NATIONAL OPEN UNIVERSITY OF NIGERIA

AFS 202

Introduction to Food Science and Technology

Course Guide

AFS 202 (Introduction to Food Science and Technology) Course Guide

Course Developer/Writer
Prof. J. B. Fashakin, Federal University of Technology, Akure

Course Coordinator
Prof. N.E Mundi, National Open University of Nigeria

Programme Leader
Professor A. Adebanjo. National Open University of Nigeria

Credits of cover-photo: Name, institute, SS

National Open University of Nigeria - 91, Cadastral Zone, Nnamdi Azikwe Express Way, Jabi, Abuja, Nigeria

www.nou.edu.ng centralinfo@nou.edu.ng
oer.nou.edu.ng oerunit@noun.edu.ng OER repository
Published in 2021 by the National Open University of Nigeria

Working Through This Course

This course involves that you would be required to spend a lot of time to read. The contents of the course are very dense and require you spending great time to study them. This accounts for the great effort put into their development in the attempt to make them very readable and comprehensible. Nevertheless, the effort required of you is still tremendous. I would advise that you avail yourself the opportunity of attending the tutorial sessions where you would have the opportunity of comparing knowledge with your peers.

Course Materials

You will be provided with the following materials:

- Course guide
- Study Units.

In addition, the course comes with a list of recommended textbooks which though are not compulsory for you to acquire or indeed read but are necessary as supplements to the course material.

Study Units

The following are the study units contained in this course:

Module 1

Unit 1 Principles of Food Science and Technology
Unit 2 Food and its Functions
Unit 3 The Role of Vitamins in Nutrition
Unit 4 The Role of Minerals in Nutrition
Unit 5 Food Poisoning

Module 2

Unit 1 Deterioration and Spoilage of Foods
Unit 2 Food Contamination and Adulteration
Unit 3 Food Processing and Preservation Operations I: Temperature Based Processes
Unit 4 Food Processing and Preservation Operations II: Use of Irradiation and Moisture Reduction
Unit 5 Food Processing and Preservation Operations III: Use of Additives, Modified Atmosphere and Fermentation

Module 3

Unit 1 Composition and Structures of Nigerian/West African Foods
Unit 2 Processing Traditional Food Products in Nigeria I: Roots, Tubers, Cereals and Legumes

Unit 3 Processing Traditional Food Products in Nigeria II: Fruits, Vegetables, Milk, Meat and Fish

The first unit under module one discusses the essential disciplines of Food Science and Technology, embracing Food Chemistry, Processing, Quality Control, Engineering, Preservation, Packaging Marketing and Storage.

The second unit introduces food groups, including cereals, legumes, starchy roots and tubers, sugar and preserves, meat, fish and eggs, fats and oils, fruits and vegetables, milk and milk products and beverages. The relationship of these groups to macro and micro nutrients are also discussed.

The third unit concentrates on the micronutrients that are called vitamins. These are divided into two major groups: The fat soluble and the water soluble. Among the fat soluble are vitamins A, D, E and K while the water soluble includes thiamine, riboflavin, niacin, pyridoxine, pantothenic acid, cyanocobalamin, ascorbic acid, biotin, choline and inositol. The vitamins are derived mainly from food sources.

The fourth unit deals with the other group of micro nutrients called minerals. These are divided into two major groups: the major elements and the trace metals. Among the major elements are calcium, phosphorous and magnesium, stored in bones and teeth; sodium and potassium located in the intracellular fluids, controlling the ionic strength of the cellular fluids. The trace metals include iodine, iron, zinc, and fluorine. The deficiencies of these elements and trace metals result in severe growth loss and other specific symptoms.

The fifth unit discusses food poisoning. It identifies various factors responsible for food poisoning, types of organisms involved in food poisoning and the mode of control.

The first unit under module two identifies factors responsible for deterioration and spoilage of foods, namely: chemical, physical and biological factors. The impact of deterioration of foods on its quality and acceptability, as well as its control was reviewed.

The second unit discusses contamination and adulteration of foods. The causes of contamination, namely: bacterial, physical and chemical factors were reviewed. The unit also discusses mode of prevention of contamination in some field produce.

The third to fifth units discuss food processing and preservation operations, namely: I: Temperature Based Processes; II: Use of Irradiation and Moisture Reduction; III: Use of Additives, Modified Atmosphere and Fermentation. These units identify the advantages and disadvantages of each process as well as food items suitable for each procedure.

The first unit under module three concentrates on the structure and composition of major Nigerian/West African food crops, namely: Roots, tubers, cereals, legumes, meat and fish.

The second to fourth units review traditional food processing of various food commodities, namely: Roots, tubers, cereals, legumes, meat and fish in Nigeria. The review highlights the basic operations and problems involved in processing of commodities in each food group

Textbooks and References

A. F. Walker. (1990). *Applied Human Nutrition*. Aspen Publishers. 300 pages.

Ammirati, J. F. and Seidl, M T. (2005). "Fungus." *Microsoft® Encarta®* 2006 [CD]. Redmond, WA: Microsoft Corporation.

ASQ. 2000. ISO 9000 Standards for quality. Amer. Soc. Qual. Available via the Internet at http://www.iso-9000-2000.com

Available via the Internet at http://www.fao.org/inpho/vlibrary/t0073e/ T0073E00.htm

Boutrif, E. and Bessy, C. (1999). *Basic Approaches to Consumer Protection* – FAO/WHO Model Food Act – Control procedures. Presented at Conference on International Food Trade – Beyond 2000: Science-based Decisions, Harmonization, Equivalence, and Mutual Recognition, Melbourne, Australia October 11-15.

Bubel M, Bubel N and Art P. (1991). *Root Cellaring: Natural Cold Storage of Fruits and Vegetables.* 2nd ed. Storey. How to build a cellar and store foods, and how long foods keep.

Codex. 2000. Codex Committee on Fresh Fruits and Vegetables. Available via the Internet at http://www.codexalimentarius.net

Coxe A. H. and Coxe A. H (1997). *The Great Book of Sausages.* Overlook, 1992, 1997. Recipes, Instructions for Making 45 varieties, and the History and Ingredients of 600 Types of Sausages.

FAO. (1989). Prevention of Post-Harvest Food Losses: Fruits, Vegetables, and Root Crops a Training Manual. FAO Training Series No. 17/2, Rome, Italy.

FAO/WHO. (1997). Codex Alimentarius Food Hygiene Basic Texts. Joint FAO/WHO Food Standards Programme, Codex Alimentarius Commission. Pub. # M-83.

FDA. (1998). Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables. U.S. Food and Drug Administration. Available via the Internet at http://www.cfsan.fda.gov/~dms/ prodguid.html

FDA. (2000). Food Standards. Available via the Internet at www.fda.gov/opacom/morechoices/smallbusiness/blubook/ foodstds.htm

FDA. (2001). FDA Publishes Final Rule to Increase Safety of Fruit and Vegetable Juices. Food and Drug Administration News Release, U.S. Food and Drug Administration. Available via the Internet at http://www.fda.gov/bbs/topics/NEWS/2001/NEW00749.html

Belitz H.D. et al (2004). Food Chemistry, W. Grosch, P. Schieberle and M.M. Burghaghen. Springer. 2004. 1071 pages

Food Science Australia (2000). Packaged Minimally-Processed Fresh-Cut Vegetables. In Food Safety and Hygiene- A Bulletin for the Australian Food Industry, Food Science Australia. May. Available via the Internet at http://www.dfst.csiro.au/fshbull/ fshbull21.htm

FSIS. (1996). FSIS Pre-HACCP Standard Sanitation Operating Procedures Reference Guide. Food Safety and Inspection Service, U.S. Department of Agriculture.

Gardner, S. (1993). Consumers and Food Safety: A Food Industry Perspective. In Food, Nutrition, and Agriculture – Consumer Participation in Food Control.

Gould, W.A. and Gould, R.W. 1993. Total Quality Assurance for the Food Industries. 2nd ed. CTI Publications, Baltimore, MD, USA.

IAFIS. 1999. Food Standards Library. Available via the Internet at www.iafis.org/fiic/stan/stan1.htm.

ICMSF. (1996). Micro-organisms in Foods 5. Characteristics of Microbial Pathogens – International Commission for Microbiological Specifications of Foods. Springer. 524 pages.

IFT. 2001. Introduction to the Food Industry – Lesson 1. Food Quality and Safety Assurance. Edited by Claus, L., Montecalvo, J., and Pappas, A. Available via the Internet at http://www.ift.org/ education/food_industry/lesson1.shtml.

Improving the Safety and Quality of Fresh Fruits and Vegetables: A Training Manual for Trainers V-26.

Improving the Safety and Quality of Fresh Fruits and Vegetables: A Training Manual for Trainers V-27.

J. L. Albert, ed. FAO, Rome. Available via the Internet at http://www.fao.org/docrep/v2890t/v2890t00.htm.

Kitinoja, L. and Kader, A.A. (1995). Small-Scale Postharvest Handling Practices – A Manual for Horticultural Crops. 3rd Edition. University of California, Davis. Available via the Internet at http://www.fao.org/wairdocs/x5403e/x5403e00.htm

Kramer, A., and Twigg, B.A. (1970). Quality Control for the Food Industry. 3rd ed. AVI, Van Nostrand Reinhold Co., New York.

Lindenmayer, I. (1999). Harmonization of Food Regulations and Food Quality/Safety Measures based on Codex Standards, Guidelines, and recommendations. Presented at Conference on International Food Trade – Beyond 2000: Science-based Decisions, Harmonization, Equivalence, and Mutual Recognition, Melbourne, Australia October 11-15.

Marquis, Robert E. "Bacteria." *Microsoft® Encarta®* (2006) [CD]. Redmond, WA: Microsoft Corporation, 2005.

Norman G. Marriot and Robert Gravani. (2006). *Principles of Food Sanitation*. 5th Edition. Springer. 413 pages.

Pattee, H. E. (1985). *Evaluation of Quality of Fruits and Vegetables*. AVI, Van Nostrand Reinhold Co., New York.

Potter, N. N., and Hotchkiss, J.H. (1995). *Food Science*. 5th ed. Chapman & Hall, New York.

Rees, N. and Watson, D. (2000). *International Standards for Food Safety*. Aspen Publishers, Gaithersburg, MD.

Hutkins R. (2006). *Microbiology and Technology of Fermented Foods – A Modern Approach*. Blackwell Publishing Professional. 488 pages.

Satin, M. (1996). *Food Irradiation: A Guidebook*. 2nd ed. Technomic. Overview of this controversial Preservation Method.

Satin, M. 2000. *Trends in Post-Production Technology. FAO, Rome, Italy*. Available via the Internet at http://www.fao.org/inpho/ vlibrary/grey_lit/g0002e/g0002e.htm.

Satin, Morton. *The Food Alert: The Ultimate Sourcebook for Food Safety*. Facts on File, (1999). The safety guide to proper food preservation and handling.

Shewfelt, R.L. (1987). *Quality of Minimally Processed Fruits and Vegetables*. J. Food Qual. 10:143.

Shewfelt, R.L. 1990. *Quality of Fruits and Vegetables*. *Food Technol*. 44(6):99- 100.

Silva, J.L. (2000). *Food Laws and Regulations in Latin America and the Caribbean*. Presented at IFT Annual Meeting, Dallas, TX. June 10-14.

Szczesniak, A.S. (1977). *An Overview of Recent Advances in Food Texture Research. Food Technol*. 31(4): 71-75.

U.S. EPA. (2001). Guidance for Preparing Standard Operating Procedures. Office of Environmental Information, U.S. Environmental Protection Agency. EPA/240/B-01/004. Available via the internet at http://www.epa.gov/quality1/qs-docs/g6-final.pdf.

USDA. (2000). Fruit and Vegetable Programs. Available via the Internet at www.ams.usda.gov/fv/fvstand.htm.

van Reeuwijk, L.P. (1998). Guidelines for Quality Management in Soil and Plant Laboratories. FAO, Rome. Publication #M-90. Available via the Internet at http://www.fao.org/docrep/w7295e/ w7295e00.htm.

Wilson, L.G., Boyette, M.D., and Estes, E.A. (1995). Postharvest Handling and Cooling of Fresh Fruits, Vegetables, and Flowers for Small Farms. Part I: Quality Maintenance. Horticultural Information Leaflet #800, North Carolina Cooperative Extension Service. Available via the Internet at http://ces.ncsu.edu/depts/ hort/hil/hil-800.html.

Yeast." *Microsoft® Encarta®* (2006) [CD]. Redmond, WA: Microsoft Corporation, 2005.

Assessment

There are two components of assessments for this course. The Tutor Marked Assignment (TMA) and the end of course examination.

Final Examination and Grading

The examination concludes the assessment for the course. It constitutes 70% of the whole course. You will be informed of the time for the examination. It may or not coincide with the University semester examination.

Summary

This course intends to provide you with some basic knowledge of Food Science Technology dealing with food components and their functions. By the time you complete studying this course, you will be able to answer the following type of questions:

1. Define Food in terms of macro and micro nutrients. Suggest sources for the major macronutrient and micronutrients
2. Discuss the effects of food processing on the nutritive values of cereals and legumes
3. Differentiate between animal fats and vegetable fats. Why are vegetable fats essential in human foods?
4. Compare and contrast the functions of Vitamin A and Vitamin C.

5(a) Name two vitamins that are derived only from animal sources.

(b) Name two vitamins that are available mainly in plants and cereals.

6. Discuss the role of minerals in enzyme activities
7. Classify foods into perishable and non perishable and show characteristics for each group.
8. List the advantages and disadvantages of Food Irradiation.
9. Discuss methods employed in achieving concentration of Moist Foods.
10. Discuss the different methods of food preservation by Freezing.
11. Differentiate between Pasteurization and Sterilization.
12. Enumerate the type of foods usually subjected to each method of Pasteurization and Sterilization.
13. Choose 2 farm produce and explain the techniques for the prevention of contamination during post harvest storage.
14. What are the advantages of Vacuum packaging and gas packaging commonly used in the beverage industries?

We wish you success in this course. In particular, we hope you will be able to appreciate the importance of energy, proteins, fats, the micro elements of vitamins and minerals. Food preservation, processing and packaging ensure the wholesomeness of foods against bacteria, moulds, fungi and other contaminants. Healthy foods are ready for storage, sales and marketing.

We sincerely hope you enjoy the course.

With the Best wishes.