# Accredited Syllabus for Mphil. Food Science and Technology
# Department of Food Science and Technology
# College of Science
# KNUST

**YEAR 1 SEMESTER 1**

| Code | Title of Course | T | P | C |
|---|---|---|---|---|
| FST 559 | Food Analysis Laboratory | 1 | 3 | 2 |
| FST 573 | Advanced Food Microbiology | 2 | 3 | 3 |
| FST 575 | Food Commodities Processing Technology | 3 | 0 | 3 |
| STATS 559 | Statistical Methods for Research | 3 | 0 | 3 |
| | **Sub-total** | **9** | **6** | **11** |
| **Electives (Must Select at least 2)** | | | | |
| FST 557 | Product Development and Sensory Evaluation | 2 | 3 | 3 |
| FST 563 | Functional Foods and Nutraceuticals | 3 | 0 | 3 |
| FST 565 | Food Mycology | 3 | 0 | 3 |
| FST 567 | Food Biotechnology | 3 | 0 | 3 |
| FSA 753 | Advanced Food Toxicology | 3 | 0 | 3 |
| | **Minimum Semester Credits** | **14** | **9** | **17** |

**YEAR 1 SEMESTER 2**

| Code | Title of Course | T | P | C |
|---|---|---|---|---|
| FST 570 | Advanced Food Chemistry | 3 | 0 | 3 |
| FST 572 | Advanced Food Engineering | 3 | 0 | 3 |
| FST 574 | Research Communication and Seminar | 2 | 2 | 3 |
| | Sub-total | **8** | **2** | **9** |
| **Electives (Must Select at least 2)** | | | | |
| FST 580 | Advanced Human Nutrition and Health | 3 | 0 | 3 |
| FST 582 | Food Microstructure and Rheology | 3 | 0 | 3 |
| FST 584 | Advanced Postharvest Technology | 3 | 0 | 3 |
| FST 586 | Modelling in Food Technology | 3 | 0 | 3 |
| FSA 752 | Food Systems Risk Assessment | 3 | 0 | 3 |
| | **Minimum Semester Credits** | **13** | **2** | **15** |

**YEAR 2 SEMESTER 1**

| Code | Title of Course | T | P | C |
|---|---|---|---|---|
| FST 651 | Research Project I | 0 | 18 | 6* |
| FST 653 | Research Seminar I | 0 | 18 | 6* |
| | Sub-total | 0 | 36 | 12 |

**YEAR 2 SEMESTER 2**

| Code | Title of Course | T | P | C |
|---|---|---|---|---|
| FST 652 | Research Project II | 0 | 18 | 6* |
| FST 654 | Research Seminar II | 0 | 18 | 6* |
| | Sub-total | 0 | 36 | 12 |

## 1. Course Description:

Provide a short description of the content of the courses in the programme to include:

a. Objective
b. Content
c. Reading material

**YEAR 1 SEMESTER 1**

**FST 559 Food Analysis Laboratory (1 3 2)**

Food Chemistry laboratory (Selected labs on carbohydrates, fats, and proteins). This course is designed to characterize chemical composition, traceability, safety, quality, and nutritional value.

**a) Objective**

- To describe the various food components and their respective chemical compositions.
- To analyze food using instrumentation.

**b) Learning Outcomes**

At the end of this course, students are expected to;

- apply the principles of food analysis instrumentation;
- analyze the components of food;
- provide information about their chemical compositions.

**c) Content**

Principles of analytical processes of equipment in food analyses; AAS, HPLC, FTIR, Types of chromatographic methods; GC-mass chromatography, Electrophoresis, and TLC; Sampling and sample preparations and storage; Titratable acidity; Analyses of moisture, total solids, ash, and minerals; Proximate analyses; Fat characterization, Protein separation procedures.

**d) Mode of delivery**

- Lectures/PowerPoint Presentation.
- Audio-visuals (videos and infographics).
- Group discussions and presentations.
- Assignments.
- Practical Sessions.

**e) Reading materials**


1. Nielsen, S.S. (2010). Food Analysis, Laboratory manual, 4th Edition, Springer NY.
2. Pomeranz, Y. (2013). Food analysis: theory and practice. Springer Science and Business Media.
3. Leo, M.L. (2004). Food Analysis by HPLC, 2nd Edition, Marcel Dekker, Inc. NY.

4. Kontominas, M.G. (2013). Food Analysis and Preservation, 2nd Edition. Apple Academic Press Inc. Canada.
5. Sehgal, S. (2016). A Laboratory Manual of Food Analysis. I K International Publishing House Pvt. Limited. India.

**FST 573 Advanced Food Microbiology (2 3 3)**
This course is designed to understand the important principles and current issues in Food Microbiology for industrial applications.

**a) Objective**
To apply knowledge in microbial ecology
- in the control food contaminations.
- industrial operations for commercial benefits.

b) **Learning outcomes**
Students are expected to:
- evaluate microbial ecology relating to food safety;
- integrate microbial activities for specific industrial food processing operations.

**c) Content**
Microbial ecology in foods. Contemporary issues in food microbiology. Emerging foodborne pathogens and toxigenic moulds. Advanced techniques in detection and typing of foodborne pathogens and mycotoxins. Foodborne Parasites, Food Production Practices Relative to Foodborne Parasites and Climate Change, Control, Transmission, Socioeconomic Burden of Foodborne Parasites, Apicomplexan Protozoa, Non-Apicomplexan Unicellular Parasites, Nematodes, Cestodes, Trematodes, Microbial modelling (Predictive microbiology in risk assessment). Biofilms. Microorganisms in food processing waste management.

**d) Mode of delivery**
- Lecturer/student Interactions.
- Audio-visuals analysis of concepts (videos and infographics).
- Group discussions and presentations.
- Assignments.
- Term paper.
- Critique of research papers.

**e) Reading materials**
1. Adams, M. R. and Moss, M. O. (2008). Food Microbiology. 3rd Edition, RSC Publishing. Cambridge.
2. Banwart, G. (2012). Basic Food Microbiology. Springer Science and Business Media. NY.
3. Matthews, K., Kniel, K. E. and Montville, T. J. (2017). Food Microbiology: An introduction. 4th Edition. ASM Press. USA.
4. Osman E., Bozoglu, F. T. (2016). Food Microbiology: Principles into Practice. John Wiley and Sons, Ltd. NY.
5. Ray, B. and Bhumia, A. (2013). Fundamental Food Microbiology. 4th Edition, CRC Press. London.

**FST 575 Food Commodities Processing Technology (3 0 3)**

This course aims at deepening food processing technologies skills and methods used to process food commodities while encouraging innovation.

**a) Objective**

- To explain the different innovative technological methods used to process food commodities.

**b) Learning outcomes**

At the end of the lessons students should be able to:

- critique technological methods used in processing food commodities;
- hypothesize innovative processing methods.

**c) Content**

**Fruits and vegetables:** Nutritional composition and classification; Principles and methods of preservation; Quality factors for processing; Minimal processing; Canning; fruit and vegetable product; Pectins and applications; Quality control

**Cereals and legumes:** Milling and extraction processes of cereals; Baking technology; Malting; Impacts of the processing; Ready-to-eat breakfast cereals; Bulk storage; (e.g., in silos); Biodegradable films.

**Meat and fish:** Production, economic importance; Anatomy and histology; Post-mortem biochemical changes. Rigor mortis, Autolysis, Tenderness, Spoilage, Zoonosis. Quality and safety; Storage and preservation methods; Fish and meat processing (sausage, corned beef, meat, and fish analogs); Nutritional value; Local and international legislation;

**Roots and tubers**: Nutritional quality; Production trends; Storage; Processing

**d) Mode of delivery**

- Lecturer/student Interactions.
- Audio-visuals analysis of concepts (videos and infographics).
- Group discussions and presentations.
- Assignments/Term paper.
- Critique of research papers.

**e) Reading materials**


1. Arvanitoyannis, I. S. (2010). Irradiation of food commodities: techniques, applications, detection, legislation, safety, and consumer opinion. Academic Press. USA.
2. Fellows, P. J. (2009). Food processing technology: principles and practice. Elsevier. The Netherlands.
3. Pan, Z., Zhang, R. and Zicari, Z. (2019). Integrated Processing Technologies for Food and Agricultural By-Products. Elsevier. USA.
4. Sommers, C. H. and Fan, X. (2008). Food irradiation research and technology. John Wiley and Sons. USA.
5. Yahia, E. M. (2019). Postharvest Technology of Perishable Horticultural Commodities. 1st Edition, Woodhead Publishing. The UK.

**STATS 559 Statistical Methods for Research (3 0 3)**

**a) Objective**

- To demonstrate the concepts of statistical methods and operations required in data collection and processing.

**b) Learning outcomes**

- After completing this course, the student should be able to determine the appropriate statistical method for collecting and processing data especially using a computer software.

**c) Content**

Meaning of research; Types of research, defining and determining a problem; Objectives of a research; Research methods and tools for collecting data; Sources (Collection) of Primary and Secondary data; Editing the data and precautions used in the use of data; Sampling Design- Census and sampling survey; Methods of Sampling; Probability and non-probability sampling methods; Size of the sample; Merits and Demerits of each sampling method; Sampling errors and methods of reducing the errors; Measures of central tendency - Mean, Median, Mode, their relative advantages and disadvantages; Measures of dispersion - mean, standard deviation, quartiles, coefficient of variation, percentile; Representation of data - Diagrammatic and Graphic significance; Types of diagrams; Types of graphs; Probability - Theorems, Simple Problems; Distributions – Binomial, Poisson, normal distribution, their properties and simple problems; Association of attributes, contingency table, correlation - coefficient of correlation and its interpretation; Rank correlation; Regression equation and predictions; Hypothesis Testing - Large and Small sample tests – t- test; Chi square test, and F- test - simple problems; Design of Experiments- Completely Randomized Design (One way ANOVA) Randomized Block Designs (Two Way ANOVA) and Latin Squares; Multivariate Analysis- Principal Component Analysis, Discriminant Analysis, MANOVA, ANCOVA.

**d) Mode of delivery**

- Lectures/ PowerPoint Presentation.
- Assignment.
- Audio-visuals (videos and infographics).
- Group discussions and presentations.

**e) Reading materials**


1. Abu-Bader, S.H. (2021). Using statistical methods in social science research: With a complete SPSS guide. Oxford University Press, USA.
2. Nemani, R. (2021). Cluster and Factorial Analysis Applications in Statistical Methods. Turkish Journal of Computer and Mathematics Education (TURCOMAT), 12(3): 5176-5182.
3. Illes, A., Bojtor, C., Szeles, A., Mousavi, S.M.N., Toth, B. and Nagy, J. (2021). Research Article Analyzing the Effect of Intensive and Low-Input Agrotechnical Support for the Physiological, Phenometric, and Yield Parameters of Different Maize Hybrids Using Multivariate Statistical Methods.
4. Bărbulescu, A. and Dumitriu, C.Ș. (2021). Assessing Water Quality by Statistical Methods.
5. Rossel, J.B., Rousson, V. and Eggli, Y. (2021). A comparison of statistical methods for allocating disease costs in the presence of interactions. Statistics in Medicine.

**FST 557 Product Development and Sensory Evaluation (2 3 3)**

This course will broaden students' knowledge with the scientific discipline required to create quality foods that are essential in food industries and ensure that the food being produced is acceptable to the consumer.

**a) Objective**

- To learn the fundamentals skills of the food product development process in food industries.

**b) Learning outcomes**

- At the end of the lessons students should be able to design innovative food products for the food industry.

**c) Content**

Overview of the role and functionality of food constituents and ingredients: proteins, carbohydrates, lipids, and additives. Introduction to food product development. Classification of food products as the basis for innovation, the sociological and technological aspects of food product development. The testing environment, Test protocol consideration, Experimental design, Panelists, sensory data and processing; Discrimination test, Preference/ Affective test, Hedonic test, and Descriptive Analysis. Scaling; Consumer field test and Questionnaire Design, Quality control and shelf life (Stability) Testing). Concepts of new product development, developing an innovation strategy, criteria for new products, critical factors in product success. The role of the consumer in product development. The food product development process. Food standards.

**d) Mode of delivery**

- Lecturer/student Interactions.
- Audio-visuals analysis of concepts (videos and infographics).
- Group discussions and presentations.
- Assignments.
- Term paper.
- Critique of research papers.
- Laboratory work/Demonstrations/ Practical Sessions.

**e) Reading materials**


1. Bordiga, M. and Nollet, L. M. (2019). Food Aroma Evolution: During Food Processing, Cooking, and Aging. CRC Press. US.
2. Meilgaard, M. C., Carr, B. T. and Civille, G. V. (2006). Sensory evaluation techniques. CRC press.
3. Kemp, S. E., Hollowood, T. and Hort, J. (2011). Sensory Evaluation: A practical Handbook, John Wiley and Sons Ltd. USA.
4. Næs, T., Brockhoff, P. B. and Tomic, O. (2010). Statistics for Sensory and Consumer Science. John Wiley and Sons Ltd. USA.
5. Stone, H., Bleibaum, R. and Heather, T. (2012). Sensory Evaluation Practices. 4th Edition, Academic Press. USA.


**FST 563 Functional Foods and Nutraceuticals (3 0 3)**

This course is designed to understand the origin, classification, mechanism of action, and chemical properties of potential and established nutraceutical compounds and their applications in functional foods.

**a) Objective**

- To explain the application of nutraceutical compounds in functional foods.
- To exemplify the sources, profiles, mechanism of action, and chemical properties of potential and established nutraceutical compounds.

**b) Learning outcomes**

- At the end of the lessons students should be able to integrate nutraceutical compounds sourced from functional foods into food products.

**c) Content**

Origin, classification, mechanism of action and chemical properties of potential and established nutraceutical compounds and applications in functional foods: Vitamins A, C, E, Folic acids; Minerals: Potassium, calcium, magnesium; Carotenoids: Lutein, lycopene, terpenes; Flavonoids, Anthocyanidins, Catechins, Tannins, Lignin, Soluble and insoluble fiber, Allicin, Beta-glucan, Fructo-oligosaccharides, Probiotics and prebiotics, Long-chain omega 3 fatty acids. Foods for prevention and treatment of cancer, cardiovascular diseases, hypertension, osteoporosis, Cannabinoids

**d) Mode of delivery**

- Lectures/ PowerPoint Presentation.
- Assignment.
- Audio-visuals (videos and infographics).
- Group discussions and presentations.

**e) Reading materials**


1. Aluko, R. E. (2012). Functional foods and nutraceuticals. Springer. New York, NY. USA.
2. Corredig, M. (2009). Dairy-derived ingredients: food and nutraceutical use. Elsevier. USA.
3. Gupta, R. C., Srivastava, A. and Lall, R. (2018). Toxicity potential of nutraceuticals. Computational Toxicology, pp.367-394.
4. Shahidi, F. and Weerasinghe, D. K. (2003). Nutraceutical Beverages: Chemistry, Nutrition, and Health Effects. American Chemical Society. USA.
5. Venugopal, V. (2008). Marine products for healthcare: functional and bioactive nutraceutical compounds from the ocean. CRC press. USA.


**FST 565 Food Mycology (3 0 3)**

The course is designed to understand the growth characteristics of fungi in foods and the consequent problems caused by these organisms concerning food quality and safety.

**a) Objective**

- To exemplify fungal growth characteristics in foods and their impact on food quality and safety.

**b) Learning outcomes**

- At the end of the lessons students should be able to attribute the presence of fungi concerning food quality and safety.

**c) Content**

Fungi and living crops:host and fungus in postharvest situations, ethylene production and fungal-plant interaction; The fungal spore in food mycology: Spore formation in food-relevant fungi, Fungal spores, germinating spores, Heat-resistant ascospores; Fungi and mycotoxins: Mycotoxin producers, types and properties of mycotoxins; Fungi as hyperproducers: Filamentous fungi, metabolite production-enzymes; Fungal spoilage: Ecology, growth and detection: Association to foods, Transport phenomena and colonisation, Molecular detection and monitoring, Fungal volatiles as Biomarkers of good and bad food, Wine vineyard infections, Cheese and fermented sausages; Fungi as food: Colonizing and provision of food, Fungal protein for food, Edible mushrooms(industrial and wild)

**d) Mode of delivery**

- Lectures/PowerPoint Presentation/Assignment.
- Audio-visuals (videos and infographics).
- Group discussions and presentations.

**e) Reading materials**


1. Hocking, A. D., Pitt, J. I., Samson, R. A., and Thrane, U. (2006). Advances in food mycology (Vol. 384). New York, NY, USA: Springer.
2. Dijksterhuis, J. and Robert, A. (2007). Samson Food Mycology: A Multifaceted Approach to Fungi and Food, CRC Press. USA.
3. Jay, J.M., Loessner, M.J. and Golden, D.A. (2008). Modern food microbiology. Springer Science and Business Media. The Netherlands.
4. Rai, M. and Bridge, P.D. (2009). Applied Mycology. CABI
5. Ulloa, M. and Hanlin, R.T., (2000). Illustrated dictionary of mycology. American Phytopathological Society Press. USA.


**FST 567 Food Biotechnology (3 0 3)**

This course in Food Biotechnology provides an opportunity to learn the concepts and theory of the experimental techniques used in food biotechnology. It is intended to provide an advanced understanding of key concepts and current applications of biotechnology in the production and processing of foods.

**a) Objective**

To exemplify biotechnological applications relating to:

- transgenic foods, biotechnological food additives;
- Biotechnological food diagnosis and regulations.

**b) Learning outcomes**

Students should be able to:

- Apply the interdisciplinary sciences relevant to food biotechnology;
- Demonstrate how molecular biotechnology is being used to address major challenges associated with healthier and safer food production, and processing;
- Describe the fundamental principles in implementing biotechnologies in various aspects of food production and processing.

**c) Content**

Microorganisms for Food Production; Enzymes in Food Production; Genetic Engineering Tools; Genetic Modification of Bacteria, Plants and Animals; Social, Economic, Ecological Issues of Food Biotechnology.

**d) Mode of delivery**

i. Lectures/ PowerPoint Presentation.
ii. Audio-visuals (videos and infographics).
iii. Group discussions and presentations.
iv. Assignment.

**e) Reading materials**


1. Byong, H. L. (2015). Fundamentals of Food Biotechnology. 2nd Edition. Wiley- Blackwell. USA.
2. Shetty, K., Paliyath, G., Pometto, A. and Levin, R. E. (2006). Food biotechnology. Taylor and Francis Group, LLC.
3. Applications of Biotechnology to Traditional Fermented Foods. Report of an Ad Hoc Panel of the Board on Science and Technology for International Development. National Academy Press. Washington D.C., 1992.
4. Shetty, K., Paliyath, G., Pomentto, A., and Levin, E. R., (eds). Food Biotechnology. 2nd Ed. Tatlor & Francis Group, LLC, 2006.
5. Smith, E. J. Biotechnology. 5th Edition. Cambridge University Press, UK. 2009.


**FSA 753 Advanced Food Toxicology (3 0 3)**

The food chain starts from the farm and ends on the plates of individual consumers. Challenges, including microbial, chemical, and environmental hazards, along the chain. There have been documented human tragedies and economic disasters due to intentional or accidental ingestion of such hazards. The most current toxicological profiles must be studied alongside their adverse health effects to ensure food safety and prevent unnecessary foodborne illnesses resulting from hazard ingestion. This course provides the advanced knowledge and training required to build such skills to safeguard public health.

**a) Objective**

- To carry out toxicological discussion of the critical foodborne hazards along the food chain.
- To exemplify foodborne hazards and their adverse health risks.

**b) Learning Outcomes**

Students would be able to:

- identify the hazards of paramount concern;
- be knowledgeable in the identification, characterization, exposure and evaluation of adverse risks foodborne hazards.

**c) Content**

Overview of toxicology and xenobiotic metabolism; Chemical Hazards: Ingredient-Related Chemical Hazards; Pesticides, Animal drug residues, Toxic Heavy metals, Environmental contaminants, Mycotoxins and other natural toxins, Hazardous Chemical Adulterants; Melamine, Lead chromate, Lead oxide, Sudan dyes. Food

allergens, Food additives, Food Processing Contaminants: Acrylamide, Dioxins, PAHs, Nitrosamines, Heterocyclic amines, Radiological hazards, Food additives, Migrants from packaging materials. Physical Hazards; Metal, Glass and Hard Plastics.

**d) Mode of delivery**

- Lectures/Tutorials and workshops/Independent study.
- Flipped classroom/Problem-based learning.
- Blended learning/ hybrid learning.
- Student-led.

**e) Reading materials**


1. Luz, Y. and Toro, S. (1996). Toxicology and Risk Assessment, 1st ed. Marcel Dekker, Inc, New York.
2. de W Blackburn, C. and McClure, P. J. (Eds.). (2009). Foodborne pathogens: hazards, risk analysis and control. Elsevier.
3. Omaye, S.T. (2009). Introduction to food toxicology, 2nd ed, Pesticide, Veterinary and Other Residues in Food. Elsevier Inc. https://doi.org/10.1016/B978-1-85573-734-1.50005-8
4. Ramesh, G. (2015). Handbook of Toxicology of Chemical Warfare Agents, 2nd ed, Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis. Elsevier Inc., London.
5. Sun, Y.J. (2005). Handbook of Industrial Chemistry and Biotechnology, 13th ed, Control, and Cybernetics. Springer Nature, Cham, Switzerland.


**YEAR 1 SEMESTER 2**

**FST 570 Advanced Food Chemistry (3 0 3)**

This course aims to understand the chemical reactions, interactions, and properties of major food components and their effects on the sensory and safety of foods.

**a) Objective**

- To integrate the chemistry and functionalities of food materials during cooking, processing, and storage.

**b) Learning outcomes**

- At the end of this course students should be able to attribute chemical principles to assess the dynamics of food materials during cooking, processing and storage.

**c) Content**

Structure, Reactions, and Functionalities of Proteins, Lipids, and Carbohydrates. Modification of carbohydrates (Starch, Cellulose). Vitamins and Minerals. Science and technology of colors and flavors. Enzymology.

**d) Mode of delivery**

- Lecturer/student Interactions.
- Audio-visuals analysis of concepts (videos and infographics).
- Group discussions and presentations.
- Assignments/Term paper/Critique of research papers.

**e) Reading materials**


1. Belitz, H. D., Grosch, W. and Schieberle, P. (2009). Food Chemistry. 4th revised and extended edition, Springer. NY.
2. Coultate, T. P. (2007). Food: The Chemistry of its Components. 4th Edition, Royal Society of Chemistry. UK.
3. Damodaran, S., Parkin, K. and Fennema, R. (2007). Fennema's Food Chemistry. 4th Edition, CRC Press. London.
4. Deman, J. M., Finely, J. W., Hurst, W.J. and Lee, C. Y. (2018). Principles of Food Chemistry. 4th Edition, Springer. NY.
5. Fennema, O. R. (2017). Food Chemistry. 3rd Edition, Marcel Dekker Inc. NY.


**FST 572 Advanced Food Engineering (3 0 3)**

This course focuses on alternatives to thermal operations, emphasizing retaining the quality and organoleptic properties of food products and presenting engineering focus on non-thermal food processing technologies.

**a) Objective**

- To demonstrate engineering focus on non-thermal food processing technologies;
- To use mathematical modelling and numerical simulations to explain outcomes treatments.

**b) Learning outcomes**

At the end of the lessons students should be able to explain the principles and application in any named non-thermal food processing technology.

**c) Content**

High Pressure-Based Food-Processing; Pulse Electric Fields; Ultrasound Processing; Osmotic Dehydration; Pulsed Light Technology; Membrane Technology; Irradiation Technology; Cryogenic Freezing; Nanofiltration: Principles, Process Modeling, and Applications; Atmospheric Pressure Non-Thermal Plasma

**d) Mode of delivery**

- Lecturer/student Interactions.
- Audio-visuals analysis of concepts (videos and infographics).
- Group discussions and presentations.
- Assignments.
- Term paper.
- Critique of research papers.

**e) Reading materials**


1. Dash, K. K., and Chakraborty, S. (Eds.). (2021). Food Processing: Advances in Non-Thermal Technologies. CRC Press.
2. Sonawane, S. K. and Patil, S. (2020). Non-thermal plasma: An advanced technology for food industry. Food Science and Technology International, 26(8), 727-740.
3. Chauhan, O. P. (Ed.). (2019). Non-thermal processing of foods. CRC Press.
4. Ohlsson, T. and Bengtsson, N. (2002). Minimal processing of foods with non-thermal methods. Minimal processing technologies in the food industry., 34-60.
5. Tewari, G. and Juneja, V. (Eds.). (2008). Advances in thermal and non-thermal food preservation. John Wiley and Sons.
6. Barba, F. J., Saraiva, J. M. A., Cravotto, G. and Lorenzo, J. M. (Eds.). (2019). Innovative thermal and non-thermal processing, bioaccessibility and bioavailability of nutrients and bioactive compounds. Woodhead Publishing.


**FST 574 Research Communication and Seminar (2 3 3)**

This course is designed to equip students to use scientific communication processes to gather high-value information and present them.

**a) Objective**

- To exemplify the scientific communication process.
- To carry out proposal writing, review literature in a defined area, and draft an article (thesis/ manuscript) for publication.

**b) Learning outcomes**

At the end of the lessons students should be able to:

- evaluate scientific communication processes.
- draft a proposal, be competent in the skills for reviewing literature and draft an article (thesis/ manuscript) for publication.

**c) Content**

Idea stage, Strategies of Planning and writing a Proposal, Article Writing strategies, Scientific communication, Research Ethics, and Responsibilities, Patenting Research Findings.

**Practical session:** Proposal writing, Seminar presentations, Library, and reference tools.

**d) Mode of delivery**

- Lectures/PowerPoint Presentation.
- Audio-visuals (videos and infographics).
- Group discussions and presentations.
- Assignments using Books, Periodicals, and on-line sources.
- Laboratory work/Demonstrations/ Practical Sessions.

**e) Reading materials**


1. Bowater, L. and Yeoman, K. (2012). Science communication: a practical guide for scientists. John Wiley and Sons. NJ.
2. Gross, A. G. and Buehl, J. (2016). Science and the Internet: Communicating knowledge in a digital age. Routledge. UK.
3. Harmon, J. E. and Gross, A. G. (2010). The craft of scientific communication. University of Chicago Press. US.
4. Hofmann, A. H. (2014). Scientific writing and communication: papers, proposals, and presentations. Oxford Univ. Press. UK.
5. Wilkinson, C. and Weitkamp, E. (2016). Creative Research Communication: Theory and Practice. Manchester University Press. Manchester, England.


**FST 580 Advanced Human Nutrition and Health (3 0 3)**

Good food is a requirement for well-rounded growth. Thus, when the health of consumers becomes lazed, food insecurity may be brought into sharp focus, and vulnerability to diseases may be increased. Such causes of diseases may be attributed to lack of food and adequate nutrition, unsafe water, and poor sanitation. This course has been designed to draw attention to relationships between food sources, nutrition, and health along the food value chain.

**a) Objective**

- To extrapolate the linkages between healthy nutrition and key preventable diseases based on improved nutritional status.

**b) Learning outcomes**

- Students should be able to construct mechanisms underlying nutrition-based disease manifestations and map out strategies to control them.

**c) Content**

Contemporary Health situation; Human nutrition; Minerals and Cognitive Function; Good nutrition for Children and all ages; Malnutrition causes diarrhea – diarrhea causes malnutrition; Nutrition and Chronic Diseases; Malabsorption; Unhealthy foods; Nutrition and Parkinson Disease; Diet Modifications and Cholesterolemia; Nutrition and Hypertension; Nutrition and Acute and Chronic Renal Failure; Diverticulitis; Diet and biodiversity; A Balanced diet; Food hygiene

**d) Mode of delivery**

- Lectures/PowerPoint Presentation.
- Assignment.
- Audio-visuals (videos and infographics).
- Group discussions and presentations.

**e) Reading materials**


1. Conant, J. and Fadem, P. (2012). A community guide to environmental health. Hesperian health guides, Barkeley, California, USA, pp.600.
2. FAO, IFAD, and WFP. (2015). The State of Food Insecurity in the World. Meeting the 2015 international hunger targets: taking stock of uneven progress. Rome, FAO, pp.62.
3. Food and Agriculture Organization of the United Nations (FAO) (2009). Global agriculture towards 2050. High-Level Expert Forum: how to feed the world in 2050. FAO, Rome.
4. FAO (2004). The state of agricultural commodity markets. Rome.
5. Berdanier, C.D., Berdanier, L.A. and Zempleni, J. (2008). Advanced nutrition: macronutrients, micronutrients, and metabolism. CRC press.


**FST 582 Food Microstructure and Rheology (3 0 3)**

This course presents food microstructure and its impact on rheology for batter systems. This will enable students to apply them in closely related courses.

**a) Objectives**

- To explain major principles and methods in food rheology.
- To describe the principles of rheology and its applications in the processing of food products.
- To distinguish solid, viscous, and viscoelastic behavior of foods.

**b) Learning outcomes**

- Upon successful completion of this course, the students should be able to evaluate the structure, viscosity, and texture in food products.

**c) Content**

Introduction to rheology; Principles of deformation elasticity and flow; shear; Newtonian and Non-Newtonian flows; Viscometry of fluid food materials - dilute and concentrated systems; Rheopexy (thixotropy); Viscoelasticity; Rheological methods and properties; Empirical methods; Textural measurement; Measuring instruments-practical aspects; Applications (Emulsions, Gels, Selected Products). Food microstructure

**d) Mode of delivery**

- Lectures.
- Audio-visuals analysis of concepts (videos and infographics).
- Group discussions and presentations.
- Assignments.
- Term paper.
- Critique of research papers.

### d) Reading materials


1. Ngamwonglumlert, L. and Devahastin, S. (2018). Microstructure and its relationship with quality and storage stability of dried foods. In Food Microstructure and Its Relationship with Quality and Stability. Woodhead Publishing. UK.
2. Ahmed, J., Ptaszek, P, and Basu, S. (2016). Advances in food rheology and its applications. Woodhead Publishing. UK.
3. McClements, D. J. (2007). Understanding and controlling the microstructure of complex foods. Elsevier. USA.
4. Morris, V. and Groves, K. (2013). Food Microstructures. Microscopy, Measurement and Modelling. 1st Edition, Woodhead Publishing. UK.
5. Ahmed, J., Ptaszek, P. and Basu, S. (2016). Advances in Food Rheology and Its Applications. 1st Edition, Woodhead Publishing. UK.


**FST 584 Advanced Postharvest Technology (3 0 3)**

This course is designed to understand and apply technologies that maintain the quality and extend the shelf-life of fresh produce.

### a) Objective

- To learn the technologies that maintain fresh produce through the supply chain to guarantee optimum quality and extended shelf-life.

### b) Learning outcomes

- It is expected that students design technologies required to maintain fresh produce throughout the supply chain to guarantee premium produce.

### c) Content

A critical review of the literature concerning post-harvest losses of agricultural products and Post-harvest handling system of perishable crops; Current methods in Postharvest Physiology and Technology; Life extension of perishable commodities, techniques; Emphasis on the effects of storage facilities and techniques; Quality evaluation as related to physiological mechanism controlling the maturation; Ripening and senescence of perishable commodities; Principles of storage of fruits and vegetables; Types of storage: natural, ventilated low-temperature storage controlled atmosphere (CA) and modified atmosphere storages (MA).

### d) Mode of delivery

- Lecturer/student Interactions.
- Audio-visuals analysis of concepts (videos and infographics).
- Group discussions and presentations.
- Assignments.
- Term paper.
- Critique of research papers.

**e) Reading materials**


1. Florkowski, W. J., Banks, N., Prussia, S. E., Shewfelt, R. L. and Brueckner, B. (2009). Post-harvest handling: a systems approach. Academic press. USA.
2. Golob, P., Farrell, G. and Orchard, J. E. (2002). Crop post-harvest: science and technology. Blackwell Science. USA.
3. Lieberman, M. (2012). Post-harvest physiology and crop preservation (Vol. 46). Springer Science and Business Media. The Netherlands.
4. Paliyath, G., Murr, D. P., Handa, A. K. and Lurie, S. (2009). Post-harvest biology and technology of fruits, vegetables, and flowers. John Wiley and Sons. USA.
5. Sudheer, K. P. and Indira, V. (2007). Post-harvest technology of horticultural crops (Vol. 7). New India Publishing. India.


**FST 586 Modelling in Food Technology (3 0 3)**

This course is designed to equip students to use mathematical tools for design and predictive food models and to interpret such predictive models' outcomes.

**a) Objective**

- To learn the mathematical or statistical tools for predictive and interpreting food models.

**b) Learning outcomes**

- By the close of the lessons students should be able to design food models based on data collected and interpret the outcomes of such predictive models.

**c) Content**

Basis of fundamental mathematical principles; Matrices, Algebra, Calculus, Set theory, Fuzzy set, and logic; Linear programming, Mathematical models and data sets in the area of food science and the outcomes of the research cycle: Data, Models, software, data analytics, visualization methods relevant for modelling in food science. Modelling in Food Safety, Food Quality, Food control, Food Defense, and Food Designs.

**d) Mode of delivery**

- Lecturer/student Interactions.
- Audio-visuals analysis of concepts (videos and infographics).
- Group discussions and presentations.
- Assignments.
- Term paper.
- Critique of research papers.

**e) Reading materials**


1. Datta, A. K., Sablani, S. S., Mujumdar, A. S. and Rahman, M. S. (2006). Handbook of food and bioprocess modeling techniques. CRC Press. USA.
2. Shi, J. and Le Maguer, M. (2002). Osmotic dehydration of foods: mass transfer and modeling aspects. Food Reviews International, 18(4): 305-335.
3. Helmroth, E., Rijk, R., Dekker, M. and Jongen, W. (2002). Predictive modelling of migration from packaging materials into food products for regulatory purposes.

Trends in Food Science and Technology, 13(3):102-109, Elsevier. The Netherlands.
4. Ozilgen, M. (2011). Handbook of Food Process Modeling and Statistical Quality Control. CRC Press. USA.
5. Tijskens, L. M. M., Hertog, M. L. A. T. M. and Nicolaï, B. M. (2001). Food process modelling (Vol. 59). Woodhead Publishing. USA.

**FSA 752 Food Systems Risk Assessment (3 0 3)**

Food systems risk outcomes advise risk managers on the likely levels of risks associated with foods. Advancement in the sensitivity of most equipment suggests scientists can quantify toxic substances in great detail. By quantifying the presence of these hazards in the food chains, it is possible to arrive at decision-making geared towards safeguarding public health. This course is designed to equip students to gain such experiences.

**a) Objective**

- To exemplify hazardous dietary chemicals, microbial and environmental agents along the food chains.
- To integrate risk assessment tools to attribute risk indicators along the food chain.
- To use risk assessment knowledge for effective risk management.

**b) Learning outcomes**

By the close of the lessons students should be able to:

- Organize the primary information sources from databases useful for risk assessment purposes.
- Produce risk assessment perspective including communicating risks.

**c) Content**

Overview of food risk analysis: Food risk assessment: Hazard and risk, risk assessment framework. Hazard Identification, Hazard Characterization, Exposure Assessment, Risk Characterization. Concepts of microbial and chemical risk assessments: Deterministic Approach, Probabilistic Approach, Tiered Approach, uncertainty and variability, limitations and challenges of risk assessment in foods; Risk Metrics: quantifying the impact of adverse health effects. Mixture Risk Assessment. Modelling and Simulation Tools, Monte-Carlo Simulations to Integrate Variability and Characterize Uncertainty, Prioritizing the different sources of uncertainty; Sensitivity Analysis Methods in Quantitative Risk Assessment. Risk–Benefit Assessment of Foods: the need for risk–benefit assessment, food safety and nutrition applications. Qualitative and Quantitative Risk–Benefit Assessment Approaches; Food Component Risk–Benefit Assessment; Risk communication.

**d) Mode of delivery**

- Lecturer/student Interactions.
- Audio-visual's analysis of concepts (videos and infographics).
- Group discussions and presentations.
- Assignments.
- Term paper.
- Critique of research papers.

**e) Reading materials**


1. Luz, Y. and Toro, S. (1996). Toxicology and Risk Assessment, 1st ed. Marcel Dekker, Inc, New York.
2. Nielsen, E., Ostergaard, G. and Larsen, J.C. (2008). Toxicological Risk Assessment of Chemicals, Toxicological Risk Assessment of Chemicals. Informa Healthcare USA, Inc. https://doi.org/10.1201/9781420006940
3. Omaye, S.T. (2009). Introduction to food toxicology, 2nd ed, Pesticide, Veterinary and Other Residues in Food. Elsevier Inc. https://doi.org/10.1016/B978-1-85573-734-1.50005-8
4. Ramesh, G. (2015). Handbook of Toxicology of Chemical Warfare Agents, 2nd ed, Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis. Elsevier Inc., London.
5. Sun, Y.J. (2005). Handbook of Industrial Chemistry and Biotechnology, 13th ed, Control, and Cybernetics. Springer Nature, Cham, Switzerland.


**YEAR 2 SEMESTER** 1

**FST 651 Research Project I (0 18 6)**

This course is designed to assess the student's preparedness to outline their research interest and their capacity to undertake research work. It allows for suitable supervisors for the project.

**a) Objective**

- To carry out scientific literature skills training especially relating to food science and technology.
- To conduct research and write scientific articles in their respective research areas.

**b) Learning outcome**

- At the end of the lessons students should be able to gain the competence to become productive experts in the food science and technology research community.

**c) Content**

The content is primarily based on the areas of specialization of students. The content will progress through the semesters as Research Project 1, 2, 3 through to the final year as Research Thesis.

**d) Mode of delivery**

- Initially, each student shall write a proposal/synopsis for presentation and submit a report based on the approved format for assessment by the supervisor and a Board of examiners. Subsequently, progress reports shall be turned in as the student/candidate progresses.
- The supervisor shall assess the quality of the research thesis based on a format prepared for the exercise.
- A final presentation of the thesis based on the approved format for oral examination and assessment by the supervisor and a team of examiners shall be made.

**e) Reading materials**


1. Thomas, D. R. and Hodges, I. D. (2010). Designing and managing your research project: Core skills for social and health research. Sage Publications.
2. Brewka, G., Niemelä, I. and Truszczyński, M. (2008). Nonmonotonic reasoning. Foundations of Artificial Intelligence, 3: 239-284.
3. DeJong, G. (2012). Investigating explanation-based learning (Vol. 120). Springer Science and Business Media.
4. O'donoghue, T. (2006). Planning your qualitative research project: An introduction to interpretivist research in education. Routledge.
5. Verschuren, P., Doorewaard, H. and Mellion, M. (2010). Designing a research project (Vol. 2). The Hague: Eleven International Publishing.


**FST 653 Research Seminar I (0 18 6)**

This course is designed to strengthen communication skills. In the beginning, there is a delivery of a synopsis to assess students' ability to handle communication in their respective research interests.

**a) Objective**

- To learn skills for research output communication in the food science and technology research community.

**b) Learning outcome**

- At the end of the lessons students should be able to gain the competence to to deliver a public lecture in the food science and technology research community

**c) Content**

- The content is primarily based on the areas of specialization of students. The scope of the research will also cover the industrial internship.

**d) Mode of delivery**

- Oral examination of students shall be conducted during seminar presentations based on a format prepared for the assessment as the candidate progresses a

report based on the approved format for assessment by the supervisor and a Board of examiners.

- Delivery shall be student-cantered, and presentation shall either be by poster presentations or timed oral presentations.

**e) Reading materials**

1. Germano, W. (2014). From: dissertation to book. University of Chicago Press.
2. Bunton, D. (2014). Generic moves in Ph. D. thesis introductions. In: Academic discourse, pp. 67-85. Routledge.
3. Rowland, C. (2004). Communication matrix. Oregon Health and Science University.
4. Lam, A. (2007). Knowledge networks and careers: Academic scientists in industry-university links. Journal of management studies, 44(6): 993-1016.
5. Downs, D. and Wardle, E. (2007). Teaching about writing, righting misconceptions:(Re) envisioning" first-year composition" as" Introduction to Writing Studies". College composition and communication, 34: 552-584.

**YEAR 2 SEMESTER** 2

**FST 652 Research Project II (0 18 6)**

This course is designed to assess the student's progress in their research output.

**a) Objective**

- To carry out deeper scientific literature skills training especially relating to food science and technology.
- To conduct deeper research and master the skills of writing scientific articles in their respective research areas.

**b) Learning outcome**

- It is expected that candidates would ultimately gain the competence to become productive experts in the food science and technology research community.

**c) Content**

Each student shall carry out Laboratory/field project work and submit a thesis report on the research project based on the approved format for oral examination and assessment by the supervisor and a team of examiners. The programme's research component shall be open to characterizing or solving a Food Science/Technology-related problem of scientific, technological, or business importance. The project shall be of a publishable manuscript(s) in any appropriate peer-reviewed journal.

**d) Mode of delivery**

- Initially, each student shall write a proposal/synopsis for presentation and submit a report based on the approved format for assessment by the supervisor and a Board of examiners. Subsequently, progress reports shall be turned in as the student/candidate progresses.

- The supervisor shall assess the quality of the research thesis based on a format prepared for the exercise.
- A final presentation of the thesis based on the approved format for oral examination and assessment by the supervisor and a team of examiners shall be made.

**e) Reading materials**

1. Davies, M. B., and Hughes, N. (2014). Doing a successful research project: Using qualitative or quantitative methods. Macmillan International Higher Education.

2. Kushkowski, J. D., Parsons, K. A. and Wiese, W. H. (2003). Master's and doctoral thesis citations: Analysis and trends of a longitudinal study. Portal: Libraries and the Academy, 3(3): 459-479.

3. Greiner, R., Darken, C. and Santoso, N. I. (2001). Efficient reasoning. ACM Computing Surveys (CSUR), 33(1):1-30.

4. Berry, R. (2013). The Research Project: How to Write It, Edition 5. Routledge.

5. Fox, N. (2009). Using interviews in a research project. The NIHR RDS for the East Midlands/Yorkshire & the Humber, 26.

**FST 654 Research Seminar II (0 18 6)**

This course which is the continuation of the first semester's is designed to strengthen communication skills and sharpen the student's ability to handle communication in their respective research interests.

**a) Objective**

- To carry out deeper scientific communication skills training to deliver their research output in the food science and technology research community

**b) Learning outcome**

- It is expected that candidates would ultimately gain the competence to deliver a public lecture in the food science and technology research community.

**c) Content**

- The content is primarily based on the areas of specialization of students. The scope of the research will also cover the industrial internship.

**d) Mode of delivery**

- Oral examination of students shall be conducted during seminar presentations based on a format prepared for the assessment as the candidate progresses a report based on the approved format for assessment by the supervisor and a Board of examiners.
- Delivery shall be student-cantered, and presentation shall either be by poster presentations or timed oral presentations.

**e) Reading materials**


1. Downs, D. and Wardle, E. (2007). Teaching about writing, righting misconceptions:(Re) envisioning" first-year composition" as" Introduction to Writing Studies". College composition and communication, 34: 552-584.
2. Bunton, D. (2002). Generic moves in PhD thesis introductions. Academic discourse, 57: 75-145.
3. Kushkowski, J.D., Parsons, K.A. and Wiese, W.H. (2003). Master's and doctoral thesis citations: Analysis and trends of a longitudinal study. Portal: Libraries and the Academy, 3(3): 459-479.
4. Germano, W. (2014). From dissertation to book. University of Chicago Press.
5. Lam, A. (2007). Knowledge networks and careers: Academic scientists in industry-university links. Journal of management studies, 44(6): 993-1016.
6. Rowland, C. (2004). Communication matrix. Oregon Health and Science University.


## 2. Requirements for graduation:

Provide information on the following requirements for graduation:

a. Course Requirements;

These cores courses are required to be taken in addition to the compulsory electives.

| | |
|---|---|
| FST 559 | Food Analysis Laboratory |
| FST 571 | Advanced Food Microbiology |
| FST 573 | Food Commodities Processing Technology |
| STATS 559 | Statistical Methods for Research |
| FST 564 | Advanced Food Chemistry |
| FST 566 | Advanced Food Engineering |
| FST 554 | Research Communication and Seminar |

According to the handbook from the Graduate School, the pass mark for any course shall be 50%. However, a cumulative Weighted Average (CWA) of 55.00 shall be obtained at the end of the taught courses to proceed with the thesis. Where a student does not maintain the minimum CWA of 55.00 and trails one or more courses, they shall be required to write supplementary examinations to be in good academic standing before starting the research work Students will be given relevant handbooks/policies documents.

b. Credits Requirements;

The minimum number of credits required for graduation is **32**.

c. Any additional requirements for graduation, e.g. attendance.

A successful graduate should have passed all the courses, including practical and written examinations, oral presentations, and writing of formal food systems reports.

## 3. Assessment Regulations:

Provide details of:

a. Students' performance and achievement

Written examinations, practicals, oral presentations, and the writing of formal reports will contribute towards the final assessment. All passes would be as prescribed by the regulations governing examinations in the University. Students will be given relevant handbooks/policy documents.

b. Mode of certification

All candidates would be deemed to have satisfactory performance for graduation when they have been graded for continuous assessment throughout the programme and have qualified for Mid-Semester (40%) and End-of-Semester examinations (60%) for each course.

c. The certificate awarding institution

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY