

# UNIVERSITY OF RAJSHAHI



DEPARTMENT OF FOOD AND NUTRITIONAL SCIENCE

Syllabus for

B. Sc. (Honours) in Food and Nutritional Science (4 Years)

Session: 2019-20

02.7.2020

ডীন  
কৃষি অনুষদ  
রাজশাহী বিশ্ববিদ্যালয়

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কৃষি অনুষদ  
রাজশাহী বিশ্ববিদ্যালয়, রাজশাহী

## **Title of the Degree Award:**

### **B. Sc. (Honours) in Food and Nutritional Science**

#### **Introduction and Objectives of the Course**

Curriculum of a subject is said to be the throbbing pulse of a nation. By looking at the curriculum one can judge the state of intellectual development and the state of progress of the nation. The world has turned into a global village; new ideas and information are pouring in like a stream. It is, therefore, imperative to update our curricula regularly by introducing the recent developments in the relevant fields of knowledge.

#### **Objectives:**

1. To provide graduate level education for students interested in applying Food and Nutritional Science to the theoretical and practical aspects of the entire food chain from the raw material to consumption of the products and public health issues.
2. To provide a focus for graduate study and research in Food and Nutritional Science.
3. To help promote interactions with other discipline which relate to the study of Food and Nutritional Science.

#### **Assignments, Spot test, Quiz test, Class test:**

There should be at least three "Class Test Examinations"/ "Assignments"/ "Spot Test" / Quiz Test. The course teacher may decide the relative marks distribution between the class test, Assignments, Spot Test, and Quiz Test. The marks will be taken form the average. It will carry 20% marks in the final result. Class attendance will carry maximum 5% marks in the final result.

#### **Final Exam:**

Final exam will carry 75% marks. For 4 credit subjects, question paper should possess 8 sets of questions of which 5 sets of question need to be answered. For 2 credit subjects, question paper should possess 7 sets of questions of which 5 sets of question need to be answered. Each sets of question should carry equal marks.

#### **Practical exam:**

Final exam will be in 50 marks. The course teacher may decide the relative marks distribution between the practical exams.

## Grading System

“Letter grade” and “Grade point”: Letter Grade and corresponding “Grade Point” will be awarded as follows-

Numerical Grade	Grade Point	Letter Grade
80% and above	4.00	A <sup>+</sup>
75% to less than 80%	3.75	A
70% to less than 75%	3.50	A <sup>-</sup>
65% to less than 70%	3.25	B <sup>+</sup>
60% to less than 65%	3.00	B
55% to less than 60%	2.75	B <sup>-</sup>
50% to less than 55%	2.50	C <sup>+</sup>
45% to less than 50%	2.25	C
40% to less than 45%	2.00	C <sup>-</sup>
Less than 40%	0.00	F

**GPA:** Grade Point Average (GPA) is the weight average of the grade points obtained in all courses completed by a student.

**CGPA:** Cumulative Grade Point Average (CGPA) will be calculated by the weighted average of previous CGPA and current GPA.

## Course Outline in Brief

<b>Basic Courses (Science, Social Science)</b>	<b>Core Courses in Food Technology</b>	<b>Core Courses in Nutritional Science</b>
Fundamental Chemistry	Introduction to Food Science and Technology	Basic Nutrition
Fundamental Biochemistry	Food Chemistry	Applied Nutrition
General Microbiology	Technology of Fish	Nutritional Assessment
Human Physiology	Technology of Meat and Poultry Products	Nutritional Biochemistry
Basic Sociology	Food Engineering Unit Operations	Applied Dietetics
Professional Management	Food Microbiology	Clinical Nutrition
Basic Computer Application	Technology of Fruits, Vegetables	Community nutrition
Biostatistics	Technology of Dairy products	Nutrition Education
Research Methodology	Food Biotechnology	Nutritional Problems
Functional English	Fermentation Technology	Management of Nutrition in Emergencies
	Technology of Cereal, Legume and Tuber Crops	Epidemiology
	Post-Harvest Technology	Public Health Nutrition
	Food Safety and Preservation Technology	
	Food Plants Design and Sanitation Management	
	Beverage Technology	
	Tea Technology	
	Food Packaging and Research & Development	
	Quality Control and Legislations	
	Technology of Sugar	
	Technology of Bakery and Confectionary Products	
	Renewable Energy and Waste Management of Food	

## **B. Sc. (Honours) in Food and Nutritional Science Part-1**

### **First Year**

Course No	Course Title	Final Exam	Tutorial	Attendance	Total Marks	Credit	
<b>Theory Courses</b>							
FN-101	Fundamental Chemistry	75	20	05	100	4	
FN-102	Fundamental Biochemistry and metabolism	75	20	05	100	4	
FN-103	Introductory Food Technology	75	20	05	100	4	
FN-104	General Microbiology	75	20	05	100	4	
FN-105	Basic Nutrition	75	20	05	100	4	
FN-106	Food Chemistry	75	20	05	100	4	
FN-107	Functional English	75	20	05	100	4	
FN-108	Basic Computer Application	75	20	05	100	4	
					<b>Total</b>	<b>800</b>	<b>32</b>
<b>Practical</b>							
FN-109	Fundamental Chemistry				50	2	
FN-110	Biochemistry				50	2	
FN-111	General Microbiology				50	2	
FN-112	Food Chemistry				50	2	
FN-113	Basic Computer Application				50	2	
FN-114	Food Industry / Nutrition work Visit				50	2	
					<b>Total</b>	<b>300</b>	<b>12</b>
<b>Grand Total</b>					<b>1100</b>	<b>44</b>	

## **B. Sc. (Honours) in Food and Nutritional Science Part-2**

### **Second Year**

<b>Course No</b>	<b>Course Title</b>	<b>Final Exam</b>	<b>Tutorial</b>	<b>Attendance</b>	<b>Total Marks</b>	<b>Credit</b>	
<b>Theory courses</b>							
FN-201	Applied Nutrition and Nutritional assessment	75	20	05	100	4	
FN-202	Nutritional Biochemistry	75	20	05	100	4	
FN-203	Technology of Fish, Meat and Poultry Products	75	20	05	100	4	
FN-204	Food Engineering Unit Operations	75	20	05	100	4	
FN-205	Food Microbiology	75	20	05	100	4	
FN-206	Technology of Fruits, Vegetables and Dairy products	75	20	05	100	4	
FN-207	Human Physiology	75	20	05	100	4	
					<b>Total</b>	<b>700</b>	<b>28</b>
<b>Practical</b>							
FN-208	Technology of Fish, Meat and Poultry Products				50	2	
FN-209	Food Microbiology				50	2	
FN-210	Technology of Fruits, Vegetables and Dairy products				50	2	
FN-211	Food Industry / Nutrition work Visit				50	2	
					<b>Total</b>	<b>200</b>	<b>08</b>
<b>Grand Total</b>					<b>900</b>	<b>36</b>	

## **B. Sc. (Honours) in Food and Nutritional Science Part-3**

### **Third Year**

<b>Course No</b>	<b>Course Title</b>	<b>Final Exam</b>	<b>Tutorial</b>	<b>Attendance</b>	<b>Total Marks</b>	<b>Credit</b>	
<b>Theory courses</b>							
FN-301	Applied Dietetics and Clinical Nutrition	75	20	05	100	4	
FN-302	Community Nutrition and Nutrition Education	75	20	05	100	4	
FN-303	Food Biotechnology and Fermentation Technology	75	20	05	100	4	
FN-304	Technology of Cereal, Legume and Tuber Crops	75	20	05	100	4	
FN-305	Post-Harvest Technology	75	20	05	100	4	
FN-306	Food Safety and Preservation Technology	75	20	05	100	4	
FN-307	Food Packaging, Research and Development	75	20	05	100	4	
FN-308	Basic Sociology and Professional Management	75	20	05	100	4	
					<b>Total</b>	<b>800</b>	<b>32</b>
<b>Practical</b>							
FN-309	Applied Dietetics and Clinical Nutrition				50	2	
FN-310	Technology of Cereal, Legume and Tuber Crops				50	2	
FN-311	Post-Harvest Technology and preservation				50	2	
FN-312	Food Packaging, Research and Development				50	2	
FN-313	Food Industry / Nutrition work Visit				50	2	
					<b>Total</b>	<b>250</b>	<b>10</b>
<b>Grand Total</b>					<b>1050</b>	<b>42</b>	

## **B. Sc. (Honours) in Food and Nutritional Science Part-4**

### **Fourth Year**

<b>Course No</b>	<b>Course Title</b>	<b>Final Exam</b>	<b>Tutorial</b>	<b>Attendance</b>	<b>Total Marks</b>	<b>Credit</b>	
<b>Theory Courses</b>							
FN-401	Nutritional Problems and Nutrition in Emergencies	75	20	05	100	4	
FN-402	Beverage and Tea Technology	75	20	05	100	4	
FN-403	Biostatistics and Research Methodology	75	20	05	100	4	
FN-404	Epidemiology and Public Health Nutrition	75	20	05	100	4	
FN-405	Quality Control and Legislations	75	20	05	100	4	
FN-406	Technology of Sugar, Bakery and Confectionary Products	75	20	05	100	4	
FN-407	Food Plants Design and Sanitation Management	75	20	05	100	4	
FN-408	Renewable Energy and Food Waste Management	75	20	05	100	4	
					<b>Total</b>	<b>800</b>	<b>32</b>
<b>Practical</b>							
FN-409	Beverage and Tea Technology				50	2	
FN-410	Quality Control				50	2	
FN-411	Technology of Sugar, Bakery and Confectionary Products				50	2	
FN-412	Study Tour				50	2	
FN-413	Research Project or Internship				100	4	
					<b>Total</b>	<b>300</b>	<b>12</b>
<b>Grand Total</b>					<b>1100</b>	<b>44</b>	

**Total Number of Credits = 166 (One Hundred and Sixty six)**



## **B. Sc. (Honours) in Food and Nutritional Science Part-1**

### **FN-101: Fundamental Chemistry**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

1. **The Structure of Atom:** Measurement of  $e/m$  for electrons, determination of charge of an electron, Protons, Neutrons, subatomic particles, Alpha particles, Rutherford model; Bohr model; atomic orbitals; electron configuration of atoms, atomic number, Mass number. Isotopes, Isobars and Isotones.
2. **Periodic Classification of Elements:** Ionization potential; electronegativity; electron affinity; atomic radius; variation of properties along a period and a group; diagonal relationship; representative elements; transition elements; and chemical properties of s-,p- and d- block elements.
3. **Chemical bonds:** Electronic theory, valence bonds theory, molecular orbital theory, sigma and pi bond, c-c bonds, catenation, polar molecules, electronegativity and electron affinity, hydrogen bonding, shapes of molecules, VSEPR theory, hybridization.
4. **Types of chemical reactions:** Reactions among atoms and molecules of same kinds, Reactions among atoms and molecules of different kinds, electron transfer reactions, non-electron transfer reactions. Concepts of oxidation-reduction reactions, Oxidation number, oxidation state,
5. **Acid and base:** The Lewis concept, the Bronsted concepts in strong and weak acids, acid base equilibrium in aqueous solutions, Ostwald dilution law, pH, buffer solutions, neutralization curve, How indicators for acid base titration works.
6. **Structure of organic compounds:** Structure and properties of molecules, Isomerism, Nomenclature of organic compounds (alkanes, alkenes and alkynes, alcohol and ethers, Aldehyde and ketones, Carboxylic acid, Amines). Hydrocarbons, Classification of hydrocarbons.
7. **Aliphatic hydrocarbons:** Saturated and unsaturated hydrocarbons, physical properties and reactions of alkanes, alkenes and alkynes, Halogenation, hydrogenation; Alcohols and ethers: Structure, classification, physical properties, industrial sources of alcohol and ethers, Fermentation of carbohydrate, Reactions of alcohol and ethers; Aldehyde and ketones: Structure, industrial source, preparation, physical properties, reactions; Carboxylic acid: Structure, industrial source, preparation, physical properties, reactions.
8. **Aromatic Hydrocarbon:** Structure, industrial source, preparation, physical properties, ring substitutions, reactions of benzene, Phenols.

### **Recommended Books:**

- Haider, S.Z. Introduction to Modern Inorganic Chemistry. 2000. 2<sup>nd</sup> edition. Friends International, Lalmatia, Dhaka.
- Madan, R.D. Modern Inorganic Chemistry. 1987. 1<sup>st</sup> edition. S Chand and Company Ltd.
- Chang, R. Physical Chemistry with Application to Biological System.
- Glasstone, S., Lewis, D. Element of Physical Chemistry.
- Morrison, R.T., Organic Chemistry, 7<sup>th</sup> edition

## **FN-102: Fundamental Biochemistry and Metabolism**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

- 1. Biochemistry, its definition and Scope:** Relationship of biochemistry with applied nutrition and food technology.
- 2. Carbohydrates:** Definition, sources, classification, structure, general reactions, color tests and biological importance of carbohydrate. Glycolysis (aerobic and anaerobic fate), Regulation of glycolytic pathway, Glycogenesis, Gluconeogenesis, TCA cycle.
- 3. Lipids:** Definition, classification, structure and basic function. Fatty acid oxidation (saturated and unsaturated), Fate of glycerol, Regulation of fatty acid oxidation, ketone body formation and its utilization
- 4. Amino Acids and Peptides:** Name and structure of 20 different amino acids, classification of amino acids, optical properties, essential and nonessential amino acids, amphoteric nature, isoelectric pH. Titration curve of amino acids, physicochemical properties of amino acids, general method of preparation of amino acids. Definition of peptides, N-terminal and C-terminal amino acids and their identification.
- 5. Proteins:** Definition, classification, primary, secondary, tertiary and quaternary structure of proteins. Denaturation and renaturation of proteins. Biological importance of proteins. Outline of amino acid decarboxylation, oxidative deamination, transamination, urea cycle, Toxicity of ammonia.
- 6. Nucleosides and Nucleotides:** Occurrence, structure, physicochemical properties; Polynucleotides: Occurrence, structure of DNA and RNA.
- 7. Enzymes and Hormones:** Enzymes as Biocatalysts; How Enzymes Work; Nomenclature and Classification of Enzymes; Control of Enzyme Activity; Enzymes Inhibition; The Endocrine System; Hormone Synthesis and functions of different hormones.
- 8. Inborn errors of Metabolism:** Galactosemia, lactose intolerance, Phenyl ketouria, Hyperlipidemia

### **Recommended Books:**

- Lehninger, A.L., Nelson, D.L., Cox, M.M. Principles of Biochemistry. 1974. CBS Publishers and Distributors.
- West, E.S., Todd, W.R., Mason, H.S., Van Bruggen, J.T. Text Book of Biochemistry. 4<sup>th</sup> edition, Amerind Publishing Co. Pvt. Ltd.
- Handler, P., Smith, E.I.; Stelten, D.W. Principles of Biochemistry. Mc-Graw Hill Book Co.
- Devlin, T.M. Text Book of Biochemistry with Clinical Correlations. John Wiley and Sons.

## **FN-103: Introductory Food Technology**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

1. Definition and components of food. Sources of food (plants, animals and marine), Classification and functions of food. Development and the scopes of food science. Role of Food Technologist.
2. Basic knowledge on food technology (processing, packaging, preservation and quality control). Important food industries and their products in Bangladesh.
3. **Properties of Food constituents:** Carbohydrates, proteins, lipids, water and other constituents.
4. **Basic principles and uses of processing and preservation methods:** Chilling, freezing, dehydration, concentration, pasteurization, blanching, sterilization, canning, food irradiation.
5. Causes of food wastage and food spoilage (chemical, biochemical, biological), General principle of food deterioration and preservation.
6. Value addition of food. Importance and scope of value addition in food in agricultural sector of Bangladesh.
7. Role of raw materials, processing materials, manpower, packaging materials, processing methods and machineries in food processing.
8. **Preliminary operations in food industries:** Material handling, mixing, cleaning, sorting, grading, packing, washing, transportation and storage.

### **Recommended Books:**

- Technology of Food Preservation. N.W Desrosier. 4<sup>th</sup> Edition AVI Pub. Co. Westport
- Elements of Food Technology. N.W. Desrosier. AVI Pub. Co. Westport
- Principles of Food Science. G. Borgstrom. Vol. I & II Macmillan, London 1968.
- Food Engineering Operation Third Edition –By Brennan, J.G Butters, R. Cowell., N.D and Li-hay, AEV. 1990. Elsevier Applied Science.
- Food Science –By N.N. Potter The AVI Pub. Co.
- Food Engineering System Vol-1 By Farral A.W The AVI Pub. Co

## **FN-104: General Microbiology**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

- 1. Introduction:** Brief history of development of microbiological science, scope of microbiology in human welfare, Nomenclature and classification of microorganisms.
- 2. Microscopy:** Principles and uses of various microscopes (eg. light, florescent and electron microscope). Techniques of slide preparation for different microscope.
- 3. Bacteria:** Structure, classification, physiology, taxonomy, nutrition, growth curve, generation time, O<sub>2</sub> and temperature dependent growth of bacteria, recombination, reproduction, staining of bacteria: classification, principle and mechanism of staining. Economic and biological importance of bacteria.
- 4. Virology:** Evolution of virus, biological status, structure, classification, growth curve, cultivation, viral replication, virus-host interaction, viral diseases, plant viruses, animal viruses.
- 5. Fungi and Algae:** Structure, classification, sexual and asexual reproduction of fungus, life cycle of fungus, unicellular algae, economic importance and diseases of unicellular fungi and algae.
- 6. Growth, Media Preparation and Pure Culture Techniques:** Study of culture media. Bacterial growth media and its classification, selective media for food pathogen, methods of preparation. Isolation of pure culture by spread plate, poured Plate and streak plate methods. Characterization and identification of microorganism, different recognized media.
- 7. Antigens:** General properties of antigens; antigenic determinants types, haptens, super antigen. MHC and Antigen presentation; Structure and function of MHC class 1 and class 2 molecules.
- 8. Antibiotics:** Definition, classification, structure, function and mode of action.

### **Recommended books:**

- Pelczar, M.J., Chan, E.C.S., Krieg, N.R. Microbiology. 1993. 5<sup>th</sup> edition. Tata McGraw-Hill Publishing Company Limited.
- Tortora, G.J., Funke, B.R., Case, C.L. Microbiology-an introduction. 8<sup>th</sup> edition. Person Education Pte. Ltd.
- Dubey, R.C., Maheshwari D.K. Microbiology. 1999. 1<sup>st</sup> edition. S Chand and Company Ltd. New Delhi. India.
- Choudhury, M.R. Modern medical Microbiology. 1999. 5<sup>th</sup> Edition.

## **FN-105: Basic Nutrition**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

- 1. Food and Nutrition:** Definition, classification and function of food. Nutritive value of foods groups: cereals and pulses, fruits and vegetables, meat, egg, fish, milk. Nutrition in life cycle.
- 2. Carbohydrates in human nutrition:** Biological importance of carbohydrates, Types of carbohydrate, their structure and properties (Glucose, Fructose, Galactose, Sucrose, Lactose, Starch, Glycogen, Cellulose). Role of dietary fibers. Glycemic index. Digestion of carbohydrates.
- 3. Protein in human nutrition:** Biological importance of proteins, Classification of naturally occurring amino acids. Essential amino acids, limiting amino acids, mutual supplementation, Classification of protein based on quality, structure and function. Protein quality evaluation (Digestibility coefficient, Biological value, Protein efficiency ratio, Net protein utilization). Protein requirement. Digestion of proteins.
- 4. Fats and Oils in human nutrition:** Biological importance of lipids. Classification of lipids according to structure. Saturated, monounsaturated, and polyunsaturated fatty acids, essential fatty acids. Role of PUFA in health. Omega 3 and 6 fatty acids. Role of HDL and LDL. Digestion of lipids.
- 5. Vitamins and minerals in human nutrition:** Definition, sources, classification, daily requirement, functions and deficiency diseases of vitamin. Minerals: definition, classification, sources, daily requirement, functions and deficiency diseases.
- 6. Energy Requirement:** Measurement of total energy requirement, PAL, SDA, BMR measurement, Factor affecting RDA. Concept of the requirements of nutrients and RDA.
- 7. Components of diet:** Definition of balanced diet, food groups and the planning of balanced diet. Food guide pyramid, Factor considering for planning a diet. Role of nutrient in diet and the result of nutrient deficiency in human body. Interrelationship between fat, protein and carbohydrate in terms of nutrition.

### **Recommended books:**

- Robinson. C.H., Lawler, M.R., Chenoweth, W.L., Garwick, A.E. Normal and Therapeutic Nutrition. 1986. 17<sup>th</sup> edition. MacMillan Publishing Co.
- Passmore, R., Eastwood, M.A. Human Nutrition and Dietetics. 1986. 8<sup>th</sup> edition. Churchill Livingstone.
- Mudambi, S.M., Rajagopal, M.V. Fundamentals of Foods and Nutrition. 2002. 4<sup>th</sup> edition. New Age International Ltd.
- Gills, N.J. Bosscher, M.V. Manual of Nutrition and Diet Therapy.
- Swaminathan, M. Food and Nutrition. 2000. 7<sup>th</sup> edition. Bangalore, India.

## FN-106: Food Chemistry

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

1. **Introduction to Chemistry of Foods:** Composition, factors affecting composition of food, function of food, general structure and composition of common food stuff (rice, wheat, egg, meat), chemistry of food nutrients (cereal, fruits, vegetables, Tubers, meat, fish).
2. **Development of Food Chemistry:** Individual variability, individual uniformity, methods of sampling, hydrogen bonding, bound water, water activity in foods, and determination of moisture in foods.
3. **Chemistry of Macronutrients:**
  - a) **Carbohydrate:** Classification, Changes of carbohydrates on cooking. Control of hydrolysis of starch, gelatinization and retrogradation of starch, chemical modification of gelling characteristics of starch. Pectic substances: occurrence, structure, chemistry, properties and uses in food. Mechanism of pectin gel formation.
  - b) **Lipid:** Classification, Physical properties and Chemical properties (iodine number, acid number, saponification value), edible fats and oils- extraction methods, oxidation mechanism, role of metal ion on lipid oxidation; Antioxidants mechanism; Hydrogenation (Definition, significance in food processing).
  - c) **Protein:** Classification, Properties (Hydration, viscosity, gelation, emulsification and foaming properties). Study of (milk protein, egg proteins, cereal protein, pulse protein, meat protein). Color test of protein.
4. **Natural pigment and bitter substance:** Definition, Occurrence, Classification and Structure of xanthophyll, carotenoids, chlorophylls, flavonoids, anthocyanin. Physiological effects of pigments. Changes of pigments during processing and cooking. Tannin (Type, properties, Source).
5. **Browning Reaction:** Enzymatic and non-enzymatic browning reaction. Mechanism of enzymatic and non-enzymatic browning reactions. Control of enzymatic and non-enzymatic browning. Loss of nutrient as a result of enzymatic and non-enzymatic browning reaction.
6. **Food Additives:** Definition, classification, functional mechanism, and functions of different food additives (color, flavor, preservative, Sweetener, antioxidant, leavening agent, emulsifier, anticaking agent, thickener). Principles of food preservation.

### **Recommended Books:**

- Meyer, L.H. Food Chemistry. 1961. Reinhold Publishing Corporation, New York.
- Beliz, H.D., Grosch, W. Food Chemistry. 1999. 2<sup>nd</sup> edition. Springer.
- Potter N.N., Hotchkiss J.H. Food Science. 5<sup>th</sup> edition. CBS Publishers and Distributors.
- John deMan. Principles of Food Chemistry. 1999. 3<sup>rd</sup> edition. Aspen Publishers, Inc., Gathersburg, Maryland.
- Aurand, L.W., Woods, A.E. Food Chemistry. 1973. AVI, Westport.

## **FN-107: Functional English**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

1. **Grammar and their usage:** Tenses, articles, prepositions, subject verb agreement, clauses, conditionals, word classes, transformation of sentences: active, passive transformations, sentence correction. Use of appropriate preposition.
2. **Reading Comprehension:** Question and Answer, True or False, Matching and Fill in the Blanks, making flow diagram. Comprehending, extracting main idea, understanding text organization, dealing with unfamiliar words and language variations, writing summaries. Vocabulary building (Fill in the blanks with appropriate words, correct spelling).
3. **Academic writing:** Generating sentences, sentence clarity and correctness. Linking sentences to form paragraphs. Paragraph writing, writing academic thesis/papers and reports, scientific and technical papers. Precise of a given passage, speech writing. Write discussion of given data table or bar graph or charts.
4. **Business writing:** Personal and formal letters, business correspondence, job application, curriculum vitae, article writing in newspaper, letter writing in email format.
5. **Public speaking:** Pronunciation, Public speaking (at the office, at the railway station, at the airport, at the bank, at the doctor's clinic, talking on the telephone, formal Interviews, making requests and seeking permissions, expressing gratitude and apologizing, Complaining, expressing sympathy and offering condolences, congratulating people and responding to congratulations), Oral presentation.

### **Books recommended:**

- A Manual for Writers. Kate L Turabian. Chicago University Press. 1972
- A Manual of Style. University of Chicago. 1964
- Intermediate English Grammar. Raymond Murphy. Cambridge University Press. 1994.
- Practical English Usage. M Swan. Oxford University Press. 1993.

## **FN-108: Basic Computer Application**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

1. Impact of computer on society, Introduction to computer (Basic organization, Types of computer, History and generations of computer)
2. Input and output devices (input/output operations, input devices, output devices, other peripheral devices). Keyboard (alphanumeric keys, modifier keys, numeric key, function key, special purpose key, How computer accepts input from the keyboards), Mouse (Using the mouse, Mouse button configuration). Printers (dot matrix printers, ink jet printers, laser printers).
3. Microprocessors (Introduction to microprocessors, ALU and Control, Microprocessors: past, present and future). Memory (Main memory and secondary memory)
4. Computer software (Introduction and classification). Operating system (system software, introduction to operating systems, purpose of operating system, types of operating system, popular operating system), Security( Firewall, digital key, digital signature, virus and antivirus software).
5. Network and internet (Introduction to computer networks, LAN, WAN, Internet service and protocols, internet and externet). Email (Using Email, Understanding Email, Email address, creating message). List of abbreviations related to Computer.

### **Recommended Books:**

- Computer Fundamentals. M. Lutfar Rahman, M. alamgir hossain. Systech publications Ltd.
- SPSS for Windows. Base System User's Guide Release 6.0. M J Norusis. 1995.
- Excel 7.0 for Windows in a Day. R A Stultz. BPB Publications. 1996.
- Introduction to Computers. Peter Nortons. McGrawHill



## Practical

### **FN-109: Fundamental Chemistry (Practical)** **Credits: 2, Full Marks: 50**

1. Identification and operation of basic tools of laboratory analysis.
2. Preparation of standard solutions (Acid and Base) and its conversion.
3. Preparation of 0.1N Na<sub>2</sub>CO<sub>3</sub> solution and determination of the strength of HCl solution.
4. Determination of Na<sub>2</sub>CO<sub>3</sub> content of washing soda.
5. Determination of permanent hardness of supplied water sample.

#### **Recommended books:**

- Analytical Chemistry- Verma, R.M., CBS Publishers and Distributors, Delhi, India.
- Introduction to Modern Inorganic Chemistry-S. Z. Haider, Edexcel Publishers, 2010.
- Modern Inorganic Chemistry-R. D. Madan, S Chand and Co Ltd, May 1987.
- Vogel, A.I. Quantitative Organic Analysis. Part 1, 2, 3. 2<sup>nd</sup> edition. 1998. CBS Publishers and Distributors, Delhi, India.
- Elementary Practical Organic Chemistry (Part 1, 2 and 3), CBS Publishers and Distributors, Delhi.

### **FN-110: Biochemistry (Practical)** **Credits: 2, Full Marks: 50**

1. Blood grouping: ABO and Rh factor.
2. Blood pressure measurement.
3. Blood glucose measurement.
4. Bleeding time and coagulation time measurement.
5. Separation of blood serum.
6. Estimation of protein in blood serum
7. Lipid profile test
8. ELISA Test
9. Use of spectrophotometer for biochemical analysis.

#### **Recommended books:**

- Textbook of Medical Physiology, 9<sup>th</sup> ed. – Arthur C. Guyton.
- Human Physiology, 11<sup>th</sup> ed. – Chandi Charan Chatterjee
- Wilson, K., Walker. Practical Biochemistry.
- Sadasivan, S., Manikam, K. Biochemical Methods.
- Nath, R.L. Practical biochemistry.

**FN-111: General Microbiology (Practical)**  
**Credits: 2, Full Marks: 50**

1. Operation of Microscopes
2. Microscopic study of living microorganisms
3. Staining techniques
4. Methods of sterilization and preparation of culture media.
5. Cultivation, isolation and identification of bacteria, yeast, molds
6. Demonstration of bacteria in specimens
7. Preservation of microorganisms
8. Methods of obtaining pure culture

**Recommended books:**

- Food Microbiology by M. P. de Figueiredo and D.F. Splittstoesser.
- Fundamental food microbiology by Bibek Ray, Arun K. Bhunia - CRC Press (2008)
- Basic Food Microbiology by George J. Banwart - Chapman and Hall.

**FN-112: Food Chemistry (Practical)**  
**Credits: 2, Full Marks: 50**

1. Determination of gluten from wheat flour.
2. Determination of moisture content of food product.
3. Determination of ash content of food products.
4. Determination of acidity of a food product.
5. Determination of P<sup>H</sup> of a food sample.
6. Determination of color in food sample.
7. Determination of total soluble solids.
8. Determination of protein content of food products.
9. Determination of fat content of a food product.
10. Determination of acid value of fat.

**Recommended Books:**

1. Gowenlock, A.H., McMurray, J.R., McLauchlan, D.M. Varley Practical Clinical Biochemistry. 6<sup>th</sup> edition. 1996. CBS Publishers and Distributors, Delhi, India.
2. Pomeranz, Y., Meloan, C.F. Food Analysis Theory and Practice. 1996. CBS Publishers and Distributors, Delhi, India.
3. Nielsen, S.S. Introduction to the Chemical Analysis of Foods. CBS Publishers and Distributors, Delhi, India.

## **FN-113: Basic Computer Application (Practical)**

**Credits: 2, Full Marks: 50**

1. Use of MS office (Word, Excel, Power point)
2. Drawing program
3. Photo-editing program
4. Data entry and analysis in SPSS.
5. Hardware application e.g., printer, scanner
6. Internet application.
7. Setup of operating system
8. Different software setup

### **Recommended Books:**

- Computer Fundamentals. M. Lutfar Rahman, M. alamgir hossain. Systech publications Ltd.
- SPSS for Windows. Base System User's Guide Release 6.0. M J Norusis. 1995.
- Excel 7.0 for Windows in a Day. R A Stultz. BPB Publications. 1996.
- Introduction to Computers. Peter Nortons. McGrawHill

## **FN-114: Food Industry / Nutrition Work Visit**

**Credits: 2, Full Marks: 50**

1. Visit to food processing industry/ Nutrition project/Clinic
2. Report writing
3. Presentation
4. Viva voce

## **B. Sc. in Food and Nutritional Science (Honours) Part-2**

### **FN-201: Applied Nutrition and Nutritional Assessment**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

- 1. Nutritional Disorder:** Etiology, sign and symptoms and prevention of underweight, obesity, PEM, Vitamin A, C and D deficiency disorders, Iodine deficiency disorder, Nutritional Anemia, Vitamin B-complex deficiencies, Zinc, Copper, Diabetes, Hypertension, CVD.
- 2. Nutrition during Pregnancy and Lactation:** Importance of nutrition during pregnancy and lactation. Nutritional requirements during pregnancy and lactation. Impact of nutritional deficiency during pregnancy and lactation. Common problems and complications of pregnancy and their managements. Nutritional composition of breast milk. Importance of breast feeding. Nutritional concerns during lactation. Special foods during lactation. Dietary modification during pregnancy and lactation.
- 3. Complementary Feeding:** Colostrum composition, complication in the complementary feeding practices, weaning food.
- 4. Food Fortification:** Definition, classification, principles, basic requirement and application of fortification and enrichment.
- 5. Parameters used for the measurement of growth and development**
- 6. Anthropometric Assessment:** Measuring weight, height, BMI, MAC, Skinfold thickness measurements and compare with standard.
- 7. Biochemical Assessment:** Blood constituents, Urinary creatinine.
- 8. Clinical Assessment:** Signs & symptoms of PEM and micronutrient deficiencies.
- 9. Food Security:** Measurement of food security at household and national level.

### **Recommended Books:**

- Rajalakshmi, R. Applied Nutrition.
- Anita, F.P. Clinical Dietetics and Nutrition. 1989. 2<sup>nd</sup> edition. Oxford University Press, Delhi.
- Passmore, R., Eastwood, M.A. Human Nutrition and Dietetics. 1986. 8<sup>th</sup> edition. Churchill Livingstone.
- Garrow W.T.P., Ralph, J.A. Human Nutrition and Dietetics. 10<sup>th</sup> edition. Churchill Livingstone, Edinburgh, London.
- Gibbson, R.S. Principle of Nutritional Assessment. 1990. Oxford University Press.

## **FN-202: Nutritional Biochemistry**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

- 1. Carbohydrates:** Dietary carbohydrates and their sources, carbohydrate derivatives and their function in biological system, specialized function of carbohydrate, regulation of carbohydrate utilization in the body. Dietary fiber- definition, sources, composition, classification, structural and functional properties, function and fate in the body. Glycemic index.
- 2. Proteins:** Protein quality, first class and second class protein, complete and incomplete protein, protein complementation, sparing of amino acids, methods of determination of protein quality and their advantage and disadvantages, amino acid supplementation, limiting amino acids, amino acid/protein toxicity, nitrogen balance, protein and amino acid pool maintenance, protein turnover, factors effecting the protein requirements, serum protein and special function of protein in the body.
- 3. Lipids:** Advantages and disadvantages of saturated and unsaturated fatty acids Functions and sources of Essential Fatty Acids, omega-3, omega-6 and trans-fatty acid.
- 4. Phospholipids and Lipoprotein:** Definition, sources, classification, structure and function, properties, advantage and disadvantages of lipoproteins and TG in the body. Relation between lipid metabolism and hypertension, atherosclerosis, stroke. Dietary sources and function of cholesterol and metabolic fates in the body.
- 5. Fluid, Electrolytes and p<sup>H</sup> Balance:** Functions, distribution, maintenance of body water, body fluids and electrolytes. Buffering systems in the body fluid, respiratory and renal compensation, body and urine. Physiological effects of p<sup>H</sup>. Causes, mechanism and dietary management during dehydration and electrolyte imbalance. Prevention of dehydration and electrolytic imbalance.
- 6. Enzymes:** Definition, nomenclature, classification. Co-enzymes and co-factors. Effects of substrate, temperature and pH on enzyme activity. Enzyme inhibition- competitive, uncompetitive and non-competitive inhibition. Role of enzymes in digestion of food nutrients (carbohydrate, Protein, Lipid).

### **Recommended Books:**

- Garrow W.T.P., Ralph, J.A. Human Nutrition and Dietetics. 10<sup>th</sup> edition. Churchill Livingstone, Edinburgh, London.
- Brody T. Nutritional Biochemistry. Academic Press Inc. Sandiago, USA.
- Bamji, M.S., Rao, N.P., Reddy, V. Textbook of Human Nutrition. 2003. 2<sup>nd</sup> edition. Pub, Oxford and IBH Publishing Co. Pvt-ltd. New Delhi.
- Swaminathan, M. Essentials of Food and Nutrition Vol I and II. The Bangalore Printing and Publishing Co. Ltd.

**FN-203: Technology of Fish, Meat and Poultry Products**  
**Credits: 4**  
**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**  
**Time: 4 hours (Eight questions to be set and five to be answered)**

**Fish and Fish Products:**

Classification, composition, structure and nutrition of fish. Post mortem changes in fish. Handling and preservation (fresh water, sea fish). Freshness test, rigor mortis, keeping qualities of fresh fish. Quality changes in fish. Low temperature preservation of fish and shrimp. Design of cold storage. Curing, drying, smoking and canning of fish. Modern approaches to fish processing including vacuum packaging, irradiating in packaging. Fish Product: fish ball, fish sausages, fish paste, fish figure, fish burger, fish soup, fish cutlet. Fish plant sanitation and safety. Utilization of by products from fish processing industries.

**Meat and Meat Products:**

Meat and meat products importance in nutrition improvement and national economy. Classification, composition, structure and nutrition of meat. Factors affecting structure, composition and quality of meat. Slaughtering of animals, skinning and cutting. Grading and inspection. Factors affecting post-mortem changes, and shelf-life of meat. Characteristics and Use of different cuts of cow and lamb meat. Processing of meat: aging or ripening, curing, tenderizing, smoking. Preservation of meat: freezing and refrigeration, drying, canning, irradiation, pickling etc. Meat products: Meat ball, kebab, burger, BBQ, sausage, biryani. Meat plant sanitation and safety. Byproduct utilization.

**Poultry Products:**

Structure and composition of poultry meat. factors affecting structure, composition and quality of poultry meat, processing of poultry meat (Slaughtering, skinning, cutting). Physical characteristics of poultry meat; tenderness, color, flavor. Poultry products: chicken based frozen product eg. soup, roast, BBQ, meat ball etc. Egg composition, structure, factors affecting composition and quality of egg. Methods of egg preservation, manufacturing of egg powder, egg substitutes, separation of egg white and egg yolk. Poultry industry by-product utilization.

**Recommended Books:**

- Food Science, Potter, N.N.
- Desrosier, N.W. The Technology of Food Preservation.
- Pyke, M. Food Science and Technology.
- Lawrie, R.A. Meat Science, 1975. 2<sup>nd</sup> edition. Pergamon Press, Oxford UK.
- Lavie A. Meat Handbook. 1980. 4<sup>th</sup> edition. AVI, Westport.
- Stadelmen, W.J., Cotterill, O.J. Egg. Science and Technology. 1977. 2<sup>nd</sup> edition. AVI, Westport.

## **FN-204: Food Engineering Unit Operations**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

- 1. Material Handling:** Unit operation. Definition and principle of material handling. conveyors, elevators, cranes and hoists.
- 2. Cleaning of raw materials:** Function of cleaning, cleaning methods and cleaning equipment. Contaminants in food raw materials.
- 3. The sorting and Grading of Foods:** Sorting and Grading-general considerations, weight sorting, size sorting, shape sorters, photometric sorting, grading of foods.
- 4. Size reduction and screening of solids:** Size reduction equipment, methods of size reduction, screening of solids, importance of size reduction and screening.
- 5. Mixing and Emulsification:** Principle of mixing and emulsification, mixing equipment's, emulsification agents, emulsion properties, emulsification methods, emulsification equipment, importance and application of mixing and emulsification.
- 6. Filtration and Extraction Techniques:** Filtration equipment, application. Membrane separation. Extraction, types of extraction, extraction equipment, methods of extraction, application.
- 7. Centrifugation:** Definition, basic principle, application of centrifugal equipment in food industry.
- 8. Heat Processing and evaporation:** Heat exchanger and their classification, function of various heat exchangers. Construction and Working mechanism of different types of dryer (Cabinet, Tunnel, Vacuum, fluidized bed, Klin, freeze dryer). Single and multiple effect evaporators and their principles of working.

### **Recommended Books:**

- Brennan, J.G., Butters, J.R., Codwell, N.D., Lilly, A.E.V. Food Engineering Operations. 1976. 2<sup>nd</sup> edition. Applied Science Publishers Limited, London.
- Sivasankar, B. Food Processing and Preservation. 2002. Prentice-Hall International, Inc.
- Dessroiser, N.W. Technology of Food Preservation. 1969. 4<sup>th</sup> edition. Pelham Manor, New York.
- Heldman, D.R., Lund, D.B. Handbook of Food Engineering. 1992. Marcel Dekker, New York.
- Earle, R.L. Unit Operation in Food Processing. 1989. Pergamon Press, NY, USA.

## **FN-205: Food Microbiology**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

- 1. Microorganisms Associated With Food:** Microbial types in food (bacteria, molds, yeasts). Factors influencing the kinds, number and growth of microorganisms in foods ( $P^H$ , moisture content, water activity, oxidation-reduction potential and nutrient content). Inhibitory substances for microorganisms.
- 2. Basic Concept of Microbial Contamination and Spoilage of Foods:** Sources of microorganisms that causes contamination, and the stages of microbial contamination of food. General principles underlying the spoilage of foods. Causes of spoilage of foods. Classification of foods based on perishability. Chemical changes caused by microorganism in carbohydrate, protein, fats and other food compounds.
- 3.** Control of microbial growth in food products.
- 4. Microbial Contamination and Spoilage of Foods and Food Products:** Cereal products, Sugar products, Fishery products and other seafood, Meat products; Poultry products, Milk products, Fruits, vegetables and their products, Canned food, Soft drinks.
- 5. Microbial Toxicity:** Definition of infection, events of infection. Intoxication, classification of bacterial toxin. Exotoxin- potency, classification, mechanism of action, detoxification of exotoxin (toxoid, diphtheria, botulinum, tetanus, cholera). Endotoxin- mechanism of action, pharmacological effects. Mycotoxin- mycotoxin that significant in foods, Effects of mycotoxin, production of mycotoxin, control of mycotoxin. Structure, chemistry, toxicity and significance in foods of aflatoxin, citrinin, ochratoxin, ergosine, arginine toxin. Viral health hazards. Determination of virus in foods. Food born viral diseases, and their control.
- 6. Foods and Water Borne Diseases:** Food borne diseases and its classification. Food poisoning, water borne diseases. Necessary condition for outbreak and prevention/control of Botulism, Staphylococcal intoxication, Clostridium perfringens gastroenteritis, Salmonellosis, Bacillus cereus gastroenteritis, cholera, *E. Coli*. Gastroenteritis, streptococcal infection.

### **Recommended Books:**

- Marriot, N.G. Principle of Food sanitation. 1994. 3<sup>rd</sup> edition. Chapman and Hall, London.
- Frazier, W.C., Westhoff, D.C., Food Microbiology. 1988. 4<sup>th</sup> edition, McGraw Hill Inc.
- James, J.N. Modern Food Microbiology. 1986. 3<sup>rd</sup> edition, Van Nestrand Reinhold Company Inc.
- Benson, H.J. Microbiological Application. 1990. Publishers, U.S.A.
- Hobbes, B.G., Gilbert, R.J. Food Poisoning and Food Hygeine.



## **. FN-206: Technology of Fruits, Vegetables and Dairy Products**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

### **Technology of Fruits and Vegetables Products**

- 1 Fruit and Vegetable Juices:** Preparation of fruit syrups, squashes and cordials, nectars, fruit juice concentrates. Packaging and storage of juices concentrates and their quality control. Modern method of fruit juice making. Types of juice-based soft drinks and their manufacture.
- 2 Pickles, Chutneys and ketchup:** Preparation of various types of pickles-theory and practices, preparation of pickles, chutneys and ketchup from fruits and vegetables, problem resulting to shelf life of pickles and chutneys, quality control.
- 3 Pectin and Sugar Related Products:** Manufacture of pectin, theories of gel formation. Processing of jams, jelly, marmalades. Food standards relating to the above products and their quality control.
- 4 Vinegar:** General methods of preparation, food standards and quality control, various types of vinegar. Acetic acid preparation from pineapple.
- 5 Mushroom:** Types and characteristics of safe mushroom. Different scale processing and its nutritional attributes. Mushroom products.

### **Technology of Dairy Products**

1. Sources and composition of milk.
2. Processing of market milk, standardization, toning of milk, homogenization, pasteurization, UHT, sterilization, storage, transportation and distribution of milk.
3. Milk product processing: Commercial milk, butter, butter oil, cheese, condensed milk, evaporated milk, whole and skimmed milk powder, ice cream, yogurt.
4. Quality assessing and platform test of milk. Judging and grading of milk and its products. CIP in milk plant.
5. Milk adulteration and its control.

### **Recommended Books:**

- Potter N.N., Hotchkiss J.H. Food Science. 5<sup>th</sup> edition. CBS Publishers and Distributors.
- Seymour, G.B., Taylor, J.E. Tucker, G.A. Biochemistry of Fruit Ripening. 1993. Chapman and Hall, London.
- Srivastava, R.P., Kumar, S. Fruit and Vegetable Preservation: Principles and Practices. 1998. 2<sup>nd</sup> edition. International Book Distributing Co. Lucknow.
- Dey, S. Outlines of Dairy Technology. 1994. Oxford Univ. Press, New Delhi.
- Rosenthal, I. Milk and Milk Products. 1991. VCH, New York.
- Warner, J.M. Principles of Dairy Processing. 1976. Wiley Eastern Ltd. New Delhi.
- Harper, D., Hall, C.W. Dairy Technology and Eng. 1970. The AVI Pub. Co. Inc. USA.

## **FN-207: Human Physiology**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

- 1. Cell and Tissue:** Cell as a basic unit of life. Cell structure, cell organelles, function of the organelles. Structure and functions of various types of tissues.
- 2. Muscle:** Structure, function and their types. Mechanism of contraction and relaxation, action potential.
- 3. Blood cells and blood clotting:** General functions and Composition of blood. Plasma, serum. Structure and function of RBC, WBC and Platelets. Function and structure of hemoglobin and myoglobin. ABO-blood grouping, Rh factor, Mechanism of blood coagulation.
- 4. Digestive system:** Structure and function of digestive systems. Mechanism of secretion of gastric acid. Physiology of digestion and absorption of food (Carbohydrate, protein, lipid).
- 5. Heart:** Structure and functions of heart, artery and vein. Cardiac cycle. Function of valves. Factors regulating blood pressure.
- 6. Lungs:** Structure of respiratory tract. Basic mechanisms of lung expansion and contraction.
- 7. The Body Fluids and Kidneys:** The lymph channels of the body, formation of lymph. Total body water, accumulation of fluid in human tissue, physiologic anatomy of the kidney, basic theory of nephron function, blood flow through the kidneys.
- 8. Endocrinology:** Nature of a hormone, endocrine glands and their hormones, hormone receptor and their activities, physiological function of different hormones.

### **Recommended Books:**

- Guyton, A.C., Hall, J.E. Text Book of Medical Physiology. 9<sup>th</sup> edition. Prism Books (Pvt.) Ltd. Bangalore.
- ChatterjeeChandiCharan. Text Book of Medical Physiology. London W.B.
- Ganoneg, W.E. Review of Medical Physiology. 1999. Prentice-Hall International, Inc.
- Chatterjee, C.C. Human Physiology Vol. I and II. Medical Allied Agency, India.
- Shahana and Ghosh. Human Physiology.
- Yusuf, H.K.M. Brain and Its Development.

## Practical

### **FN-208: Technology of Fish, Meat and Poultry Products (Practical)** **Credits: 2, Full Marks: 50**

1. Slaughtering and dressing of meat animals.
2. Study of post-mortem changes, Meat cutting and handling,
3. Experiments in freezing, canning, curing, smoking and pickling of fish and meat
4. Determination of Nitrite in meat
5. Evaluation of quality and grading of eggs (candling)
6. Preservation of shell eggs,
7. Estimation of meat- bone ratios
8. Test of freshness of fish
9. Determination of Sulphur Dioxide in canned fish
10. Preparation of meat products- Meat ball, kebab, burger, BBQ, sausage, biryani. Preparation of
11. Preparation of fish products- fish ball, fish sausages, fish paste, fish figure, fish burger, fish soup, fish cutlet
12. Egg products- Use of Egg powder in food products, egg sandwich preparation

#### **Recommended Books:**

- Rosenthal, I. 1991. Milk and Milk Products. VCH, New York.
- Warner, J.M. 1976. Principles of Dairy Processing. Wiley Eastern Ltd. New Delhi.
- Yarpar, WJ. and Hall, C.W. 1975. Dairy Technology and Engineering AVI, Westport.
- Lawrie, R.A. 1975. Meat Science, 2nd Edn. Pergamon Press, Oxford UK.

### **FN-209: Food Microbiology (Practical)** **Credits: 2, Full Marks: 50**

1. Study of culture media.
2. Preparation of nutrient Agar and Nutrient Broth Media.
3. Culture of Bacteria in Nutrient Broth Medium.
4. Culture and count of Bacteria in Agar plate by pour plate, streaking method.
5. Culture and count of yeast and molds in Agar plate by pour plate method.
6. Culture and count of coliform in selective media.
7. Identification of *E. coli* in selective media.
8. Identification of *Salmonella* in food sample
9. Preparation of pure culture (Lactic acid bacteria)
10. Study of Bacterial Morphology by Gram's staining method.
11. Identification of food pathogen and spoilage bacteria in water, milk, meat, poultry and bakery products.

### **Recommended Books:**

- Frazier, W.C., Westhoff, D.C., Food Microbiology. 1988. 4th edition, MaGraw Hill Inc.
- James, J.N. Modern Food Microbiology. 1986. 3rd edition, Van Nestrand Reinhold Company Inc.
- Peleazar, M.I., Reid, K.D. Microbiology. 1978. McGraw Hill Company, New York.

### **FN-210: Technology of Fruits, Vegetables and Dairy Products (Practical)** **Credits: 2, Full Marks: 50**

1. Equipment for fruits and vegetable processing.
2. Preparation of fruit juices, squashes, syrups and ready-to-serve beverages.
3. Preparation of jams, jellies, marmalade, preserves, and candies.
4. Preparation of pickles, chutneys, and tomato products.
5. Drying of fruits and vegetables.
6. Alcohol and fat test of milk (Garber method)
7. Determination of lactose content in milk.
8. Platform tests of milk.
9. Determination of Lactic acid content of milk by titration method.
10. Determination of acidity by simple method.
11. Milk pasteurization and sterilization.
12. Preparation of yogurt, Ghee, Cheese, milk sweets and ice cream.
13. Processing of mushroom products.

### **Recommended books:**

- Rice: Chemistry and Technology. Edited by B/O/Juliano, AACC. Inc. St. Paul Minnesota 1985.
- Chocolate, Cocoa and Confectionery. By B.W. Minifie. Churchills London. 1970.
- Sugar Confectionery and Chocolate Manufacture. By R. Lees and B. Jackson. Leonard Hill Aylesbury.
- Food Engineering System. Vol. I- Operations. A.W. Farral . Pub: The AVU Publishing to Inc.

### **FN-211: Food Industry / Nutrition Work Visit** **Credits: 2, Full Marks: 50;**

1. Visit to a food processing industry / Nutrition project / Clinic
2. Report writing
3. Presentation
4. Viva voce

## **B. Sc. in Food and Nutritional Science (Honours) Part-3**

### **FN-301: Applied Dietetics and Clinical Nutrition**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

- 1. Basic Concept of Diet Therapy/Meal planning:** Objectives, classification, principle, importance of diet therapy or meal planning. Considering factors in diet planning.
- 2. Nutrition in pregnancy:** Physiology of pregnancy, additional requirements of the nutrients due to pregnancy and recommended allowances. Plan a diet chart for pregnant woman
- 3. Nutrition in lactation:** Physiology of lactation, extra demand calculation due to lactation, recommended allowance. Plan a diet chart for lactating mother.
- 4. Diet and Diseases of Childhood:** Nutritional needs and diet in early childhood. Plan a food menu for infant. Causes, sign and symptoms, nutrition therapy of malabsorption, pneumonia, rheumatic fever, dysentery.
- 5. Nutrition in adolescence:** Nutritional need and plan for the adolescence. Calculation of diets and prepared menu planning based on food exchange lists for Adolescent girls and boys.
- 6. Dietary Management of non-communicable diseases:** Calculation of diets and prepared menu planning based on food exchange lists for specific diseases state (Obesity, Diabetes, Hypertension, CVD, Kidney disease, Liver and gall bladder diseases, gastrointestinal disorders, cancer).
- 7. Geriatric nutrition:** Physiological changes in elder person. Nutritional requirement in elder people. Guidelines for meal planning. Simple meal plan for an old person (60-80) years.
- 8. Diet planning for Vegetarian:** Types of vegetarian, Supplementary diet for vegetarian, Plan a diet for vegetarian.
- 9. Specialized Feeding Methods:** Definition, classification of feeding procedure, complications, advantages of tube feeding, supplementary feeding, intravenous feeding. Composition of tube, supplementary and intravenous feeds.

### **Recommended Books:**

- Robinson. C.H. Lawler, M.R. Chenoweth, W. L., and Garwick, A.E. Normal and Therapeutic Nutrition. 1986. 17<sup>th</sup> edition, MacMillan Publishing Co.
- Gills, N.J., Bosscher, M.V. Manual of Nutrition and Diet Therapy.
- Passmore, R., Eastwood, M.A. Human Nutrition and Dietetics. 1986. 8<sup>th</sup> edition. Churchill Livingstone.
- Anita, F.P. Clinical Dietetics and Nutrition. 1989. 2<sup>nd</sup> edition, Oxford University Press, Delhi.
- Joshi, S.A. Nutrition and Dietetics. 2002. 2<sup>nd</sup> edition. Tata McGraw Hill, Publications, New Delhi.

## **FN-302: Community Nutrition and Nutrition Education**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

- 1. Dynamics of Community Nutrition:** Definition of community nutrition. Aspects of community nutrition diagnosis. Application of the principles of nutrition to various community problems of specific groups of the public. Specific educational objectives for community assessment.
- 2. Community based approach:** Characteristics of community based programs. Techniques of community mobilization. Assessment, analysis and action approach of management of nutrition at the community level. Community based management of acute malnutrition (CMAM). Nutrition programs in Bangladesh.
- 3. Nutrition communication:** Strategies of nutrition communication, identification of target groups and their needs, tools, methods and media of nutrition communication and their limitation.
- 4. Nutrition Education:** Concepts and importance of nutrition education.
- 5. Dissemination of Nutrition Knowledge:** Through group discussions, Mass media. Importance of practical demonstrations and play in nutrition education. Preparation and demonstration of educational materials.
- 6. Nutrition Awareness Building:** Messages in Nutrition education. Audio and visual aids in nutrition education.
- 7. Addressing Malnutrition:** Need for nutrition planning, Short term and long term objectives. Strategies of nutrition planning. Sequences of nutrition planning. Relative sectorial approach of nutrition planning.
- 8. Field Testing and Nutrition Education Materials:** Testing of nutritional messages and communication materials. Group exercise on the preparation of nutrition education materials.

### **Recommended Books:**

- Community Nutrition Assessment- Jelliffe & Jellif
- Principle of Nutrition Assessment- R. Gibson
- Human Nutrition in developing world – M.C. Latham
- Economics Development in the third world- M.P. Todaro

## **FN-303: Food Biotechnology and Fermentation Technology**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

- 1. Introduction:** An introduction to biotechnology and food biotechnology. Scope and application of food biotechnology. Impact of biotechnology in Health care, Agriculture and Food.
- 2. Genes and genetic engineering:** Basic concepts of gene, Structure and chemical nature of DNA, nucleic acids. Tools of genetic engineering: Restriction enzymes, DNA ligase, cloning vector, linker, adapter. DNA multiplication. Basic steps of gene cloning.
- 3. Enzyme Biotechnology:** Biocatalyst, source and application of enzymes, properties of enzymes, production of enzymes: Amylase, protease, lipase. Application of enzymes in food and beverage industry.
- 4. Microbial products:** Primary and secondary metabolites, commercial production of vitamin B<sub>12</sub>, citric acid, alcohol and insulin from microorganism. Source and production of microbial enzyme renin.
- 5. Biotechnological application in food and agriculture:** GM food, single cell protein (SCP), genetically modified rice. Use of molecular genetics to improve food properties.
- 6. Fermentation:** Definition, importance and types of fermentation, substrates of fermentation, role of microorganisms in fermentation. Basic function and types of fermenters, construction of fermenters, design and operation. Aseptic operation and containment. Scale up of fermentation, significance of scale up, sterilization of gases and nutrient solution, bioreactor and their classification. Oxygen requirement. Process of fermentation product recovery, unit operation in product recovery. Controlling fermentation in various foods (beer, wine, and vinegar).
- 7. Antibiotics:** natural and synthetic antibiotics, antibiotic producing microorganisms, major types of naturally produced commercially important antibiotics.
- 8. Prebiotics and Probiotics:** Manufacture of food yeast. Production of Soya sauce, fish sauce, yoghurt.

### **Recommended Books:**

- Glazer A.N., Nikaido, H. Microbial Biotechnology. 2007. 2nd edition. Cambridge University Press.
- Bains W. Biotechnology from A to Z. 1993. Oxford Univ. Press, Oxford.
- Joshi, V.K., Pandey, A. Biotechnology. Food Fermentation. 1999. Education Publ. New Delhi.
- Knorr, D. Food Biotechnology. 1982. Marcel Dekker, New York.
- Crueger, W., Crueger A. Biotechnology: A Textbook of Industrial Microbiology. 1984. Science Tech. Madison, USA.
- Stanburry, P.P., Whitaker, A. Principles of Fermentation Technology. 1984. Pergamon Press, Oxford UK.

## **FN-304: Technology of Cereal, Legume and Tuber Crops**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

- 1. Rice:** Structure and nutrient composition of rice. Parboiling, drying, milling, storage of milled rice, enrichment of rice with vitamins and minerals, manufacture of puffed rice, by-products of rice milling industry and their utilization.
- 2. Wheat:** Structure and nutrient distribution of wheat. Wheat types, milling of wheat, Wheat product manufacture: whole wheat flour, white flour, semolina. Extraction rates, Flour treatment, storage of flour, Test for flour quality. Dough development and dough ripening. Byproduct utilization.
- 3. Corn:** Structure and nutrient composition of maize. Corn-wet and dry milling. Uses of dry milled and wet milled maize products. Manufacture of corn flakes, puffed corn, corn starch, corn syrup. Byproduct utilization.
- 4. Other cereals:** Milling operation of Barley and oats. Malting process of Barley.
- 5. Breakfast cereals:** Cooking of cereals, hot cereals, and ready –to-eat cereals.
- 6. Legumes:** Nutrient composition of common Legumes in Bangladesh. Milling procedure of Legumes, Methods of cooking dry legumes, Factors affecting the cooking quality of legumes. Processed legume products: Puffed chickpea and pea, Quick cooking Dhal, Canned dry beans.
- 7. Tuber crops:** Cleaning and storage of various tuber crops such as potatoes, sweet potatoes, cassava etc. Manufacture of potato chips, French-fries, potato starch.

### **Recommended Books:**

- Potter N.N., Hotchkiss J.H. Food Science. 5<sup>th</sup> edition. CBS Publishers and Distributors.
- Chakraverty, A. Postharvest Technology of Cereals, Pulses and oilseeds. 1988. Oxford and IBH, New Delhi.
- Kent, N.L. Technology of Cereals. 1984. 3rd edition. Pergamon Press, Oxford, UK.
- Mathews, R.H. Legumes: Chemistry, Technology and Human Nutrition. 1989. Marcel Dekker, New York.
- Pomeranz, Y. Modern Cereal Science and Technology. 1987. VCH Pub., New York.



## **FN-305: Post Harvest Technology**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

Composition of major and minor field crops in Bangladesh, Post - harvest handling and storage of field crops, Pre-harvesting factors effect on post- harvest quality of crops. Effects of temperature, water loss, humidity, storage atmosphere, ethylene on fruits and vegetables. Chemical and biochemical changes of crops. Maturity and quality indices of crops. Postharvest pathology. Post-harvest damage to fresh product. Harvesting, cleaning, sorting, grading, handling, pre-packaging, transportation and distribution of different crops. Postharvest handling of temperate fruits, subtropical fruits, subtropical fruits, leafy vegetables, Root, tuber and bulb vegetables, immature and mature fruits-vegetables, minimally processed products.

Common oil seeds in Bangladesh: Production and use. Oil extraction: expeller pressing and solvent extraction of oil. Oil refining. Rice bran oil: Importance and processing. Fermented and traditional products from soybean. Importance of fats and oils in human nutrition. Hydrogenated vegetable oil: manufacturing and uses of HVO, types of HVO. Margarine: manufacturing process and its uses. Mayonnaise: manufacturing process and its uses. Imitations dairy products: peanut butter and vegetable ghee. Packing and storage of fats and oils.

### **Recommended Books:**

- W.V. Cricss (1958) Commercial fruits and vegetable products. 4<sup>th</sup> Ed, McGraw Hill Book Co. New York.
- Anonymous (1995). Fruits and vegetables. Postharvest Management and marketing. Hort, Res. & Dev. Project, FAO/UNDP. DAE/BADC, Dhaka.
- Pruthi. J.S. 1986. Spices and condiments. National Book Trust, New Delhi.
- Nagg, S. and P.E. Shaul. 1980; Tropical and sub-tropical fruits; composition properties and uses, CRC Press.
- Theodore J. Weiss, PhD 1970. Food Oils and Their Uses. The Avi Publishing Company, Inc.
- Hamilton, R.J. and Bharti, A. Ed. 1980. Fats and Oils: Chemistry and Technology. Applied Science, London
- Bailey, A. E. 1967. Industrial oil and fat products. 2<sup>nd</sup> edition. Interscience. New York

## **FN-306: Food Safety and Preservation Technology**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

- 1. Food Safety:** Food Safety, Food Safety measures, Food safety authority and legislation, Food adulteration and hygiene practice, use of adulterants in food of Bangladesh. Food Safety Standard (HACCP, ISO, GMP, GSP), causes of spoilage, principles and methods of food preservation.
- 2. Preservation by Low Temperature:** Principle and methods of refrigerated storage, cold storage and freezing, requirements for refrigerated storage, changes during refrigerated storage. Types of freezing, factors determining freezing rate, refrigeration load.
- 3. Heat Preservation:** Sterilization, pasteurization, HTST, UHT, blanching. Factors affecting heat resistance of microorganisms, principle of thermal destruction of spoilage microorganisms, factors affecting thermal process time, calculation of thermal process time and adequacy of heat treatment.
- 4. Dehydration and Concentration:** Principle of dehydration and concentration, importance of dehydration and concentration, factors determining rate of dehydration and concentration, effect of food properties upon dehydration, freeze drying and other methods of dehydration and concentration. Description of different dryers.
- 5. Chemical Preservation of Food, Curing and Pickling:** Principle of chemical preservation, types of chemical preservation, commonly used chemical preservatives, consideration during chemical preservation, curing and pickling- their preservative role, effective combine preservation.
- 6. Irradiation and Microwave Heating:** Food irradiation- objectives, classification, application, Effect of irradiation on nutrition, Irradiated food and health, chemical changes of irradiated foods, irradiation dose of foods. Mechanism, advantages and disadvantages of Microwave heating. Legal strands for microwave heating and irradiation.
- 7. Storage:** Storage temperature, Humidity and other parameter control, Insect and rodent control, Control atmosphere storage and modified atmosphere storage.

### **Recommended Books:**

- Potter N.N., Hotchkiss J.H. Food Science. 5th edition. CBS Publishers and Distributors.
- Dessroiser, N.W. Technology of Food Preservation. 1970. The AVI Pub. Co. USA.
- Sivasankar B. Food Processing and Preservation. 2002. Prentice-Hall International, Inc.
- Bianu, I.C., Pessen, H. Physical Chemistry of Food Processing. Rahman, M.S. Handbook of Food Preservation. 1999. Marcel Dekver Pub, New York.

## **FN-307: Food Packaging, Research and Development**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

- 1. Introduction to Food Packaging:** Definition, importance, functions and scope of packaging of foods.
- 2. Packaging Materials:** Origin of packaging materials, types, properties, advantages and disadvantages of packaging materials. Machineries related to food packaging.
- 3. Forms of Packaging:** Box, PET, bottle, tetra, pouch, CAP, MAP, aseptic packaging, active packaging, Vacuum packaging.
- 4. Package Quality Check:** Brief Introduction to bursting strength, tensile strength, tearing strength, drop test, puncture test, impact test etc.
- 5. Packaging Requirements:** Packaging requirements and their selection for raw and processed foods- Meat, fish, poultry, eggs; Milk and dairy products; Fruits and vegetables; Cereal grains and baked food products; Beverages; Snacks.
- 6. Research and Development (R&D):** Objectives of research and development, selection and training of sensory panel. Hedonic rating of food. Identification and ranking of food product attributes. Sensory and instrumental methods for measuring food attributes, Documentation of R&D,
- 7. Product Development:** Development and quality assessment of nutraceutical and functional food production, health beneficial product, Dairy products low calories drinks, vitamin and mineral enrich products
- 8. Formulation:** Formulation procedure, process of patent, Technique of formula developments.

### **Recommended Books:**

- Munich, H. Principle of Food Packaging. FAO, USA P Keppler Veriag KG.
- Brodly, A.L. Flexible Packaging of Foods. 1970. Chemical rubber Co. Butterworth, London.
- Painy, F.A and Painy, H.Y. 1993. A Handbook of Food packaging. Leonard Hill, Glasgow, UK
- Scicharow, S. and Griffin, R.C. 1990. Food packaging. AVI, Westport.
- Nielsen, S. S., Food Analysis, 1998. 2<sup>nd</sup> edition. Aspen Publishing.

**FN-308: Basic Sociology and Professional Management**  
**Credits: 4**  
**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**  
**Time: 4 hours (Eight questions to be set and five to be answered)**

**Basic Sociology**

1. **Classification of Sciences:** Physical science and social science. Establishment of sociology as a science.
2. Definition, nature, scope, importance of sociology.
3. **Basic Concepts on Sociology:** Society- meaning and characteristics. Community- meaning and characteristics, difference between society and community. Association- Definition and characteristics. Institutions- Definition and characteristics, Primary and secondary institutions, Functions of social institutions. Groups- Definition and characteristics, importance and classification of social groups, Difference between primary and secondary groups. Culture- meaning, characteristics, contents, functions, development, element and change of culture. Civilization- Difference between culture and civilization. Organization- nature and characteristics.
4. **Family:** Family structure in Bangladesh, Marriage types.
5. **Social Problems:** Juvenile delinquency- definition and causes. Population problem (effect of overpopulation). Problems of poverty (consequence). Unemployment problem (Causes and consequences).

**Professional Management**

Concepts of personality, roles, personal style, motivation, Groups, teams and leadership. Explore problem definition, solutions, selection of preferences, implementation, and evaluation. Active and passive listening, verbal and non-verbal communication. Oral and writing presentation (MS Power point). Interviewing roles and expectations. IT within a professional context (Internet browsing, E-mailing), word processing software and techniques (MS word, MS Excel). Authority and responsibility, policy and strategy, decision making: standard and prioritization. Administration systems, allocation of resources. Personal and formal letters, job application, cover letter, curriculum vitae.

**Recommended Books:**

- Sharma, R.N. Principles of Sociology. 1994. 2<sup>nd</sup> edition. Media Promoters and Publishers Pvt. Ltd. India.
- Spencer, M. Foundation of Modern Sociology. 2<sup>nd</sup> edition. Prentice-Hall International, Inc.
- Harris. S. 1996: Human Communication and Information Systems. Blackwell
- Biddle, D, Evenden, R. 1993: Human aspects of management, IPD

## Practical

### **FN-309: Applied Dietetics and Clinical Nutrition (Practical)**

**Credits: 2, Full Marks: 50**

1. Estimation of Blood glucose.
2. Estimation of Blood hemoglobin
3. estimation of Serum cholesterol
4. Prepare your own diet chart using accurate estimation method.
5. Prepare a diet chart for lactating mother
6. Prepare a diet chart for adolescent boy and girl
7. Prepare a diet chart for Overweight and Obesity, Underweight, Cardio vascular disease, Diabetes mellitus, Liver disease, Disease of the kidney and Urinary tract.
8. Develop nutritious food item and use them for serving size estimation.

#### **Recommended Books:**

- Passmore, R., Eastwood, M.A. Human Nutrition and Dietetics. 1986. 8<sup>th</sup> edition. Churchill Livingstone.
- Anita, F.P. Clinical Dietetics and Nutrition. 1989. 2<sup>nd</sup> edition, Oxford University Press, Delhi.
- Joshi, S.A. Nutrition and Dietetics. 2002. 2<sup>nd</sup> edition. Tata McGraw Hill, Publications, New Delhi.

### **FN-310: Technology of Cereal, Legume and Tuber Crops (Practical)**

**Credits: 2, Full Marks: 50**

1. Determination of foreign matter in wheat flour
2. Determination of moisture content of wheat flour
3. Determination of gluten content of wheat flour.
4. Determination of calcium carbonate in flour.
5. Quality test of corn flour and corn flakes
6. Determination of aflatoxins in legumes.
7. Flour quality tests for bread making
8. Bread preparation
9. Cake preparation
10. Biscuit preparation
11. Potato chips preparation
12. Starch extraction from potato, cassava etc.

#### **Recommended Books:**

- Chakraverty, A. 1988. Postharvest Technology of Cereals, Pulses and oilseeds. Oxford and IBH, New Delhi.
- Kent, N.L. 1983. Technology of Cereals. 3rd Edn. Pergamon Press, Oxford, UK.
- Mathews, R.H. Ed. 1989. Legumes: Chemistry, Technology and Human Nutrition. Marcel Dekker, New York.

**FN-311: Post Harvest Technology and Preservation (Practical)**  
**Credits: 2, Full Marks: 50**

1. Determination of starch from the supplied sample.
2. Determination of total soluble solids from the supplied food sample.
3. Extraction of oil from different sources.
4. Manufacture of shortening, margarine.
5. Preparation of peanut butter.
6. Preparation of mayonnaise.
7. Determination of ureic acid in Mastered oil.
8. Determination of saponification number of fats or oils
9. Determination of iodine number of fats or oils.
10. Determination of acid value of fats or oils.
11. Determination of peroxide value of fat.
12. Preservation of food and food products by chemical preservative.

**Recommended Books:**

- O'Mahony, M. Sensory Evaluation of Food: Statistical Methods and Procedures.
- Moskowitz, H.R. Food Texture: Instrumental and Sensory Measurement.
- Daniel, Y., Fung, C., Matthews, R.F. Instrumental Methods for Quality Assurance in Foods.
- Dessroiser, N.W. Technology of Food Preservation. 1970. The AVI Pub. Co. USA.

**FN-312: Food Packaging, Research and Development (Practical)**  
**Credits: 2, Full Marks: 50**

1. Identification of different types of packaging and packaging materials
2. Quality test of PET bottle
3. Measurement of thickness of packaging materials
4. Leakage test of packets.
5. Determination of bursting strength of packaging material
6. Drop test of food carton
7. Determination of Sodium Benzoate in food and beverage sample.
8. Product Development: Baby food, Herbal tea products, Diabetic bakery product

**Recommended Books:**

- Total Quality Assurance for the Food Industries- GOULD, Wilbur, A. 3<sup>rd</sup> ed. CT1 Publications. 2001
- Food Analysis: Theory and Practice- POMERANZ, Yeshajahu and MELOAN, Clifton. 3<sup>rd</sup> Ed. Van Nostrand Reinhold Co. U.S.A. 1994

**FN-313: Food Industry / Nutrition Work Visit**  
**Credits: 2, Full Marks: 50**

1. Visit to a food processing industry / Nutrition project / Clinic
2. Report writing
3. Presentation
4. Viva voce

## **B. Sc. in Food and Nutritional Science (Honours) Part-4**

**FN-401: Nutritional Problems and Nutrition in Emergencies**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

- 1. Gender Issue in Nutrition:** Identification of Nutrition Problem associated with gender issue and their solution
- 2. Food Security:** National and Household Food Security. Nutrition security, Nutrition throughout life cycle.
- 3. Pattern of Malnutrition in Developing Countries:** Major nutritional problems in Bangladesh, protein-energy malnutrition, micro nutrients and health development, care and nutrition, protection, support and promotion of caring practice for the socio-economically deprived and nutritionally vulnerable groups. Addressing malnutrition and Planning to combat malnutrition.
- 4. Urban nutrition problem:** Urban nutrition problems and their characteristics; solution of urban nutrition problem.
- 5. Emergency nutrition:** Definition of nutritional emergency, its causes and implications. Management and practice of different type of emergency feeding program (general food distribution, mass feeding, therapeutic feeding, and special foods during emergency, vulnerable group feeding).
- 6. Importance of nutritional relief.** Field level difficulties- camp administration, transportation, food storage etc.
- 7. Macro and Micro- nutrient deficiencies in emergency;** Assessment and surveillance of nutritional status in emergency.
- 8. Monitoring and evaluation of nutritional emergencies;** Responsibilities and mandate of UN bodies and different GO and NGOs in emergency situation.

### **Recommended Books:**

- Latham, M.C. Human Nutrition in the Developing World.
- Robson, J.R.K. Malnutrition its causation and control. Vol I and II. 1972. Gordon and Breach.
- Jelliffe, D.B., Jelliffe, E.F.P. Community Nutritional Assessment. 1989. Oxford University Press.
- The Management of Nutritional Emergencies in Large Populations- Goyet & Geijer
- The Management of Nutrition in Major Emergencies- WHO, Geneva, 2000.



## **FN-402: Beverage and Tea Technology**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

### **Beverage Technology:**

1. **Beverage:** Introduction, classification. Beverage industry in Bangladesh.
2. **Ingredients for Beverages:** Water – sources and purification, types of water purification system. Fruit pulps, juices, concentrates and other additives; Sweeteners –natural sweetener, artificial sweeteners, acid, colors, flavors, gums, preservatives.
3. **Fruit Based Beverages:** Nectar, cordial, squash, syrup, juice concentrates, fruit flavored powders.
4. **Carbonated Beverages:** Carbonation Procedure, Formulation, process and quality control of CSD products.
5. **Other Beverages:** Barley water, low calorie beverages, dry mix, and formulation of coffee and tea.
6. Bottled water and Traditional beverages production.

### **Tea Technology:**

7. Health benefits of tea, Quality analysis of green leaf, processing of black tea, green tea, oolong tea
8. **Tea Processing:** Withering: Objectives, physical withering, chemical withering, effect of withering on quality of tea, calculation of withering percentage. Fermentation: Objectives of fermentation, Biochemical changes during fermentation, factors affecting fermentation, Methods of fermentation. Drying: Objectives of drying, factors considering during drying. Sorting and Grading. Storage and Packaging.
9. **Tea Testing:** Characteristics of Black tea, Green tea and semi-fermented tea

### **Recommended Books:**

- Dittmer, P.R., Keefe, J.D. Principles of Food, Beverage. 2008.
- Cichy, R.F., Philip, J., Hickey, Jr. Managing Service in Food and Beverage Operations. 2005.
- Varnam, A.H., Sutherland, J., Varnum, A. Beverages: Technology, Chemistry, and Microbiology. 1994.
- Sarma, GC. Tea Technology.
- Harper, C.R. Tea Manufacturer. 1974. Oxford University Press, London.
- Thorner, M.E., Herzberg, R.J. Food Beverage. 1970. AVI Pub. Co. USA.

## **FN-403: Biostatistics and Research Methodology**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

1. Definition and scope of statistics, Population, Sample, sources of data, variable and its types, Graphical and diagrammatic representation of data with numerical example.
2. **Sampling Techniques:** Types of sampling, sample size calculation.
3. **Measures of Central Tendency:** Mean, median and mode. Measures of central tendency with numerical examples.
4. **Measures of Dispersion:** Range, Mean deviation, Standard deviation, Variance, Coefficient of variation. Measures of dispersion with numerical examples.
5. **Fundamentals of Research:** definition and scope, methods and methodology, goals of research, areas of research, typology of research, characteristics of research, desirable quality of research, evaluating the proposed research.
6. **Basic Concept and Ethics in Research:** variable and its types, properties of relationship between variables, level of measurement, research hypothesis, research objectives, operational definition, and ethics in research.
7. **Research Process:** identifying the problem, review of literature, setting objectives and hypothesis, choosing research design, choosing sample design, data collection, processing and analyzing data, report writing.
8. **Data Collection Technique:** Quantitative and qualitative data collection techniques, Advantages and disadvantages of data collection technique, data quality check. Data collection tools, steps involved in designing a questionnaire.
9. **The Relationship Between Variables:** Normal distribution, confidence level, Correlation and regression with numerical example.
10. **Hypothesis Testing:** normal test, t-test, chi-square test.
11. **Research Proposal:** Component of proposal, report writing.

### **Recommended Books:**

- Basic Statistics (Methods and Applications), M.A. Jalil and R. Ferdous
- Business Statistics, S.P. Gupta and M.P. Gupta, Sultan Chand & Sons
- Applied Statistics (Handbook for Human Settlements Planning), M.A. Quader Miah, Asian Institute of Technology.
- M.Nurul Islam, 2008. An Introduction to Research Methods. Mullick & Brothers, Dhaka.
- Oppenheim AN. Questionnaire design, interviewing, and attitude measurements, Printer, 1992

## **FN-404: Epidemiology and Public Health Nutrition**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

- 1. Basic Concept of Epidemiology:** Introduction; definition and background. History and overview of Nutritional Epidemiology.
- 2. Basic Terms and Methods Used in the Epidemiology:** Accuracy and reliability: sensitivity, specificity; Association (e.g. Relative risk, Attributable risk); frequency (e.g. Prevalence rate, Incidence rate, Standardized rate, SMR ); and odds ratio
- 3. Epidemiological Study Designs:** Describe and compare basic features and uses of epidemiological study designs (e.g. cross-sectional, case-control, cohort), strengths and limitations of case-control studies, cohort studies, prospective versus retrospective studies.
- 4. Nutritional Epidemiology:** Techniques used to evaluate relationships of diet to health and disease in human populations; understanding dietary risk or protective factors for disease.
- 5. Epidemiology of Communicable and Non-communicable Diseases:** Introduction and classification to infectious disease epidemiology, modes of disease transmission, host susceptibility and response to infectious diseases, biomedical interventions to prevent infectious diseases (Small Pox, Cholera). Understand the epidemiology of non-communicable diseases (CVD, Hypertension and Diabetes).
- 6. Concepts of Public Health Nutrition:** Definition, goals of public health nutrition, steps of public health nutrition, key reasons of public health nutrition problems in developed and developing countries.
- 7. Evidence of nutrient intake:** Review critically the evidence relating to desirable levels of intake for the population of the Bangladesh of fats (including essential fatty acids), sugar, fiber, sodium chloride and some micronutrients.
- 8. Public health nutrition strategies for intervention at the individual level:** Definition of the individual approach, interventions of supplementary foods, changing behavior without giving foods, advantages and disadvantages of this approach. Primary health care (PHC)

### **Recommended Books:**

- Park, K. Preventive and Social Medicine. 2003. 17<sup>th</sup> edition. Banarsidas Bhanot Publishers, India.
- Bealehole, R., Bonita, R., Kjellstem, T. Basic Epidemiology. 1993. WHO.
- Willet, W. Nutritional Epidemiology. 1990. Oxford University Press.
- Smith, G.W. Preventive Medicine and Public Health. 2<sup>nd</sup> edition. Macmillon Co. New York.
- Department of Health, Health related Behaviour-An Epidemiological Overview, Department, HMSO, 1996

## **FN-405: Quality Control and Legislations**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

### **Quality Control:**

- 1. Introduction:** Quality control and quality assurance, objectives and need of quality control, principles and functions of quality control, difference between quality control and quality assurance.
- 2. Quality attributes:** qualitative, hidden and sensory attributes, methods of quality control.
- 3. Sampling:** Definition of sampling, purpose, sampling techniques requirements and sampling procedures for liquid, powdered and granular materials
- 4. Physicochemical quality:** Color, gloss, flavor, consistency, acidity, moisture content, viscosity, texture and their relationship with food quality.
- 5. Sensory quality control:** Definition, objectives, panel selection and their training, methods of testing.

### **Food Legislation:**

- 6. Existing food laws:** Concept, significance of Pure Food Ordinance, 1959 and pure food rules, 1967; The animal slaughter (Restriction) and meat control (Amendment) ordinance-1983; BSTI ordinance 1985 has been amended as BSTI (amendment) Act 2003
- 7. Food standards:** Objectives, requirements and benefits of food grades and standards (BSTI, PFA, Codex Alimentarius Commission)
- 8. Food safety management system:** ISO 22000, TQM, TQC, GMP, HACCP (Hazard analysis and critical control point), HARPC (Hazard analysis and risk-based Preventive control). Role of different organization (BSTI, FDA, FAO, WHO, WFP, Bangladesh Food Safety Authority, BIRTAN, CAB) for maintaining food safety

### **Recommended Books:**

- Krammer, A., Twigg, B.A. Quality Control for the Food Industry, Vol I and II. 1970. 3<sup>rd</sup> edition. AVI, Westport.
- Ranganna, S. Handbook of Analysis and Quality Control for Fruits and Vegetable Products. 1986. Tata McGraw Hill, New Delhi.
- Rosenthal, A. J. Food Texture, Measurement and Perception. 1999. Aspen Publishers Inc., Gaithersburg, Maryland.

## **FN-406: Technology of Sugar, Bakery and Confectionary Products**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

### **Sugar Technology**

1. **Sugarcane and Sugar Beet:** production and quality.
2. **Utilization of Sugar:** Indigenous technology for small scale sugar production: Jaggery (Gur)
3. **Raw Sugar Manufacturing:** Juice extraction, purification, heating, evaporation, crystallization.
4. **Refining:** Affination, clarification, decolonization, crystallization, centrifugation, drying, bagging, storage
5. Sugar industry byproduct utilization.

### **Bakery and Confectionary Technology**

1. **Properties of the raw materials of bakery products:** Wheat varieties, shortening agents, emulsifying agents and antioxidants, leavening agents and its working mechanism, flavor, yeast, sweeteners, milk products used in bakery products.
2. **Bakery machinery and equipment:** Classification of bakery equipment. Describe the weighting equipment. Selection criteria of mixing equipment. Describe a horizontal and vertical dough mixture. Describe a tunnel oven used in a bakery industry.
3. **Bread Making:** Characteristics of bread flour and yeast. Gluten development, method of preparation of bread dough, proofing and baking of bread. Defects in bread.
4. **Cake making:** Characteristics of cake flour, cake manufacturing process, common faults in cakes and its remedies
5. **Biscuit Making:** Characteristics of biscuit flour, classifications of biscuits, Manufacturing process of biscuit, common faults in biscuit and its remedies
6. **Frozen Food Processing:** Processing and storage of meat and fish based products, pizza, spring role, samosa, vegetable role etc.
7. **Confectionary Technology:** Formulation and manufacturing of chocolate, candy, toffee, fruit jam, pastry, doughnuts.

### **Recommended Books:**

- The sugarcane, A.C. Barnes, World crop Books Interscience Publishers Inc New York, 1964
- The principles of cane sugar manufacture. J.G. Davies. Norman Rodger, London 1938.
- Cane sugar Handbook. G.P. Meade; J.C.P. chen, 10<sup>th</sup> Ed. John Wiley, New York. 1977
- Booth R G, 1997. Snack foods. CBS Publishers and Distributors, New Delhi.
- Jackson E B, 1995. Sugar confectionery manufacture. 2<sup>nd</sup> ed. Blackie Academic and Professional Wester Cleddens Road, Bishophiggs, Glassow

## **FN-407: Food Plants Design and Sanitation Management**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

1. **Design of food plant:** Site selection, planning the building on the site. Basic types of plant layout, factors determining plant layout, criteria of a good plant layout, flow patterns of plant layout, general guideline for plant layout and symbols used for food plant design and layout. Examples of plant layout for different products, such as fish canning plant, milk, yogurt and ice cream plant, poultry and meat processing plant, egg processing plant etc.
2. **Design of machineries:** Principles of designing machine elements and basic consideration in designing food processing machinery.
3. **Hygienic design of food plant:** Basic principles of hygienic design of equipment, design of foundations and walls, introduction of floors, types of floors and materials used for construction them. Hygienic design of floor drain, types of floor drain.
4. **Effective detergency and cleaning practices:** Importance of cleaning technology, physical and chemical factors in cleaning, classification and formulation of detergents and sanitizers, cleaning and sanitation practice in a food industry.
5. **Sanitary aspects of water supply:** Source of water, water supply and its uses in food industries. Water pollution and hazards of water pollution. Purification and disinfection of water, preventing contamination of potable water supply. Hardness of water and its removal, water quality standards.
6. **Sanitary aspects of waste disposal and management:** Types of food wastes, milk wastes, canning wastes, meat, poultry and fish processing wastes, packaging wastes, fruits and vegetables processing wastes. Treatment of various wastes and byproducts in food industries. Uses of various wastes after treatment.
7. **Employee welfare:** Definition, activities for employee welfare, function and types. Labor laws, factory safety and fire protection system of a plant.

### **Recommended Books:**

- Farral, A.W. 1997. Food Engineering Systems. Vol I, The AVI publication .Co. Inc. Westport, Connecticut, USA.
- Allen, L.A. 1958. Management and Organization. Newyork, Mc Graw Hill.
- Lundy, J.L. Effective Industrial Management. 1968. New Delhi.
- Hall, C.W., Davis, L. Agricultural Processing Equipments. 1979. The AVI Pub. Co. Inc. USA.

## **FN-408: Renewable Energy and Food Waste Management**

**Credits: 4**

**Full Marks: 100 (Theory 75, Class Test 20 and Attendance 5)**

**Time: 4 hours (Eight questions to be set and five to be answered)**

- 1. Biomass resources for energy:** Residues & wastes, Agricultural forest residue, aquatic biomass and energy plantation. Biomass conversion process for energy and fuels-Direct combustion process, Thermo-chemical process: Pyrolysis, gasification and liquefaction gasification techniques; design of gasifier, kinetic and thermochemistry in gasification, air and steam gasification, Biochemical process: Anaerobic and aerobic digestion.
- 2. Waste treatment:** Origin of wastes, economic values and methods of waste treatment. Waste collection methods, Solid waste disposal methods, Biological oxygen demand, Chemical oxygen demand, Dissolved oxygen.
- 3. Food industry waste management:** Pre-treatment of waste: sedimentation, coagulation, flocculation and floatation. Secondary treatments: Biological oxidation – trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, lagoons. Tertiary treatments: Advanced waste water treatment process-sand, coal and activated carbon filters.
- 4. Composting:** Factors affecting composting, value of compost, composting plant design and preparation of compost from food waste.
- 5. Biogas generation:** Scope and necessity, factors affecting fermentation, digester models and their design. Production of biogas from food waste.
- 6. Incineration:** Standards, waste classification for incinerators, types and process of incinerators.
- 7. Sanitary land fill:** Factors for site selection, classification of sites, methods of fill.
- 8. Waste reuse:** Waste reuse as fuel and feed for animals and poultry, Protein isolation from food wastes.
- 9. By-products utilization of specific foods:** Fruits and vegetables, dairy industry, meat, fish poultry, sugar industry.

### **Recommended Books:**

- Groombridge, B. Global bio-diversity in status of earth living resources. 1992. Champen and Hall, London. UNEP 1995, Global diversity assessment, Cambridge University Press.
- Meffi, G.K., Ronald, C.C. Principles of Conservation Biology. 1994. Sinauer Associates. Inc- Massachusetts
- S.S. Das. A text book of Environmental Chemistry and Pollution Control. CBS Publishers, India.

# Practical

## **FN-409: Beverage and Tea Technology (Practical)**

**Credits: 2, Full Marks: 50**

1. Production of fresh fruit juice, squash
2. Preparation of mixed fruit and vegetable juice
3. Manufacture of non-carbonated drinks
4. Preparation of cold coffee and cold tea.
5. Preparation of mixed fruit milk shake.
6. Manufacture of carbonated soft drinks
7. Determination of citric acid in fruit juice
8. Determination of ascorbic acid in juice.
9. Determination of lactic acid in milk based beverage
10. Tea quality testing

### **Recommended Books:**

- Fermented Beverage Production, Second Edition by Andrew G.H. Lea and John R. Piggott, 2nd edition, Springer publishers, June, 2003.
- Mithcell A J (Ed). 1990. Formulation and production of carbonated soft drinks. The AVI Pub. Co. Inc. Westport, Connecticut.

## **FN-410: Quality Control (Practical)**

**Credits: 2, Full Marks: 50**

1. Test of sensory evaluation by using Hedonic scale
2. Detection of adulteration in food products (milk, ghee, honey, spices, pulses, oils, sweets)
3. Prepare a HACCP plan for Different Food Processing Industry (Dairy, Beverage, Bakery etc.)
4. Quality test of raw materials of milk, bakery, beverage etc.
5. Quality test of products of milk, bakery, beverage etc.
6. Spectrophotometer operation for color analysis
7. HPLC operation
8. Detecting formalin, carbide, pesticide residue, Iso-alyl sianide, urea in different adulter food products

### **Recommended Books:**

- Quality Control in the Food Industry- HERSCHDOERFER, S.M. 3<sup>rd</sup> ed. Academic Press 1998.
- Modern Methods of Food Analysis- STEWART, K and WHITAKER, J. AV1 Pub. Co. 1984.
- Sensory Evaluation Practices- STONE, H and SIDEL, J. Academic Press. 1985.



**FN-411: Technology of Sugar, Bakery and Confectionary Products (Practical)**  
**Credits: 2, Full Marks: 50**

1. Procedure of juice extraction from sugarcane.
2. Technology of gur (jiggery) production from sugarcane juice.
3. Sugarcane machinery handling, operation and maintenance.
4. Utilization of sugarcane by-products.
5. Preparation of bread, cake and biscuit and their quality evaluation.
6. Preparation of pizza, spring role, samosa
7. Preparation of milk toffee.
8. Preparation of fruit jam.
9. Manufacture of hard candy

**Recommended Books:**

- Chen J C P, 1985. Meade-Chen Cane Sugar Handbook. John Wiley and Sons, New York
- Mathur, R.B.L. 1987. Hand Book of Cane Sugar Technology. Oxford and IBH Publishing Co. Calcutta

**FN-412: Study Tour**  
**Credits: 2, Full Marks: 50**

1. Visit to a food processing industry or Nutrition project implementation area.
2. Report writing
3. Presentation
4. Viva voce

**FN-413: Research Project / Internship**  
**Credits: 4, Full Marks: 100**

**Research Project:** A short dissertation on Food processing problems, Food product development, Nutritional and health issue concerning mainly Bangladesh or dealing with academic advancement of the concepts of Applied Nutrition and Food Technology to be submitted by students under the supervision of a teacher of this department who will suggest and guide the student on the topic of the problem and dissertation will be accepted for evaluation with the consent of supervisor. The dissertation will be evaluated by an internal examiner and external examiner nominated by the examination committee. Among the 100 marks 30 marks for his/her seminar representation in presence/consent of the examiner and 70 marks evaluated from his/her dissertation paper.

**Internship:** Student will attach with a Food industry, Clinic, Diet center or Nutritional project implementing NGOs as an intern for minimum 1 month and submit a report, give an oral presentation of his/her work and will attain a via voce.