

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

YEAR 1**SEMESTER 1**

Code	Course Title	T	P	C
FST 151	Introductory Food Science and Technology	2	0	2
BIOL 151	Cell Structure	2	3	3
CHEM 159	Foundation Chemistry I	3	0	3
CSM 183	Introduction to Computers I	2	3	3
ENGL 157	Communication Skills I	2	0	2
MATH 171	Calculus I	3	0	3
Minimum Semester Total		14	6	16

YEAR 1**SEMESTER 2**

Code	Course Title	T	P	C
FST 152	Laboratory Practice and Techniques	1	3	3
FST 154	Introductory Biochemistry for Food Scientists	2	0	2
BIOL 162	Introductory Genetics	2	3	3
CHEM 160	Foundation Chemistry II	2	3	3
ENGL 158	Communication Skills II	2	0	2
MATH 172	Calculus II	3	0	3
Minimum Semester Total		12	9	16
Electives (Optional)				
SOC 192	Logic and Reasoning	2	0	2

YEAR 2**SEMESTER 1**

Code	Course Title	T	P	C
FST 251	Food Engineering I	2	3	3
FST 253	Physical Chemistry of Foods	2	3	3
FST 255	Metabolism in Health and Disease	3	0	3
BIOL 251	Basic Microbiology	2	3	3
MATH 153	Statistical Methods I	2	0	2
PHY 291	Mechanics and Thermal Properties of Food Materials	2	3	3
Sub Total		13	12	17
Electives (Choose only one)				
FST 263	Food Service Operations and Management	2	0	2
ENVS 351	Solid Waste Management	3	0	3
FC 181	French for Communication I	3	0	3
Minimum credits		15	12	19

YEAR 2**SEMESTER 2**

Code	Course Title	T	P	C
FST 252	Food Engineering II	2	3	3
BIOL 262	Principles of Physiological Functions	2	0	2
CHEM 292	Organic Chemistry	3	0	3
CSM 184	Introduction to Computers II	2	2	3
MATH 176	Linear Algebra I	3	0	3
Subtotal Total		12	5	14
Electives (Choose at least one)				
FC 182	French for Communication II	2	0	2
FST 261	Traditional Foods and Nutrition	2	0	2
Minimum credits		14	0	17

YEAR 3**SEMESTER 1**

Code	Course Title	T	P	C
FST 351	Food Chemistry	2	3	3
FST 353	Postharvest Technology	2	0	2
FST 355	Food Packaging and Shelf life	1	3	2
FST 357	Principles of Sensory Evaluation	1	3	2
FST 359	Food Analysis	2	3	3
SCI 352*	Research Design and Implementation	1	3	2
STATS 351	Statistics	3	0	3
Minimum Semester Total		12	15	17
Electives (Optional)				
FST 363	Food Additives	2	0	2

* The 3rd year students shall go through this training in the first semester since they would be out on internship in the second semester.

YEAR 3**SEMESTER 2**

Code	Course Title	T	P	C
FST 352	Field Routine Reports	0	10	5
FST 354	Field Mini-Project	0	20	10
FST 356	Field Work Seminar	0	2	1
Minimum Semester Total		0	32	16

YEAR 4**SEMESTER 1**

Code	Course Title	T	P	C
FST 451	Food Hygiene and Sanitation	2	0	2
FST 453	Food Processing Technology I	2	3	3
FST 455	Research Project and Seminar I	0	4	2
FST 457	Food Product Development	1	4	3
FST 459	Food Microbiology	2	3	3
MAS 261	Fundamentals of Entrepreneurship I	3	0	3

	Minimum Semester Total	10	14	16
	Electives (Optional)			
FST 461	Nutrition-Sensitive Food Systems	2	3	3
FST 463	Food Processing and Preservation	3	0	3
FST 465	Nutrition and Health	2	0	2
FST 467	Food Enzymology	2	0	2
ENVS 453	Water and Waste Water treatment	3	0	3
LAW 151	Law of Contract I	3	0	3

YEAR 4 SEMESTER 2

Code	Course Title	T	P	C
FST 452	Food Quality Assurance	3	0	3
FST 454	Food Commodities	2	3	3
FST 456	Food Processing Technology II	2	3	3
FST 458	Research Project and Seminar II	0	8	4
MAS 262	Fundamentals of Entrepreneurship II	3	0	3
FST 460	Food Fermentation	2	0	2
	Minimum Semester Total	12	14	18
	Electives (Optional)			
FST 462	Food Plant Design and Economics	3	0	3
BCHEM 468	Food Biotechnology	2	0	2
PL 356	Project Analysis and Evaluation	3	0	3
LAW 152	Law of Contract II	3	0	3

1. Course Description:

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

- a. Objective
- b. Learning outcome
- c. Content
- d. Reading material

YEAR 1 SEMESTER 1

FST 151 Introductory Food Science and Technology (2 0 2)

Introduction to Food Science and Technology is designed to introduce students to food science and technology as a discipline and expose them to various career options in the field. The course will introduce students to all aspects of food science and technology; food chemistry, food microbiology, and food engineering. The course will cover the primary constituents of food and its implications on nutrition and health. Students will also be introduced to basic processes used in manufacturing food products, from unit operations to product development and preservation techniques. Students will discuss policies related to the production, marketing, and consumption of food products.

a) Objectives

The objectives for this course are to:

- identify various aspects of food science and technology and related career options;
- learn the various food components and their implications on nutrition and health;
- learn basic unit operations and their practical application in food manufacturing;
- assess different quality attributes associated with various food products;
- learn the various processing and preservation techniques;
- learn the issues related to food safety and policies.

b) Learning Outcomes

On completion of this course, the students should be able to:

- know what food science and technology entails and be aware of the various career prospects available;
- explain the relationship between various food components and their impact on nutrition;
- understand basic unit operations and their practical applications in food manufacturing;
- identify quality characteristics of different food products;
- describe the various processing and preservation techniques;
- understand the issues related to food safety and policies.

c) Course content

Introduction to food science as a discipline, Constituent of foods and their nutritional aspects, Unit operations in food processing, Quality factors in foods, Food Preservation, Food processing, Food commodities, Food safety, Food policy.

d) Mode of Delivery

- Series of lectures.
- Lecture notes and other resources will be available before each class.
- Class sessions will also include group discussions and assignments.
- Multimedia resources will also be used to complement class discussions.
- There will also be journal club sessions where groups will critically review research articles.

e) Reading Materials

1. Stewart, G. F. and Amerine, M. A. (2012). Introduction to food science and technology. Elsevier.
2. Vaclavik, V., Christian, V. and Elizabeth, W. (2008). Essentials of Food Science. Springer-erlag New York.
3. Schmidhuber, J. and Tubiello, F. N. (2007). Global food security under climate change. Proceedings of the National Academy of Sciences, 104(50), 19703-19708.
4. Porter, J.R., Xie, L., Challinor, A.J., Cochrane, K., Howden, S.M., Iqbal, M.M., Lobell, D.B. and Travasso, M.I. (2014): Food security and food production systems. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Cambridge University Press, Cambridge, United Kingdom
5. Gregory, P. J., Ingram, J. S. and Brklacich, M. (2005). Climate change and food security. Philosophical Transactions of the Royal Society B: Biological Sciences, 360(1463), 2139-2148

BIOL 151 Cell Structure**(2 3 3)**

Students learn the foundation of various cell structures and related functions. Expert knowledge in these areas would give a sound understanding of the roles of the organelles within the cells as they relate to their structure and function.

a) Objective

The main objective of this course is to:

- learn the basic knowledge of structure, forms and reproduction, and evolution of tissue systems of cell structures;
- acquire skills used in techniques used in microscopy.

b) Learning outcomes

- Students would be able to use microscopy to effectively study the general structure of cells and understand cells' behavior under different conditions.

c) Content

The basic structure of cells and macromolecules and the techniques used in their study including light and electron microscopy, X-ray diffraction, and scanning probe microscopy. It introduces the historical development of cell biology. Light Microscopic Techniques. Electron Microscopy. Specialized Microscopic Techniques. Scanning Probe Microscopy and X-ray Diffraction. It also explores Cell Membranes, The Endomembrane System, Chloroplast and Mitochondria, Cytoskeleton and cell junctions, Extracellular Matrix, Cell Fractionation, and Chemical Analysis.

d) Mode of delivery

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

e) Reading materials

1. Davis, L. (2012). Basic methods in molecular biology. Elsevier Holland.
2. Watson, J.D. (2004). Molecular biology of the gene. Vol. 1. Pearson Education India.
3. Buchanan, B.B., Gruissem, W. and Jones, R.L. (2015). Biochemistry and molecular biology of plants. John Wiley and Sons. USA.
4. Jardetzky, O. and Roberts, G.C.K. (2013). NMR in molecular biology. Academic Press. USA
5. Hutchings, P., Kingsford, M. and Hoegh-Guldberg, O. (2019). The Great Barrier Reef: biology, environment and management. CSIRO publishing. Australia.

CHEM 159 Foundation Chemistry I**(3 0 3)**

This course provides a broad foundation in Chemistry that stresses scientific reasoning and analytical problem solving with a molecular perspective concerning the synthesis of food materials.

a) Objective

- To learn the basic chemistry of elements, compounds and their properties / reactions.

b) Learning outcome

- Students should be able to demonstrate the understanding of the basic chemistry that is required to appreciate the attributes of food materials.

c) Content

Organic: Functional group chemistry: Hybridization, Classification of organic compounds, IUPAC system of organic compound nomenclature, Functional group chemistry, Chemistry, properties, preparations and reactions of Hydrocarbons, Alcohols and Sulphydryl derivatives, Alkyl halides, Carboxylic acids and derivatives, Amines and derivatives, Azo compounds, Phenols, and derivatives.

Physical: State of matter (classification, structure properties of matter, types of systems state variables, and equations of state). Introductory thermodynamics (first and second laws, enthalpy, entropy, the free energy of chemical reactions). Fundamental chemical kinetics (order and molecularity of reactions, properties of zero-order, first-order reactions, the effect of temperature, and Arrhenius).

Inorganic: Periodic table and periodicity, periodic properties of elements, periodic properties of compounds. The introductory chemistry of groups, Properties of transition elements.

d) Mode of delivery

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

e) Reading material

1. House, J.E. and House, K. A. (2015). Descriptive inorganic chemistry. Academic Press. NY.
2. Klein, D.R. (2019). Organic Chemistry as a second language. 5th Edition. Wiley
3. Reger, D. L., Goode, S. R. and Ball, D. W. (2010). Chemistry principles and practice, 3rd Edition, Brooks and Cole Australia.
4. Hein, M., Arena, S. and Willard, C. (2016). Foundations of college chemistry. John Wiley and Sons NY.
5. Taber, K.S. (2003). Foundations for Teaching Chemistry: Chemical Knowledge for Teaching, Taylor and Francis, UK.

CSM 183 Introduction to Computers I (2 3 3)

This course introduces the basic features of Microsoft Office, Windows basics, and file management. It also develops familiarity with Word, Excel, Access, PowerPoint, email, and Internet basics.

a) Objective

- To identify components of a computer system.
- To identify types of software applications and operating systems.

- To develop skills in essential file management.

b) Learning outcome

It is expected that students would be able to:

- recognize when to use each of the Microsoft Office programmes to create professional and academic documents;
- use Microsoft Office programmes to create personal, academic and business documents following current professional and industry standards; and
- apply skills and concepts for the primary use of computer hardware, software, networks, and the Internet in the workplace.

c)Content

Introduction (Processing Device, Input / Output devices. Storage Devices System Software. Application Software); Introduction to Windows (The Basics, Working with a Window. File Management in Windows XP. Managing Files with My Computer. Using the On-Line Help and Support. Log On and Off Windows. Introduction to the Internet. Introduction to MS-WORD: Creating Word document. Formatting, Creating tables and indexes. Formatting tables. Inserting Objects. Formatting Objects, Formatting with unique features. Merging Documents and Sorting Data).

d)Mode of delivery

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

e) Reading materials

1. Williams, B.K. and Sawyer, S.C. (2007). Using information technology: A practical introduction to computers and communications.
2. Manhas, R. (2008). Use of the Internet and electronic resources for Dental Science information: a case study. Library Philosophy and Practice, 9, pp.1-8.
3. Comer, D.E. (2018). The Internet book: everything you need to know about computer networking and how the Internet works. CRC Press.
4. O'brien, J.A. and Marakas, G. (2005). Introduction to information systems. McGraw-Hill, Inc.
5. Linn, M.C. and Hsi, S. (2000). Computers, teachers, peers: Science learning partners. Routledge.

ENGL 157 Communication Skills I

(2 0 2)

This course provides the skills and tools to express your thoughts and opinions with confidence and conviction. In this course, you will explore a range of proven communication techniques and strategies that can be used to develop and maintain effective communication both inside and outside the workplace.

a) Objective

- To strengthen the written and oral communication skills in the English language.

b) Learning outcomes

- The student would have developed vocabulary, grammar, presentation, and interactive communication skills so that any deficiencies in skill or practice do not interfere with communication.

c) Content

Introduction to parts of speech, nouns and pronouns, verbs, tenses, adjectives, adverbs, conjugations, prepositions, and interjections. Concord, the article, direct and indirect speech, the sentence, punctuation, and paragraphing. The communication process, skills in communication and communication in organizations, Preparing efficient documents, the dynamics of oral communication, written communication, letters, and employment correspondence. Writing technical reports, proposals, memos, and writing dissertations and extended essays.

d) Mode of delivery

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

e) Reading materials

1. Gangal, J.K. (2012). A Practical Course in Spoken English. PHI Learning Pvt. Ltd. India.
2. Gangal, J.K. (2011). A Practical Course for Developing Writing Skills in English. PHI Learning Pvt. Ltd. India.
3. Bhatia, P.S. and Sheikh, A.M. (2008). Professional Communication Skills. S. Chand Publishing. India.
4. McCullagh, M. and Wright, R. (2008). Good Practice. Student's Book: Communication Skills in English for the Medical Practitioner. Ernst Klett Sprachen. Holland.
5. Raman, M. (2004). English language teaching. Atlantic Publishers and Dist. India.

MATH 171 Calculus I**(3 0 3)**

This course aims to introduce students' minds to the scientific method of analysis. Scientific practical problems can be identified, explanations generated, and logical solutions selected through science.

a) Objective

- This course aims to introduce students to the definition of a function, the basics of functions and their graphs, function operations, and function transformations.

b) Learning outcomes

- Students would be able to develop and strengthen their problem-solving skills and learn how to apply the tools of calculus to a variety of problem situations.

c) Content

Functions: Definitions and types. Basic types; Polynomials, Rational, Exponential, and Trigonometry. Properties of functions; Zeros, Even and Odd, Periodicity, Inverse and Fixed points. Sequence and Finite Series. The Binomial Theorem; Positive integer exponents, Integer, and rational exponents.

Limits of functions. Differentiation of Functions. Integration of Polynomials, Trigonometric (Cosine and Sine only), and Exponential. Applications of Derivatives; Maxima and Minima, Linear approximations and Related rates.

d) Mode of delivery

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

e) Reading materials

1. Larson, R., Hostetler, R.P. and Edwards, B.H. (2006). Calculus p. 1328. Boston: Houghton Mifflin.
2. Gelfand, I.M. and Silverman, R.A. (2000). Calculus of variations. Courier Corporation. USA
3. Rudin, W. (2006). Principles of Mathematical Analysis. 3rd Edition. McGraw-Hill Publishing Company.
4. Kac, V. and Cheung, P. (2001). Quantum calculus. Springer Science and Business Media. Vienna
5. Sabatier, J.A.T.M.J., Agrawal, O.P. and Machado, J.T. (2007). Advances in fractional calculus 4 (9). Dordrecht: Springer. NY

YEAR 1

SEMESTER 2

FST 152

Laboratory Practice and Techniques

(1 3 3)

This course introduces laboratory safety to students while enabling them to study basic quantitative and qualitative theory and practice some aspects of specific phenomena for food material.

a) Objective

- To introduce students to laboratory rules and regulations to foster safety.
- To understand the basic principles and techniques involved in chemical analyses.

b) Learning outcomes

- It is expected that students would be able to apply the basic skills acquired in preparing laboratory chemicals.
- Students would be able to perform tests on food components.

c) Content

Laboratory Safety; Glassware; Preparation of solutions; General techniques related to the following: Quantitative tests on Carbohydrates, Proteins, and Lipids, Principles of polarimetry, Separation techniques: Thin Layer chromatography and Paper

chromatography, Concept of partitioning and distribution coefficient, Centrifugation and Filtration.

Practical sessions: Preparation of solutions, Demonstrations using separation techniques

d) Mode of delivery

- Lectures.
- PowerPoint Presentation.
- Substantial laboratory sessions.
- Group discussions and presentations.

e) Reading materials

1. Weaver C. N. and James R. D. (2003). The Food Chemistry Laboratory- A manual for experimental foods, dietetics and food scientists, CRC Press. NY
2. Prichard, E. (2003). Practical Laboratory Skills Training Guide (Complete Set). Royal Society of Chemistry.
3. Ridley R. (2001). Handbook of good laboratory practices, World Health Organization. Switzerland.
4. Seiler, J.P. (2006). Good Laboratory Practice: The Why and the How. Springer Science and Business Media. Germany.
5. Sehgal, S. (2016). A Laboratory Manual of Food Analysis. I. K International Publishing House Pvt. Limited. India.

FST 154 Introductory Biochemistry for Food Scientists (2 0 2)

This course is expected to deliver the fundamental chemical principles that govern complex biological systems in foods.

a) Objective

- To understand the basic biochemical interconversion components of food in the body.

b) Learning outcomes

- Students would be able to explain the functionalities of these components of food.

c) Content

Structure, reactions, and functions of molecular components of foods. Carbohydrates (monosaccharides to polysaccharides). Lipids (fatty acids, acylglycerols, waxes, complex and derived lipids, eicosanoids, lipid-soluble vitamins). Amino acids to proteins. Essential aspects of Enzymes, Coenzymes. Vitamins. Introduction to porphyrins and nucleotide bases. Primary structure and properties of nucleic acids. Basic principles of thermodynamics as applied to biological systems. Bioenergetics, Principles of ATP cycle.

d) Mode of delivery

- Lectures.
- Assignment.
- PowerPoint Presentation.
- Audio-visuals (videos and infographics).

- Group discussions and presentations.

e) Reading materials

1. Tymoczko, J. L., Berg, J. M. and Stryer, L. (2011). Biochemistry: a short course, 5th Edition, W.H. Freeman and Co. NY.
2. Michael, N.A., Shahidi, E. and Shahidi, F. (2013). Biochemistry of Foods 3rd Edition, Elsevier Inc Holland.
3. Kohlmeier, M. (2015). Nutrient metabolism: structures, functions, and genes. Academic Press. NY.
4. Eskin, N.M. and Shahidi, F. (2012). Biochemistry of foods. 1st Edition, Academic Press. NY.
5. Toldrá, F., Paliyath, G., Hui, Y.H., Simpson, B.K., Nollet, L.M. and Benjakul, S. (2012). Food Biochemistry and Food Processing. Wiley NJ.

BIOL 162 Introductory Genetics

(2 3 3)

This course discusses the principles of genetics with application to the study of biological function at the level of molecules, cells, and multicellular organisms, including humans.

a) Objective

The objective of this course is to;

- learn to relate the structure and function of the DNA molecule to its functional role in encoding genetic material;

b) Learning outcomes

Student should be able to:

- demonstrate understanding of the chemical basis of heredity;
- evaluate the genetic concepts that impact health, disease, food, and the sustainability of natural and environmental resources.

c) Content

Introduction to Heredity, Preformation, Epigenesis, Pangenesis, and Lamarckism. Mendelism: Independent assortment, Factors that influence Mendelian ratios. Types of chromosomes, Chromosome abnormalities, and human disease. Meiosis and gene segregation, with examples of human genetic disorders. Sex determination and sex-linked genes. Production of genetic maps. Human genetics.

d) Mode of delivery

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

e) Reading materials

1. Beaumont, M. and Wang, J. (2019). Conservation genetics. Handbook of Statistical Genomics Wiley and Sons USA.
2. Bell, G. (2019). The masterpiece of nature: the evolution and genetics of sexuality. Routledge.

3. Wimp, G.M., Tomasula, J. and Hamilton, M.B. (2019). Putting the genes into community genetics. Molecular ecology Wiley and Sons USA.
4. Barton, N., Hermisson, J. and Nordborg, M. (2019). Population genetics: Why structure matters. Elife
5. Gardner, A., Stauffer, S., Petley-Ragan, L., Wismer, P. and Ungu, D.A.K. (2019). Medical Genetics. In Labster Virtual Lab Experiments: Genetics of Human Diseases. Springer Spektrum, Berlin, Heidelberg.

CHEM 160 Foundation Chemistry II (2 3 3)

This course provides a broad foundation in Chemistry that stresses scientific reasoning and analytical problem-solving skills concerning molecular perspectives of reactions and syntheses of food materials.

a) Objective

- To introduce students to the basic chemistry of elements, compounds and their properties / reactions.

b) Learning outcome

- Students should be able to demonstrate the understanding of the basic chemistry that is required to appreciate the attributes of food materials.

c) Content

Essential organic reactions (Substitution, Addition, Elimination, Free radical, Rearrangement and Oxidation-Reduction reactions). Equilibrium: Description of Chemical equilibria, Equilibrium Constant calculations, predicting the direction of equilibria, Heterogeneous equilibria. The response of equilibria to conditions: Pressure, Temperature, and added reagents. Solubility equilibria, K_{sp} . Oxidation-reduction reactions. Chemical bonding: ionic, covalent, van der Waal's forces, Hydrogen bonding concerning water: Physical and chemical properties of Water; Hybridization and shapes of simple inorganic molecules. Introduction to coordination chemistry. Applications of inorganic elements in biological systems.

Practical sessions: The laboratory experimentally demonstrates the topics covered in the lecture.

d) Mode of delivery

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

e) Reading materials

1. House, J. E. and House, K. A. (2015). Descriptive inorganic chemistry. Academic Press. NY.
2. Klein, D.R. (2019). Organic Chemistry as a second language. 5th Edition. Wiley
3. Reager, D. L., Goode S. R. and Ball D. W. (2010). Chemistry principles and practice, 3rd edition Brooks and Cole, Australia.

4. Hein, M., Arena, S. and Willard, C. (2016). Foundations of college chemistry. John Wiley and Sons NY.
5. Taber, K.S. (2003). Foundations for Teaching Chemistry: Chemical Knowledge for Teaching, Taylor and Francis, UK.

ENGL 158 Communication Skills II (2 0 2)

This course provides the skills and tools to express your thoughts and opinions with confidence and conviction. In this course, you will explore a range of proven communication techniques and strategies that can be used to develop and maintain effective communication both inside and outside the workplace.

a) Objective

- To develop competence in written and oral communication skills.

b) Learning outcomes

- The student would have developed vocabulary, grammar, presentation, and interactive communication skills in English language.

c)Content

The communication process, skills in communication and communication in organizations, Preparing efficient documents, the dynamics of oral communication, written communication, letters, and employment correspondence. Writing technical reports, proposals, memos, and writing dissertations and extended essays.

d)Mode of delivery

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

e) Reading materials

1. Gangal, J.K. (2012). A Practical Course in Spoken English. PHI Learning Pvt. Ltd. India.
2. Gangal, J.K. (2011). A Practical Course for Developing Writing Skills in English. PHI Learning Pvt. Ltd. India.
3. Bhatia, P.S. and Sheikh, A.M. (2008). Professional Communication Skills. S. Chand Publishing. India
4. McCullagh, M. and Wright, R. (2008). Good Practice. Student's Book: Communication Skills in English for the Medical Practitioner. Ernst Klett Sprachen. Holland.
5. Azar, B.S. and Hagen, S.A. (2009). Understanding and Using English Grammar. 4th Edition. Pearson Longman
6. Raman, M. (2004). English language teaching. Atlantic Publishers and Dist. India.

MATH 172 Calculus II (3 0 3)

The purpose of this course is simply to discuss scientific methods of analysis. It is hoped that their experiences with calculus applications, practical problems can be identified, explanations generated, and logical solutions selected.

a) Objective

- This course aims to introduce students to the definition of a function, the basics of functions and their graphs, function operations, and function transformations.

b) Learning outcomes

- Students are expected to know and apply the relevant tools of calculus to a variety of problem situations.

c) Content

Integration; Definite and Indefinite Integral, Applications of Integrations to Areas and Volumes. Integration by substitution, By part, By resolution to Partial Fractions. Approximate Integration. Coordinate Geometry; Equations of Lines and Circles, Conic Sections, Parabola, Ellipse, and Hyperbola. Parametric representation of curves.

d) Mode of delivery

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

e) Reading materials

1. Larson, R., Hostetler, R.P. and Edwards, B.H. (2006). Calculus. pp. 1328. Boston: Houghton Mifflin.
2. Gelfand, I.M. and Silverman, R.A. (2000). Calculus of variations. Courier Corporation. USA
3. Rudin, W. (2006). Principles of Mathematical Analysis. 3rd Edition. McGraw-Hill Publishing Company.
4. Kac, V. and Cheung, P. (2001). Quantum calculus. Springer Science and Business Media. Vienna.
5. Sabatier, J.A.T., Agrawal, M.J. and Machado, J.T. (2007). Advances in fractional calculus Vol. 4, No. 9. Dordrecht: Springer. NY.

SOC 192 Logic and Reasoning

(2 0 2)

The course focuses on the elaborate coherent systems that allow for the investigation, classification, and evaluation of good and bad forms of reasoning.

a) Objective

- To illustrate how to identify various components of any given objective to create rational scientific responses.

b) Learning outcomes

Students would be able to apply structured thinking to deduce the most accurate response to an objective from a given information.

c) Content

Argument and Critical Thinking. Basics of formal logic (methods for representing and assessing the logical form of arguments). Developing an understanding of symbolic language and logic. Familiarity with precise models of deductive reasoning.

d) Mode of delivery

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

e) Reading materials

1. Capaldi, N. and Miles, S. M. (2007). The Art of Deception: An Introduction to Critical Thinking. Prometheus Books. USA.
2. McInerney, D. Q. (2005). Being Logical: A Guide to Good Thinking. Random House Trade. NY.
3. Aggarwal, R.S. (2018). A modern Approach to Logical Reasoning. 2nd Edition S Chad Publishing India.
4. Aggarwal, R.S. (2010). A Modern Approach to Verbal and Non-Verbal Reasoning. S. Chand Publishing India.
5. Atkinson, W.W. (2018). The Art of Logical Thinking. BoD–Books on Demand. Germany.

YEAR 2 SEMESTER 1

FST 251

Food Engineering I

(2 3 3)

This course aims to provide students with basic knowledge in food engineering and prepare them for the industry and academia.

a) Objectives:

- to learn the fundamental MATLAB, food engineering and principles of operations employed during food processing;

b) Learning outcomes:

- Students should be able to understand the underlying principles of material and energy balances;
- Students should be able to apply MATLAB software for food engineering-based calculations.

c) Content:

Units, Dimensions and Conversion factors, Mass and Energy balances. Heat transfer (conduction, convection, and radiation). Fluid flow (Energy flows and fluid flows, laminar and turbulent flows), pumping of fluids (the Bernoulli equation). Introduction to drying and exergy. Introduction to MATLAB software.

d) Mode of delivery:

- Lectures/PowerPoint Presentation.
- Assignments/ Practicals.
- Reading of relevant publications.
- Class activities and group discussions/ Audio-visuals

e) Reading Materials:

1. Singh, R. P. and Heldman, R. D. (2014). Introduction to food engineering (5th Edition).
2. Richard, M. F., Rousseau, W. R. and Lisa, G. B. (2018). Elementary Principles of Chemical Processes. Wiley USA.
3. Fellows, P. J. (2016). Food Processing Technology (Principles and Practice).
4. Theodoros, V. and Constantina, T. (2015). Food Process Engineering.
5. Megh, R. G. and Meghwal, M. (2016). Food Engineering. CRC Press, NY

FST 253 Physical Chemistry of Foods (2 3 3)

Understanding food processes and the properties of foods requires knowledge of physical chemistry and how it applies to specific foods and food processes. Food physical chemistry is essential for improving foods' quality, stability, and food product development. This course involves the study of physical and chemical interactions in foods in terms of physical and chemical principles applied to food systems and the applications of physical/chemical techniques and instrumentation for the study. This course focuses on understanding the fundamental physical characteristics of how food materials (solid, liquid, or gas) interact with their surroundings.

a) Objective

To gain solid understanding of the structure and physicochemical properties of solutions, dispersions, biopolymers and food systems.

b) Learning outcomes

Upon completion of this course, the students are expected to:

- Understand the physical chemistry underlying the properties and reactions of various food components;
- have sufficient knowledge of food chemistry to control reactions in foods;
- be able to apply physiochemical principles to reactions and transformations in the manufacture, handling, and storage of foods.

c)Content

Chemistry of food acids, bases and salts, Principles, and properties of colloidal systems. (Emulsions-DVLO theory, Food Emulsifiers, Hydrophilic Lipophilic balance, Phase inversion temperature, and emulsifiers), The interfacial phenomenon, Surface tension, and surfactants, Viscosity.

d)Mode of delivery

- Lectures/Online Lecturing/ PowerPoint Presentation.
- Audio-visuals (videos and infographics).
- Group discussions and presentations.
- Quizzes and Assignments.
- Laboratory practicals.

e) Reading Materials

1. Atkins, P. (2015). Physical Chemistry for the Life Sciences. 2nd Edition. Oxford University Press.
2. Atkins, P. W., De Paula, J. and Keeler, J. (2018). Atkin's physical chemistry. Oxford University Press. The UK.
3. Ndob, A. M., Melas, M. and Lebert, A. (2015). Physical, chemical properties of food, 1st edition, Elsevier France.
4. McQuarrie, D.A. (2008). Quantum Chemistry, 2nd Edition, University Science Books, California.
5. Levine, I. (2008). Physical Chemistry. 6th Edition. McGraw-Hill Education.

FST 255 Metabolism in Health and Disease (3 0 3)

This course outlines how biochemistry, cell biology, and genetics relate to significant health problems and disorders.

a) Objective

- To illustrate to students the metabolism of crucial food components and how to apply them concerning disorders and outcomes of digestion and assimilation.

b) Learning outcomes

- Students should be able to apply their knowledge on the degradative and synthetic pathways and the diseases associated with them.

c) Content

Digestion, absorption, and metabolism of carbohydrates, fats, and proteins. Disorders of digestion, including indigestion and malabsorption. Other degradative and synthetic pathways of carbohydrates, lipids, and proteins - glycolysis, Tricarboxylic Acid Cycle (TCA), The Pentose Phosphate Pathway (PPP), redox reactions and electron transport chain, Glycogenolysis, Gluconeogenesis, β -oxidation of fatty acids, amino acid degradation with details nitrogen balance and nitrogen turnover and the Uric Acid Cycle. Glyoxylate Cycle. Diseases associated with malfunctioning of the various pathways.

d) Mode of delivery

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

e) Reading materials

1. Kohlmeier, M. (2015). Nutrient metabolism: structures, functions, and genes. Academic Press. NY.
2. Rosenthal, M. D. and Glew, R. H. (2011). Medical biochemistry: human metabolism in health and disease. John Wiley and Sons. NJ.
3. Lammert, E. and Zeeb, M. (2014). Principles of metabolism in health and disease, Springer Germany.
4. Eskin, N.M. and Shahidi, F. (2012). Biochemistry of foods. 1st Edition, Academic Press. NY.
5. Gonzalez, J.T. (2018). Carbohydrate Metabolism in Health and Disease. MDPI Books Switzerland.

BIOL 251 Basic Microbiology**(2 3 3)**

Microbiology is an essential branch of the life sciences that deals with all aspects of microbes, such as their structure, growth and development, genetics and molecular biology, systematics, role in the environment, and potential applications for human welfare.

a) Objective

- To learn the structure, identification and classification of microorganisms;
- To acquire the skills needed to identify and quantify microorganisms,

b) Learning outcomes

- Students should have a thorough knowledge and understanding of the core concepts. Students will describe how microorganisms are used as model systems to study basic biology, genetics, and metabolism.

c)Content

Introduction to the science of microbiology; Brief description of nature and kinds of microorganisms (Prokaryotic and Eukaryotic). Introduction to bacteriophage and the nature of viruses. Structure of microorganisms; size and shape, rigidity and flexibility, storage materials, motility, etc. Nutrient and growth requirements (types of media and conditions for cultivation); physiology and kinetics of growth, Isolation, and characterization of bacteria: pure culture, direct isolation, and enrichment culture techniques. Classification of bacteria types based on Gram staining reactions; carbon and energy, oxygen, temperature, sporulation, etc. Preservation methods for short, medium, and long-term purposes.

d)Mode of delivery

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

e) Reading materials

1. Banwart, G. (2012). Basic food microbiology. Springer Science and Business Media.
2. Ray, B. and Bhunia, A. (2013). Fundamental Food Microbiology, 4th Edition, CRC Press.
3. Jay, J.M., Loessner, M.J. and Golden, D.A. (2008). Modern Food Microbiology. Springer Science and Business Media.
4. Osman, E. and Bozoglu, E.T. (2016). Food Microbiology: Principles into Practice. John Wiley and Sons Ltd. NY.
5. Matthews, K., Kniel, K.E. and Montville, T.J. (2017). Food Microbiology: An introduction, 4th Edition. ASM Press. USA.

The lectures aim to develop the foundations of statistical thinking and introduce the most important statistical models used in social and bioscience research.

a) Objective

To learn the basic statistical methods of design, collection and analysis of data.

b) Learning outcomes

- Students should be able to use statistical knowledge and skills to analyze and interpret scientific data and effectively present the result.

c) Content

Nature and Uses of Statistics: some basic concepts of statistics. Data collection: Types and sources, data collection methods, and questionnaire design. Descriptive Analysis of Data: Organization and presentation of data: Measures of central tendency and dispersion, quartiles, percentiles, skewness, and kurtosis. Elementary Probability Theory: Random experiments, definitions of terms, and probability measures. Some basic laws of probability involving compound events. Computation of probabilities involving simple events, counting techniques, and decision problems. Random Variables and Probability Distributions: Concepts of random variables: Definition and properties of a probability distribution; Expectation, Median and Variance of random variables; Application to decision problems.

d) Mode of delivery

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

e) Reading materials

1. Hedges, L.V. and Olkin, I. (2014). Statistical methods for meta-analysis. Academic Press.
2. Robert, C. and Casella, G. (2013). Monte Carlo statistical methods. Springer Science and Business Media.
3. Manly, B.F. and Alberto, J.A.N. (2016). Multivariate statistical methods: a primer. CRC press.
4. Schabenberger, O. and Gotway, C.A. (2017). Statistical methods for spatial data analysis. CRC press.
5. Sprent, P. (2019). Data-driven statistical methods. Routledge.

PHY 291 Mechanics and Thermal Properties of Food Materials (2 3 3)

This course explains food's mechanical and thermal properties and how they control heat transfers.

a) Objective

- To study the mechanical properties of foods and how they behave during processing.

b) Learning outcomes

- Students should be able to relate food properties in terms of heat transfer with the environment during processing, packaging, storage, and distribution.

c) Content

Mechanics: Circular motion, Rotational dynamics, Static bodies and fluids, Elasticity, Surface tension, Solid friction, and Viscosity. Thermal properties: Heat capacity, Kinetic theory of gases, Changes of state, Heat transfer, Thermal expansion of solids and liquids.

Practical sessions:

Analysis of structural-physical properties and food quality to define texture profiles, rheological and thermal properties, and colors of solid and liquid foods.

d) Mode of delivery

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

e) Reading materials

1. Figura, L. and Teixeira, A. (2007). Food physics: physical properties-measurement and applications. Springer Science and Business Media. NY.
2. Bourne, M. C. (2002). Food Texture and Viscosity: Concept and measurement, Elsevier Science and Technology Holland.
3. Barbosa-Canovas, G. V., Juliano, P. and Peleg, M. (2004). Engineering properties of foods, encyclopedia of life support systems, USA.
4. Christensen, R.M. (2005). Mechanics of Composite Materials. Dover Publications USA.
5. Beretta, G.P. and Elias, E.P. (2010). Thermodynamics: Foundations and Applications. Dover Publications USA.

FST 263 Food Service Operations and Management (2 0 2)

The course seeks to develop skills required to provide food and beverage deliveries in the current consumer needs and potential future markets.

a) Objective

- To learn the concepts of foodservice operations relating to providing food, types of consumers, menu patterns, and foodservice systems.

b) Learning outcomes

- Students should understand and apply the essential concepts in the operation and management of food service facilities.

c) Content

Concept of Food Service-Definition and importance of foodservice; Food Service system, commercial and institutional foodservice, types of consumers, types of food services, Menu patterns and types of menus, primary considerations in menu planning, layout, design, and planning of a foodservice operation. Food Service Management: functional and personnel aspects.

d) Mode of delivery

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

e) Reading materials

1. Ardusser, L. and Brown, D.R. (2005). HACCP and Sanitation in Restaurants and Food Service Operations: A Practical Guide Based on the USDA Food Code. Atlantic Publishing Group Inc.
2. Pentz, J.A. (2010). Nutrition Manager Programme. Lifestyle Management Association. USA.
3. Payne-Palacio, J. and Theis, M. (2016). Food Service Management: Principles and Practices. 13th Edition. Pearson
4. Ninemeier, J.D. and Hayes, D.K. (2006). Restaurant Operations Management: Principles and Practices, Pearson Prentice Hall USA.
5. Gregoire, M.B. (2016). Foodservice Organizations: A Managerial and Systems Approach, Pearson USA.

ENVS 351 Solid Waste Management**(3 0 3)**

This course in Solid Waste Management (SWM) aims to enlighten the state-of-the-art technology, organizational and legislative developments, practices, and financial burdens and benefits of handling solid wastes.

a) Objective

- To learn the impact of reducing and eliminating waste materials on human health quality of life;
- To learn the delivery of waste management services that meet the needs of the customer cost-effectively.

b) Learning outcomes

- Students should be able to demonstrate an understanding of the main aspects of waste policy and systems.

c) Content

Types of Solid Wastes- Organic, Inorganic Plastic Glass. Waste Management options and their application to the different types of solid wastes (e.g. Source Reduction, Reuse, Recycling, Composting, Energy Recovery, Incineration, and Landfilling). Development, use, and management of biodegradable polymers. Organic waste decomposition and its significance in composting. Regulations on waste management options. Landfilling is a significant form of solid waste management system in Ghana.

d) Mode of delivery

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

e) Reading materials

1. Rada, E.C. (2016). Solid Waste Management Policy and Planning for a Sustainable Society 1st Edition, Apple Academic Press. NY
2. Jayarama, P.R. (2011). Municipal Solid Waste Management Processing - Energy Recovery - Global Examples 1st edition, CRC Press NY.
3. Epstein, E. (2015) Disposal and Management of Solid Waste Pathogens and Diseases, 1st Edition, CRC Press NY.
4. Kumar, S. (2016). Municipal Solid Waste Management in Developing Countries, 1st Edition CRC Press NY.
5. Pichtel, J. (2014). Waste Management Practices Municipal, Hazardous, and Industrial, 2nd Edition, CRC Press NY.

FC 181

French for Communication I

(3 0 3)

The first semester provides an initiation to conversational French. The course is specially tailored for students who have little or no knowledge of French. These courses are aimed at helping the student to grasp basic vocabulary to be able to function in everyday situations.

a) Objective

- To learn simple, practical tools required in handling simple interactions in everyday French conversation.

b) Learning outcome

- It is expected that students will gain basic communication skills in French.

c)Content

Spoken French and oral comprehension. The communicative approach enables students to express themselves in different situations.

d)Mode of delivery

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

e) Reading materials

1. Grahan, G. (2010). Complete French. Teach yourself
2. Mazet, V. (2008). Advanced French Grammar. McGraw-Hill Education.
3. Charlot, S. and Duranton, G. (2006). Cities and workplace communication: some French quantitative evidence. *Urban Studies* 43(8). 1365-1394.
4. Leclerc, D. and Martin, J.N. (2004). Tour guide communication competence: French, German and American tourists' perceptions. *International Journal of Intercultural Relations*, 28(3). 181-200.
5. Chalaby, J.K. (2005). French political communication in a comparative perspective: The media and the issue of freedom. *Modern and Contemporary France*, 13(3). 273-290.

YEAR 2

SEMESTER 2

FST 252

Food Engineering II

(2 3 3)

This course aims at providing students with the basic knowledge in food engineering in meeting expectations of the job market.

b) Objective

- To learn the various thermal processes used in food processing and their effects on foods.

c) Learning outcomes

Students should be able to:

- apply various thermal processes employed in the food industry and their importance in respect of forward and reverse feed evaporation (single effect);
- show competence in the calculations involved in heat inactivation of microorganisms;
- evaluate drying behaviors of various biomass and predict the same using MATLAB software;
- apply exergy analysis to investigate the efficiency of a thermodynamic system.

d) Content

Thermal processing of foods: Blanching (types, equipment involved and the effects on food), Pasteurization (types, equipment involved and effects on food), Commercial Sterilization (types, equipment involved and effects on foods), Evaporation (single effect) advantages and disadvantages of forward and reverse double-feed effect. Refrigeration and freezing on the properties of food during cold storage.

d) Mode of delivery

- Lectures/PowerPoint Presentation.
- Assignments.
- Reading of relevant publications.
- Class activities and group discussions.
- Audio-visuals/Practicals.

e) Reading Materials

1. Singh, R.P. and Heldman, R. (2014). Introduction to food engineering. 5th Edition.
2. Felder, M.R., Ronald, R.W. and Bullard, L.G. (2018). Elementary Principles of Chemical Processes. Wiley USA.
3. Fellows, P.J. (2016). Food Processing Technology (Principles and Practice).
4. Theodoros, V. and Constantina, T. (2015). Food Process Engineering.
5. Goyal, R.M. and Meghwal, M. (2016). Food Engineering.

BIOL 262 Principles of Physiological Functions (2 0 2)

This course involves the study of the plant way of life, which includes various aspects of the plant lifestyle and survival, including metabolism, water relations, mineral nutrition, development, movement, irritability (response to the environment), organization, and growth.

a) Objective

- This course aims to introduce to students the functions of critical physiological, reproductive and metabolic systems.

b) Learning outcomes

- Students would acquire knowledge and appreciation of plant and animal physiology.

c) Content

Plant cells, tissues, and structural organization of the plant body. Primary and secondary growth and tissue system. Structure, types, and modification of roots, stems, and leaves. Structure and types of inflorescences, flowers, fruits, and seeds. Physiology of germination of seeds. Photosynthesis, Mineral nutrition, Physiology of flowering in plants. Transpiration and adaptation to water regimes. The ascent of sap and translocation of organic materials in plants. Post-mortem animal physiology.

d) Mode of delivery

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

e) Reading materials

1. Jones, H.G. (2013). Plants and microclimate: a quantitative approach to environmental plant physiology. Cambridge university press. The UK.
2. Pessarakli, M. (2014). Handbook of Plant and Crop Physiology. CRC Press
3. Buchanan, B.B., Gruissen, W. and Russel, J.L. (2015). Biochemistry and Molecular Biology of Plants. 2nd Edition. Wiley
4. Li, G., Santoni, V. and Maurel, C. (2014). Plant aquaporins: roles in plant physiology. Biochimica et Biophysica Acta (BBA)-General Subjects, Elsevier Holland
5. Taiz, L., Zeiger, E., Møller, I.M. and Murphy, A. (2015). Plant physiology and development.

CHEM 292 Organic Chemistry**(3 0 3)**

In this course, functional group transformations, simple reaction mechanisms, and the synthesis of organic molecules are studied.

a) Objective

- To learn the structure and properties of organic compounds concerning components that makeup food.

b) Learning outcomes

- Students should be able to demonstrate comprehension of the primary functional group chemistry that make up food components.

c) Content

Carbon structure and bonding; Nature of organic compounds; Stereochemistry; Nucleophilic substitution and elimination reactions; Electrophilic aromatic substitution reactions; Nucleophilic addition reactions; Condensation reactions; Dienes; Alcohols; Carboxylic acids; Thiols; Ethers; Epoxides, Sulphides; Arylamines; Phenols; Synthetic polymers; Basic Spectral techniques.

d) Mode of delivery

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

e) Reading materials

1. Graham Solomons, T.W. and Fryhle, C.B. (2008). Organic Chemistry, 10th Ed., John Wiley and Sons, Inc NJ.
2. Bruckner, R. (2010). Organic Mechanisms, Reactions, Stereochemistry and Synthesis, Springer NY.
3. Ouellette, R. and Rawn, J. D. (2015). Principles of organic chemistry, Elsevier Holland.
4. Anslyn, E.V. and Dougherty, D.A. (2006). Modern Physical Organic Chemistry. University Science Books. California.
5. McMurry, J. (2011). Fundamentals of Organic Chemistry, 7th Edition. Brooks and Cole. Australia.

CSM 184 Introduction to Computers II**(2 2 3)**

This course is intended for students who require hands-on knowledge of computer applications to deepen their computer literacy.

a) Objective

- To learn computer skills in spreadsheet, database and presentation of results.

b) Learning outcome

- Students should be able use Microsoft Office programmes to create professional documents and manage data.

c) Content

Introduction to Windows (The Basics, Working with a Window. File Management in Windows XP. Managing Files with My Computer. Using the On-Line Help and Support. Log on and Off Windows. Introduction to the Internet); Introduction to MS-WORD (Creating Word document. Formatting, Creating tables and indexes. Formatting tables. Inserting Objects. Formatting Objects, Formatting with unique features. Merging Documents and Sorting Data); Microsoft Excel (Introduction. Creating a worksheet. Entering data in cells. Editing data in a cell. Saving a workbook. Closing a workbook and exiting Excel. Formatting a worksheet. Working with Formulas and Functions. Using Advanced Functions. Creating a chart. Working with Lists. Printing worksheets); Microsoft Access (Introduction to Database. Creating database files. Creating tables. Modifying a table's design. Creating Forms. Adding Titles and Graphics to Forms. Resizing, Moving, and Editing Control Objects. Creating calculated controls. Creating Forms with two tables. Creating Queries. Applying filters to Queries. Specifying multiple criteria for a Query in Design view. Creating Reports. Understanding parts of a Report. Modifying a Report in Design view. Sorting Records in a Report. Calculate a total or an average. Printing Reports. Defining Relationships in Access database. Viewing existing relationships between Tables. Editing existing relationships. Understanding referential integrity).

d) Mode of delivery

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

e) Reading materials

1. Humphrey, M.L. (2017). Excel for Beginners (Excel Essentials). Createspace Independent Publishing Platform.
2. Winston, W. (2019). Microsoft Excel 2019 Data Analysis and Business Modelling. 6th Edition. Microsoft Press.
3. Bovey, R., Bullen, S., Wallentin, D. and Green, J. (2009). Professional Excel Development: The definitive guide to developing applications using Microsoft Excel, VBA, and. Net. Addison-Wesley Professional.
4. Humphrey, M. (2019). Word for Beginners. M.L. Humphrey
5. Mishra, K. D., Azar, A.T. and Joshi, A. (2018). Information and Communications Technology. Springer Singapore.

MATH 176 Linear Algebra I

(3 0 3)

Linear Algebra is the foundation of a very significant part of mathematical modelling. It is, thus, necessary to understand both the theory and the practice of using linear algebra so that it can be helpful in applied science.

a) Objective

- To learn linear Algebra and their applications;

b) Learning outcome

- It is expected that students should be able to apply algebraic techniques in applied mathematical problems and models in food science and technology.

c) Content

Matrices and Determinants. Systems of Linear Equations. Vector spaces and subspaces, Basic dimension, and coordinates. Algebra of Linear transformations and representations by Matrices. Eigenvalues and Eigen Vectors; Similar Matrices, Change of Bases, Cayley-Hamilton Theorem.

d) Mode of delivery

- Lectures/PowerPoint Presentation, Consulting external references.
- Audio-visuals (videos and infographics).
- Group discussions and presentations, Dealing with feedback from students.
- Assignments, required readings associated with each lecture.

e) Reading materials

1. Dym, H. (2013). Linear algebra in action. Vol. 78. American Mathematical Soc.
2. Batory, D., Höfner, P., Köppl, D., Möller, B. and Zelend, A. (2015). Structured document algebra in action. In *Software, Services, and Systems* pp. 291-311. Springer, Cham.
3. Dorier, J.L. and Sierpinska, A. (2001). Research into the teaching and learning of linear algebra. In *The teaching and learning of mathematics at university level*. pp. 255-273. Springer, Dordrecht.
4. Stewart, S. and Thomas, M.O. (2009). A framework for mathematical thinking: The case of linear algebra. *International Journal of Mathematical Education in Science and Technology*, 40(7).951-961.
5. Lay, C.D., Lay, S.R. and McDonald, J.J. (2015). *Linear Algebra and their Applications*. Pearson Education.

FC 182

French for Communication II

(2 0 2)

In the second semester, the goal is to train students to grasp deeper vocabulary to function in everyday situations.

a) Objective

- To learn simple, practical tools required in handling simple interactions in everyday French conversation.

b) Learning outcome

- Students are expected to express themselves proficiently in French.

c) Content

More profound applications of spoken French and oral comprehension in critical scenarios.

d) Mode of delivery

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

e) Reading materials

1. Gahan, G. (2010). Complete French. Teach Yourself.
2. Mazet, V. (2008). Advanced French Grammar. McGraw-Hill Education.
3. Charlot, S. and Duranton, G. (2006). Cities and workplace communication: some quantitative French evidence. *Urban Studies*, 43(8).1365-1394.
4. Leclerc, D. and Martin, J.N. (2004). Tour guide communication competence: French, German and American tourists' perceptions. *International Journal of Intercultural Relations*, 28(3).181-200.
5. Chalaby, J.K. (2005). French political communication in a comparative perspective: The media and the issue of freedom. *Modern and Contemporary France*, 13(3).273-290.

FST 261 Traditional Foods and Nutrition (2 0 2)

The traditional food system plays a significant role in maintaining the well-being and health of indigenous people. This course will discuss the importance of traditional foods concerning culture, nutrition/ health, and how their consumption could be sustained.

a) Objectives

- To describe the various traditional foods for the different ethnic groups in Ghana.
- To explain the nutritional value of the different traditional foods and their potential contribution to the populace's health.

b) Learning outcomes

Students are expected to:

- evaluate the structure and characteristics of the Ghanaian traditional food service system and use of modern-day technology to improve upon the traditional foods industry.
- develop improved prototypes of traditional foods suitable to address health challenges and changing lifestyles.
- demonstrate good understanding of traditional foods and their nutritional/cultural significance;
- demonstrate the ability to propose of select appropriate traditional ingredients to manage diets related health challenge;
- prepare one traditional dish/drink/snack with their associated cultural values;
- propose an improved prototype of traditional food.

c) Content

The different types of food and their nutritional value in Ghana. Peculiar foods in the various ethnic groups and beliefs and taboos associated with different traditional dishes. Processing procedures and types of foods specially prepared for different festivals - religious foods, ancestral foods, courtship foods, ritual foods, everyday foods, and desserts and snacks would be treated. The traditional restaurants and modern food service systems

d) Mode of delivery

- Lectures.
- Virtual lectures/ Videos.
- Journal clubs.
- Group works/presentations and discussions (Hands-on practicals).

e) Reading materials

1. Dayle, H. and Rachel, L. (2009). Food and Nutrition, Volume 7 Marshall Cavendish
2. Aruna, T. and Arlene, B. (2012). Multicultural Handbook of Food, Nutrition and Dietetics John Wiley and Sons
3. Jessica, F., Danny H., Teresa B. and Federico, M. (2013). Diversifying Food and Diets: Using Agricultural Biodiversity to Improve Nutrition and Health Issues in Agricultural Biodiversity Routledge
4. Asogwa, I. S., Okoye, J. I. and Oni, K. (2017). 'Promotion of Indigenous Food Preservation and Processing Knowledge and the Challenge of Food Security in Africa' Journal of food security 5(3). 75–87.
5. Jordana, J. (2000). 'Traditional foods: challenges facing the European food industry, Food research international 33. 147–152.
6. Popkin, B. M. (2009). 'Global Changes in Diet and Activity Patterns as Drivers of the Nutrition Transition, 63, 1–14.

YEAR 3

SEMESTER 1

FST 351

Food Chemistry

(2 3 3)

This course focuses on furnishing students with an understanding of the chemical processes and interactions of foods' biological and non-biological components. This course covers the chemistry (structure, properties, functions, and reactions) of crucial food components (including water, protein, carbohydrate, lipids, minerals, and vitamins). Practical sessions in the laboratory will cover selected laboratory protocols on the physical and chemical properties of carbohydrates, fats, proteins, vitamins, and pigments.

a) Objectives

- To describe the chemical structure, nomenclature, functional properties of food components.
- To explain the significant chemical changes/reactions food components undergo during processing and storage.

b) Learning outcomes

Upon successful completion of the course, the student will be able to:

- know the chemical and functional properties of food components;
- establish the relationship between the structure and their properties;
- explain the chemical principles underlying the significant reactions or interactions of food components during processing and storage of the foods and their effects on sensory and nutritional quality, functional properties, and safety of foods;

c) Course content

The structure of food components, reactions, and their functionality. Structure and properties of water - moisture and water activity; Carbohydrates (monosaccharides, disaccharides, oligosaccharides, polysaccharide/ complex carbohydrates - starch, cellulose, pectin, gums); Proteins and amino acids- structure and reactions; Browning reactions, Acrylamide formation. The functionality of proteins (hydration and solubility, surface-active properties - emulsion and foaming, gelation, dough, texturization, flavor binding). Lipids (fats and oils - fatty acids, acylglycerols, waxes, sterols, etc.); Fat and oils peroxidation mechanisms and role of antioxidants; Interesterification; Hydrogenation and Trans-fat, refining of edible oil. The functionality of lipids- emulsion,

crystallinity and polymorphism, palatability. Fat mimetics. Reactions during processing and storage concerning vitamins and minerals. Food Chemistry laboratory (Selected labs on the physical and chemical properties of carbohydrates, fats, proteins, etc.).

d) Mode of delivery

- Lectures (including virtual)/ PowerPoint Presentation.
- Assignment.
- Audio-visuals (videos and infographics).
- Group discussions and presentations.
- Quizzes and Assignments.
- Laboratory practicals.

e) Reading materials

1. Coultate, T.P. (2002). Food - The Chemistry of its Components -, (4th Edition)
2. Belitz, H.D., Grosch, W. and Peter, S. (2012). Food Chemistry - (springer 4th Revised and Extended Edition)
3. Owen, R. and Fennema, M. Food Chemistry (Marcel Dekker Inc. 3rd Edition)
4. deMan, J. M. (2002). Principles of Food Chemistry -, (Aspen Publications, 3rd Edition)
5. Campbell-Plat, G. (2014). Food Science and Technology – (John Wiley and Sons Ltd. Publications)

FST 353 Postharvest Technology (2 0 2)

This course examines and discusses physiological and biochemical processes unique to postharvest of food produce. Principles and practices of storing fruits and vegetables.

a) Objectives

- To identify the global challenge of meeting food demand of an increasing population and the current challenge of postharvest losses.
- To explain the physiological and biochemical changes that occur after harvest, and how such changes lead to the deterioration of the produce.
- To evaluate available technologies and their principles for the preservation of produce shelf life and quality.

b) Learning outcomes

The students are expected to:

- attribute the global/regional challenge of postharvest loss and the role of Food Scientist/Technologist in addressing the challenges;
- demonstrate an understanding of the physiological and biochemical changes that occur after harvest of produce, and how to use available technologies to maintain produce quality, extend shelf life and

reduce losses;

- develop creative thinking and practical skills to advise on potential solution(s) to prevailing postharvest challenges.

c) Content

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

- Lectures.
- Virtual lectures.
- Field visits.
- Videos.
- Journal clubs.
- Group works/presentations and discussions.

e) Reading materials

1. Kader, A.A. (2002). Postharvest technology of horticultural crops (Vol. 3311).
2. University of California Agriculture and Natural Resources.
3. Bartz, J.A. and Brecht, J.K. (2002). Postharvest physiology and pathology of vegetables (Vol. 123). CRC Press.
4. Sudheer, K.P. and Indira, V. (2007). Postharvest technology of horticultural crops (Vol. 7). New India Publishing.
5. Florkowski, W.J., Prussia, S.E., Shewfelt, R.L. and Brueckner, B. (2009). Postharvest handling: a systems approach. Academic Press.
6. Caleb, O.J., Mahajan, P.V., Al-Said, F.A.J. and Opara, U.L. (2013). Modified atmosphere packaging technology of fresh and fresh-cut produce and the microbial consequences—a review. *Food and Bioprocess Technology*, 6(2).303- 329.

FST 355 Food Packaging and Shelf-life**(1 3 2)**

This course introduces students to the various packaging materials available, their suitability, and their reaction to food packages in them. The different packaging systems with their technologies are dealt with in this course. Students are introduced to the future trends in the food packaging industry and how they will impact society.

a) Objective

- To appreciate the types and functions of food packaging.
- To learn the laws regulating food packaging.

b) Learning outcomes

After the completion of the course, the students will be able to:

- know different types and characteristics of packaging materials;
- apply appropriate packaging for different food products;
- estimate the shelf life of different food materials.

c) **Content**

Historical development of food packaging as a Science; Functions of packaging; Properties of packaging materials; Types of Packaging materials - Glass, metal cans, paper, plastics; Packaging requirements of foods; An integrated approach to the materials used for the packaging of food products, considering the physical, chemical, and functional characteristics and their utility relative to the chemistry of the food system they are designed to enclose and preserve. New packaging technologies; statutory regulations affecting food packaging. Fundamental chemical kinetics of food matter; Shelf-life determination.

d) **Mode of delivery**

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

e) **Reading materials**

1. Robertson, G.L. (2016). Food Packaging Principles and Practice. Third Edition. CRC Press.
2. Robertson, G.L. (2010). Food Packaging and Shelf life, A Practical Guide, CRC Press, Taylor, and Francis Group.
3. Han, J.H. (2005). Innovations in Food Packaging (Food Science and Technology International)
4. Ahvenainen, R. (2003). Novel food packaging techniques. Woodhead Publishing Ltd.
5. Richard C., McDowell, D., and Kirwan, M. J. (2003) Food Packaging Technology, Blackwell Publishing Ltd.

FST 357 Principles of Sensory Evaluation (1 3 2)

This course presents an in-depth scientific review on the concepts and application of experimental research for the evaluation/testing of consumer goods through the use of the human senses. Also, the need for sensory evaluation in the food industry is addressed and familiarizes students with sensory scientists' role in product development. This course also explores the physiology of the senses in response to stimuli relating to food attributes. Lastly, students will be exposed to various career options related to food science and technology and industries where sensory evaluation is needed.

a) **Objectives:**

The objectives of this course are to:

- learn the scope and importance of sensory evaluation to the food industry;
- explain the basic physiology of the human sense systems;
- infer the different kinds of sensory techniques, their roles (objectives) for usage and appropriate application;
- explain the basic knowledge (and skills) in statistical analysis, interpretation and communication of sensory data;
- learn the skills required to search for relevant publications, review and work in teams.

b) Learning outcomes

On completion of this course, the students should be able to:

- demonstrate the understanding of the science behind food sensory evaluation and its relevance to the sustainable growth of the food industry;
- plan and conduct appropriate sensory tests, analyze and interpret sensory data;
- apply sensory evaluation in product development and quality management.

c) Course content

Introduction to sensory Evaluation, Physiological Foundation of Sensory Evaluation (Anatomy and physiology of taste, Anatomy, and Physiology of Smell, Chemesthesis and Trigeminal Senses, Qualities of Chemesthesis experience, Mechanisms of chemesthesis, Examples of chemesthesis chemical cooling, chemical heat, astringency, metallic taste), Anatomy and physiology of Sight, Texture Evaluation (Types of texture (Auditory, Tactile, Tactile hand feel, Sensory Texture profiles), Principles of Good Practice (The testing environment, Test protocol consideration, Experimental design, Panellist consideration, Tabulation and analysis of sensory Data) Types of Sensory Testing (Discrimination testing, Preference/ Affective? Hedonic Testing, Descriptive Analysis), Scaling (Scaling methods, Rules and guidelines of scaling, Consumer Field Test and Questionnaire Design, Quality Control and Shelf life (Stability) Testing).

d) Mode of delivery

- Face-to-face/On-line Lecturers.
- Audio-visuals (videos and infographics).
- Group discussions and presentations.
- Quizzes and Assignment.
- Practicals.

e) Reading materials

1. Amerine, M.A., Pangborn, R.M. and Roessler, E.B. (2013). Principles of sensory evaluation of food. Elsevier.
2. Lawless, H.T. and Heymann, H. (2010). Sensory evaluation of food: principles and practices. Springer Science and Business Media.
3. Meilgaard, M.C., Carr, B.T. and Civille, G.V. (2006). Sensory evaluation techniques. CRC press.
4. Stone, H., Bleibaum, R.N. and Thomas, H.A. (2012). Sensory evaluation practices. Academic Press.
5. Stone, H. and Sidel, J. L. (2004). Sensory evaluation practices. Academic Press.
6. Stone, H., Bleibaum, R., and Thomas, H. A. (2012). Sensory evaluation practices. Academic Press.
7. Lawless, H. T., and Heymann, H. (2010). Sensory evaluation of food: principles and practices. Springer.

This course will introduce the students to the principles, purposes, and analytical techniques/methods/instrumentation used to determine food components or properties. This course is specially designed to equip students with basic skills required for the characterization of food products in terms of chemical composition, safety, quality, and nutritional values.

a) Objectives:

- to learn the basic principles, purposes, and applications of techniques to foods' chemical and instrumental analysis;
- to explain the appropriate methods for proximate analysis of food products;
- to learn about food constituents and characteristics necessary in quality control and research laboratories;
- to learn the laboratory skills required for performing a range of chemical analyses of food components;
- to learn the skills required in searching the literature, evaluating data, problem-solving, and writing scientific reports related to food composition and analysis .

b) Learning outcomes:

Upon successful completion of this course, the students should be able to:

- demonstrate understanding and competency in using standard techniques of food analysis and the treatment of experimental data; employed in government, research and industry;
- apply modern instrumental methods to analyze chemical and physical properties of foods;
- compare the purposes and methods of food analysis.

c) Content

Sampling and data analysis, the principle and analytical techniques such as spectrophotometric methods, chromatographic and titrimetric methods associated with the analysis of carbohydrates, lipids, and protein constituents of food. Proximate analysis, Vitamins and minerals analyses. Proximate analysis and analysis of micronutrients must be handled in the laboratory sections. Colour analysis.

c) Mode of delivery:

- Lectures/ PowerPoint Presentation.
- Assignment.
- Audio-visuales (videos and infographics).
- Group discussions and presentations.
- On-line Lecturing.
- Quizzes and Assignments.
- Laboratory practicals.

d) Reading materials:

1. Yolanda, P. (2012). Chemical Analysis of Food. Academic Press.
2. Nielson, S. (2003). Food Analysis (3rd Edition), Kluwer Academic/Plenum Publishers, N.Y
3. Nollet, L.M.L. (2004). Handbook of Food Analysis (2nd Edition), Marcel Dekker, N.Y

4. Cruz, R.U.M.S., Khmelinskii, I. and Vieiar, M.C. (2018). Methods in Food Analysis. CRC Press, N.Y
5. Sehgal, S. (2016). A Laboratory Manual of Food Analysis. IK. International Publishing House Pvt. Ltd, India.

SCI 352 Research Design and Implementation (1 3 2)

This course seeks to develop research skills, sound collection, data analysis, documentation, communication, and publication.

a) Objective

- To learn research skills concerning literature search and documentation of scientific facts.

b) Learning outcome

- Students would be competent in literature search and scientific report writing.

c) Content

Concept and characteristics of research; Basic types of research; Scientific Research and Steps in conducting research. Data collection and analysis; Documentation; Communication; Publication; Patency. Research Proposal Development. Referencing styles and software with emphasis on the format used in KNUST (College of Science).

Practical sessions: Key components include referencing techniques such as Direct quotations, acknowledging sources, using referencing tools, reference technique, styles and standards, terminology.

d) Mode of delivery

- Lectures/PowerPoint Presentation.
- Library experience.
- Audio-visuals (videos and infographics).
- Group discussions and presentations.
- Assignments using Books, Periodicals, and on-line sources.
- Practicals.

e) Reading materials

- 1) Harmon J. E. and Gross A. (2010). The craft of scientific communication. University of Chicago Press, Chicago, and London.
- 2) Bowater, L. and Yeoman, K. (2012). Science Communication: A Practical Guide for Scientists 1st Edition Wiley-Blackwell USA.
- 3) Leykum, L.K., Pugh, J. A., Lanham, H.J., Harmon, J. and McDaniel, R.R. (2009). Implementation Research Design, Springer NY.
- 4) Merriam, S.B. (2009). Qualitative Research: A Guide to Design and Implementation. The Jossey-Bass USA.
- 5) Tisdell, E.J. and Merriam, S.B. (2019). Qualitative Research: A Guide to Design and Implementation, 4th Edition Audiobook, Recorded Books: Gildan Audio USA.

This course aims to develop knowledge and skills in theoretical, computational, and application-oriented statistics in students.

a) Objectives

- To understand the basic principles and statistical methods for research;
- To perform statistical analysis appropriate to data and interpret the results;
- To present statistical results clearly.

b) Learning outcomes

Students would be able to

- use to collect and analyze the data using appropriate statistical tools;
- demonstrate competence in the use of statistical software.

c) Content

Data collection and analysis: Sampling, Tabulation, graphical representation, describing location, spread, and skewness; Sampling distributions and the central limit theorem; Introductory probability and distribution theory; Statistical inference: Basic principles, estimation and testing in the one- and two-sample cases (parametric and non-parametric). Experimental designs. One- and two-way designs, randomized blocks; Multiple statistical analysis: Bivariate data sets: Curve fitting (linear and non-linear), growth curves. Statistical inferences in the regression cases. Categorical analysis: Testing goodness of fit and contingency tables. Multiple regression and correlation: Fitting and testing of models. Residual analysis. Use of computer packages in data analysis and report writing.

d) Mode of delivery

- Lectures/PowerPoint Presentation.
- Library experience.
- Audio-visuals (videos and infographics).
- Group discussions and presentations.
- Assignments using Books, Periodicals, and on-line sources.

e) Reading materials

1. McBride, G.B. (2005). Using statistical methods for water quality management: issues, problems, and solutions (Vol. 19). John Wiley and Sons.
2. Spiegelhalter, D. (2019). The art of Statistics: How to Learn from Data. Basic Books
3. Hastie, T., Tibshirani, R. and Friedman, J. (2009). The Elements of Statistical Learning. Springer.
4. Wasserman, L. (2010). All of Statistics: A Concise Course in Statistical Inference. Springer
5. Field, A. (2000). Discovering Statistics Using IBM SPSS Statistics. 4th Edition. SAGE Publication.

FST 363 Food Additives**(2 0 2)**

A wide variety of additives and the essential technologies available for their production is examined, including their toxicities. Their alternatives and reactions in food or interactions with other food components will be critically assessed. This course analyzes the contributions that the additives and the technology behind their use make to society, along with their associated ethical dilemmas. In this course, students will develop some food products and use available additives to observe the effects on the product.

a) Objectives

The objectives of the course are to enable students to:

- learn the various classes of food additives;
- explain the mechanisms and function of various food additives in food products;

b) Learning outcomes:

By the end of the lecture, the students should be able:

- to identify types of additives and their functions;
- recommend suitable additives for a particular food product.

c) Content

Historical Background, Concepts of food preservation and preservation techniques
Food Additives: Non-calorific sweeteners, Preservatives, Antioxidants, Sequestrants, Surface Active agents, (Surfactants) Stabilizers and thickeners, Synthetic food colorants. Flavors and flavor enhancers, Bleaching and maturing agents, Flavoring agents and Taste; Miscellaneous additives.

d) Mode of delivery

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

e) Reading materials

1. Potter, N. N. and Hotchkiss, J. H. (2012). Food science. Springer Science and Business Media.
2. Fellows, P. J. (2009). Food processing technology: principles and practice. Elsevier.
3. Smith, J. and Hong-Shun, L. (2011). Food Additives Data Book, Second Edition. Wiley
4. Velisek, J., Koplik, R. and Cejpek, K. (2020). The chemistry of food. John Wiley and Sons.
5. World Health Organization. (2015). Evaluation of certain food additives. World Health Organization technical report series, (990), 1-124.

FST 352**Field Routine Reports****(0 10 5)**

Nowadays, the trend is to augment traditional training methods to improve performance, engagement, or promote change. This course seeks to introduce students to experience-based learning in the food industry while giving detailed scientific reports relating to activities carried during such training.

a) Objective

- To enable students to give a detailed account of weekly activities with scientific content carried out in their respective companies.

b) Learning outcomes

- Students would be able to create a scientific content report of their experiential training in a new environment.

c) Content

This involves the daily or weekly activities carried out by students in their respective companies and institutions. Students will submit a written report. An oral examination will be carried out by lecturers to evaluate lessons learned, skills acquired, experience gained, and impact made.

d) Mode of delivery

- It involves students' attachment to Food and Beverage production companies and Institutions for 16 weeks to ensure that the students get the opportunity to be trained practically in the different areas of Food Science and Technology.
- Specific areas required are production, processing, quality assurance, packaging, and marketing of food and beverage products.
- Students will be assessed on work ethics by supervisors within the establishment and team of examiners at the Department.
- Students shall be assigned supervisors (randomly selected by students) to guide them.

e) Reading materials

1. Beard, C.M. and Wilson, J.P. (2006). *Experiential learning: A best practice handbook for educators and trainers*. Kogan Page Publishers.
2. Kolb, D.A. (2014). *Experiential learning: Experience as the source of learning and development*. FT press.
3. Silberman, M.L. (2007). *The handbook of experiential learning*. John Wiley and Sons.
4. Roberts, T.G. (2006). A philosophical examination of experiential learning theory for agricultural educators. *Journal of Agricultural Education*, 47(1) 17.
5. Miettinen, R. (2000). The concept of experiential learning and John Dewey's reflective thought and action theory. *International Journal of Lifelong Education*, 19(1). 54-72.

FST 354 Field Mini-Project**(0 20 10)**

This project aims to allow students to single-handedly identify problems in the food industry and develop remedies to correct these identified problems.

a) Objective

- To identify problems in the food industry and conduct a mini project.

b) Learning outcomes

- Students would be able to develop critical thinking and problem-solving skills as applicable in the food industry;

c) Content

The student would be required to carry out a mini-project during the attachment. The project selected should either be a problem identified within the establishment by the students or any problem related to food in areas such as production, processing, handling, and storage.

d) Mode of delivery

- Student-centred but under the guidance of the academic supervisor and supported by the industry supervisor.
- Students will submit a written report which shall be examined according to regulation.

e) Reading materials

1. Peixoto, C.D.M., Rosa, G.R., da Silva, C.N., dos Santos, B.T. and Engelmann, T.L. (2012). Mini-project on fermentation of sugarcane juice for practical general chemistry courses. *Química Nova*, 35(8).1686-1691.
2. Nahman, A., De Lange, W., Oelofse, S. and Godfrey, L. (2012). The costs of household food waste in South Africa. *Waste Management*, 32(11). 2147-2153.
3. Jain, R.K., Prajapati, P.R. and Pandya, V.C. (2008). An Analysis of student's feedback on the current scenario of the teaching-learning process. *The Indian Journal of Technical Education*, 31(4.)
4. Nahman, A., De Lange, W., Oelofse, S. and Godfrey, L. (2012). The costs of household food waste in South Africa. *Waste Management*, 32(11). 2147-2153.
5. Adrienne, W. (2014). *Project Management*. BCampus

FST 356 Field Work Seminar**(0 2 1)**

This is designed to equip students to master the skills required in scientific research, documentation of findings, and communication of findings in a time-bound presentation.

a) Objective

- To practise literature search, review of papers,
- To prepare and deliver PowerPoint presentations.
- To write reports covering food industry experiential training.

b) Learning outcomes

Students would be able to:

- demonstrate competence in presentation and public speaking;

- present and defend their industrial internship report.

c) Content

The student would be required to write a summarized report of all the internship experience and make presentations of all the reports written comprising: a) Field Routine Report and b) Field Mini-Project. Make a 10-page Powerpoint presentation.

d) Mode of delivery

- Student-centred but under the guidance of a supervisor.
- Write a 10-page PowerPoint and deliver in 10 min.

e) Reading materials

1. Birol, G., Han, A., Welsh, A. and Fox, J. (2013.) Impact of a first-year seminar in science on student writing and argumentation. *Journal of College Science Teaching*, 43(1).82-91.
2. Charney, J., Hmelo-Silver, C.E., Sofer, W., Neigeborn, L., Coletta, S. and Nemeroff, M. (2007). Cognitive apprenticeship in science through immersion in laboratory practices. *International Journal of Science Education*. 29(2). 195-213.
3. Göranzon, B. and Hammarén, M. (2006). The methodology of the dialogue seminar. *Dialogue, skill and tacit knowledge* .57-68.
4. Fox, J., Birol, G., Han, A., Cassidy, A., Nakonechny, J., Berger, J., Peacock, S. and Samuels, L. (2014). 2013 Alan Blizzard Award Feature Article--Enriching Educational Experiences through UBC's First-Year Seminar in Science (SCIE113). *Collected Essays on Learning and Teaching*, 7(1). 1.
5. Bowden, J. (2009). *Writing a Report: 8th Edition*. How-to Books

YEAR 4

SEMESTER 1

FST 451

Food Hygiene and Sanitation

(2 0 2)

This course aims to equip students determine unhygienic practices that are likely to introduce pathogens into food thereby making them unfit for consumption. It also examines a wide variety of technologies that are available to the industries in maintaining proper hygienic codes or standards in the place of work which influences the society significantly

a) Objective

- To describe the principles of food hygiene and sanitation;
- To learn the regulations governing food hygiene design;
- To be acquainted with the cleaning regimes in food industry;
- To acquire skills in handling of pests and waste.

b) Learning outcomes

Students would be able to:

- demonstrate understanding of food hygiene;
- apply the skills acquired to the prevention and control of foodborne illnesses;
- design appropriate cleaning schedule for a food processing facility;

c) Content

Scope and definition of hygiene; Prevention of microbial growth in foods; Causes, effects and prevention of food contaminants; Personal hygiene, waste disposal; Plant set up and sanitation; Cleaning and Cleaning agents; Food hygiene legislation.

d) Mode of delivery

The student centred-learning approach in face-to-face sessions or via KNUST virtual learning platform or use zoom platform in the following delivery modes:

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

e) Reading materials

1. Lelieveld, H. L., Mostert, M. A., White, B., and Holah, J. (Eds.). (2003). Hygiene in food processing: principles and practice. Woodhead Publishing.
2. Marriott, N. G., and Robertson, G. (1997). Essentials of food sanitation. Springer Science and Business Media.
3. Troller, J. A. (2012). Sanitation in food processing. Academic Press.
4. Marriott, N. G., Schilling, M. W., and Gravani, R. B. (2018). Principles of food sanitation. Springer.
5. Lelieveld, H. L., Holah, J., and Gabric, D. (Eds.). (2016). Handbook of hygiene control in the food industry. Woodhead Publishing.

FST 453 Food Processing Technology I**(2 3 3)**

This course covers principles of operation and design of industrial equipment used in the processing, storage, and packaging of foods. Food quality and food safety aspects related to food processing equipment are emphasized.

a) Objectives

- To learn the various unit operations involved in food processing.
- To familiarize with the size reduction and mixing operations of different types of foods necessary to process foods.
- To describe the various equipment used for mixing, filtration, and evaporation.

b) Learning outcomes

- Students should be able to demonstrate the use of unit operations different processing equipment.

c) Content

Cleaning of food raw materials, Size reduction, enlargement/agglomeration, Extraction, Mixing, Emulsification, Mechanical Separation processes: Filtration, Screening, and Centrifugation. Membrane Separation processes such as Ultrafiltration, Reverse osmosis, and Electro-dialysis.

d) Mode of delivery

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

e) Reading materials

1. Theodoros, V. and Constantina, T. (2014). Food Engineering Handbook: Food Process Engineering, Contemporary Food Engineering Series, CRC Press.
2. Berk, Z. (2013). Food process engineering and technology, 2nd edition, Academic Press.
3. Fellows, P. J. (2009). Food Processing Technology- Principles and Practice, 3rd Edition, Woodhead Publishing Limited.
4. Singh, R. P. and Heldman, D. R. (2008). Introduction to Food Engineering, 4th Edition Academic Press.
5. Sivacankar, B. (2002). Food Processing and Preservation, PHI Learning Pvt. Ltd.,

FST 455 Research Project and Seminar I**(0 4 2)**

This course aims to develop research skills, proper collection and analysis of data, documentation, presentation skills.

a) Objective

- To learn skills for literature search, plan synopsis, review of papers, and make PowerPoint presentations.

b) Learning outcomes

Students should be able to:

- apply their knowledge in literature search, plan synopsis, and review papers;
- create PowerPoint documents and present them.

c) Content

Each student is supposed to carry out a complete literature review on a research project using reference books, a book of abstracts, scientific journals, and scientific information from the internet.

d) Mode of delivery

- Each student will be assigned a research project (preferably already started in the internship period) by a supervisor (previously randomly selected by students) to carry out a complete literature review and methodology on the project.
- Students will present a synopsis on how to execute the project after the literature review.
- Each student will submit a report (based on the appropriate format) on the research project (up to literature review) at the end of the first semester for assessment by the supervisor.

e) Reading materials

1. Bowden, J. (2009). Writing a Report: 8th Edition. How-to Books.
2. Adams, K. (2004). Modelling success: enhancing international postgraduate research students' self-efficacy for seminar presentations. Higher Education research and development, 23(2).115-130.
3. Godin, P., Davies, J., Heyman, B., Reynolds, L., Simpson, A. and Floyd, M. (2007). Opening communicative space: A Habermasian understanding of a user-led participatory research project. The Journal of Forensic Psychiatry and Psychology, 18(4). 452-469.
4. Adrienne, W. (2014). Project Management. BCampus
5. Göranzon, B. and Hammarén, M. (2006). The methodology of the dialogue seminar. Dialogue, Skill and Tacit Knowledge, pp.57-68.

FST 457 Food Product Development

(1 4 3)

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

a) Objective

- To learn the concept of new product development
- To understand the impact of consumers on the marketability of a product.

b) Learning outcomes

Students should be able to:

- apply the key concepts of new product development for some food products.
- explain food products success based on consumers' behaviors.

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 a basis for innovation, the sociological and technological aspects of food product development. 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.

Practical sessions: Formulation and reformulation of food products and presentation based on selected food ingredients.

d) Mode of delivery

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

e) Reading materials

1. Moskowitz, H.R., Porretta, S. and Silcher, M. (2008). Concept Research in Food Product Design and Development. John Wiley and sons.
2. Frewer, L. and Van Trijp, H. (2006). Understanding consumers of food products, Woodhead publishing NY.
3. Costa, A.D.A., Dekker, M. and Jongen, W.M.F. (2004). Trends in food science and technology. Elsevier. Holland.
4. Bordiga, M. and Nollet, L.M. (2019). Food Aroma Evolution: During Food Processing, Cooking and Aging. CRC Press. US.
5. Naes, T., Brockhoff, P.B. and Tomic, O. (2010). Statistics for Sensory and Consumer Science. John Wiley and Sons Ltd. USA.

FST 459 Food Microbiology

(2 3 3)

This is an introductory course in Food Microbiology. Students will explore and understand the history of food microbiology, sources and types of microorganisms associated with food, factors influencing microbial behavior in foods, and the organizations involved in food regulatory processes and policy development. Student assessments would be based on group work, projects, quizzes, individual assignments, laboratory work, and examinations.

a) Objectives

- To learn the history and development of food microbiology.
- To comprehend the impact of microbial behavior on food production, food spoilage, foodborne illnesses, and emerging foodborne pathogens.
- To learn selected food preservation methods for the control of microbial food spoilage.

b) Learning Outcomes

On completion of this course, the students should be able to:

- present a general overview of microorganisms in food, their sources, and types;
- evaluate the type of microorganisms and the factors influencing microbial growth in foods in terms of food production, spoilage, and foodborne illnesses;
- apply food preservation methods to reduce microbial food spoilage;
- identify and describe some emerging foodborne pathogens.

c) Content

Brief History and Development of Food Microbiology, Microorganisms in Foods – Sources and Types, Determining Microorganisms and or their products in foods, Factors influencing microbes in foods - Growth, death and survival, Microbiology of selected food commodities, the impact of microbial growth in foods - Food production, Food spoilage, and Foodborne illnesses, Food Preservation, Emerging Foodborne pathogens.

d) Mode of delivery

- Lectures.
- Virtual interactions.
- Audio-visual analysis of concepts (videos and infographics).
- Project work and Group activities.
- Practicals.

e) Reading materials

1. Doyle, M. P., Diez-Gonzalez, F. and Hill, C. (2020). Food Microbiology: fundamentals and frontiers. John Wiley and Sons.
2. Jay, J. M., Loessner, M. J. and Golden, D. A. (2008). Modern food microbiology. Springer Science and Business Media.
3. Martin, R. A. and Maurice, O. M. (2008). Bacterial Agents of Foodborne Illness. Food Microbiology 3(4), 182-269.
4. Ray, B. and Bhunia, A. (2014). Fundamental Food Microbiology. 5th Edition. CRC Press
5. Lynne, M. (2004). Food Microbiology Laboratory. CRC Press.

MAS 261 Fundamentals of Entrepreneurship I (3 0 3)

This course discusses the in-depth understanding of crucial entrepreneurship and business development concepts. It will cover the different types of entrepreneurs and addresses the theories and techniques applied to business development, including finance and small business and development strategies.

a) Objective

- To learn the various concepts used in identifying the processes involved in entrepreneurship and business development.
- To investigate the differences between small and large firms and the economic environment.

b) Learning outcome

After this course, students should be able to:

- evaluate the qualities and functions of a successful entrepreneur;
- show understanding of the issues and problems faced by entrepreneurs;
- describe the entrepreneurial trend in Ghana.

c) Content

Basic knowledge in management with the tools of decision-making, organization, and management of decision-making organization and management of firms and organizations. Nature and scope management; managerial functions; organizational theories; goals of business organization economic and social responsibilities of management; decision-making techniques and influence; Organizational behavior/human relations-interpersonal and group processes; application of concepts,

like leadership, motivation, communication, morale to the management of people and organization; time management; analysis of causes, of change managing change, innovation; management control.

d) Mode of delivery

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

e) Reading materials

1. Mohanty, S.K. (2005). Fundamentals of entrepreneurship. PHI Learning Pvt. Ltd.
2. Nwangwu, I.O. (2006). Fundamentals of entrepreneurship in educational management. Enugu: Cheston Books.
3. Stepanchuk, A.A. (2016). Application of Innovative Educational Technologies in Teaching the Fundamentals of Entrepreneurship Within Programmes of Self-Employment of The Population. Business Strategies.
4. Comer, R.J. (2011). Fundamentals of Abnormal Psychology. New York: Worth Publishers.
5. Maluleke, J. (2016). Entrepreneurship 101: Tackling the Basics of Business Start-ups in South Africa. BlackBird Books.

FST 461 Nutrition-Sensitive Food Systems (2 3 3)

This course will prepare students to develop global solutions fit for local contexts that bridge the gap between agricultural development and its largely unfulfilled health and nutritional benefits. To achieve this goal, this course will bring together research and development professionals across the agriculture, nutrition, and health (ANH) nexus to jointly facilitate discussions on challenges and design joint solutions.

a) Objective

- To learn the synthesis of the integrated approach involving stakeholders in food insecurity, malnutrition, and poor health in developing countries;
- To learn global solutions aimed at bridging the gap between agricultural development, health and nutritional benefits.

b) Learning Outcomes

After this course, students should be able to:

- articulate commonalities and differences in international perspectives on the nutrition-sensitive food systems.
- identify cultural assumptions and reflect on how nutrition shapes the attitudes and behaviors of consumers.
- apply discipline-specific concepts, theories, and methods to analyze and evaluate situations at home and abroad.

c) Content

Fundamental principles and concepts of food processing and preservation. Fundamental aspects of chilling and freezing foods, including pre-freezing treatments (blanching, ageing, scalding, etc.). Principles and practice of refrigeration, pre-freezing, freezing, thermal processing, concentration, dehydration, and irradiation of foods. Chemical preservation of foods, including the use of additives. Fermentation and biotransformation processes.

d) Mode of delivery

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

e) Reading materials

1. Fellows, P.J. (2000). Food Processing Technology, Principles and Practices, 2nd Edition. Woodhead Publishing Limited, UK.
2. Sivasankar, B. (2004). Food processing and preservation Kindle Edition, PHI Publishers India.
3. Rhaman, M.S. (2007). Handbook for food preservation. CRC Press. NY
4. Ibarz, A. and Barbosa-Cánovas, G.V. (2002). Unit Operations in Food Engineering, CRC Press NY.
5. Duea, W.A. (2010). The Complete Guide to Food Preservation. Atlantic Publishing Group Inc.

FST 465 Nutrition and Health

2 0 2

This course is aimed at introducing students to the different stages of nutrition in the human life cycle. The course also presents the metabolism of macro and micronutrient food and how they benefit the human system.

a) Objective

- To learn the composition of the macro-and micronutrients and their roles in human well-being.

b) Learning outcomes

Students should be able to:

- critique the impact of nutrients on human health,
- project health outcomes resulting from over-nutrition or under-nutrition
- evaluate interventional measures in challenged environment.

c)Content

Basic principles of nutrient metabolism. Roles of Vitamins and Minerals. Functional and nutraceutical foods. Food habits, Food behavior, Infant nutrition, Adolescent nutrition, Aged nutrition, Diseases, and diets. Dietary formulations, Analysis, and intervention. Food standards, Food composition, and frequency tables. Essential amino acids and fatty acids; Antinutrients.

d) Mode of delivery

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

e) Reading materials

1. Berdanier, C.D. (2015). Advanced and Nutrition: Micronutrients, CRC Press Washington DC.
2. Roizen, M., Crupain, M., and Spiker, T. (2018). What to Eat When: A Strategic Plan to Improve Your Health and Life Through Food, DM Publishers.
3. Kohlmeier, M. (2015). Nutrient metabolism: structures, functions, and genes. Academic Press. USA.
4. Eskin, N.M. and Shahidi, F. (2012). Biochemistry of foods. 1st Edition, Academic Press. NY.
5. Toldrá, F., Paliyath, G., Hui, Y.H., Simpson, B.K., Nollet, L.M. and Benjakul, S. (2012). Food Biochemistry and Food Processing. Wiley NJ.

FST 467 Food Enzymology

(2 0 2)

This course covers enzymes and industrial food's general characteristics and some non-food applications.

a) Objective

The objectives of this course are to:

- learn the general properties/characteristics of enzymes;
- learn the basic concepts of enzymatic mechanisms and factors affecting enzymatic reactions;
- learn the applications of food enzymes in food processing and food analysis.

b) Learning outcome

Upon successful completion of this course, the students should be able to:

- describe the properties of enzymes in general and enzymes explicitly used in food processing;
- describe the practical application of these enzymes to various phases of the food industry;
- analyze simple kinetic data and estimate important parameters (K_m , V_{max});
- mount independent research work in food enzymology.

c) Content

General characteristics of enzymes; enzyme specificity; food and some non-food applications of enzymes (examples from local small, medium, and large industries), Extraction and purification of enzymes (peroxidase and polyphenol oxidases), Classification and nomenclature of enzymes; enzyme kinetics; Reversible and irreversible inhibitors (including natural inhibitors like trypsin inhibitors and anti-amylases), Factors affecting enzymatic reactions; Briefly survey of nature of cofactors (metallic ions, anions, coenzymes, and prosthetic groups).

e) Reading materials

1. Qu, X., Alvarez, P.J. and Li, Q. (2013). Applications of nanotechnology in water and wastewater treatment. *Water Research*, 47(12) 3931-3946.
2. Bratby, J. (2016). Coagulation and flocculation in water and wastewater treatment. IWA publishing.
3. Drinan, J.E. and Spellman, F. (2013). *Water and Wastewater Treatment*. CRC Press
4. Galankis, C.M. and Agrafioti, E. (2019). *Sustainable Water and Wastewater Processing*. Elsevier
5. Xuan-Thanh, B., Chart, C., Takahiro, F. and Sunita, V. (2019). *Water and Wastewater Treatment Technology*. Springer

LAW 151

Law of Contract I

(3 0 3)

In this course, the foundations of the legal instruments that protect rights in every agreement shall be discussed. Students shall learn the initial concepts governing Contract law.

a) Objective

- To learn contracts their essential elements.
- To learn the types of contracts and modes of their creation.
- To identify the essentials of a valid contract.

b) Learning outcome

Students should be able to:

- master the essential of a contract by identifying the critical points that must be present in a valid contract to make it enforceable.
- to demonstrate how a contract can be discharged.

c) Content

Nature of contract sources of law, the concept of bargain, and classification. Formation of a contract; offer and acceptance, consideration, intention to create legal relations. Contents of contract, terms, representation, excluding and limiting terms, and fundamental breach of terms. Capacity; infants, illiterates, co-operations, people with a mental health condition, and drunken persons.

d) Mode of delivery

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

e) Reading materials

1. Fifoot, C.H.S., Seddon, N., Ellinghaus, M.P. and Bigwood, R.A. (2012). *Cheshire and Fifoot's law of contract*. LexisNexis.
2. Collins, H. (2003). *The law of contract*. Cambridge University Press.
3. Anson, W.R., Beatson, J., Burrows, A.S. and Cartwright, J. (2010). *Anson's law of contract*. Oxford University Press.

4. Bohnet, I., Frey, B.S. and Huck, S. (2001). More order with less law: On contract enforcement, trust, and crowding. *American Political Science Review*, 95(1). 131-144.
5. Stone, R. (2005). *The modern law of contract*. Psychology Press.

YEAR 4

SEMESTER 2

FST 452

Food Quality Assurance

(3 0 3)

Food quality assurance aims to improve development and test processes for food production so that defects do not arise when products are being developed.

a) Objective

- To learn the principles that govern the quality of food products.
- To learn the local and international laws regarding the safety of foods.

b) Learning outcomes

Students should be able to:

- apply principles that govern food quality matters;
- critique processes and synthesize strategies to avoid defects that may arise in food products.

c) Content

Definition and Importance of food safety and food quality across the food chain. Quality Control, Quality Assurance, Quality Assurance Systems, Quality Standards and Specifications (ISO, Codex), Total Quality Management (TQM) programmes, Pre-requisite programmes, and HACCP as tools for assuring food safety. Local and international laws regarding the safety and quality of food. Role of regulatory agencies (FDA, GSA, Tourist Board).

d) Mode of delivery

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

e) Reading materials

1. Hoyle, D. (2015). *ISO 9000: Quality Systems Handbook*, 5th Edition, Elsevier NY.
2. Alli, I. (2003). *Food Quality Assurance: Principles and Practices*, CRC Press. N.J.
3. Pre-implementation Genetic Diagnosis International Society. (2008). *Guidelines for good practice in PGD: programme requirements and laboratory quality assurance*. Elsevier. NY
4. Luning, P.A. and Marcelis, W.J. (2009). *Food Quality Management: Technological and Managerial Principles and Practices*. Wageningen Academic Publishers. Holland.
5. Gould, W.A. and Gould, R.W. (2001). *Total Quality Assurance for Food Industries*. CTI Publications USA.

In this course, students are introduced to technologies that address the consumer's demands for safe, nutritious, appealing, healthier, and functional products in the food and beverage industry.

a) Objective

- To learn the principles and technologies that govern food manufacturing
- To learn and how those technologies are used in producing beverages, plant and animal-based products.

b) Learning outcomes

Students should be able to:

- understand the underlying principles governing food manufacturing practices;
- apply innovative technologies in manufacturing some key food products.

c) Content

Beverage: Modern soft drink manufacturing: ingredients, water treatment, carbonation, bottling, sweeteners, production equipment, quality, and safety. Beverage commodities: Cocoa; Coffee; Tea; Sugar.

Plants: Cereals, fruits and vegetables, roots and tubers, fats and oils processing

Dairy Science: Composition of milk; some physical properties of milk; factors affecting the composition of milk; microbiological aspects of milk production; lactation; mechanical milking; milk defects; the nutritional value of milk and milk products, Yogurt making,

Meat, Poultry, Fish, and Egg Science: The composition, nutritional value, and quality of meat, poultry, fish, and eggs; factors affecting quality from slaughter or harvesting to consumption.

d) Mode of delivery

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

e) Reading materials

1. Davis B., Lockwood A., Alcott P. and Pantelidis, I.S. (2018). Food and Beverage Management, 4th Edition, Elsevier Holland.
2. Hui, Y. H. (2007). Handbook of Food Products Manufacturing Principles, Bakery, Beverages, Cereals, Cheese, Confectionary, Fats, Fruits, and Functional Foods. John Wiley and Sons, Inc USA.
3. Davis, B., Lockwood, A. and Stone, S. (2002). Food and Beverage Management, Butterworth-Heinemann. UK.
4. Loannis, S.A. (2020). Authenticity of Foods of Animal Origin. CRC Press
5. Panda, S.K. and Halady, P.K.S. (2018). Innovations in Technologies for Fermented Food and Beverage Industries. Springer International Publishing. India.

FST 456 Food Processing Technology II (2 3 3)

This course covers principles of operation and design of industrial equipment used in the processing, storage, and packaging of foods. Food quality and food safety aspects related to food processing equipment are emphasized. Food processing equipment is classified and described according to the basic unit operations, including mechanical transport, mechanical processing and separations, heat transfer operations, evaporation, dehydration, and thermal processing.

a) Objectives

- To exemplify various unit operations involved in food processing.
- To recognize the importance of water in food processing (water quality, steam generation).

b) Learning outcomes

After the completion of the course, the students should be able to:

- critique the important applications of water in food processing;
- demonstrate the applications of heat transfer operations during food processing;
- attribute technological operations during food processing.

c)Content

Importance of water in food processing (water quality, steam generation). Methods and equipment involved in Concentration, Dehydration (including air-drying psychometrics), Salting, Smoking, Roasting, Irradiation, and Extrusion.

d)Mode of delivery

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

e) Reading materials

1. Theodoros, V. and Constantina, T. (2014). Food Engineering Handbook: Food Process Engineering, Contemporary Food Engineering Series, CRC Press.
2. Berk, Z. (2013). Food process engineering and technology, 2nd Edition, Academic press
3. Fellows, P. J. (2009). Food Processing Technology- Principles and Practice, 3rd Edition, Woodhead Publishing Limited.
4. Singh, R. P. and Heldman D. R. (2008). Introduction to Food Engineering, 4th Edition Academic Press.
5. Sivacankar, B. (2002). Food Processing and Preservation, PHI Learning Pvt. Ltd.,

FST 458 Research and Project Seminar II (0 8 4)

This course aims to develop research skills, including detailed collection and analysis of data, documentation, and presentation.

a) Objective

- To learn the skill of literature search, review of papers and making of PowerPoint presentations, and publishing of papers.

b) Learning outcomes

Students should be able to:

- apply the skills in searching the literature, reviewing papers, and creating a report based on research;
- prepare PowerPoint documentation and deliver presentations;
- create a poster for a research project.

c) Content

Each student will carry out the practical or laboratory aspects of the project work, write a thesis, and make a poster presentation on the project's findings.

d) Mode of delivery

- Students will be required to defend the research project work in a team of examiners at the end of the semester.
- Each student will submit a report on the research project at the end of the semester for assessment by the supervisor.
- Lecturers will assess the students individually during Poster presentations organized for that purpose.

e) Reading materials

1. Adams, K. (2004). Modelling success: enhancing international postgraduate research students' self-efficacy for seminar presentations. *Higher Education research and development*, 23(2):115-130.
2. Godin, P., Davies, J., Heyman, B., Reynolds, L., Simpson, A. and Floyd, M. (2007). Opening communicative space: A Habermasian understanding of a user-led participatory research project. *The Journal of Forensic Psychiatry and Psychology*, 18(4):452-469.
3. Göranson, B. and Hammarén, M. (2006). The methodology of the dialogue seminar. *Dialogue, Skill and Tacit Knowledge* 23: 57-68.
4. Bowden, J. (2009). *Writing a Report: 8th Edition*. How-to Books
5. Adrienne, W. (2014). *Project Management*.

MAS 262 Fundamentals of Entrepreneurship II (3 0 3)

This course aims to deepen students' exposure to entrepreneurial cultures and industrial growth in the industry. The course explains the intricate theories in entrepreneurship. A thorough discussion on the promotion of venture and raising funds is stressed.

a) Objective

- To learn the various classifications and functions of an entrepreneur.
- To interpret the principles involved in customers demand.
- To learn the strategies involved in raising funds from various sources to support enterprises.

b) Learning outcome

- It is expected that students will apply sound entrepreneurial strategies to provide excellent performance in different challenging scenarios.

c) Content

Entrepreneurship and free enterprise; Business planning; Product and service concepts for new ventures; Marketing and new venture development; Organizing and financing new ventures; Current trends (Internet commerce, e-commerce); Business law.

a) Mode of delivery

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

e) Reading materials

1. Mohanty, S.K. (2005). Fundamentals of entrepreneurship. PHI Learning Pvt. Ltd.
2. Burduş, E. (2010). Fundamentals of entrepreneurship. Revista de Management Comparat Internațional, 11(1): 3-42.
3. Bill, F. (2006). The apocalypse of entrepreneurship. Växjö University Press.
4. Viramgami, H.S. (2007). Fundamentals of Entrepreneurship. APH Publishing.
5. Inegbenebo, A.U. (2006). The fundamentals of entrepreneurship. Malthouse Press

FST 460 Food Fermentation

(2 0 2)

The course is structured to provide knowledge of traditional fermented foods and beverages, including their microbiology and production technologies. Understanding the unique roles of fermented foods in delivering probiotics in nutrition, their effects on health and disease control, and their future perspectives in the context as drivers of a healthy diet and innovative products are studied.

a) Objective

- To learn the principles underlying fermentation,
- To learn the methods of fermentation used to preserve agricultural products.

b) Learning outcome

Students should be able to:

- apply the principles of food fermentation to enrich diets by developing a diversity of flavors, aromas, and textures in food substrates;
- create food models with enhanced sensory characteristics.

c) Content

The microbe and fermentation; Inoculum preparation. Starter cultures; Microbial Kinetics - Batch, Fed-batch, and Continuous systems. Design and construction principles; Fermentation processes - Lactic acid fermentation (Yogurt, sauerkraut), Alcoholic fermentation (Ethanol, beer, wine, alcohol by-products), Acetic acid fermentation (Vinegar); Indigenous fermented foods (Kenkey, Gari, cassava dough, soy sauces, malted cereal drinks -Pito).

b) Mode of delivery

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

c) Reading materials

1. Katz, S.E. (2012). The Art of Fermentation: An In-Depth Exploration of Essential Concepts and Processes from Around the World, Chelsea Green Publishing. UK.
2. Hornsey, I.S. (2003). A history of beer and Brewing, RSC UK.
3. Hornsey, I.S. (2007). The chemistry and biology of winemaking. RSC UK.
4. Osman, E. and Bozoglu, E.T. (2016). Food Microbiology: Principles into Practice. John Wiley and Sons Ltd. NY.
5. Matthews, K., Kniel, K.E. and Montville, T.J. (2017). Food Microbiology: An introduction, 4th Edition. ASM Press. USA.

FST 462 Food Plant Design and Economics (3 0 3)

The course offers design systems for food processing. Process simulation or modelling for optimization purposes in food processing, evaluation of food processing plant systems, and utilities and regulatory requirements are studied.

a) Objective

- To learn concepts underlying the design and structural layout of food processing plants

b) Learning outcomes

Students should be able to:

- apply principles of process economics through the analysis and interpretation of case studies.
- create plant design models with efficient and economized space for machines, materials, personnel, and storage.

c) Content

Design concepts, Structure, and layout of food processing plants. Design codes and standards. Computer-aided design software for process flowsheets in the food industry. Process economics: fixed capital investment, manufacturing and profitability analysis, pay-back period, break-even point, sensitivity analysis: project evaluation. Case studies.

d) Mode of delivery

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

e) Reading materials

1. Maroulis, Z. and Saravacos, G.D. (2007). Food Plant Economics, RCR Press USA.
2. Saravacos, G. and Kostaropoulos, A.E. (2002). Handbook of Processing Equipment. Springer NY.
3. Saravacos, G.D. and Maroulis, Z. (2010). Food process economics. In food engineering interfaces. Springer, NY.
4. Peters, M., Timmerhaus, K. and West, R. (2017). Plant Design and Economics for Chemical Engineers, 4th Edition. McGraw-Hill USA.
5. LeBlanc, S.E. and Coughanowr, D.R. (2008). Process Systems Analysis and Control, 3rd Edition, McGraw-Hill USA.

BCHEM 468 Food Biotechnology

(2 0 2)

Developments in biotechnology related to food production and processing concerning traditional food fermentations as well as novel food biotechnology, enzymes, ingredients, genetic engineering, plant tissue culture, and developments for microbiological and food analysis. This course in Food Biotechnology provides an opportunity to learn the concepts and theory of the experimental techniques used in food biotechnology.

a) Objectives

To learn the biotechnological applications in food materials.

To comprehend the properties of transgenic foods, biotechnological food additives, diagnosis, and their regulations.

b) Learning outcomes

On completion of this subject, the student is expected to:

- appreciate **the interdisciplinary sciences relevant to food biotechnology**;
- integrate food biotechnology in modern food production;
- apply molecular biotechnology methods for healthier, safer food production and processing;
- appraise the applications and implications of genomics and genetic modification on foods.

c) Course content

Definition of: Biotechnology, Food Biotechnology, Impacts of Food Biotechnology, Theory (Genetic Engineering, Plasmid Vectors, Bacteriophage Vectors, BACs, PACs, YACs, etc., Getting DNA into Cells, Inserting Genes into Eukaryotic Cells: Artificial Means, Detecting Clone Containing Desired Fragment), Genetic Manipulation of Microorganisms for Biotechnology Applications (Strain Development, Genetic Engineering), Biotechnology and Traditional Fermented Foods, Contribution of Modern Biotechnology to the Improvement of Traditional Fermented Foods, Enzymes in Food Processing and New Products Development, Impact of Biotechnology on Food Flavour and Colour Industry, Plant Biotechnology and Genetically Modified Foods, Meat Quality Improvement through Biotechnology Applications, Biotechnology and Food Safety, Public Perception of Genetically Modified Foods.

d) Mode of delivery

- Lectures.
- Assignments and quizzes.
- Group discussions and presentations.

e) Reading materials

1. Shetty, K., Paliyath, G., Pomentto, A. and Levin, E. R. (2006). Food Biotechnology. 2nd Ed. Taylor and Francis Group, LLC.
2. Smith, E. J. (2009). Biotechnology. 5th Edition. Cambridge University Press, UK.
3. Pometto, A., Shetty, K., Paliyath, G. and Levin, R.E. (2005). Food Biotechnology. 2nd Edition. CRC Press
4. Shetty, K. and Sarkar, D. (2020). Functional Foods and Biotechnology. CRC Press
5. Holban, A.M. and Mihai, A.G. (2018). Advances in Biotechnology for Food Industry. Academic Press.

PL 356

Project Analysis and Evaluation

(3 0 3)

It is accepted that development projects are essential means for implementing policies, plans, and programmes. But their sustainability must be assessed to ensure that the resources committed are employed as productively as practicable. This course emphasizes and explains the various stages of the project life cycle and introduces the basic techniques available to assess the feasibility of projects from economic, financial, social, environmental, technical and institutional viewpoints. This course also exposes students to the various techniques in project planning, project implementation, monitoring and evaluation, and project management. It relates theory to applying these techniques and combines relevant development concepts with a clear understanding of what can be done in practice. The course ultimately aims to make existing techniques readily accessible and understandable.

a) Objective

- To understand and appreciate the place and relevance of a project in the planning process;
- to learn basic analytical techniques available for project implementation, monitoring and evaluation, and designing appropriate implementation, monitoring, and evaluation systems;
- to know a set of management skills that planners require to facilitate project success; and

b) Learning outcome

Students should be able to:

- apply project planning techniques and skills through case studies;
- critique the relevance and level of achievement of project objectives, development effectiveness, efficiency, impact, and sustainability.
- evaluate feedback lessons into the decision-making process of the project stakeholders, including donors and national partners.

a) Content

Topics to be covered during the semester are scheduled as follows: Project Basics (Defining "Project", Project Life Cycle); Project Analysis; (Economic Appraisal, Financial Appraisal, Social Appraisal, Environmental and Technical Appraisal); Project Planning, Implementation, and Management Techniques (Project Preparation and Implementation); Project Monitoring and Evaluation (Project Monitoring, Project Evaluation).

b) Mode of delivery

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

c) Reading materials

1. Grisham, T. W. (2010). International Project Management: Leadership in Complex Environments. New Jersey: John Wiley and Sons, Inc.
2. Project Management Institute (2008). A Guide to the Project Management Body of Knowledge. Fourth Edition.
3. Horine, G. (2017). Project Management Absolute Beginner's Guide. 4th Edition. Que Publishing
4. Bowden, J. (2009). Writing a Report: 8th Edition. How-to Books
5. Adrienne, W. (2014). Project Management. campus

LAW 152

Law of Contract II

(3 0 3)

In this course, the foundations of the legal instruments that protect rights in every agreement shall be discussed. Students shall learn the initial concepts governing Contract law.

a) Objective

- To learn the essential elements of contracts.
- To learn the types of contracts and modes of their creation.
- To exemplify the essentials of a valid contract.

b) Learning outcome

Students should be able to:

- identify critical definitions that must be present in a valid contract to make it enforceable;
- demonstrate how a contract can be discharged;
- create contracts for different scenarios.

c) Content

Nature of contract sources of law, concept of bargain, and classification. Formation of a contract; offer and acceptance, consideration, intention to create legal relations. Contents of contract, terms, representation, excluding and limiting terms, and fundamental breach of terms. Capacity; infants, illiterates, co-operations, people with a mental health condition, and drunken persons.

d) Mode of delivery

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

e) Reading materials

1. Peel, E. and Treitel, G.H. (2007). The law of contract (pp. 1-2. London: Sweet and Maxwell.
2. Fifoot, C.H.S., Seddon, N., Ellinghaus, M.P. and Bigwood, R.A. (2012). Cheshire and Fifoot's law of contract. LexisNexis.
3. Collins, H. (2003). The law of contract. Cambridge University Press.
4. Anson, W.R., Beatson, J., Burrows, A.S. and Cartwright, J. (2010). Anson's law of contract. Oxford University Press.
5. Bohnet, I., Frey, B.S. and Huck, S. (2001). More order with less law: On contract enforcement, trust, and crowding. American Political Science Review, 95(1., pp.131-144.
6. Stone, R. (2005). The modern law of contract. Psychology Press.

13. Requirements for graduation:

Provide information on the following requirements for graduation:

- a. Course Requirements;

Candidates are deemed to have satisfied all requirements for graduation when all the core courses plus the compulsory electives have been duly passed.

- b. Credits Requirements;

The minimum number of credits required for graduation is **134**.

- 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.

14. Assessment Regulations:

Provide details of:

- a. Students' performance and achievement

Written examinations, practicals, oral presentations, and 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

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