102	Food Chemistry	Theory	40	60	100	3	4
PSHSIB103	Advances in Food Science	Theory	40	60	100	3	4
PSHSIB104	Advanced Food Microbiology	Theory	40	60	100	3	4
PSHSIB105	Nutrition and Biochemistry	Theory	40	60	100	3	4
PSHSIBP101	Food Science	Practical	-	50	50	3	2
PSHSIBP102	Analytical Food Chemistry - I	Practical	-	50	50	3	2
	Total				600	21	24

Course code	Title	Periods/week	Marks	Credits
PSHSI101	RESEARCH METHODS AND BIOSTATISTICS- PAPER I	3	100	4

Objectives:

1. To inculcate knowledge about essentials of high quality research.
2. To introduce students to the skills needed in conducting a research.

Course content	Periods
<p>Unit I</p> <p>A. An introduction to research methodology: -Definition, Objectives of research Types of research a) Descriptive vs. Analytical b) Applied vs. Fundamental c) Quantitative vs. qualitative d) Conceptual vs. Empirical Other types: a) Cross sectional vs. longitudinal b) Field setting or laboratory c) Clinical or diagnostic d) Exploratory Research e) Historical research. B. Research approach: Quantitative and qualitative approach C. Ethics in research: a) Applying for ethical approval/ clearance b) Defining the research problem: Selecting and defining the problem D. Literature review E. Formulation of hypothesis F. Research designs: a) Need for a research design, features of a good design b) Types of research designs- Explorative/ descriptive/ experimental/ Survey/ Case Study</p>	15
<p>Unit II</p> <p>A. Sampling techniques for nutrition research a) Sample design-Criteria of selecting a sampling procedure b) Characteristics of a good sampling design c) Types of sample designs: -Non-probability sampling -Probability sampling -Purposive sampling -Simple random sampling -Systematic sampling -Stratified sampling -Quota sampling -Cluster sampling - Multi-stage sampling -Sequential sampling. d) Determination of sample size for different type of research B. Measurement and scaling techniques a) Measurement scales: Nominal, Ordinal Interval, Ratio b) Validity c) Reliability and Practicality d) Scaling, scaling techniques e) Rating scales (paired comparison, rank order), likert scales etc.</p>	15
<p>Unit III</p> <p>A. Methods/ tools of data collection a) Collection of primary data: Observation method, Interview method, Questionnaire method, case study method. b) Collection of secondary data c) Selection of appropriate method of data collection</p>	15

	B. Data processing and management a) Processing operations: Editing, coding, classification, tabulation b) Use of data entry software (MS Excel & SPSS)	
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References

- Bhattacharyya, G.K. & Johnson, R. A. (1977). Statistical concepts and methods. NY: John Wiley.
- Dwiwedi, R. S. (1997). Research methods in behavioral sciences. Delhi: Macmillan India.
- Gravetter, F. J. & Waillnau, L. B. (2000). Statistics for the behavioral sciences. Belmont, CA: Wadsworth/Thomson Learning.
- Kerlinger, F. N. & Lee, H. B. (2000). Foundations of behavioral research. Orlando, Florida: Harcourt.
- Kothari, C.R. (2004). Research Methodology-Methods and Techniques. New Age International Publishers, New Delhi.
- Leong, F.T.L. & Austin, J. T. (Eds.) (1996). The psychology research handbook. New Delhi: Sage

Course code	Title	Periods/week	Marks	Credits
PSHSIB102	FOOD CHEMISTRY	3	100	4

Objectives:

1. To enable understanding of the chemistry of food components, the chemical and biochemical reactions in foods.
2. To impart a systematic knowledge of basic and applied aspects of food chemistry

Course content	Periods
<p>Unit I</p> <p>Major Food Components</p> <p>A. Water:</p> <ol style="list-style-type: none"> a) Chemistry of water, b) Physical properties: specific heat, latent heat, vapor pressure, boiling point, c) water as dispersing medium, states of water, water activity, d) Water in food preparation and preservation, practical applications in industry. <p>B. Carbohydrates:</p> <ol style="list-style-type: none"> a) Carbohydrate chemistry – Monosaccharides, disaccharides, polysaccharides, isomerization, ring structures. Properties of sugars - Hydrolysis, Caramelization, Maillard reaction. b) Starch: Structure, functional properties - Gelatinization, pasting, syneresis, retrogradation, dextrinization. Factors affecting gelatinization and gelation. Modified and resistant starches, c) Gums – Functions, sources, applications. d) Pectic substances, pectin gels <p>C. Proteins –</p> <ol style="list-style-type: none"> a) Protein chemistry – Amino acids, protein structure, classification of proteins b) Properties of proteins – Amphoterism, Isoelectric point, Water-binding capacity, hydrolysis, denaturation, Coagulation, Salting in, salting out, Gluten complex development, Gelation, texturization (spun and extruded textures) , <p>D. Lipids</p> <ol style="list-style-type: none"> a) Lipid chemistry - Structure and composition of fats, fatty acids, b) Properties of Fats: crystallinity of solid fats, Polymorphism, Melting points, Plasticity of Fats, chemical degradation, oxidative and hydrolytic rancidity, effect of heat, chemical modifications c) Hydrogenation, Interesterification, Winterization d) Functional roles of fats - fat replacements. <p>E. Enzymes</p> <ol style="list-style-type: none"> a) Biocatalysts, enzyme specificity b) Use of exogenous enzymes in foods – amylases, lipases, proteases c) Endogenous enzymes – phenol oxidases, peroxidases, oxido-reductases, lipxygenases d) Factors affecting enzyme activity 	15
<p>Unit II</p> <p>Minor Food Components</p> <p>A. Vitamins</p> <ol style="list-style-type: none"> a) Fat soluble (vitamin A, D, E & K) & water soluble (Vitamins of B-complex & vitamin C)- sources, Bio-availability, losses and stability metabolic role, RDA, deficiency & excess consumption b) Fat soluble vitamins – A, D, E and K – structure, general properties and functions 	15

	<ul style="list-style-type: none"> c) Water soluble vitamins – C and B- complex – structure, general properties and functions <p>B. Minerals</p> <ul style="list-style-type: none"> a) Principles of Mineral Chemistry, stability, toxicity, Dietary recommendations, bioavailability, General causes of losses and variations in mineral content of food b) Sodium and Potassium replacers/substitutes c) Food fortification and enrichment 	
Unit III	<p>Flavours, Pigments and Food Additives</p> <p>A. Flavours</p> <ul style="list-style-type: none"> a) Molecular mechanism of flavor perception (sweet, bitter, salty, sour, umami, kokumi, pungent, cooling and astringent) b) Flavours from vegetables, fruits, spices, fats and oils, milk and meat products <p>B. Pigments</p> <ul style="list-style-type: none"> a) Pigments in Animal and Plant tissues (Haeme compounds, Chlorophyll, Carotenoids, Anthocyanins, Betalins) b) Synthetic Food Colors (toxicity and regulatory aspects) <p>C. Additives</p> <ul style="list-style-type: none"> a) Buffer systems and salts, chelating agents b) Antioxidants c) Antimicrobials d) Fat replacers, sweeteners e) Masticatory substances f) Firming texturizers g) Clarifying agents, bleaching agents h) Flour improvers, anti-caking agents, i) Gases and propellants. 	15

References

- Vacklavick, V. and Christian, E. (2003). *Essentials of Food Science*. New York: Kluwer Academic/ Plenu Publisher.
- Damodaran S., Parkin KL. and Fennema OR. *Fennema's Food Chemistry* (4th Edition), Florida: CRC Press
- Rick Parker (2003) *Introduction to Food Science*, New York: Delmar Thomson Learning
- Borvers, J. (1992). *Food Theory and Application* (2ndEd), New York: Maxwell MacMillan International Edition.
- Manay, N. S. and Sharaswamy, S. M. (1997). *Foods: Facts and Principles* New Delhi: New Age International Publishers.
- McWilliams, M (2007). *Foods: Experimental Perspectives* 5th Ed, New Jersey: Macmillan Publishing Co.
- Potter, N. N. and Hutchkiss, J. H. (1997). *Food Science*, 5th Ed, New Delhi: CBS Publishers and Distributors.
- Scottsmith and Hui Y.H (Editors) (2004) *Food Processing – Principles and Applications* London Blackwell

Course code	Title	Periods/week	Marks	Credits
PSHSIB103	ADVANCES IN FOOD SCIENCE	3	100	4

Objectives:

1. To learn fundamental concepts and recent advances in food science.
2. To learn industrial application of food science in food product development.

Course content	Periods
<p>Unit I</p> <p>Introduction Role of food scientists, Scope of food science in the area of changing consumer trends (unprocessed, organic)</p> <p>Cereal and Cereal Products, Fruits and Vegetables</p> <p>A. Cereal grains</p> <ol style="list-style-type: none"> a) Structure and Chemical composition b) Flours, cooking cereals, breakfast cereals c) Gluten, classes of batters and doughs, leavening process in baked products d) Effect of food processing on nutrient <p>B. Fruits and Vegetables</p> <ol style="list-style-type: none"> a) Structure and Chemical composition b) Physiochemical changes during, harvesting, post-harvesting, ripening, cooking, storage c) Organically grown fruits and vegetables d) Effect of food processing on nutrient 	15
<p>Unit II</p> <p>Milk and milk products, meat, fish and poultry, eggs, pulses</p> <p>A. Milk and milk products</p> <ol style="list-style-type: none"> a) Structure and Chemical composition b) Milk components as Food ingredients (Lipid phase, protein micelles, milk salt system, whey proteins, lactose) c) Use of milk in formulated foods d) Effect of food processing on nutrients <p>B. Meat, fish, and Poultry</p> <ol style="list-style-type: none"> a) Structure and functions of muscles b) Conversion of Muscle to meat (Rigor Mortis, Ageing, Tenderizing) c) Natural and Induced post-mortem biochemical changes (cold shortening, thaw rigor, electrical stimulation) d) Fish – composition, spoilage e) Eggs- structure and composition, Cooking changes, effect of added ingredients on coagulation f) Effect of food processing on nutrients <p>C. Pulses</p> <ol style="list-style-type: none"> a) Structure and composition, anti-nutritional factors in pulses b) Texturized vegetable proteins, soy isolates, beverages c) Effect of food processing on nutrient 	15
<p>Unit III</p> <p>Fats and Oils, Sugars sweeteners and Confectioners</p> <p>A. Fats and Oils</p> <ol style="list-style-type: none"> a) Structure, function and composition b) Functional properties of fats used in food industry c) Changes while cooking, d) Fat substitutes e) Effect of food processing on nutrient <p>B. Sugars, Sweeteners and Confections</p> <ol style="list-style-type: none"> a) Role of sugars in food systems b) Types of sugars and sugar syrups c) Sugar based and cocoa based confections d) Effect of food processing on nutrients 	15

References

- Vacklavick, V. and Christian, E. (2003). *Essentials of Food Science*. New York: Kluwer Academic/ Plenum Publisher.
- Damodaran S., Parkin KL. and Fennema OR. *Fennema's Food Chemistry* (4th Edition), Florida: CRC Press
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- Borvers, J. (1992). *Food Theory and Application* (2ndEd), New York: Maxwell MacMillan International Edition.
- Manay, N. S. and Sharaswamy, S. M. (1997). *Foods: Facts and Principles* New Delhi: New Age International Publishers.
- McWilliams, M (2007). *Foods: Experimental Perspectives* 5th Ed, New Jersey: Macmillar Publishing Co.
- Potter, N. N. and Hutchkiss, J. H. (1997). *Food Science*, 5th Ed, New Delhi: CBS Publishers and Distributors.
- Scottsmith and Hui Y.H (Editors) (2004) *Food Processing – Principles and Applications* London Blackwell Publishing.
- Subbulakshmi, G and Udipi, S. A. (2001). *Foods Processing and Preservation*, New Delhi: New Age International (P) Ltd. Publishing.
- Swaminathan, M. (1995). *Food Science Chemistry and Experimental Food*. The Bangalore Printing and Publishing Co. Ltd.
- ** All new journals related to Food Science**

Course code	Title	Periods/week	Marks	Credits
PSHSIB104	ADVANCED FOOD MICROBIOLOGY	3	100	4

Objectives:

1. Develop an advanced understanding of microbiological issues associated with the food continuum.
2. Develop an understanding of the physiological processes by which microorganisms use to survive food processing interventions
3. Develop familiarity with organisms identified as leading causes of food borne disease.

Course content		Periods
Unit I	<p>A. Review of Food Microbiology basics</p> <ol style="list-style-type: none"> a) Taxonomy, Characterization, classification and identification of microorganisms b) Role of microorganisms and microbial enzymes in food industry c) Microbial flora in common food groups (cereals, pulses, milk and milk products, meat, poultry, fish, eggs, vegetables, fruits, sugars and fats) <p>B. Microbial Ecology of Foods-Foods as ecosystems</p> <ol style="list-style-type: none"> a) Factors affecting microbial growth and control in foods: intrinsic factors, extrinsic factors, implicit factors b) Effect of environment on microbial growth (temperature, water activity, pH, anti-septic/disinfectant) 	15
Unit II	<p>A. Food borne illnesses</p> <ol style="list-style-type: none"> a) Produce as a source of food borne disease b) Microbial survival in the food chain c) Antimicrobial resistance in the food supply d) Food borne pathogen reservoirs, pre/post-harvest control, and microbiological quality of food Epidemiology and etiology of food borne disease (infection and intoxications) <p>B. Biofilms in food systems</p> <ol style="list-style-type: none"> a) Cell signalling and quorum sensing b) Biofilm development c) Biofilms in food systems d) Role of quorum sensing in biofilm development Identification and control of biofilms in food processing facilities 	15
Unit III	<p>A. Microbial Food safety and quality control</p> <ol style="list-style-type: none"> a) Food microbiology/safety history, disease, trends and emerging pathogens b) New and emerging technologies for the reduction of pathogenic and spoilage organisms in food c) Food production plant sanitation, hygiene practices and the role of genotyping d) Conventional and rapid methods of food analysis -Limitations of classical methods -Rapid microbiological methods (RMM): manual, semi-automated and automated -Genetics-based diagnostic and identification systems (gene probes and PCR) - Predictive microbiology models and microbial risk assessment 	15

References

- Jay, James M.; Loessner, Martin J.; Golden, David A. Modern Food Microbiology. 7th edition, Springer 2005
- Biology of Microorganisms, Brock, Thomas D. and Michael T. Madigan.1988 5th Edition. Prentice halls, Englewood Cliffs, New Jersey.
- Developments in Food Microbiology R. K. Robinson
- Food Microbiology Frazier, W.C., and D.C. westhoff.1978., 3rd and 4th edition McGraw-Hill, Inc., New York
- Food Microbiology-Advances and Prospects Roberts, Skinner, Academic Press
- General Microbiology Boyd, Robert F.1988. 2nd Edition. McGraw-Hill, Inc., New York

General Microbiology Stainer, Ingraham, Wheelis, Painter, 5th Edition, Macmillan
Practical Food Microbiology and Technology. George J. Mounthey and Wilbur A. Gould 3RD edition
Motarjemi, Yasmine; Adams, Martin. Emerging Foodborne Pathogens. Woodhead Publishing.
Lund, B. M.; Baird-Parker, T. C.; Gould, G. W. Microbiological Safety and Quality of Food, Volumes 1-2. Springer -
Verlag.
Blackburn, C.W.; McClure, P.J. (2002). Foodborne Pathogens - Hazards, Risk Analysis and Control. Woodhead
Publishing
Journals: Applied and Environmental Microbiology; Comprehensive Reviews in Food Science and Food Safety;
International Journal of Food Microbiology; Food Control; Food Microbiology; Journal of Applied Microbiology;
Journal of Food Protection; Journal of Food Science
Adams, M.R. and Moss, M.O. (2005) *Food Microbiology* 1st edition, New Age International (P) Limited, Publishers,
New Delhi.
Banwant G,J, (2002) *Basic Food Microbiology* 2nd Edition, Chapman and Hall Inc., New York

Course code	Title	Periods/week	Marks	Credits
PSHSIB105	NUTRITION AND BIOCHEMISTRY	3	100	4

Objectives:

1. To acquire knowledge and understanding of biochemistry principles applied in human nutrition
2. To learn the physiologic and metabolic role of macronutrients and micronutrients
3. To understand the utilisation of nutrients from various food sources and its implications in optimal nutrition and health
4. To estimate the contribution of nutrient profile of processed food in meeting required dietary recommendation

Course content	Periods
<p>Unit I</p> <p>A. Introduction to cell structure</p> <ol style="list-style-type: none"> a) Cell membrane b) Transport mechanisms across cell membrane (diffusion, osmosis, facilitated diffusion & active transport) c) Electron transport chain: Oxidative phosphorylation, role of high energy phosphates <p>B. Energy</p> <ol style="list-style-type: none"> a) Units of energy b) Law of thermodynamics c) Assessment of energy requirements (Direct and indirect calorimeter) d) Components of energy expenditure e) Energy utilisation by the cells f) Energy balance (Hunger, appetite & satiety, calorie density of food) g) Recommended Dietary Allowances <p>C. Water</p> <ol style="list-style-type: none"> a) Fluid compartments in the body, fluid balance, role of water in human nutrition b) Dehydration; commercial rehydration solutions 	15
<p>Unit II</p> <p>A. Carbohydrates</p> <ol style="list-style-type: none"> a) Classification, food sources, functions b) Carbohydrates of industrial importance, c) Digestion (Process of digestion, resistant starch, rapidly digestible starch), absorption & transport. d) Metabolism of carbohydrates (brief outline of various pathways without structures) Embden–Meyerhof pathway, TCA-cycle, Gluconeogenesis, glycogen synthesis, glycogenolysis, HMP-shunt. e) Consequences of hyperglycemia and significance of Glycemic Index and glycemic load f) Dietary fibre (insoluble dietary fibre, soluble dietary fibre) - nutritional significance g) Sugar alcohols <p>B. Lipids</p> <ol style="list-style-type: none"> a) Classification, sources, essential fatty acids (sources), functions b) Digestion, absorption & transport. c) Metabolism of fatty acids- beta oxidation & biosynthesis of fatty acids, cholesterol functions, prostaglandin, recommendation for fat (SFA, MUFA, PUFA) d) Composition of various edible oils –its anti-atherogenic role 	15
<p>Unit III</p> <p>A. Protein</p> <ol style="list-style-type: none"> a) Classification of amino acids (chemical & nutritional), protein structure, b) Sources (animal protein versus plant protein, casein, whey protein, egg protein, wheat germ protein, soy protein) c) Digestion, absorption and transport d) Amino acid metabolism (brief outline) 	15

	<ul style="list-style-type: none"> e) Amino acid imbalances f) Significance of specific amino acid and biogenic amines(e.g. BCAA, glutamine, GABA, serotonin, histamine, creatine), disposal of ammonia (urea cycle without structure),protein synthesis. g) Recommended Dietary Allowances h) Evaluation of protein quality (NPR, NPU, DIAS,PDCAS, BV) <p>B. Enzymes</p> <ul style="list-style-type: none"> a) Definition, classification b) Enzyme specificity c) Factors affecting enzyme action d) Enzyme inhibition e) Enzymes of industrial significance <p>C. Vitamins</p> <ul style="list-style-type: none"> a) Vitamin stability, toxicity, dietary recommendations, bioavailability, General causes of losses and variations in vitamin content of foods. b) Fat soluble vitamins – A, D, E and K – structure, general properties and functions c) Water soluble vitamins – C and B- complex – structure, general properties and functions <p>D. Minerals</p> <ul style="list-style-type: none"> a) Macro minerals (Calcium, phosphorus, potassium, sodium & magnesium) & Micro minerals (Iron, zinc, copper, iodine,fluorine, chromium, selenium) b) Sources, Bio-availability, losses and stability, RDA, specific physiological and metabolic roles, deficiency, toxicity or effects of excess consumption. 	
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References

- Agarwal A., Udipi S. Textbook of Human Nutrition, Jaypee brothers Medical publishers (p) Ltd.
- Banji, M., Rao, N. P. and Reddy, V. (2003) Textbook of Human Nutrition, 2nd Edition, Oxford and IBH, New Delhi, India.
- Nelson D.L. and Cox M.M. (2004) Lehninger Principles of Biochemistry. 4th Edition, W. H. Freeman & Company, New York, U.S.A.
- Rastogi S.C. Biochemistry, Tata Mac Graw Hill Publishing Co. Ltd.
- Whitney, E. N.andRolfes, S. R. (1996) Understanding Nutrition, 7th Edition, West publishing Company, St. Paul, U.S.A.

Course code	Title	Periods/week	Marks	Credits
PSHSIBP101	FOOD SCIENCE PRACTICAL	3	50	2

Objectives:

1. To understand principles of food science involved in bringing changes in foods.
2. To observe and identify physical and chemical changes underlying the preparation of diverse foods.

Course content	Periods
Unit I A. Solutions and Ice crystallization: a) Effect of formula and procedure on crystal size of frozen deserts B. Sugar cookery a) Tests for stages of sugar cookery b) Effect of dry heat on sucrose. c) Crystalline and Non crystalline candies	15
Unit II A. Cereals and Flours a) Gelatinization of Starch (different types) b) Comparison of different cereals for water absorption and consistency c) Comparison of - different methods of cooking rice, different varieties of rice d) Starches as thickening agents (potato, corn and other) B. Temporary and Permanent emulsions a) Salad Dressings b) Effect of Stabilizers and Emulsifiers in salad dressings c) Comparisons of low fat and high fat French dressing d) Preparation and Comparison of Mayonnaise with variations (with and without egg) C. Principles that maintain high quality fried foods a) Smoke point of different fats and oils b) Effect of Temperature on fat absorption c) Effect of Formulation on fat absorption d) Effect of Coating and binding agents on fat absorption e) Comparison of Texture, flavor and mouth-feel of food products using fat substitutes	15
Unit III A. Effect of different conditions on properties of proteins e.g milk a) Effect of acids (citric acid, lactic acid and acetic acid) on coagulation of milk proteins b) Effect of gums on gelation c) Effect of fat content, pH stabilizers in cream and whipped toppings d) Difference between natural and processed Cheese B. Examination of properties of egg/meat a) Denaturation and Coagulation b) Egg white foams – volume and stability c) Effect of acid and alkalies on meat/poultry C. Factors affecting Gelatin gel a) Temperature of liquid b) Proteolytic enzymes c) Whipping D. Factors affecting vegetable pigments a) Temperature b) Acid, c) Alkalies E. Pectin gel a) Determination of pectin content, development of a fruit jam, using natural and commercial pectin.	15

References

- Jameson K. (1998). *Food Science – A Laboratory Manual*, New Jersey:Prentice Hall Inc.
- Lawless, H. and Heymann, H. (1998).*Sensory Evaluation of Food – Principles and Practices*, Kluwer Academic/Plenum Publishers.USA: CRC Press Inc..
- McWilliam, M.(2001). *Foods – Experimental Perspectives* (4th Ed.), New Jersey: Prentice Hall Inc.
- Weaver, C. (1996), *Food Chemistry Laboratory – A manual for Experimental Foods*
- Damodaran S., Parkin KL. and Fennema OR. *Fennema's Food Chemistry*(4th Edition), Florida: CRC Press

Course code	Title	Periods/week	Marks	Credits
PSHSIBP102	ANALYTICAL FOOD CHEMISTRY-I	3	50	2

Objectives:

1. To impart required knowledge and skills for estimation of various macro and micro nutrients in raw and processed foods.
2. To impart required knowledge and skills for estimation of various non nutrient components in raw and processed foods.
3. To impart the knowledge and skills for detection of common food adulterants.
4. To compare the estimated values with the recommended values and thereby assess the quality of foods.

Course content		Periods
Unit I	a) Estimation of ash content in different foods. b) Estimation of moisture content by air oven method c) Estimation of calcium content in different foods. d) Modified Gravimetric determination of calcium e) Calcium determination using EDTA titration f) Calcium determination using redox titration g) Determination of phosphorous content of foods by colorimetry h) Determination of phytin phosphorus in foods i) Estimation of iron content of different foods by colorimetric methods j) Mohr titration of salt in butter (AOAC method 960.29)	15
Unit II	a) Determination of iodine content in salt b) Estimation of reducing and non reducing sugars in different foods by Lane Eynon's method.	15
Unit III	a) Titrable acidity assessment in orange juice, yogurt, apple juice and grape juice b) Estimation of tannin content in tea c) Sodium content in different foods by Flame photometric method d) Potassium content in different foods by flame photometric method	15

References

- Nielsen, S. Suzanne (ed) (2002) Introduction to the Chemical Analysis of Foods CBS Publishers and Distributors, New Delhi.
- Egan, H. Kirk, r. sawyer R (1981) Pearsons Chemical Analysis of Foods 8th edition longman scientific and Technical, U.K.
- A.O.A.C. (1990) Official Methods of Analysis 15th ed. Association of official analytical chemists, Washington, D.C.
- Meyer, L.H (1987) Food Chemsitry CBS Publishers and distributors, Delhi
 ISI Publications on different foods.
- Pearson, D.(1970) Chemical Analysis of Foods, 6th ed., London, T.A. Churchill.
- Damodaran S., Parkin KL. and Fennema OR. *Fennema's Food Chemistry*(4th Edition), Florida: CRC Press

M.Sc. (HOME SCIENCE) BRANCH IB : FOOD PROCESSING AND PRESERVATION

SEMESTER II

Course Code	Title	Theory/ Practical	Internal Marks	Semester End Exam	Total Marks	Periods/ week	Credits
PSHSI201	Research Methods and Biostatistics - Paper II	Theory	40	60	100	3	4
PSHSIB202	Principles of Food Preservation	Theory	40	60	100	3	4
PSHSIB203	Food Informatics and Packaging	Theory	40	60	100	3	4
PSHSIB204	Principles of Food Analysis	Theory	40	60	100	3	4
PSHSIB205	Advances in Human Nutrition	Theory	40	60	100	3	4
PSHSIBP201	Food Product Development Practical	Practical	-	50	50	3	2
PSHSIBP202	Analytical Food Chemistry-II Practical	Practical	-	50	50	3	2
	Total		260	340	600	21	24

Course code	Title	Periods/week	Marks	Credits
PSHSI201	RESEARCH METHODS AND BIostatISTICS PAPER II	3	100	4

Objectives:

1. To enable in students the skills in selecting, computing, interpreting and reporting statistics.
2. To introduce students to principles of good scientific writing.

Course content		Periods
Unit I	A. Role of statistics in research <ol style="list-style-type: none"> a) Measures of central tendency: Mean, Median, Mode b) Measures of dispersion: Range, Interquartile range, Variance and Standard Deviation c) Normal distribution and normal curve d) Testing of Statistical Hypothesis e) Type I and Type II errors f) Guidelines for selecting an appropriate test 	15
Unit II	A. Statistical tests- Applications and interpretation <ol style="list-style-type: none"> a) Parametric test of difference- T-test, ANOVA, Post Hoc tests b) Parametric tests of association- Pearson's correlation coefficient c) Non parametric tests of difference- Chi-square d) Regression Analysis B. Computer applications in analysis of data <ol style="list-style-type: none"> a) Introduction to SPSS- Application of SPSS (Demonstration) 	15
Unit III	A. Interpretation and Presentation of data <ol style="list-style-type: none"> a) Tables- Frequency distributions, Relative Frequency, Graphs- Bar graphs, Histograms, Scatter plots, Line graphs; Pie charts, Pictogram b) Preparation of research report/ Publication of scientific research articles c) Research Proposal Writing for Funding and Academic Purposes B. Information search and data retrieval <ol style="list-style-type: none"> a) Use of internet to extract evidence b) Tools for web search/ web search engines (PubMed, Cochrane Databases, Google Scholar, ResearchGate), data mining of biological databases 	15

References

1. Mahajan B.K. (2010). Methods in Biostatistics for Medical students and Research Workers, Jaypee Brothers Medical Publishers (P) Ltd.
2. Pagano, M. and Gauvreau, K. (2011). Principles of Biostatistics. Cengage Learning India Private Limited.
3. Bhattacharyya, G.K. & Johnson, R. A. (1977). Statistical Concepts and Methods. NY: John Wiley.
4. Dwivedi, R. S. (1997). Research Methods in Behavioral Sciences. Delhi: Macmillan India.
5. Gravetter, F. J. & Wailnau, L. B. (2000). Statistics for the Behavioral Sciences. Belmont, CA: Wadsworth/Thomson Learning.
6. Kerlinger, F. N. & Lee, H. B. (2000). Foundations of Behavioral Research. Orlando, Florida: Harcourt.
7. Leong, F.T.L., & Austin, J. T. (Eds.) (1996). The Psychology Research Handbook. New Delhi: Sage

Course code	Title	Periods/week	Marks	Credits
PSHSIB202	PRINCIPLES OF FOOD PRESERVATION	3	100	4

Objective:

To learn important methods for food preservation are to ensure the quality of processed food.

Course content	Periods
Unit I A. Principles of Food Preservation a) Meaning, mode of action and changes in foods B. Use of High temperature (Heat preservation) a) Moist and Dry heat methods b) Blanching c) Dehydration d) Concentration e) Canning f) Commercial sterilization g) Pasteurization C. Use of Low Temperatures a) Cold Preservation: Freezing and Refrigeration- Air freezing b) Indirect contact freezing c) Immersion freezing d) Dehydro-freezing e) Cryo-freezing f) Changes in foods during refrigeration and frozen storage D. Use of dehydration and Concentration a) Benefits and factors affecting heat and mass transfer b) Physical and chemical changes during dehydration and concentration c) Methods and techniques used (Air convection, drum driers and vacuum driers) d) Use of various evaporators for concentration of foods	15
Unit II A. Use of Ionizing radiation and microwave heating a) Ionizing radiations and sources b) Units of radiation c) Radiation effects d) Mechanism of microwave heating e) Application of radiation technology B. Use of Fermentation a) Benefits and mechanisms of fermentation b) Fermented food products e.g Beer, Wine, Soya sauce, Cheese, Soya bean products c) Microbial vs Industrial Fermentation C. Use of Food Additives a) Broad classes b) Intentional and unintentional food additives c) Laws and regulations D. Food Enzymes and their applications in Food industry. E. Application of Hurdle Technology	15
Unit III Traditional Methods of Food Preservation a) Smoking b) Sun drying c) Pickling/ Salting	15

	d) Fermentation Recent advances in food preservation a) Pulse electric field special packaging b) Use of technology for minimal processing for preservation of fresh foods c) Use of Antioxidants in food preservation d) Cold pressed juices e) Use of Natural Preservatives f) Preservatives on food labels	
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- Manay, N. S. and Sharaswamy, S. M. (1997). *Foods: Facts and Principles* New Delhi: New Age International Publishers.
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- Rick Parker (2003) *Introduction to Food Science*, New York: Delmar Thomson Learning.
- Scottsmith and Hui Y.H (Editors) (2004) *Food Processing – Principles and Applications* London Blackwell Publishing.
- Subbulakshmi, G and Udipi, S. A. (2001). *Foods Processing and Preservation*, New Delhi: New Age International (P) Ltd. Publishing.
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- Vacklavick, V. and Christian, E. (2003). *Essentials of Food Science*. New York: Kluwer Academic/ Plenum Publisher.
- ** All new journals related to Food Preservation**

Course code	Title	Periods/week	Marks	Credits
PSHSIB203	FOOD INFORMATICS AND PACKAGING	3	100	4

Objective:

To enable use of IT to make food-related information available for food researchers.

Course content		Periods
Unit I	Introduction to Food Packaging: Packaging Trends- Global Scenario a) Functions/ Objectives/ Purpose of food packaging b) Requirements for effective packaging c) Variations in Packaging d) Package design requirements e) Food Packaging Materials (types, special features) f) Packaging Closures and Sealing Systems g) F.F.S. Operation h) Logistical Packaging for Food Marketing Systems i) Testing and Quality Control j) Shelf-life evaluation of Packaged Food Products k) Application of Nano Technology Environmental concerns and future prospects	15
Unit II	Introduction to food informatics a) Role of food informatics in food research b) Use of food informatics in food science laboratories and food industries c) Important search engines d) Software and IT skill requirements to build a food database e) Application in major centers of food research in India - CFTRI, DFRL & CIFT, Food Research & Development, Ministry of Food Processing Industries and major Food Industries in India, APEDA and MPEDA f) Careers in food informatics	15
Unit III	Application of Food Informatics a) Avenues for application of food informatics b) Data collection, organization in areas of food science and nutrition. c) Data storage and distribution by using various information technology tools and methods. d) Database management system. e) Application of various software f) Visit to laboratory/facility to see demonstration of the software	15

References

Food Packaging Technology Hand book NIIR New Delhi
Food packaging – Principles & Practice Gordon L Robertson
Food informatics textbooks

Course code	Title	Periods/week	Marks	Credits
PSHSIB204	PRINCIPLES OF FOOD ANALYSIS	3	100	4

Objectives:

1. To familiarize students with the principles underlying various analytical methods.
2. To help understand criteria to select appropriate food analysis method.

Course content	Periods
Unit I A. Introduction to Food Analysis a) Trends and demand, consumer and food industry, steps in analysis, choice and validity of method, criteria for choice of food analysis methods, role of AOAC International b) Sampling and sample preparation. c) Brief overview of physical, chemical, Instrumental and Gravimetric methods of analysis. B. Compositional Analysis of foods a) Moisture and total solid analysis, ash analysis b) Total fiber analysis c) Protein analysis d) Carbohydrate analysis (mono, oligo and polysaccharides, starch and starch derivatives) e) Vitamin and mineral analysis	15
Unit II A. Chemical properties and characteristics of foods a) pH and titrable acidity b) Fat characterization – Analysis of fatty acids, oil fat indices. c) Protein separation, characterization procedures, amino acid composition, Application of enzymes in food analysis, Immunoassays d) Spectroscopy – Basic principles of spectroscopy, ultra violet, visible and fluorescence spectroscopy. Atomic absorption and emission spectroscopy	15
Unit III A. Physical properties of foods B. Chromatographic techniques a) Principles of chromatography b) Types of chromatographic techniques – HPLC, Gas chromatography C. Rheological principles used for food analysis a) Viscosity of liquids b) Solutions and fine suspensions D. Pigments and colourants a) Extraction, isolation, purification b) Measurements of natural pigments and colour analysis E. Thermal Analysis a) Principles and procedures of calorimetry b) Differential scanning of calorimeters.	15

References

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2. Wrolstad R.E. et al (2005). *Handbook of Food Analytical Chemistry: Water, Protein, Enzymes, Lipids and Carbohydrates*. Published by John Wiley and Sons
3. Wrolstad R.E. et al (2005). *Handbook of Food Analytical Chemistry: Colourants, Flavours, Textural and Bioactive food components*. Published by John Wiley and Sons
4. Egan H., Kirk R., Sawyer R., (1981). *Pearson's Analysis of Foods. (8th Edition) Longman Group Limited*
4. Dr. Latimer G. W., Jr.(2012) (19th Ed). *Official Methods of Analysis of AOAC International: Volume I and II*.
5. ** All new journals related to Food Science and Processing**

Course code	Title	Periods/week	Marks	Credits
PSHSIB205	ADVANCES IN HUMAN NUTRITION	3	100	4

Objectives:

- To understand the role of nutrition in health and disease
- To understand the role of various bio-active compounds in health promotion, disease prevention and management

Course content		Periods
Unit I	Overview of Nutrition and Digestive System <ol style="list-style-type: none"> Nutrition and Metabolism of Carbohydrates Fiber in Nutrition and Health Nutrition and Metabolism of Lipids Nutrition and Metabolism of Protein and Amino acids Ultratrace minerals Integration and Regulation of Metabolism and The Impact of Physical Activity Body Composition, Energy Expenditure, and Energy Balance 	15
Unit II	Nutrient requirements <ol style="list-style-type: none"> RDA, AI, RDI, TUL, EAR Methods of determining RDAs National vs International dietary standards Food pyramid, food plate Concerns of RDAs for vulnerable groups of population Role of nutrition in health and disease <ol style="list-style-type: none"> Metabolic and lifestyle disorders (diabetes, cvd etc) Nutragenomics and Inborn Errors of Metabolism 	15
Unit III	Complementary Nutrition <ol style="list-style-type: none"> Role of selected bioactive constituent Functional foods and nutraceuticals in health promotion, disease prevention and management. Beta glucan/ Arabinoxylan/ Resistant starch Bioactive peptides and GABA Ω-3 fatty acids, CLA, Phytosterols Probiotics/ Prebiotics/Synbiotics Phytochemicals (Phenolics/ Flavanoids/ Carotenoids/ Isoflavones) 	15

References

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- Judith E. Broch (1998) *Nutrition Now*, West/wadsworth International Thomson Pub.Co.
- Goodhart R.S.S and Shils, M.E (1998) *Modern nutrition in health and disease*. Philadelphia Lea and Febiger.
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- Paul, I, Turner, E.R., Ross, Don – 2006 (2nd ed.) *Discovering Nutrition* – Jones and Bartlett Publishers – Canada.
- Prakash D. (2014). Phytochemicals of Nutraceutical Importance, CAB International
- Wildman R.E.C (2016). Nutraceuticals and Functional Foods, 2nd edition, CRC Press

Course code	Title	Periods/week	Marks	Credits
PSHSIBP201	FOOD PRODUCT DEVELOPMENT	3	50	2

Objectives:

1. To apply principles of food science in development of innovative product.
2. Use of functional foods, novel (less utilized) ingredients in development of products.
3. To identify a suitable packaging label and storage conditions for a developed product.
4. To learn and apply principles of sensory evaluation.

Course content	Periods
<p>Unit I</p> <p>Food Product Development</p> <ol style="list-style-type: none"> a) Hypothetical proposal for new product development b) Nutritive value of foods, Enhancement of Nutritive Value c) Role of Ingredients d) Understanding weights and measures, metric conversions e) Use of Ready Reckoners /Exchange list/ NIN Food database/ USDA Food Database f) Construction of Recipes (Standard, File Card format, Picture recipes) g) Waste Utilisation, Cost Effectiveness, Value Addition <p>Sensory evaluation of foods</p> <ol style="list-style-type: none"> a) Threshold concentrations of primary tastes. b) Effect of Temperature on taste. c) Identification of samples through Difference, Descriptive and Affective testing d) Determination of sensory evaluation methods for evaluating quality e) Developing score card as an evaluation tool 	15
<p>Unit II</p> <p>Food Product Development laboratory trials</p> <ol style="list-style-type: none"> a) Categories: Fruit based snacks, Long shelf life snacks, High protein snacks/beverages (whey protein), Ready to eat breakfast cereal, Probiotic yoghurt/ beverage, Salad dressing, Low fat snack product b) Development of the formula (Modification of Home based recipes for Innovation) c) Preparing a flow chart indicative of the operational processes d) Understanding the concept of scale up e) Identifying suitable packaging material f) Shelf life studies in various altered conditions 	15
<p>Unit III</p> <p>Marketing exercise</p> <ol style="list-style-type: none"> a) Business Analysis b) Marketing Strategy c) Launching of the product d) Evaluation of product acceptability on the basis of cost effectiveness and other e) nutritive parameters through survey 	15

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- Lawless, H. and Heymann, H. (1998).*Sensory Evaluation of Food – Principles and Practices*, Kluwer Academic/Plemer Publishers.
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Course code	Title	Periods/week	Marks	Credits
PSHSIBP202	ANALYTICAL FOOD CHEMISTRY-II	3	50	2

Objectives:

1. To impart required knowledge and skills for estimation of various macro and micro nutrients in raw and processed foods.
2. To impart required knowledge and skills for estimation of various non nutrient components in raw and processed foods.
3. To impart the knowledge and skills for detection of common food adulterants.
4. To compare the estimated values with the recommended values and thereby assess the quality of foods.

Course content		Periods
Unit I	a) Determination of crude fiber in different foods. b) Protein estimation in different foods by Kjeldahl method, Lowry's method and Biuret and Bradford method. c) Crude fat determination by solvent extraction method d) Fat characterization with respect to the determination of the following: e) Refractive index, melting point, solid fat index, cold test, smoke point,	15
Unit II	a) Iodine value b) Saponification number c) Acid value d) Free fatty acids value e) Peroxide value f) Estimation of thiamin content of foods by Fluorimetric method. g) Estimation of riboflavin content of foods by Fluorimetric method. h) Estimation of ascorbic acid content of different foods by 2,6 dichloro indophenol method	15
Unit III	a) Different chromatographic techniques: Paper chromatography, Thin layer chromatography and HPLC techniques b) Estimation of lycopene in tomatoes c) Estimation of oxalates from spinach d) Estimation of Total Polyphenol content in green tea e) Estimation of chlorophyll extract in leafy vegetables by spectrophotometric method. f) Visit to Research Institutes and Food Industries	15

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