

M.Sc. in Food Science

SYLLABUS (2018-19)



**CENTER FOR FOOD SCIENCE &
TECHNOLOGY**

SAMBALPUR UNIVERSITY

JYOTI VIHAR

**Courses of Studies for the M. Sc Food Science & Nutrition Examination
(Under Course Credit Semester System)
Effective from First Semester Examination, 2018-19**

FIRST SEMESTER

Course No.	Title	Credit Hour
FS. 411	Food and Food products	4 (Theory)
FS. 412	Food Microbiology	4 (Theory)
FS. 413	Food Chemistry	4 (Theory)
FS. 414	Basic Concepts of Nutrition	4 (Theory)
FS. 415	Practical related to 411&412	4 (Practical)
FS. 416	Practical related to 413&414	4 (Practical)
NON-CREDIT/ADD-ON	ANYONE:	00

- | | |
|---------------------------------------|-----------|
| 1. Soft and IT Skills | |
| 2. Leadership/Personality Development | |
| Total | 24 |

SECOND SEMESTER

Course No.	Title	Credit Hour
FS. 421	Food ingredients, Additives and Neutraceuticals	4 (Theory)
FS. 422	Techniques in Food Analysis	4 (Theory)
FS. 423	Food Safety and Quality Control	4 (Theory)
FS. 424	Food Processing and Preservation	4 (Theory)
FS. 425	Practical related to 421 & 422	4 (Practical)
FS. 426	Practical related to 423 & 424	4 (Practical)

Total	24
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THIRD SEMESTER

Course No.	Title	Credit Hour
FS. 511	Food Packaging and Post harvest Technology	4 (Theory)
FS. 512	Statistical Methods in Food Science	4 (Theory)
FS. 513	Food Biotechnology & By-product Utilization	4 (Theory)
FS. 514	Elective Paper(Any one)	4 (Theory)
	(a) Beverages, Bakery and Snacks food technology	
	(b) Dairy Technology	
	(c) Food Engineering	
	(d) Nutrition and Dietetics	
FS. 515	Practical related to all theory papers	4 (Practical)
FS. 516	Seminar-I	2
NON-CREDIT/ADD-ON	ANYONE:	00

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|-------------------------------------|-----------|
| 1. Communicative English | |
| 2. Entrepreneurship and Development | |
| Total | 22 |

FOURTH SEMESTER

Course No.	Title	Credit Hour
FS. 521	Term paper/Review paper	2
FS. 522	Final Dissertation & Viva-voice	12+2
FS. 523	Seminar-II	2
FS. 524	Industrial Tour Report	2
Total		20

Instruction to Paper Setters

1. In theory papers questions will be set unit-wise with 2 questions from each unit (total 8 questions).The students shall answer any one question from each unit.
- 2.60% of the questions shall be long-answered type and 40% short-answered

FIRST SEMESTER

Course No: FS. 411 Food and Food Products

4CH

Objective: To develop the skills for structural, compositional and nutritional importance of various foods and their processed products.

Learning Outcome:

- ❖ Students will have a thorough understanding of various cereals, legumes and their value added products after processing.
- ❖ The students will know the specifications of various products, their variation in composition basis and nutritional details after certain processing.

UNIT-I

Cereals: Structure of cereal grains, composition, processing and storage of some common cereals (Rice, Wheat, Maize, Oats) ;Pulses: composition, nutritive value, processing and storage of some common pulses(Bengal gram, Black gram, Horse gram, Green gram); Nuts & plantation crop: processing, nutritional value of some common nuts(Coconut, Ground nut, Almond, Cashewnut), tea, coffee and cocoa.

UNIT-II

Fruits: Composition, Processing, nutritive value, fruit ripening and storage of fruits, processing of juices, candy, preserve, dried powder, ketch up, sauce, jam and jellies; Beverages: Composition, classification and Processing of Carbonated Beverages Vegetables: Classification, composition, processing of some common vegetables like pickles, potato chips; Spices: Composition, flavoring compounds, processing, nutritive value, adulteration of some common spices of India.

UNIT-III

Meat: Structure, composition, Slaughtering types, post-mortem changes and grading of meat, tenderization and curing of meat; Poultry: composition, classification, nutritive value and processing; Egg: Structure, composition, classification, nutritive value and processing; Fish: composition, classification, nutritive value and processing.

UNIT-IV

Milk and milk products: composition, physic-chemical properties of milk and nutritional importance of milk, processing of milk, Classification and study of milk products- Cream, Butter, Ghee, Khoa, Chhanna, Paneer, Cheese, Ice-cream, Fermented milk products. Various defects in milk products.

References:

1. Food Facts and Principles -N. ShakuntalaManay& M. Shadaksharaswamy, New Age International (P) Limited, New Delhi.
2. Food Science – B.Srilakshmi, New Age international (P) Limited, New Delhi.
3. Essentials of Food & Nutrition-M.Swaminathan-vol I &vol II.
4. Nutrition: An Integrated Approach- Pike & Brown
5. Principles of Nutrition E.D Wilson,K.H.Fisher&M.C.Faqua
6. Food Science- N.Potter&J.H.Hotchkiss- CBS Publishers & Distributors, New Delhi.
7. Encyclopedia of Food Science(1-3 volume) Anmol Publications.

Course No: FS. 412

Food Microbiology

4CH

Objective: To develop the skills for structural variation of micro-organisms, various types of spoilage in food and its remedy.

Learning Outcome:

- ❖ Students will have a thorough understanding of various factors responsible for food spoilage.
- ❖ The students will know the specifications of various contamination sources and disease developed in certain processed products.
- ❖ Students will have a thorough understanding of importance of hygiene and sanitation in during food processing.

UNIT-I

Introduction to food Microbiology: Growth and survival of microorganisms in foods (Yeast, Mould, Bacteria); Factors affecting growth of microorganism: Intrinsic, Extrinsic; Physical and chemical methods to control microorganisms, General principles of spoilage, Biochemical changes caused by microorganisms; microbes in food fermentation, putrefaction, lipolysis; Antagonism and synergism in microorganism; General concept of Prebiotics, probiotics and symbiotic; Principle of food preservation by controlling growth of microorganism (asepsis, high temp., low temp.,)

UNIT-II

Contamination, Preservation and Spoilage of different kind of foods-cereal, Pulses, Fruit and Vegetable, Meat, fish egg, poultry and their processed products, Milk and milk Products, Canned foods and Beverages.

UNIT-III

Food toxicology & food borne illness: Food hazards microbiological, nutritional, environmental, natural toxicants, pesticides, food additives, preservatives, food borne illness: (Clostridium, botulinum, Escherichia coli, Brucella, Bacillus, Salmonella, Staphylococcus) Non bacterial agent & food borne illness, (Helminths & Nematodes, protozoa, toxic algae, fungi & food borne viruses

UNIT-IV

Microbial Food hygiene and sanitation: Method for microbial examination of food: indicator organisms, direct examination, cultural techniques, Rapid methods in detection of microorganisms. Contamination during handling, processing and its control.

References:

1. Food Microbiology – M.R.Adams&M.O.Moss, New Age International (P) Limited, New Delhi.
2. Food Facts and Principles -N. ShakuntalaManay& M. Shadaksharaswamy, New Age International (P) Limited, New Delhi.
3. Food Microbiology – William C.Frazier, Tata McGraw Hill publishing Company limited, New Delhi.
4. General Microbiology – Power &Daginawala, Himalaya Publishing House, Mumbai. (vol-II)
5. Basic Food Microbiology – G. Banwart, CBS Publishing & Distributors.
6. Modern Food Microbiology – Jay, James, Aspen publishers.
7. Microbiology- M.I.Pelear&R.D.Reid McGraw Hill Book Company, New York.
8. Food Hygiene & Sanitation – S.Roday- Tata McGraw Hill, New Delhi.
9. Modern Food Microbiology: J.M.Hay, CBS Publications & Distributions..

Course No: FS. 413

Food Chemistry

4CH

Objective: To develop the skills for structure, functions, metabolism of various components of food and their role in body.

Learning Outcome:

- ❖ Students will have a thorough understanding of structure and classification various components of food.
- ❖ The students will know the process of complete digestion and assimilation of food component.

UNIT-I

Carbohydrates: classification and chemical structure of carbohydrate; chemical properties, nutritive roles of carbohydrate, important carbohydrates in food (glucose, sucrose, starch, agar, glycogen, cellulose, pectin, Gums and resins); Carbohydrates: digestion, absorption, metabolism (glycolysis, citric acid cycle, glycogenesis, Glycogenolysis, Gluconeogenesis, hexose monophosphate pathway), Blood sugar level and equilibrium.& effect of deficiency.

UNIT-II

Amino acids and its classification, essential amino acids; Proteins: properties, classification, structure of proteins (primary, secondary, tertiary, quaternary), protein denaturation, Protein: Digestion, absorption, transportation and metabolism of Protein (Nitrogen balance, transamination & deamination of protein, urea cycle and biosynthesis of protein), Functional properties of protein & effect of deficiency.

UNIT-III

Lipid: role of lipid in body, structure, classification and physiochemical properties of Lipids, Chemical aspects of lipolysis-rancidity, Lipids: Digestion, absorption, transport and Metabolism of lipids, importance of lipo -protein, oxidation of fatty acids, fatty acid synthesis, metabolism of cholesterol, triacylglycerol and phospholipids- their role in health & diseases.

UNIT-IV

Water: physical properties, structure of water molecule, Role and types of water in Food, water activity and sorption isotherm, Importance of dietary fiber in body, Enzymes: properties, classification, kinetics and mechanism of

enzyme inhibition. Terpenoids and alkaloids: Definition, Classification, Structure, Biosynthesis, Properties, Extraction, Biological Role. Naturally occurring phenolic compounds: Definition, Classification, Structure, Biosynthesis, Properties and Biological Role.

References:

1. Aurand, L.W. and Woods, A.E. 1973. Food Chemistry. AVI, Westport.
2. Birch, G.G., Cameron, A.G. and Spencer, M. 1986. Food Science, 3rd Ed. Pergamon Press, New York.
3. Fennema, O.R. Ed. 1976. Principles of Food Science: Part-I Food Chemistry. Marcel Dekker, New York.
4. Meyer, L.H. 1973. Food Chemistry. East-West Press Pvt. Ltd., New Delhi. Potter, N.N. 1978. Food Science. 3rd Ed. AVI, Westport.
5. Belitz HD.1999. *Food Chemistry*. Springer Verlag. DeMan JM. 1976. *Principles of Food Chemistry*. AVI.
6. Fennema OR.1996. *Food Chemistry*. Marcel Dekker.
7. Meyer LH. 1987. *Food Chemistry*. CBS.

Course No: FS. 414

Basic Concepts of Nutrition

4CH

Objective: To develop the skills nutritional need during various stage of life and their assessment procedures.

Learning Outcome:

- ❖ Students will have a thorough understanding of structure and classification various minor components of food.
- ❖ The students will know the process of nutritional need during growth and ageing process in detail.
- ❖ The student will have thorough understanding of various procedures followed for nutritional status of and individual and role of certain agencies and NGO's in combating malnutrition.

UNIT-I

Food as a source of nutrients: classification of nutrients; functions, recommended dietary allowances, BMR, SDA. Vitamins: (A, B complex, C,D, E & K)& all major and minor mineral elements with their role in body , importance of Roughages in the diet. Water& electrolytes balance.

UNIT-II

Nutritional Needs: Nutrition during infancy, childhood, adolescence and adult, nutrition during pregnancy& lactation, nutrition in later maturity period, nutrition and infection, nutrition and immunity, nutrition & stress.

UNIT-III

Nutritional Assessment: Assessment of nutritional status by direct & indirect methods, use of various methods for the assessment of nutritional status, anthropometric assessment, clinical examination, bio-physical or radiological measurement, functional assessment, laboratory & biochemical assessment, dietary assessment, vital health statistics.

UNIT-IV

Nutritional problems: food intake and its regulation, food pattern, population and food production, malnutrition, background problem of malnutrition in India ecology of malnutrition, effect of malnutrition on vulnerable society, impact of malnutrition on national development, major to combat malnutrition, national nutrition policy and programmes, National and International agencies in combating malnutrition.

References:

1. Human Nutrition and Dietetics – S. Davidson & R. Passmars.
2. Essentials of Food and Nutrition – M. Swaminathan, vol. I & II, The Bangalore printing and Publishing Co. Ltd.
3. Human Nutrition and Dietetics – Davidson, Passmore, East wood, English Language Book Society (ELBS).
4. Dietetics – B.Srilakshmi; New age International (P) Limited, New Delhi.
5. Nutrient Requirements and Recommended Dietary Allowances for Indians – Indian Council of Medical Research, National Institute of Nutrition, Hyderabad.
6. Text Book of Human Nutrition – Mahtab. S. Bamji; N.Pralhadrao&Vinodini Reddy, Oxford & IBH Publishing Co. Pvt.Ltd
7. Principles of Nutrition – Fisher and Fuqua, wiley eastern Private Limited, New Delhi.

Course No: FS. 415

Practical related to 411&412

4CH

Course No: FS. 416

Practical related to 413&414

4CH

SECOND SEMESTER

Course No: FS. 421

Food Ingredients, Additives & Nutraceuticals

4CH

Objective: To develop the skills on the properties of food and various ingredients and their role in food products.

Learning Outcome:

- ❖ Students will have a thorough understanding on properties of food.
- ❖ The students will know the important nutritional component for therapeutic aspect of food.
- ❖ The student will have thorough understanding of various types of additives to be added and their role in respective food items.

UNIT-I

Properties of solid and liquid foods: Physical properties (solutions, vapor pressure, boiling point, freezing point, osmotic pressure, viscosity, surface and interfacial tensions, specific gravity), Dispersion systems in foods - Sol, Gel, Foam, Emulsion; Food preparation: Objective and method of cooking, cooking media, changes during cooking,

UNIT-II

Food pigments and colors: Some common pigments used in food industry (chlorophylls, myoglobin, anthocyanin, betalain, carotenoids, synthetic colors & lake /dye colors and other colourants); Flavors: types of flavor, flavor compounds, extraction principles of flavor, Sensation- smell sensation, texture sensation, visual appearance and sensation of taste.

UNIT-III

Food additives: definition, need and classification of food additives, preservatives - Natural and Artificial, antioxidants, chelating agents, coloring agents, curing agents, Emulsions, flavors and flavor enhancers, leavening agents, nutritional supplements, non-nutritive sweeteners, pH control agents, stabilizer and thickeners, humectants, anti-caking agents, firming agent, clarifying agent, flour bleaching agents.

UNIT-IV

Nutraceuticals and phytochemicals: definition, Classification. Dietary supplements, Functional foods - their legislation and health claims, Natural occurrence of certain photo-chemicals. Antioxidants and flavonoids: omega - 3 fatty acids, carotenoids, dietary fiber, phytoestrogens; Nutraceuticals for effective control of disease or health benefit with adequate safety. Role of nutraceuticals against - skin health/ageing, bone health, eye health, mental health, cardiovascular health, cancer prevention etc. Safety, adverse effect and interactions of nutraceuticals.

References:

1. Food Facts and Principles - N. Shakuntala Manay & M. Shadaksharaswamy, New Age International (P) Limited, New Delhi.
2. Branen AL, Davidson PM & Salminen S. 2001. *Food Additives*. 2nd Ed. Marcel Dekker.
3. George AB. 1996. *Encyclopedia of Food and Color Additives*. Vol. III. CRC Press.
4. George AB. 2004. *Fenaroli's Handbook of Flavor Ingredients*. 5th Ed. CRC Press.
5. Madhavi DL, Deshpande SS & Salunkhe DK. 1996. *Food Antioxidants: Technological, Toxicological and Health Perspective*. Marcel Dekker.
7. Morton ID & Macleod AJ. 1990. *Food Flavours*. Part A, BC. Elsevier.
8. Nakai S & Modler HW. 2000. *Food Proteins. Processing Applications*. Wiley VCH.
9. Stephen AM. (Ed.). 2006. *Food Polysaccharides and Their Applications*. Marcel Dekker.

Course No: FS. 422

Techniques in Food Analysis

4CH

Objective: To develop the skills on the quantification technique of various components, allergens present in food products.

Learning Outcome:

- ❖ Students will have a thorough understanding on the working principle and instrumentation of various instruments used in food analysis.
- ❖ The students will know the importance of various methods to identify any malfunction aspect of food.

UNIT-I

Nature and Concept of Food analysis, Basic instrumentation: Principle for pH meter, Dialysis, ultra filtration, Reverse osmosis. Centrifugation: Principle, Theory (RCF, Sedimentation coefficient) and types of Rotors, Ultracentrifugation, Calorimetry: Bomb calorimeter, Principle of Rheological Analysis- Rheological parameters, rheological methods, instruments and application, Texture profile analysis, Densimetry, Refractometry,

UNIT-II

Spectroscopic analysis of food components, Principle, instrumentation & application of Colorimetric (colorimeter, colourflex), UV-Vis spectrophotometer, Spectrofluorometer, IR, Atomic Absorption Spectroscopy, Mass spectroscopy, NMR and ESR.

UNIT-III

Chromatography: Theory & Principle, chromatographic parameter (partition coefficient, capacity factor, retention & dead time, Resolution & their calculation), components of chromatography & types (paper, thin layer, partition) Advance chromatography: GC, HPLC, HPTLC (principle, instrumentation & application). Separation technique & analysis: Electrophoresis: Paper & gel electrophoresis, PAGE, iso-electric focusing, 2D electrophoresis, Immuno electrophoresis.

UNIT-IV

Isotopic & immune techniques: Principle & theory of isotopic method, types, measurement & detection of radioactivity, Autoradiography, Immuno-techniques, Principle, antigen-antibody interaction, enzymatic immune assay- ELISA and its types. Different immuno techniques of antigen detection in food sample.

References:

1. Bioinstrumentation by .Veerakumari,
2. Biochemical & Molecular biology techniques. by Wilson & Walker,
3. Food Chemistry, Aurand, L.W. and Woods, A.E. 1973. AVI, Westport.
4. Principles of Food Science: Part-I Food Chemistry. Fennema, O.R. Ed. 1976 Marcel Dekker, New York.
5. Methods in Food Analysis. Joslyn, M.A. Ed. 1970. Academic Press, New York.
6. Developments in Food Analysis Techniques-1. Applied Science King, R.D. Ed. 1978 Publishers Ltd., London.
7. Separation Methods in Biochemistry 2nd Ed Morris, C.J. and Morris, P. 1976. Pitman Pub., London.
8. An Introduction to Practical Biochemistry. Plummer, D.T. 1971 Mc-Graw Hill Pub. Co., New York.
9. A Manual of Laboratory Techniques. Raghuramulu, N., Madhavan Nair, K., and Kalyanasundaram, S. Ed. 1983. National Institute of Nutrition, ICMR, Hyderabad.

Course No: FS. 423

Food Safety and Quality Control

4CH

Objective: To develop the skills on the standardization of food products with respect to quality maintain according to universal food standards worldwide.

Learning Outcome:

- ❖ Students will have a thorough understanding on the quality attributes, their measurement principle and instrumentation of various instruments used in food quality analysis.
- ❖ The students will know the importance of various methods to identify any adulteration aspect of food.
- ❖ Students will have a thorough understanding on various food laws with their amendments and regulation guidelines followed in national and international level.

UNIT-I

Concept of quality: quality attributes: physical, chemical, nutritional and microbial evaluation and measurement, physiochemical method, microscopic examination and physical method; Sensory evaluation: Sensory characteristics of food, sensory requirements, Types of sensory evaluation. Objective evaluation: Tests used for objective evaluation, application and limit, Instruments used for quality assessment-color & gloss, size & shape, defects, texture, Viscosity & consistency,

UNIT-II

Food adulteration and food toxins: common adulterant in food (milk and milk products, edible oils, cereals & pulses, prepared foods, spices, beverages); simple screening, control of food adulteration. Food Toxins: Natural anti-nutritional factors, microbial toxins. Food Toxicology: Dose-response, Measurement of toxicants and toxicity, Assessment of toxicity of evaluation of limits of contaminants in contexts of food safety. Food associated carcinogenesis, Food chemical carcinogens-sources and mechanism, food allergens, Industrial food processing and Packaging contaminants.

UNIT-IV

Quality assurance, Quality Control, Total Quality Management; GMP, GHP; GLP, GAP; Sanitary and hygienic practices; HACCP; Quality manuals, documentation and audits;

UNIT-V

Food laws and regulation: Mandatory and voluntary food laws, International quality systems and standards like ISO and Food Codex, BRC; International trades & federal agencies, Indian act-Food Safety and Standards Act, 2006, Various food acts- PFA,FPO,AGMARK, MMPO,MFPO, edible oil acts, standard weight acts.

References:

1. Subash. C Jain, International Marketing, 6th edition.
2. Varshney, R.L and Bhattacharya, B International markaetying management and Indian perspective, Sultan chand and sons, New Delhi.
3. Kohler P, Keller K.L, Koshy A, Jha M, 13th edition 2009, Marketing Management- A South Africa Perspective, Pearson Education, New Delhi.
4. Ramaswamy, V.S and Namakumari ,S.; 4th edition Marketing Manangement –Global Perspective- Indian Content, McMillan Publishers India Ltd, New Delhi.
5. Saxena, Rajan, 3rd edition; Marketing management, Tata McGraw Hill Publishing Company Ltd, New Delhi

Course No: FS. 424

Food Processing and Preservation

4CH

Objective: To develop the skills for processing of food after postharvest and use of various preservation techniques in food processing industries.

Learning Outcome:

- ❖ Students will have a thorough understanding of various food processing techniques.
- ❖ The students will know the importance of various preservation techniques.

UNIT-I

Basic concept of food processing and preservation: Reason of food Spoilage and Scope of food processing preservation; principles of food processing and preservation. Principle and preservation by low temperature: (refrigeration, freezing, and dehydro freezing; cold storage, frozen food), changes during freezing-physical and chemical changes. Processing and preservation by drying: factors affecting drying rate, types of dryer – (kiln, tray, drum, spray, tunnel, fluidized bed drying), types of drying technique (freeze drying, vaccum drying),

UNIT-II

Processing and preservation by heat: (blanching, pasteurization, sterilization, UHT processing, heating, dehydration, canning, Microwave cooking-(principle, changes during microwave cooking, advantages),difference between microwave and conventional heating, Use of Nano technology in food. Concentration and evaporation-(flash evaporator, falling film evaporator and multiple effect evaporators), changes during Concentration

UNIT-III

Processing and preservation by non-thermal method: irradiation, high pressure, pulsed electric field, high hydrostatic pressure, Hurdle technology: concept of hurdle technology and its application, Ultrasonic processing: Properties of ultrasonic, application of ultrasonic as processing techniques, ohmic heating, IR heating;

UNIT-IV

Food processing equipments: material handling, cleaning and grading, conveyors, size reduction, food grain storage, milling, Separation Technique: filtration, agitation and mixing. Baking, Roasting, Frying. Extrusion Technology-(principle, types of extruders).

References

1. Arsdel WB, Copley MJ & Morgan AI. 1973. *Food Dehydration*. 2nd Ed. Vols.I, II.AVI Publ.
2. Desrosier NW & James N.1977. *Technology of Food Preservation*.4th Ed. AVI.Publ.
3. Fellows PJ. 2005. *Food Processing Technology: Principle and Practice*. 2nd Ed. CRC.
4. Jelen P. 1985. *Introduction to Food Processing*.Prentice Hall.

Course No: FS.425

Practical related to 421&422

4CH

Course No: FS.426

Practical related to 423&424

4CH

THIRD SEMESTER

Course No: FS. 511 Food Post-harvest Technology and FoodPackaging

4CH

Objective: To develop the skills on the postharvest changes in plant based foods, their losses and to preserve food by suitable packaging.

Learning Outcome:

- ❖ Students will have a thorough understanding the unit operations followed for raw form to an edible form of cereals and legumes.
- ❖ The students will know the importance of various methods to identify any disorder in fresh commodities.
- ❖ Students will have a thorough understanding on various methods of preparation of food packaging materials, their defects and standards.
- ❖ The students will know the importance of packaging in food preservation, shelf-life determination and deterioration of nutritional components with the use of various types of packaging materials.

UNIT-I

Post harvest Technology: Importance, principles & scope of post harvest treatments, value-addition, and traceability; Post harvest technology for cereals, legumes, oilseeds and spices (cleaning, grading, milling), Hydrothermal treatment & conditioning of grains, Modern paddy and wheat parboiling-systems, equipment, Advances in heat transfer and fluid flow in grain processing operations. Crop drying methods/systems and Crop dryers-selection

UNIT-II

Post-harvest of fruits & Vegetables: physiological and biochemical changes in fruits and vegetables; ripening of climacteric and non-climacteric fruits. Physiological post harvest disorders - chilling injury and disease; prevention of post harvest diseases and infestation; Handling and packaging of fruits and vegetables; factors affecting post harvest losses; Standards and specifications for fresh fruits and vegetable.

UNIT-III

Packaging Fresh and Processed Food: Packaging requirement for different foods and processing methods- Types (paper, glass, metal container and plastic), varieties, and trends; protective packaging of foods; packaging of food products sensitive to oxygen, light, moisture; special problems in canned foods. Permeability – theoretical consideration permeability of gases and vapours, permeability of multilayer packages, permeability in relation to products.

UNIT-IV

Food packaging: Packaging material, packaging system and methods- vacuum packaging, gas flush packaging, aseptic packaging, modified atmosphere packaging (MAP), controlled atmosphere packaging (CAP), active packaging ,retort pouch technology Packages of radiation stabilized foods, microwave packaging, bio-degradable packages, aseptic and edible package. Food Labelling and barcode technology. Packaging of convenience foods; packaging of food products-fruits and vegetables; packaging requirements of fresh fruits and vegetables; packaging of fruit juices, spices, meat & poultry, fish, seafood; criteria for selection of proper packaging based on the shelf life desired, diary product, beverages, cake and snacks food.

References:

1. Kadar AA.1992. *Post-harvest Technology of Horticultural Crops*.2nd Ed. University of California.
2. Lal G, Siddapa GS &Tandon GL.1986. *Preservation of Fruits and Vegetables*.ICAR.
3. Pantastico B. 1975. *Post Harvest Physiology, Handling and Utilization of Tropical and Subtropical Fruits and Vegetables*. AVI Publ.
4. Salunkhe DK, Bolia HR & Reddy NR. 1991. *Storage, Processing and Nutritional Quality of Fruits and Vegetables*. Vol. I. *Fruits and Vegetables*.CRC.
5. Thompson AK. 1995. *Post Harvest Technology of Fruits and Vegetables*. Blackwell Sci.
6. Verma LR. & Joshi VK. 2000. *Post Harvest Technology of Fruits and Vegetables*. Indus Publ.
7. Robertson, G.L. Food Packaging: Principles and Practice (2nd ed.), Taylor & Francis 2006
8. Parry R. T. and Blakistone B. A. Principles & Applications of MAP –Springer, New York, 1999
9. Food Packaging Technology Handbook. NIIR Board, National Institute of Industrial Research, 2003
10. Ahvenainen, R. (Ed.) Novel Food Packaging Techniques, CRC Press, 2003
11. Han, J.H. (Ed.) Innovations in Food Packaging, Elsevier Academic Press, 2005
12. Coles, R., McDowell, D. and Kirwan, M.J. (Eds.) Food Packaging Technology, CRC Press, 2003

Course No: FS. 512 Statistical Methods in Food Science

4CH

Objective: To develop the skills on statistical methods and to understand data analysis for writing up a dissertation/ thesis/research article.

Learning Outcome:

- ❖ Students will have a thorough understanding the arrangement of data to draw an analytical conclusion.
- ❖ The students will know the importance of various methods to design the research work.
- ❖ Students will have a thorough understanding on relation, deviation and accuracy of their experimental data..
- ❖ The students will know the importance of research work and have some contribution towards science.

UNIT-I

Research Methodology: Meaning, aim & objective of research, significance of research, Research types, Different types of research design. Fundamentals of statistics: Research process, Population, Variables, Primary and secondary data, Collection of data, Classification and tabulation of data, Need and usefulness of Diagrams & Graphs, Different types of diagrams and graphs. Frequency distribution: Discrete and continuous frequency distribution, population & sample, sampling methods and its types, sampling errors.

UNIT-III

Descriptive statistics: Measure of central tendency: (Arithmetic mean, mean, median, mode), relation between mean median and mode ;Measure of dispersion: Range, Mean deviation & Standard deviation; Skewness and Kurtosis .

UNIT-IV

Theoretical Probability Distribution: Binomial, Poisson and normal distribution; Testing of Hypothesis: Null and Alternative Hypothesis, level of significance, Student 't' distribution and its application, Chi-square(χ^2) test & its application, 'F' test and its application.

UNIT-V

Correlation, Regression and ANOVA analysis: Types of correlation; simple, partial and multiple correlation, Method of study & testing the significance of correlation coefficient, Rank Correlation, Regression analysis: regression equations and regression lines, Properties of regression lines, regression coefficient, testing the significance of regression coefficient. Analysis of variance (ANOVA): One way and two way classification and their applications.

References:

1. Statistical Methods – S.P.Gupta, Sultan Chand & Sons Publisher- New Delhi
2. Research Methodology, Methods and Techniques – C.R. Kothari Wiley Eastern Limited – New Delhi
3. Elements of Statistics, Theory & Practice – M.Singhal. Lakshmi Narain Agarwal, Educational Publisher – Agra
4. An Introduction to Statistical Methods – C.B.Gupta & V.Gupta- Vikas Publishing House PVT Ltd. New Delhi.
5. Research Methods & Measurements in Behavioural & Social Sciences – G.L.Bhatnagar – Agri. Cole. Publishing Academy, New Delhi.
6. Statistical Methods – S.P.Gupta, Sultan Chand & Sons Publisher- New Delhi
7. Research Methodology, Methods and Techniques – C.R. Kothari Wiley Eastern Limited – New Delhi
8. An Introduction to Statistical Methods – C.B.Gupta & V.Gupta- Vikas Publishing House PVT Ltd. New Delhi.

Course No: FS. 513 Food Biotechnology and by-product Utilization

4CH

Objective: To develop the skills on role of biotechnology in food, genetically modified food development with respect to genetic engineering, biochemical-technology and industrial microbiology.

Learning Outcome:

- ❖ Students will have a thorough understanding the biotechnological tools and techniques.
- ❖ The students will know the importance of various fermentation methods to design various fermented foods and food products.
- ❖ Students will have a thorough understanding on utilization of food wastes to produce value-added products or ingredients.
- ❖ The students will know the importance of research on new product development and its scope.

UNIT-1

Basic tools of r-DNA technology: Restriction endonuclease and DNA ligase, cloning vectors, cloning of foreign DNA, screening of recombinant clone, DNA fingerprinting, PCR technology, DNA sequencing technique, Cell/tissue-culture. Transgenic for food production: Development and current status of transgenic crops for crop improvement and enhanced agronomic performance; molecular farming, GM foods: Ethical issues concerning GM foods; testing for GMOs; IPR.GMO Act 2004.

UNIT-II

Fermentation and Industrial Microbiology: Microbes in food process operations and production, microbes in food fermentation: lactic acid bacteria, yeast and mould. Fermentation as a method of processing and preserving foods; fermented foods and beverages; citric acid production, vinegar, Yoghurt, tofu, miso, tempeh, Soya sauce(shoyu); microbes used in pickling and sauerkraut, producing colors-*angkak*, beta-carotene, production of microbial enzymes, baker's yeast, amino acids and anti-biotics; bacteriocins from lactic acid bacteria-production and application in food preservation, nisin, SCP.

UNIT-III

Basic concepts of Bioprocess Technology: Up stream processing, Bioreactor and its operation, optimization of process, scale-up; downstream processing, separation and purification. Application of enzymes in food processing: enzyme catalyzed bioprocess, enzymatic bioconversions e.g- starch and sugar conversion processes, hydrolysed protein etc. and their downstream processing; baking by amylases; de-oxygenation and de-sugaring by glucose oxidase; beer mashing and chill proofing, Cheese production and processing.

UNIT-IV

Industrial by-products and waste, utilization of agricultural waste (cereal, legume and oil seed based waste), dairy waste, fruit and vegetable waste, meat, poultry, egg and fish wastes, by-products of fermentation industries, Sugar and bakery industry. New product development- need, importance and objectives of formulation, ideas and strategy of new product, market testing and plan, cost evaluation and commercialization of product.

References:

- 1- Bains W.1993.Biotechnology from A to z. Oxford Univ.Press
- 2- Joshi VK and Pandey A.1999.Biotechnology: Food fermentation.vol.1,2.Education publ.
- 3- Knorr D.1982.Food Biotechnology. Marcel Dekker.
- 4- Lee BH.1996.Fundamentals of Food Biotechnology.VCH
- 5- Perlman D.1977-1979.Annual Reports of fermentation processes.
- 6- Percott SC and Dunn CG.1959.Industrial Microbiology.McGraw Hill.
- 7- Ward.OP.1989.Fermentation Biotechnology.Prentice Hall.

Course No: FS. 514

Elective Paper (Any one)

4CH

Beverages, Bakery and Snacks food technology (A)

Objective: To develop the skills on development of popular snack foods present in Indian Market.

Learning Outcome:

- ❖ Students will have a thorough understanding the processing and preservation of appetizers.
- ❖ The students will know the importance of various fermentation methods used for beverage preparation for respective flavor development.
- ❖ Students will have a thorough understanding on effect of blending and baking on final product of bakery items.
- ❖ The students will know the various extruded product development.

UNIT-I

Types of beverages and their importance; Manufacturing technology for juice-based beverages; synthetic beverages; spices, dairy and imitation dairy-based beverages. Technology of carbonated beverages, carbonation of soft drinks. low-calorie and dry beverages; role of various ingredients of soft drinks, isotonic and sports drinks, Cultivation and processing of Tea, Coffee and cocoa.

UNIT-II

Alcoholic beverages- types, manufacture and quality evaluation; the role of yeast in beer and other alcoholic beverages, ale type beer, lager type beer, technology of brewing process, wine and related beverages, Processing of distilled spirits- (whisky, rum, brandy, vodka, gin, sake, champagne). Packaged drinking water- definition, types, manufacturing processes, quality evaluation and raw and processed water, methods of water treatment, BIS quality standards of bottled water; flavored water, carbonated water.

UNIT-III

Bakery products: role of bakery ingredients, bread manufacturing process (straight and sponge dough method), bread faults (staleness, ropiness, retrogradation of starch), quality evaluation of dough and bread, manufacturing process of cookies, crackers, biscuits, cakes (and its types), pizza, pastry, noodles, pasta, vermicelli.

UNIT-IV

Technology for grain-based snacks: whole grains – roasted, toasted, puffed, popped and flakes, coated grains-salted, spiced and sweetened, chocolate processing, papads, and instant premixes of traditional Indian snack foods. Technology for fruit and vegetable based snacks: Chips, wafers; Extruded snack foods: Formulation and processing

technology, colouring, flavouring and packaging. Confectionary products- high boiled sweets, toffee, fondant, tablets, lollipop, jellies, Lozenges, sugar panning and Chewing gum.

References:

1. Edmund WL. *Snack Foods Processing*. AVI Publ.
2. Frame ND .1994.*The Technology of Extrusion Cooking*. Blackie Academic.
3. Gordon BR.1997 *Snack Food*.AVI Publ
4. Dubey SC. 2002. *Basic Baking*.The Society of Indian Bakers, New Delhi.
5. Francis FJ. 2000. *Wiley Encyclopedia of Food Science & Technology*. John Wiley& Sons.
6. Manley D. 2000.*Technology of Biscuits, Crackers & Cookies*.2nd Ed. CRC Press.
7. Pylar EJ. *Bakery Science & Technology*.3rd Ed. Vols.I, II.Sosland Publ.
8. Qarooni J. 1996. *Flat Bread Technology*.Chapman& Hall.
- 9.. Samuel AM.1976. *Snack Food Technology*. AVI Publ.
10. Hardwick WA. 1995. *Handbook of Brewing*. Marcel Dekker.
11. Hui YH. *et al* 2004. *Handbook of Food and Beverage Fermentation Technology*. Marcel Dekker.
12. Priest FG & Stewart GG. 2006. *Handbook of Brewing*. 2nd Ed. CRC.
13. Richard P Vine. 1981. *Commercial Wine Making - Processing and Controls*. AVI Publ.
14. Varnam AH & Sutherland JP. 1994. *Beverages: Technology, Chemistry and Microbiology*. Chapman & Hall.
15. Woodroof JG & Phillips GF.1974. *Beverages: Carbonated and NonCarbonated*. AVI Publ.

Diary Technology (B)

Objective: To develop the skills on milk, its standards, processing and development of popular milk based products present in Indian Market.

Learning Outcome:

- ❖ Students will have a thorough understanding the processing and preservation of milk.
- ❖ The students will know the importance of various milk based products, its standard specification and various defects found in them.

UNIT-I

Present status of milk & milk products in India and Abroad; market milk- Composition of milk of various species, quality evaluation and platform-testing of milk, procurement, transportation and processing of market milk, Special milks such as flavoured, sterilized, recombined & reconstituted toned & double toned.

UNIT-II

Condensed milk- Definition, methods of manufacture, evaluation of condensed & evaporated milk; dried milk- Definition, methods of manufacture of skim & whole milk powder, instantiation, physiochemical properties, evaluation, defects in dried milk powder.

UNIT-III

Cream- Definition, classification, composition, cream separation, sampling, neutralization, sterilization, pasteurization & cooling of cream, evaluation, defects in cream; Butter- Definition, composition, classification, methods of manufacture, theories of churning, evaluation, defects in butter. Ice cream- Definition, composition and standards, nutritive value, classification, methods of manufacture, evaluation, defects in ice cream, and technology aspects of softy manufacture.

UNIT-IV

Cheese: Definition, composition, classification, methods of manufacture, cheddar, Gouda, cottage and processed cheese, evaluation, defects in cheese.Indigenous milk products - Present status, method of manufacture of *yoghurt, dahi, khoa, burfi, kalakand, gulabjamun, rosogolla, srikhand, chhana, paneer, ghee, lassi* etc; probiotic milk products.Fermented Milk Products, Dahi and Yoghurt, Scope and functioning of milk supply schemes and various national and international organizations, Dairy revolutions in India, CIP of Milk plant.

References:

1. Aneja RP, Mathur BN, Chandan RC & Banerjee AK. 2002. *Technology of Indian Mil Products*. Dairy India Publ.
2. Dey. S.1980. *Outlines of Dairy Technology*.Oxford Univ. Press. New Delhi
3. Henderson JL. 1971. *Fluid Milk Industry*. AVI Publ.
- 4.Rathore NS *et al*. 2008. *Fundamentals of Dairy Technology - Theory &Practices*.HimanshuPubl
5. Spreer E. 1993. *Milk and Dairy Products*. Marcel Dekker.
- 6.Walstra P. 1999. *Dairy Technology*. Marcel Dekker.
7. Walstra P. (Ed.). 2006. *Dairy Science and Technology*. 2nd Ed. Taylor &Francis.

8. Web BH, Johnson AH & Lford JA. 1987. *Fundamental of Dairy Chemistry*. 3rd Ed. AVI Publ.
 9. Robinson, R.K. (2 vol. set). 1986. *Modern Dairy Technology* Elsevier Applied Science, UK.

Food Engineering (C)

Objective: To develop the skills for engineering properties of food and processes also developing ideas regarding design of food processing equipment.

Learning Outcome:

- ❖ Students will have a thorough understanding of various engineering properties of food.
- ❖ The students will know the importance of thermodynamics in food processing.

- ❖ Students will have a thorough understanding on the effectiveness of mass transfer in food processing units.
- ❖ The students will get complete knowledge of food chilling and freezing and importance in food storage.

UNIT I

Introduction to food engineering & processes: principles of thermodynamics and heat transfer applied to food engineering; Engineering properties of foods (electrical, Optical, Frictional, Aerodynamic, Rheology, Physical), their significance in equipment design, processing and handling. Size reduction equipment: Principal types, hammer mills and impactors, attrition mills, buhr mill, tumbling mills, colloid mill, cutting machines (slicing, dicing, shredding, pulping); Mixing: Theory of solid and liquid mixing, Mixing equipment: Mixers for low- or medium-viscosity liquids (paddle agitators, impeller agitators, powder-liquid contacting devices).

UNIT-II

Process Heat Transfer – Thermal properties of food, Modes of heat transfer and overall heat transfer; Fourier’s law, steady state and unsteady state conduction; heat exchange equipment; energy balances; rate of heat transfer; thermal boundary layer; heat transfer by forced convections; heat transfer to flat plate and in non Newtonian fluids; heat transfer in turbulent flow; heating and cooling of fluids in forced convection outside tubes

UNIT III

Mass transfer, molecular diffusion and diffusivity, Fick’s law, diffusion in solids, liquids and gases equilibrium stage process, convective mass transfer co-efficient, mass transfer with laminar and turbulent flow. Heat and mass transfer analogy Design equations for convective mass transfer, simultaneous momentum; Application of mass transfer in food processing.

UNIT IV

Refrigeration system; components, refrigerants types, cooling load estimation, refrigeration design and application in food processing., Food chilling and freezing – Precooling and cold storage, freezing point depression; general introduction to enthalpy change during freezing; Plank's equation for predicting rates of product freezing; Cryogenic freezing and IQF.

References:

1. Sahay KM & Singh KK. 1994. *Unit Operation of Agricultural Processing*. Vikas Publ. House.
2. Heldman DR & Singh RP. 1995. *Food Process Engineering*. AVI Publ.
3. Rao.D.G, Fundamentals of food engg, PHI publ
4. Batty, J.C. and Folkman, S.L. 1983. *Food Engineering Fundamentals*. John Wiley and Sons, New York.
5. Fennema O.R. Ed. 1985, *Principles of Food Science: Part-II Physical Principles of food Preservation*. Marcel Dekker, New York.
6. Heldman, D.R. and Lund, D.B. Ed. 1992. *Handbook of Food Engineering* marcel, Dekker, New York.
7. Brennan JG, Butter JR, Corell ND & Lilly AVE. 1990. *Food Engineering Operations*. Elsevier.
8. Charm SE, McCabe WL, Smith JC & Harriott P. 1993. *Unit Operations of Chemical Engineering*. McGraw Hills.

Nutrition and Dietetics(D)

4CH

Objective: To develop the skills on role of nutrition and diet to maintain a disease free sustainable life.

Learning Outcome:

- ❖ Students will have a thorough understanding the responsible of an dietician with respect to different disease.
- ❖ The students will know the importance of an dietician in hospitals.

UNIT-I

Community Nutrition: Importance of dietetics, Concept of community nutrition, Nutritional problem in our country- malnutrition and infection. Importance of Nutritional education- Nutritional education methods and strategy to

combat nutritional problem, Hospital Dietetics: Principle of hospital dietetics, Dietician as a part of medical team and services, medical history and assessment of patient profile. Methods of dietary assessment, Modes of feeding- Enteral, parenteral, feeding, tube feeding.

UNIT-II

Diet in Relation to Deficiency Diseases: Pathogenesis and dietary management in Nutritional Anemia, PEM, Vitamin A deficiency. Diseases of Cardio Vascular System: Aetiological factors, symptoms, diagnostic tests and dietary treatment for Atherosclerosis, Ischemic Heart Disease, Congestive Cardiac Failure, Hypertension, High fibre, low fat, Sodium restricted diet, Cardiovascular diseases. Diseases of the Kidney: Aetiological factors, symptoms, diagnostic tests and dietary treatment for Acute and chronic Glomerulonephritis. - Low Sodium and low potassium diet, Nephrotic Syndrome, Acute and chronic Renal Failure- uremia, Nephrolithiasis and urolithiasis, Kidney transplantation and Dialysis, Use of Sodium and Potassium exchange lists.

UNIT-III

Therapeutic Diets: Therapeutic adaptation of normal diets. Principles and classification of therapeutic diets. Fever and infections – aetiology, symptoms, diagnostic tests and dietary treatment – High Protein diet, Surgical conditions – Pre-Operative and Post Operative conditions. Burns and Trauma – complications and dietary treatment.

Diet in Allergy - Definition, Symptoms, diagnostic tests and dietary management in allergy. Elimination diet and desensitization., Nutrition in Cancer and AIDS- Aetiological factors, Symptoms, Diagnostic tests and Dietary Management.

UNIT-IV

Diabetes Mellitus - Classification, Aetiological factors, symptoms, diagnostic tests, metabolic changes in the body, Insulin and oral hypoglycaemic drugs. Dietary Modifications with and without insulin, Complications of Diabetes, Food Exchange List, Glycemic Index and its use. Diseases of the Gastro Intestinal Tract: Etiologic factors, symptoms, diagnostic tests and dietary treatment for Esophagitis and hiatus hernia, Diarrhoea and Constipation – high and low fiber diet. Gastritis, Peptic Ulcer and Ulcerative colitis. Malabsorption Syndrome – Celiac Sprue – Gluten restricted diet, Steatorrhea- MCT restricted diet. Pancreatitis Liver - Aetiological factors, symptoms, diagnostic tests and dietary treatment for Viral Hepatitis, Cirrhosis of the liver and liver encephalopathy – high carbohydrate diet. Cholelithiasis and cholecystitis – low fat diet

References:

1. Antia, F.P (1973): Clinical dietetics and Nutrition, Second Edition, Oxford University Press, Delhi.
2. Joshi, S.A (1992): Nutrition and Dietetics, TATA McGraw Hill publications, New Delhi
3. Mahan, L.K. Arlin, M.T (1992) Krause's Food, Nutrition and Diet Therapy, 8th Ed. W.B. Saunders, Company, London
4. Williams S.R. (1989): Nutrition and Diet Therapy, 6th Ed. Times Mirror / Mosby College Publishing, St. Louis.
5. Raheena Begum (1989) A Test Book of Foods, Nutrition and Dietetics, Sterling Publishers, New Delhi.
6. Robinson, C.H., Lawler, M.R, Chenoweth, W,L, and Garwick A, E (1986) Normal and Therapeutic Nutrition, 17th Ed., Macmillan Publishing Co.
7. Human Nutrition and Dietetics – S. Davidson & R. Passmars.
8. Essentials of Food and Nutrition – M. Swaminathan, vol. I & II, The Bangalore printing and Publishing Co. Ltd.
9. Human Nutrition and Dietetics – Davidson, Passmore, East wood, English Language Book Society (ELBS).
10. Dietetics – B. Srilakshmi; New age International (P) Limited, New Delhi.
11. Nutrient Requirements and Recommended Dietary Allowances for Indians – Indian Council of Medical Research, National Institute of Nutrition, Hyderabad.

Course No: FS. 515	Practical related to all the theory papers	4CH
Course No: FS. 516	Seminar-I	2CH

FOURTH SEMESTER

Course No: FS. 521	Term Paper/Review Paper	2CH
Course No: FS. 522	Final Dissertation & Viva Voce	12+2CH
Course No: FS. 523	Seminar-II	2CH
Course No: FS. 524	Industrial Tour Report	2CH

M.Sc.IN FOOD SCIENCE
P.G. DEPARTMENT OF FOODSCIENCE TECHNOLOGY & NUTRITION

Name of the HOD: The Chairman, P.G. Council, Sambalpur University

Name of the Course Coordinator: Dr. Binata Nayak

Mob. No. 9439896178, 7978477327

Email id: cordcfst@suniv.ac.in

1. MINIMUM ELIGIBILITY: Any Science Graduate or any Technical/Professional Graduate (B.Tech, B.Sc. Agriculture, B.Pharm, B.Sc. Home Science and other related subjects of four years study after +2 Science) of Sambalpur University or of any other University recognized by Sambalpur University as equivalent there to with a minimum of 45% marks is eligible. Graduates with Home Science Honours/ Pass along with P.G Diploma, Diploma, or Certificate Course in any of the subjects like Food & Nutrition/ Nutrition & Health Education/ Nutrition & Dietetics/ Hospital & Health Management and other related subjects with a minimum of 45% marks at Graduation level are also eligible for admission to M.Sc. in Food Science.

2. SELECTION CRITERIA: Career-30 marks, written test-70 marks (Total-100 Marks). When the number of applications is less than the sanctioned strength, merit list will be prepared on the basis of career marks only.

For students who have passed Technical / professional Graduates

Degree	First Division	Second Division	Third Division/Pass
High School	6	4.5	3.0
+2	9	7	5
B.E./B.Tech./B.Sc. Home Sc./B.Pharm (4 years study after +2)			
First Class Hons or equivalent grade-75% marks or above			15
First Class or equivalent grade-above 60% marks and below 75%			13
Second Class or equivalent grade-above 50% marks and below 60%			10
Pass or equivalent grade with below 50% marks			07

+3 (Honours): Marks secured in Honours Subject X 15

Maximum Marks in Honours Subject

+3 (Pass): Aggregate Marks secured X 12

Maximum Marks

3. DURATION OF THE COURSE: 2 Years

4. NUMBER OF SEATS: 20 with reservation as per rule.

5. COURSE FEE: Rs. 15,000/- per Semester per Student.

* This is in addition to the fee prescribed at clause 11 of the prospectus.

* **Course Fee once deposited shall not be refunded in any circumstances.**

6. SPECIAL FEATURE OF THE COURSE: M.Sc. in Food Science programme focuses on the Food Science, an area of increasing importance to Consumers, Government and the Food Industry. This M.Sc programme is interdisciplinary in nature and is a challenging and practical course which demands a good grasp of knowledge in science.

The aim of the course is to provide knowledge and understanding of Fundamentals of food and food products, basic concepts of Nutrition, Chemistry of Food Components & Techniques in Food Analysis, Food Microbiology, Food Safety, Quality Control & Packaging, Food Biotechnology & Statistical Methods in Food Science etc.

This programme will enable to develop:

- An understanding of the subjects at the interface between human nutrition and food science.
- An understanding of food constituents in the context of their manufacture and storage, particularly from the stand points of safety and nutritional attributes.
- One's capacity to undertake research in food science.
- Skills in critical appraisal of data, presentational and inter personal skills.

7.CAREER PROSPECT: This M.Sc .programme is for those wishing to develop a career in food-related research or the food industry. It is designed to meet the increasing demand for nutrition scientists experienced in human nutritional trials and in the evaluation of physiological, biochemical and molecular basis for effects of diet on human health. As a food nutritionist, one is endowed with the skills and knowledge to improve another's quality of life. Right from providing assistance in planning meals in times of oldage, sickness or extreme stress, to advising them with regards to healthy eating-selection. The main area of a food scientist cum nutritionists' work is Food Service Industry, Institutional Catering, Research and Development and Social Welfare, Health Care field etc. Food service consists of Restaurants and Catering service where nutritionists need to plan the menu and monitor food preparation. Same as Food service, Institutional Catering even requires dietetics professionals to plan, administer and arrange nutritious balanced diets for cafeterias of schools, colleges, offices, factories etc. Apart from that, their work might include evaluation and acquisition of food materials and equipment, checking and receiving inventories of supplies etc. Professionals carrying on such work are recognized as Administrative or Management Nutritionists. Nutritionists involved in Social Welfare activities, often called as Community dietitian or Public Health Nutritionists are mostly attached to government-aided public health divisions to improve the mass food habits and public health. Our postgraduates can therefore expect to find themselves in demand from employers and often have to choose from several excellent job offers.
