STUDENTS WORKLOAD AND COURSE DESCRIPTION (FIRST SEMESTER M. AgSE IN FOOD PROCESSING AND VALUE ADDITION PROGRAM

FOOD PRODUCT DEVELOPMENT AND QUALITY EVALUATION					
Module code FPV 802	**Student workload** 210 hours	**Credits** 7.0 ECTS	**Semester** Second. Semester	**Frequency** One time in each second Semester	**Duration** 15 Weeks

1	**Types of courses** a) Class Work b) Seminars c) Students' Presentation	**Contact hours** 75 hours	**Independent study** 135 hours	**Class size** Avg of 10 (Max 20)
2	**Prerequisites for participation** a) Participation in the course is compulsory for all students admitted for M.AgSE (FPVA) b) Participation is subject to confirmation of student's registration for the course c) e.g. must have successfully completed Food product development and sensory evaluation at Undergraduate level.			
3	**Learning outcomes** **Knowledge outcomes** After studying all materials and resources in this course, the students will be able to: a) carry out a market survey and design a questionnaire to find out consumers need for a product or concept b) develop a product to meet the identified requirements after survey c) use the concept of SWOT (Strengths, weakness, opportunities and threats) analysis in developing a Food product d). understand and apply the process and activities involved in new food product development e) apply important new food product development models such as Stage-Gate model f) identify, select and use novel food ingredients and novel processing technologies in food product development g). identify and source for equipment needed and optimize the quality parameters h) determine and apply the appropriate sensory tests required for the products developed and also compare with the market samples i) understand the stages involved and practical steps to take in market integration of the developed product j) understand how environmental conditions affects product stability and how to determine storage stability of developed products k) understand the concept of outcomes and activities involved in product commercialization			

	l) determine when product launch should take place and how to evaluate it. m) understand successes and failures involved in product development using some case studies **Skills Outcomes** The students will be able to: a) develop questionnaires of various type and carry out market survey; b) develop any product of their choice after taking into consideration results from the questionnaire; c) apply SWOT analysis for the intended new product; d) combine the appropriate ingredients for the intended purpose during product development; e) choose the most appropriate equipment needed as well as the sensory test prior to launch f) determine the storage stability of a product as well as the shelf life
4	**Subject aims** The module is designed for postgraduate students in the field of Food Processing and Value Addition to deepen student knowledge in Food Product Development to meet identified consumers demands using well defined models. The course will also include various stages involved in the selection of novel ingredients, equipment required, product design, sensory testing of the products, shelf life prediction and packaging development. The course will also introduce steps involved in pre-launch trial, product launch,launch evaluation, product performance testing, and developing test market strategies. Case Studies of some successes and failures, food choice models and new product trends will also be discussed extensively **Course Contents** Students will learn the following contents: a. Market survey and design of questionnaire b. The SWOT analysis of a product c. New Food Product Development (NPD) process and activities d. The Stage-Gate model e. use of novel food ingredients and novel processing technologies f. Process design, equipment needed; establishing process parameters for optimum quality g. Sensory Evaluation h. Product Stability; evaluation of shelf life i. Pre-launch trial, Steps in product launch, Evaluation of the Launch, product performance testing
5	**Teaching methods** Lectures, seminars, laboratory practice, fieldwork, tutorials, placements, interactive teaching, The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS
6	**Assessment methods** The students will be provided with challenging and thought-provoking assignments. Individual

	Presentations, Group Assignments, Continuous Assessment, Summative Assessment, Written end-of-the-semester examination and grading of practical manuals This course will be graded as follows: Individual Presentation-5%, Group Assignments-5%, Test(s)-20%, Final Examination-60% and practicals-10%
7	**This module is used in the following degree programmes as well** N/A
8 .	**Responsibility for module** Dr. A.A. Adebowale (Coordinator) and Dr. (Mrs.) O.E. Kajihausa
9	**Other information** **Suggested References** a. Jacqueline H., Beckley, M., Foley, M., Topp, E.J. and Huang Witoon Prinyawiwatkul, J.C. (2007). Accelerating New Food Product Design and Development. Blackwell Publishing Company. IFT Press. USA b. Howard R., Moskowitz, I., Saguy, S. and Straus, T. (2009). An Integrated Approach to New Food Product Development. Taylor and Francis Group, LLC.USA c. Earle, M. and Earle, R. (2008). Case studies in food product development Woodhead Publishing Limited and CRC Press LLC.USA d. Earle, M.D. and Earle, R.L. (2001). Creating New Foods. The Product Developer's Guide: Chadwick House Group Ltd. New Zeeland. e. Lyon, D.H., Francombe, M.A., Hasdell, M.A. and Lawson, K. (1992). Guidelines for sensory analysis in food product development and quality control. Chapman & Hall, 2-6 Boundary Row, London. f. Earle, M., Earle, R. and Anderson, A. (2001). Food product development. Woodhead Publishing Limited g. Moskowitz, H.R. (2006). Sensory and consumer research in food product design and development / Howard R. Moskowitz, Jacqueline H-. Beckley, and Anna V. A. Resurreccion. First Edition 2006. IFT Press Series. Related Academic Journals -Journal of Food Processing and Preservation (Wiley) -Food Science and Nutrition Journal (Wiley) -Journal of Food Science (IFT) -Journal of Food Products Marketing (Taylor and Francis) **Important Note:** This course is a 3-unit course based on the credit system in use in Nigeria. Students are expected to devote about 210 hours to learning of the course content, including participation in 75 hours of course lectures and practicals, and 135 hours of self-study (assigned reading, personal studies, assignments, and group work). Hence, the course is of 6.0 ECTS credit equivalent.

FOOD PROCESSING AND PRESERVATION TECHNOLOGY

Module code	Student workload	Credits	Semester	Frequency	Duration
FPV 803	210 hours	7.0 ECTS	First Semester	Each First Semester	15 Weeks

1	Types of courses	Contact hours	Independent study	Class size
	a) Class Work b) Seminars c) Practicals	75 hours	135 hours	Average of 10 (Max 20)

2 Prerequisites for participation

a) Participation in the course is compulsory for all students admitted for M.AgSE

b) Participation is subject to confirmation of student's registration for the course

c) Students are exxpected to have elementary knowledge of principles of Food Processing and Preservation

3 Learning outcomes

Knowledge outcomes

After studying all materials and resources as well as the practical sessions of this course, the students will be able to learn the fundamental methods and principles used in Food Processing and Preservation and be provided with the basic information and practical experiences required to understand some basic Food processing and preservations techniques commonly employed for livestock products.

Specifically, students will be able to:

a) have understanding of basic principles and application of different methods of processing and preserving food materials using heat;
b) have a thorough understanding and knowledge of the application of low-temperature processing and preservation methods of livestock products;
c) understand the principle behind the application of electromagnetic radiation in Food processing and preservation;
d) understand the principle in controliiing undesirable changes in Food using ionizing radiations;
e)understand the various methods employed in production of dehydrated commercial products, selection of methods based on characteristics of foods to be produced and advantages and disadvantages of different drying methods;
f) have the basic knowledge of physical and chemical changes during drying and control of chemical changes;

g) understand the principle and application of Food Concentration- methods of food concentration, freeze concentration, Ultra-filtration, reverse osmosis;

h) describe and understand the prinicple involved in the application of the following non-thermal

	methods: High pressure, pulsed electric field, hurdle technology, in Food processing. i) understand permissible limits for chemical preservatives as well as the use and application of enzymes and microorganism in processing and preservation of foods; j) know and apply the following in preserving food materials: fermentations, pickling, smoking; k) understand the concept of Food additives; Definition, types and functions, permissible limits and safety aspects. Chemical Preservatives- type I and type II. **Skills Outcomes** The students will be able a) to know and determine which methods of Food processing and preservation can be used to achieve a particular purpose depending on quality, nutrition, safety and sustainability. a) to use low temperature processing and preservation methods such as freezing, cooling, controlled and modified atmosphere in Food processing; b) to control undesirable changes in Food materials during processing using any of the applicable techniques; c) carry out drying operations to enhance the quality, nutrition and safety of dehydrated Food products; d) identify the most suitable non-thermal processing methods, chemical preservatives and permissive levels for use in Food processing and preservation.
4	**Subject aims** The module is designed for graduate students to deepen their knowledge in Food Processing and Preservation with respects to principle and application of thermal, low temperature, non-thermal methods as well as use of preservatives. **Course Contents** Students will learn the following contents: a. heat treatment such as blanching, pasteurization, sterilization and UHT processing, canning, extrusion cooking, dielectric heating, microwave heating, baking, roasting and frying b. low Temperature-cooling, refrigeration, freezing, controlled atmosphere (CA), modified atmosphere (MA), and dehydro-freezing. c. Principles of using electromagnetic radiation in food processing, ionizing radiations and non ionizing radiations, advantages and disadvantages d. Processing and preservation by drying, concentration and evaporation; e. Processing and preservation by non-thermal methods: High pressure, pulsed electric field, hurdle technology f. Use and application of enzymes and microorganism in processing and preservation of foods; g. Food additives. **Practicals:** Blanching and browning control in Foods; dehydration of food products such as meat, egg and milk; application of freeze concentration and reverse osmosis; use of approved preservatives to preserve traditional food materials based on GRAS; preparation and standardization of traditional Nigerian fermented and smoked foods

5	**Teaching methods** Lectures, seminars, laboratory practice, fieldwork, tutorials, placements, interactive teaching, The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS
6	**Assessment methods** Individual Presentations, Group Assignments, Continuous Assessment, Summative Assessment, Written end-of-the-semester examination This course will be graded as follows: Individual Presentation 5%, Group Assignments 5%, Test(s) 20% Final Examination 70%
7	**This module is used in the following degree programmes as well** N/A
8 .	**Responsibility for module** Prof. T.A. Shittu and Dr. O.P. Sobukola
9	**Other information** **Suggested References** • Rodi, P.S. (1995). Food Preservation Methods, Stamoulis Publications, Athens. • Lewis, M. (2000). Continuous Thermal Processing of Foods. Aspen. • Tzia, C., Oraiopoulou, B. (2003). Food Preservation & Packaging, N.T.U.A.. • Bloukas, I.G. (2004). Food Processing & Preservation, Stamoulis Publications, Athens, 2004 • Chandra Gopala, R. (2006). Essentials of food process engineering. B.S. Publications. • Khatkar, Bhupendra Singh ed (2007). Food science and technology. Daya Publishing House. • Ahlluwalia, V. (2007). Food processing. Paragon International Publishers. • Meenakshi, P. (2007). Effects of food processing on bioactive compounds. Gene-Tech Books. • Shafiur, R. (2007). 2nd Edn Handbook of food preservation. CRC press. • Fellows, P (2005). 2nd edn Food processing technology. woodhead publishing company. • Koutchma, T. (2007). Ultraviolet light in Food Technology, CRC Press. • Sun, Da-Wen (2005). Emerging technologies for food processing. Elesevier Academic Press. • Zeuthen, P. (2005). Food preservation techniques. Woodhead publishing ltd, • Berk, Z. (2009). Food process engineering and technology. Elsevier. • Kioseoglou, B., Blekas, G. (2010). Principles of Food Technology, Agis-Savvas Gartaganis Publications • Daniel B.-Gagne, Chloe M. (2013). Processed Foods, Jones, Nova Science Publishers, Inc. Related academic journals: -Journal of Food Processing and Preservation (Wiley) -Annals of Food Processing and Preservation (JSciMed Central) -Journal of Food Processing & Technology (OMICS International) -Journal of Food Science and Technology (Springer) - International Journal of Food Science and Technology (Wiley)

	Note: This course is a 3-unit course based on the credit system in use in Nigeria. It is delivered through 75 hours of class lectures and practicals. Students are however, expected to devote a total of 210 hours of learning to the course, including participation in 75 hours of course lectures and practicals, and 135 hours of self-study (assigned reading, personal studies, assignments, group work and hands-on practice). Hence, the course is of 7.0 ECTS credit equivalent.

FOOD PACKAGING TECHNOLOGY					
Module code FPV 804	**Student workload** 180 hours	**Credits** 6.0 ECTS	**Semester** Second. Semester	**Frequency** One time in each second Semester	**Duration** 15 Weeks

1	**Types of courses** a) Class Work b) Seminars c) Students' Presentation	**Contact hours** 45 hours	**Independent study** 135 hours	**Class size** Avg of 10 (Max 20)
2	**Prerequisites for participation** a) Participation in the course is compulsory for all students admitted for M.AgSE b) Participation is subject to confirmation of student's registration for the course c) Students are exxpected to have elementary knowledge of Food Product Packaging			
3	**Learning outcomes** **Knowledge outcomes** After studying all materials and resources in this course, the students will be able to: a) explain the meaning, importance and roles of packaging in Food Processing b) identify the characteristics of foodstuff that determines the choice of packaging material to be used c) identify different packaging materials available in the industry and their properties d). determine the type of test that can be done on different packaging materials e) understand the principles and differences in packaging systems and methods f) analyse the various factors that can affect the shelf stability of packaged food materials g). explain the concept of eco-friendly packaging systems h) understand the principle and practices of packaging fresh and processed foods i) explain the concept of package design and environmental issues in packaging j) explain the role of Food packaging in marketing k) explain the concept of migration in packaging and its effect on food quality l) understand regulations concerning food packaging at National and International levels **Skills Outcomes** The students will be able to: a) understand the concept of Food packaging and the need for maintaining product quality			

	b) choose the appropriate packaging material based on the properties of the food; c) to carry out simple test for a particular packaging material. d) determine the stability of food materials based on the packaging material used; e) to use the appropriate packaging material to be used for fresh amd processed food materials.
4	**Subject aims** The module is designed for graduate students to deepen their knowledge of Food packaging as it relates to maintenance of Food quality, determining the appropraite packaging material to be used, and testing the material. The aim is also to expose the students the role it plays in marketing as well as the regulations governing its use **Course Contents** Students will learn the following contents: a. Definitions of termilogies in packaging and its functions b. Selection of appropriate packaging materials based on characteristics of foods c. Diffrent packaging materials and their properties d. Testing of packaging materials e. Packaging systems and methods f. Eco-friendly packaging of food materials g. Packaging of fresh and processed foods h. Packaging design and environmental issues in packaging i. Migration in food packaging and regulations; **Practical:** Determination of WVTR and GTR in different packaging materials, Application of anti-microbial packaging for moisture sensitive foods, Application of MAP packaging in selected foods, Study of time temperature indicators, Determination of oxidative changes in packaged foods, Comparative evaluation of flexible and rigid packages for fragile foods, Packaging of foods under inert atmosphere, study textural characteristics of selected food materials under MAP storage, Shelf life evaluation of packaged food product. Visit to food packaging material manufacturing industry.
5	**Teaching methods** Lectures, sharing of materials via learning tools, case studies, group work, individual presentations, and discussions
6	**Assessment methods** Individual Presentations, Group Assignments, Continuous Assessment, Summative Assessment, Written end-of-the-semester examination This course will be graded as follows: Individual Presentation 5%, Group Assignments 5%, Test(s) 20% Final Examination 70%
7	**This module is used in the following degree programmes as well** N/A

8.	**Responsibility for module** Prof. M.A. Idowu
9	**Other information** **Suggested References** a) Miquel Angelo, P. R. C., Ricardo Nuno, C. P., Oscar Leandro, D.S.R., Jose Antonio, C.T., Antonio Augusto, V. (2016). Edible Food Packaging: Materials and Processing Technologies, CRC Press. Taylor & Francis, Boca Raton, FL b) Luciano, P., Sara, L. (2016). Food Packaging Materials, Springer cham Heildelberg, New york c). Robertson, G.L. (2006). Food Packaging: Principles and Practice (2nd ed.), Taylor & Francis 4. NIIR. (2003). Food Packaging Technology Handbook, National Institute of Industrial Research Board, Asia Pacific Business Press Inc. d). Ahvenainen, R. (Ed.) 2003 Novel Food Packaging Techniques, CRC Press, e). Han, J.H. (Ed.) 2005 Innovations in Food Packaging, Elsevier Academic Press, f). Coles, R., McDowell, D. and Kirwan, M.J. (Eds.) 2003 Food Packaging Technology, CRC Press Related Academic Journals -Journal of Packaging Technology and Research (Springer) -Food Packaging and Shelf life (Elsevier) -Packaging Technology and Science (Wiley) **Important Note:** This course is a 3-unit course based on the credit system in use in Nigeria. Students are however, expected to devote about 180 hours to learning of the course content, including participation in 45 hours of course lectures and demonstrations, and 135 hours of self-study (assigned reading, personal studies, assignments, group work and hands-on practice). Hence, the course is of 6.0 ECTS credit equivalent.

ADVANCED FOOD CHEMISTRY					
Module Code FPV 805	**Student workload** 210 hours	**Credits** (according to ECTS) 7.0	**Semester** First Semester	**Frequency** Once every academic session by the First Semester	**Duration** 15 Weeks

1	**Types of courses** a) Class Work b) Hands–on Practical c) Students' Presentation	**Contact hours** 75 hours	**Independent study** 135 hours	**Class size** Avg of 10 (Max 20)
2	**Prerequisites for participation** Basic knowledge of Food Chemistry and Biochemistry at the undergraduate level			

3	**Learning outcomes** After the completion of this course, the Students will: a) Understand the physical and chemical properties of water as it affects quality of foods b) distinguish between physical, chemical, functional properties of proteins and their effect on application in product development c) understand the effect of processing on some properties of proteins d) know and understand the roles of enzymes and the factors that affect their rate of reactions e) characterize enzymic and non-enzymic reactions especially deleterious and positive enzymes in food systems f) understand the principles governing browning reactions and how to prevent it g) know the roles of lipids in food and the effect of processing h) know the basic structures, reactions and effect of processing on simple and complex sugars
4	**Subject aims** The aim of the module is to a) provide an understanding of the chemical function and properties of major food components. b) provide an understanding of the chemical interactions of food components and their effects on sensory and nutritional quality, functional properties, and safety of foods. c) provide an understanding of the chemical basis of food preservation and the effects of processing and storage on food quality. d) familiarize the student with common analytical and experimental methods used in the study of the major food components. e) examine the basis of food chemistry-related issues in food safety, regulation and current events. **Course Contents** a) Physical and Chemical Properties of Water- b) Principles, measurement, control and effects of water activity c) Properties of proteins in relation to protein structure, analytical methods and d) effects of food processing on chemical, functional & nutritional properties of proteins e) Factors affecting reaction rate of enzymes, characteristics of enzymatic and non enzymatic reactions f) chemical, physical and nutritional properties of lipids g) Physical, chemical and nutritional properties of simple and complex sugars; notable reactions and effects of processing on such properties **Practical:** Water activity and moisture isotherm, emulsions and foaming properties of proteins, maillard Reaction, qualitative test for protein, quantitative estimation of protein by biuret method, factors affecting protein quality, Fehling's test for reducing sugars, Microscopic examination of starch, Starch Gels, Viscosity curves of starch pastes, Lipids: Solubility, specific gravity and refractive index of fats, water absorption and plasticity of fats, Oxidative rancidity

5	**Teaching methods** Lectures, practical demonstrations, sharing of materials via learning tools, case studies, group work, individual presentations, and discussions
6	**Assessment methods** Individual Presentations, Group Assignments, Practicals, Summative Assessment, Written end-of-the-semester examination Assignments & Presentations (10%), practical (20%) and Final Examination (70%)
7	**This module is used in the following degree programmes as well** Nil
8	**Responsibility for module** Prof. M.A. Idowu/Dr. O.P. Sobukola/Dr. (Mrs) O.E. Omohinmi
9	**Other information** **References** a. Fellows, P. (2000). Food Processing Technology-Principles and Practice. Published by Woodhead Publishing, Cambridge, England. b. Ohlsson, T. and Bengtsson, N. (2002). Minimal Processing Technologies in the Food Industry. Published by Woodhead Publishing Limited, Cambridge, England c. Wilson, C.L. and Droby, S. (2000). Microbial Food Contamination. Published by CRC Press Ltd., USA. d. Brody, A.L., Strupinski, E.R. and Kline, L.R. (2001). Active packaging for Food Applications. CRC Press Ltd., USA e. Damodaran, S., K. Parkin, O. R. Fennema, eds. (2007). Fennema's Food Chemistry, 4th Ed., CRC Press. ISBN: 0849392721 f. Deutscher, M.P. (1990). Guide to Protein Purification. Methods in Enzymology, Vol. 182, Academic Press, San Diego, CA. Call # QP 601 .M49 v.182 g. Damodaran, S. (1996). Food proteins: properties and characterization. New York, N.Y.: VCH,. Call # TP453.P7 F68. h. Nielsen, S.S. (2003). Food Analysis, Third Ed., Kluwer Academic/Plenum Publishers, New York. Call # TX 545 I 58 1998 i. Segel, I.H. (1976). Biochemical Calculations, 2nd ed. John Wiley and Sons, Inc., New York. Call # 442.7 S454b2 j. Troller, J.A. and Christian, J.H.B. (1978). Water Activity and Food. Academic Press, New York. Call # TX553 .W3 T76 k. Whitaker, J.R. (1994). Principles of Enzymology for the Food Sciences, 2nd Ed. Marcel Dekker, Inc., New York. Call # QP601.W44.1994 Related Academic Journals a. Food Chemistry (Elsevier) b. Journal of Agriculture and Food Chemistry d. Food and Chemical Toxicology (Elsevier) e. Journal of the Science of Food and Agriculture (Wiley)

	f. Trends in Food Science and Technology **Important Note** This course is a 3-unit course based on the credit system in use in Nigeria. Students are however, expected to devote a total of 210 hours of learning to the course, including participation in 75 hours of course lectures and practicals, and 135 hours of self-study (assigned reading, personal studies, assignments, group work and hands-on practice). Hence, the course is of 7.0 ECTS credit equivalent.

SPECIAL TOPICS IN SENSORY EVALUATION					
Module Code FPV 806	**Student workload** 180 hours	**Credits** (according to ECTS) 7.0	**Semester** Second Semester	**Frequency** Once every academic session by the second Semester	**Duration** 15 Weeks

1	**Types of courses** a) Class Work b) Hands–on Practical c) Students' Presentation	**Contact hours** 75 hours	**Independent study** 135 hours	**Class size** Avg of 10 (Max 20)
2	**Prerequisites for participation** Basic knowledge of statistics, mathematics and econometrics at the undergraduate level			
3	**Learning outcomes** On completion of the learning event the student will be able to: a. Define sensory evaluation, types, objectives and applications b. Demonstrate deep learning of the recent developments in taste, odour and flavour measurements c. Describe the principles and theories of instrumental sensory analysis in the food industry (e.g. Optical Sensors and Electronic Eyes, Mechanical texture analysis of foods) d. Understand the relationships and interactions between physical, chemical and sensory attributes of foods. **e.** Have a good grasp and describe the use automation in sensory analysis (control systems and information technologies) to reduce the need for human work in determining consumer acceptability, preference and willingness to pay for premium.			
4	**Subject aims** The aim of the module is to: Expose the students to recent developments on taste, odour and flavour assessments in food products. Principles of consumer acceptability studies. Interrelationship between physical, chemical and sensory attributes of foods. Automation in sensory analysis. **Course Contents** a. Introduction to sensory analysis; general testing conditions, b. Organizing sensory evaluation program,			

	c. Development of sensory testing, human subjects as instruments (test design, instrumentation, interpretation of results). d. Sensory attributes of food products, Human senses (sense of vision, sense of touch, olfactory sense, sense of taste, sense of hearing). e. Sample preparation, supplies and equipment, materials, preparation procedure, sample preparation, order, coding, number of samples, product sampling. f. Panelist control, Panel training orientation, Factors affecting sensory verdicts, physiological factors, psychological factors, poor physical condition. g.Different tests for sensory evaluation, Difference (Qualitative test: Paired comparison, duo-Trio, Triangle test). Rating (Quantitative: Ranking, single, two and multiple sample, hedonic, Numerical scoring, composite), Sensitivity (Threshold, dilution). h. Applications and Advances in Electronic-Nose Technologies, Aroma Types and Characteristics, Conceptual Development of the Electronic Nose and instrumentation, Data Analysis for Electronic Noses, E nose applications. i. Computer-aided sensory evaluation of food & beverage, statistical analysis of sensory data. **Practical:** Selection and training of sensory panel, detection and threshold tests, study of paired comparison test, study of duo-trio test, ranking tests for taste, aroma colour and texture, study of hedonic rating test, sensory evaluation of various food products using hedonic scales, Objective estimation of color and texture, subjective estimation of colour and texture, study of single and two sample tests as well as statistical analysis.
5	**Teaching methods** Lectures; practical demonstrations; assigned reading, critique and replication (hands-on practice using local data) of econometric analysis in published economic papers; presentations and discussions.
6	**Assessment methods** Performance in the course will be assessed by a combination of assignments (10%), a Mid Semester Test (15%), a term paper (25%) and a final examination (50%). .
7	**This module is used in the following degree programmes as well** Nil
8	**Responsibility for module** Prof. T.A Shittu and Dr A.A. Adebowale

9	**Other information** **References** a. Moskowitz, Howard R. (2006). Sensory and consumer research in food product design and development / Howard R. Moskowitz, Jacqueline H-. Beckley, and Anna V. A. Resurreccion. First Edition 2006. IFT Press Series b.Stephanie Clark I Michael Costello I MaryAnne Drake I Floyd Bodyfelt (2009) (Editors). The Sensory Evaluation of Dairy Products. Second edition. Springer ScienceþBusiness Media, LLC 2009 c. Andrew J. Rosenthal (1999). Food Texture Measurement and Perception. Aspen Publishers, Inc. Gaithersburg, Maryland. d. Amerine MA, Pangborn RM & Rossles EB. 1965. *Principles of Sensory Evaluation of Food.* Academic Press. e. Early R.1995. *Guide to Quality Management Systems for Food Industries*. Blackie Academic. f. Jellinek G. 1985. *Sensory Evaluation of Food - Theory and Practice*. Ellis Horwoood. *g.* Lawless HT & Klein BP. 1991. *Sensory Science Theory and Applications in Foods*. Marcel Dekker. h. Maslowitz H. 2000. *Applied Sensory Analysis of Foods*. Vols. I, II. CRC Press. i. Morten C. Meilgaard, B. 2007. Sensory Evaluation Techniques, Fourth Edition. Thomas Carr, Gail Vance Civille j. Piggot JR. 1984. *Sensory Evaluation of Foods*. Elbview Applied Science Publ. k. Rai SC & Bhatia VK. 1988. *Sensory Evaluation of Agricultural Products.* Indian Agricultural Statistics Research Institute (ICAR). l. Stone H & Sidel JL. 1985. *Sensory Evaluation Practices*. Academic Press. m. Watts CM, Ylimaki CL, Jaffery LE & Elias LG. 1989. *Basic Sensory Methods for Food Evaluation*. Int. Dev. Res. Centre, Canada. **Related Academic Journals** a. Journal of Food Science (Wiley) b. Journal of Sensory Studies (Wiley) c. Food Quality and Preference (Elsevier) d. Trends in Food Science and Technology (Elsevier) **Important Note** This course is a 2-unit course based on the credit system in use in Nigeria. Students are however, expected to devote about 120 hours to learning of the course content, including participation in 30 hours of course lectures and practicals, and 90 hours of self-study (assigned reading, personal studies, assignments, group work and hands-on practice using econometric software to analyse data). Hence, the course is of 4.0 ECTS credit equivalent.

<table>
<tr><td colspan="6">SPECIAL TOPICS IN FOOD MICROBIOLOGY, QUALITY AND SAFETY</td></tr>
<tr><td colspan="2">Module Code
FPV 807</td><td>Student workload
210 hours</td><td>Credits (according to ECTS)
7.0</td><td>Semester
First Semester</td><td>Frequency
Once every academic session by the First Semester</td><td>Duration
15 Weeks</td></tr>
<tr><td>1</td><td colspan="2">Types of courses
a) Class Work
b) Hands–on Practical
c) Students' Presentation</td><td>Contact hours
75 hours</td><td>Independent study
135 hours</td><td colspan="2">Class size
Avg of 10 (Max 20)</td></tr>
<tr><td>2</td><td colspan="6">Prerequisites for participation
Basic knowledge of general and Food Microbiology at undergraduate level</td></tr>
<tr><td>3</td><td colspan="6">Learning outcomes
On completion of the learning event the student should be able to:
f. Define food microbiology and describe microorganisms that influence microbial quality/safety or can be used in the manufacture of foods
g. Demonstrate deep learning of the influence of intrinsic (pH, aw, nutrients, etc.) and extrinsic (temperature of storage, atmosphere of storage, etc.) parameters on microbial growth and apply this to ensure the microbial stability and safety of foods and beverages.
h. Describe and manufacture fermented foods.
i. Describe and predict the spoilage patterns of foods and beverages.
j. Describe the various food preservation techniques such as pasteurisation, heat sterilisation, irradiation, freezing, etc. and their role in the manufacture of safe food and beverage products.
k. Identify and describe food poisoning organisms, elaborate on factors that lead to foodborne illness and methods to prevent/limit the incidence of foodborne illness.
l. Demonstrate learning and apply principles of Hazard Analysis Critical Control Points (HACCP), microbiological criteria and the use of microbiological analysis to monitor food quality and safety.</td></tr>
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4	**Subject aims** The aim of the module is to: a. expose the students to the importance and significance of microbiology in Food Science b. ensure that the students know the intrinsic and extrinsic factors that affects growth of micro-organisms in food and how to control them c. ensure that the students understand the concept of microbial food spoilage and how to control them d. expose the students to different spoilage organisms, how to determine, identify and how to control them **Course Contents** a. Characteristics and ecology of micro-organisms of importance in food burned disease b. Methods and techniques for isolation and identification of micro-organisms, c. factors affecting their growth and survival of micro-organisms in relation to food processing and preservation. d. Food sampling. e. Specialized fermentations including alcoholic, lactic fermentations, etc. f. Microbiological criteria for foods, quality assurance, hygiene including appropriate aspects of process plant sanitation. g. Principles and application of HACCP in monitoring quality and safety of foods **Practical:** Preparation of common laboratory and special media, staining: Gram's staining methods, acid-fast, spore, capsule and flagellar staining, Motility of bacteria, Staining of yeast and molds, Identification of important molds and yeast. Microbiology of milk, meat and egg, Microbiology of water, Microbiology of hand and effect of sanitation on the hand microbiology in a small food joint, Microbiological analysis of typical processed food. Microbiological analysis of some common traditional unprocessed food
5	**Teaching methods** Lectures; practical demonstrations; assigned reading, critique and replication project work, case studies, group work.
6	**Assessment methods** Performance in the course will be assessed by a combination of assignments (10%), a Mid Semester Test (15%), a term paper (25%) and a final examination (50%). .
7	**This module is used in the following degree programmes as well** FST 809
8	**Responsibility for module** Dr. A.O. Obadina and Dr (Mrs) Celestina Omohinmi
9	**Other information** **References** a. Prescott LM Harley JP and Klein DA (2006). Microbiology (7th edition) McGraw Hill, Newyork.

	b. Frazier, W.C. (1988) Food Microbiology, Mc Graw Hill Inc. 4th Edition. c. Vijaya Ramesh,K. (2007) Food Microbiology. MJP publishers, 2007 d. Yasmine Motarjemi and Martin Adams. (2006) Emerging Food borne pathogen- Wood Head Publishing England. e. Arun, K Bhunia. (2008) Food borne microbial pathogens: Mechanisms and pathogenesis. Springer. f. Thomas J. Montville, Karl R. Matthews, Kalmia E. Kniel (2012). Food Microbiology: An Introduction, American Society for Microbiology. g. Dubey, R.C. and Maheswari, D.K. (2008) Text book of Microbiology. S Chand Publishing. **Related Academic Journals** a. International Journal of Food Microbiology (Wiley) b. Food Microbiology (Elsevier) c. Microbiology Research (Elsevier) d. Trends in Food Science and Technology (Elsevier) **Important Note** This course is a 3-unit course based on the credit system in use in Nigeria. Students are however, expected to devote about 210 hours to learning of the course content, including participation in 75 hours of course lectures and practicals, and 135 hours of self-study (assigned reading, personal studies, assignments, group work and hands-on practice using econometric software to analyse data). Hence, the course is of 7.0 ECTS credit equivalent.

TRADITIONAL VALUE ADDED PRODUCTS					
Module Code FPV 808	**Student workload** 120 hours	**Credits** (according to ECTS) 4.0	**Semester** Second Semester	**Frequency** Once every academic session by the Second Semester	**Duration** 15 Weeks

1	**Types of courses** a) Class Work b) Hands–on Practical c) Students' Presentation	**Contact hours** 30 hours	**Independent study** 90 hours	**Class size** Avg of 10 (Max 20)
2	**Prerequisites for participation** Nil			
3	**Learning outcomes** On completion of the learning event the student should be able to: a. Understand the current status of traditional foods in Nigeria and West Africa			

	b. know the plans and policies of government and developmental agencies in relation with traditional foods c. describe and characterize different traditional products from animals especially poultry obtained by heat-desiccation, coagulation, frying, and fermentation d. understand and describe the process technology used for different traditional value added products e. determine the use of natural and permitted synthetic preservatives for traditional food products f. determine and apply new packaging systems for traditional food products; g. understand the techno-economic aspects for establishing commercial units for traditional products
4	**Subject aims** The aim of the module is to know the current status of traditional food processing in Nigeria and West Africa, be knowledgeable about policies and plans of government in this respect and appreciate different traditional products available in Nigeria and West Africa. It is also aimed at ensuring that students know the issues surrounding use of preservatives and new packaging systems in traditional food processing, **Course Contents** a. Present status of traditional food products in Nigeria and West Africa; b. Globalization of traditional food products; c. Plans and policies of the Government and developmental agencies. d.Overview of heat-desiccated, coagulated, fried, fermented traditional food products from Animals especially poultry. e. Process technology for common Nigerian products, fried foods; fermented traditional food and its improvement; convenience traditional food products (ready to eat and serve); f. Use of natural and permitted synthetic preservatives and new packaging systems for traditional food products; g. Techno-economic aspects for establishing commercial units for traditional products
5	**Teaching methods** Lectures; practical demonstrations; assigned reading, critique and replication project work, case studies, group work.
6	**Assessment methods** Performance in the course will be assessed by a combination of assignments (10%), a Mid Semester Test (15%), a term paper (25%) and a final examination (50%). .
7	**This module is used in the following degree programmes as well** Nil
8	**Responsibility for module** Dr. O.P. Sobukola and Dr. (Mrs.) A.T. Omidiran
9	**Other information** **References** a. Fellows, P. (2003). Traditional Foods-Processing for Profits. ITDG Publishing, UK. b. Azam-Ali, S., Judge, E., Fellows, P. and Battcock, M. (2003). Small-scale Food Processing-A directory of equipment and methods. ITDG Publishing, UK.

	c. Rozis, J.F. (1997). Drying Foodstuffs-Technical guidebook. Backhuys Publishers, Netherlands. **Related Academic Journals** a. International Journal of Food Science and Technology (Wiley) b. Food Science and Nutrition (Wiley) c. Nigerian Food Journal (NIFST) **Important Note** This course is a 2-unit course based on the credit system in use in Nigeria. Students are however, expected to devote about 120 hours to learning of the course content, including participation in 30 hours of course lectures and 90 hours of self-study (assigned reading, personal studies, assignments, group work and hands-on practice using econometric software to analyse data). Hence, the course is of 4.0 ECTS credit equivalent.

FOOD PRODUCT DESIGN					
Module Code FPV 809	**Student workload** 210 hours	**Credits** (according to ECTS) 7.0	**Semester** First Semester	**Frequency** Once every academic session by the First Semester	**Duration** 15 Weeks

1	**Types of courses** Theory with practicals and case studies	**Contact hours** 75 hours	**Independent study** 135 hours	**Class size** Avg of 10 (Max 20)
2	**Prerequisites for participation** A general knowledge of Food Science and Technology			
3	**Learning outcomes** On completion of the learning event, the student should be able to: -Describe and apply the principle of process optimization using any experimental design technique -case study on application of different rheological models to food products from different sources -understand the concept of Food structuring in the development of complex food products -predict quality parameters of developed food products using existing models - explain and infer the nature of food quality attributes in relation to food quality; - classify and infer food quality attribute changes from thermodynamic and kinetic principles; - practice with the nature and properties of mathematical equations relevant for food quality; - deduce models, parameters and model predictions and their uncertainties; - assess competing models on their ability to predict and appraise models on food quality that are applied in food science literature. - design new food products, processes and chains that meet the demands of an interested party while paying attention to dynamically changing consumer needs and wants; - acquire, apply and evaluate theoretical and practical knowledge of own specialization in relation			

	to new food product development in an integrated approach; - evaluate the importance and effect of sustainability in food production and processing; - make judgements on societal and ethical consequences of developments in the area of food technology; - demonstrate an academic attitude in the new food product design process, recognizing the limits of scientific knowledge; - cooperate as a specialist in a multidisciplinary, multicultural (international) team; - communicate verbally and in writing about the results of the project work with colleagues and non-colleagues.
4	**Subject aims/Content** This course will expose the students to the basic concept of design and development of new or improved products from a consumer perspective using experimental design. It also include modeling of new product concepts or processes and predicting food quality attributes in a quantitative way. Students will also be exposed to application of differnt rheological models in predicting behaviour of food materials. To also expose students to basic concept of Food structuring to meet consumers demand, quality prediction using relevant mathematicaal models and ability to desgn products and processes **Course content** a. Basic concept of experimentation: experimental variables and statistical procedure, data description, random variable and some distributions. b. Sampling distribution concept. c. Principles of experimental design. Analysis of variance, single factor experimental design, multifactorial designs, Fractional Factorial Design, Nested Design and Response Surface Methodology (RSM). d. Process optimization and control limits. The course will emphasize design concepts and the presentation of results. e. Application of different rheological models to food products from different sources with case studies, f. concept of Food structuring in the development of complex food products and g. quantitative prediction of quality parameters of developed food products using existing models
5	**Teaching methods** Class lectures, case studies, group work, assigned readings and discussions.
6	**Assessment methods** Graded assignments (5-10marks), mid-semester test (15 - 20 marks), course project report and presentations based on group work (20 - 30marks) and final examination (50 marks)
7	**This module is used in the following degree programmes as well** Nil
8	**Responsibility for module** Prof. T.A. Shittu and Dr. O.P Sobukola
9	**Other information** **1. References**

	a. Linnemann, A.R., Schroen, C.G.P. and Martinus A. J. S. (2011). Food Product Design: An Integrated Approach. Wageningen Publsihers. b. Hu, R. (2017). Food Product Design: A computer Aided Statistical Approach. Taylor and Francis Groups. c. Beckley, J.H., Foley, M.M., Topp, E.J., Huang, J.C. and Prinyawiwatkul, W. (2008). Accelerating New Food Product Design and Development. Wileys and Sons Related Academic Journals -Journal of Food Processing and Preservation (Wiley) -Journal of Food Process Engineering (Wiley) -Food and Bio-product Processing (Wiley) -International Journal of Food Science and Technology (Wiley) -Journal of Food Engineering (Elsevier) -Journal of Food Process Engineering (Wiley) **Important Note** This course is a 3-unit course based on the credit system in use in Nigeria. Students are however, expected to devote a total of 210 hours of learning to the course, including participation in 75 hours of course lectures and practical and 135 hours of self-study (assigned reading, personal studies, assignments, group work and hands-on practice using statistical software to analyse data). Hence, the course is of 7.0 ECTS credit equivalent.

MANAGEMENT OF BY-PRODUCTS AND WASTE					
Module Code FPV 810	**Student workload** 120 hours	**Credits** (according to ECTS) 4.0	**Semester** Second Semester	**Frequency** Once every academic session by the Second Semester	**Duration** 15 Weeks

1	**Types of courses** Theory with case studies	**Contact hours** 30 hours	**Independent study** 90 hours	**Class size** Avg of 10 (Max 20)
2	**Prerequisites for participation** A general knowledge of Food Science and Technology			
3	**Learning outcomes** On completion of the learning event, the student should be able to: -under the current issues about waste generation in the food industry -classify waste in the food industry into differnt categories -Describe different technologies applied in the removal of waste in Food Industry -Describe the concept of process optimization to minimize water use in the food industry			

	-Describe in details the principle -Describe and apply the principle of super critical extraction and other technologies for extraction of high-value food processing co-products
4	**Subject aims/Content** This course will expose the students to the status of waste generation in the food industry, their classification, methodologies in removing them and how to minimize the use of water through process optimization **Course content** a. Waste generation in the food industry; b. Classification of waste from food industry-fruits and vegetable processing; baking industry; grain processing industry; snack food industry; meat processing abattoir; c. BOD and Technologies for separation of waste-Physical, chemical and advance technologies. d. Physical- screening; sedimentation; flotation; centrifugation; filtration; adsorption; hydro-cyclones etc. e. Chemical- precipitation; coagulation etc. f. Advanced Processes- reverse osmosis, ion-exchange; electro-coagulation; ultrafiltration; electrodiaysis; supercritical fluid extraction. g. Process optimization to minimize water use in food processing. h. Super critical extraction and other technologies for extraction of high-value food processing co-products. i. Membrane and filtration technologies and the separation and recovery of food processing waste.
5	**Teaching methods** Class lectures, case studies, group work, assigned readings and discussions.
6	**Assessment methods** Graded assignments (5-10marks), mid-semester test (15 - 20 marks), course project report and presentations based on group work (20 - 30marks) and final examination (50 marks)
7	**This module is used in the following degree programmes as well** Nil
8	**Responsibility for module** Dr. (Mrs) A.T. Omidiran and Engr. K. Adegoke
9	**Other information** **1. References** Waldron K. (2007). Handbook of waste management and co-product recovery in food processing Vol 1. Woodhead Publishing Limited, Cambridge, England 2. Vuong, Q.V. (2017). Utilization of Bioactive Compounds from Agricultural and Food Waste. CRC Press, Taylor and Francis Group. 3. Waldron, K. (2007). Handbook of waste management and co-product recovery in Food Processing. Woodhead Publishing. 4. Kosseva, M. and Webb, C. (2013). Food Industry Waste: Assessment and recuperation of commodities. Academic Press

	Related Academic Journals -Journal of Food Processing and Preservation -Journal of Food Process Engineering **Important Note** This course is a 2-unit course based on the credit system in use in Nigeria. Students are however, expected to devote a total of 120 hours of learning to the course, including participation in 30 hours of course lectures and practical and 90 hours of self-study (assigned reading, personal studies, assignments and group work). Hence, the course is of 4.0 ECTS credit equivalent.

LIVESTOCK PROCESSING PRACTICAL I					
Module code FPV 811	**Student workload** 120 hours	**Credits** 4.0 ECTS	**Semester** Second Semester	**Frequency** Each Second Semester	**Duration** 15 Weeks

1	**Types of courses** Class Work	**Contact hours** 30 hours	**Independent study** 90 hours	**Class size (Potential)** Avg of 10 (Max 20)

2 Prerequisites for participation

a) Participation in the course is required for all students admitted for M.AgSE

b) Student's participation is subject to confirmation of registration for the course

c) Students are exxpected to have basic knowledge of Meat and Fish Processing at Undergraduate level

3 Learning outcomes

Knowledge outcomes

Students will be taking this course at a meat and poultry processing industry

Specifically, students will be able to:

a) have an understanding of the status of meat and poultry processing industry in Nigeria;
b) understand the effect of different slaughtering techniques on quality of meat
c) describe the effect of post mortem changes in meat and how it affects quality;

d) describe some processing techniques leading to value addition of meat;

e) understand the need to carry out quality checks on eggs and how

f) determine and describe value addition procedures for egg and poulltry based on the need

. **Skills Outcomes**

The students will be able to:
a) slaughter animals using different techniques available in the Industry to enhance quality of final product;

	b) monitor and control post mortem changes in slaughtered animals for the purpose of quality; c) process and package meat into different value added products; d) use the by-products recovered from meat processing for other uses; e) carry out quality checks on eggs and grade them for different uses; f) develop value added products from eggs and poultry
4	**Subject aims** The module is designed to expose students to real time activities in the meat and poultry processing industry. They will be under the supervision of an industry based personnel and the University based supervisor making scheduled visits. **Course Contents** Students will learn the following: a. Meat industries in Nigeria and West Africa, b. slaughtering technique of animal and slaughtering practices, c. meat cuts and portions of meat. Post mortem changes in meat (Rigor Mortis), colour of meat. d. Meat processing-smoking and curing, prepared meat products including fermented meats, sausages, bacon. Frozen meat and meat storage, e. Packaging of meat products. f. Meat microbiology and safety, Meat plant hygiene – GMP and HACCP, g. By-products from meat industries and their utilization. h. Processing of poultry meat and eggs. Spoilage and control. i. By-product utilization, Value Added Products (Frozen chicken, dehydrated powders, Sausages). j. Egg Types and composition, quality check and grading of eggs, value added products (Frozen eggs, canned egg whites/yolks, pasteurized egg products, dried eggs, pickled eggs)
5	**Teaching methods** Hands on practical, case studies and discussions.
6	**Assessment methods** a. Group work - 40%; b. Practical report - 60%
7	**This module is used in the following degree programmes as well** N/A
8.	**Responsibility for module** TUNS Farms Plc, Osogbo and Obasanjo Farms, Ota both in Nigeria. and Prof T.A. Shittu
9	**Other information** **1. Suggested Further Readings** a. Pearson, A.M. and Gillett, T.A. (1999). Processed Meats. 3rd edition, An Aspen publication. b. Lawrie, R.A. (1981). Development in Meat Science (Development series 3, Applied Sciences. c. Stadelman, W.J., Olson, V.M., Shemwell, G.A. and Pasch, S. (1988). Egg and Poultry Meat Processing –, Ellis Horwood Ltd.

	Related Academic Journals -Meat Science (Elsevier) -International Journal of Meat Science -Journal of Muscle Foods (Wiley) -International Journal of Food Science and Technology (Wiley) **Important Note:** This course is a 2-unit course based on the credit system in use in Nigeria. Students are however, expected to devote a total of 120 hours of learning to the course, including participation in 30 hours of practicals, and 90 hours of self-study (assigned reading, personal studies, assignments, group work and hands-on practice). Hence, the course is of 4.0 ECTS credit equivalent.

LIVESTOCK PROCESSING PRACTICAL II					
Module code FPV 812	**Student workload** 120 hours	**Credits** 4.0 ECTS	**Semester** Second Semester	**Frequency** Each Second Semester	**Duration** 15 Weeks

1	**Types of courses** Class Work	**Contact hours** 30 hours	**Independent study** 90 hours	**Class size (Potential)** Avg of 10 (Max 20)
2	**Prerequisites for participation** a) Participation in the course is required for all students admitted for M.AgSE b) Student's participation is subject to confirmation of registration for the course c) Students are exxpected to have basic knowledge of Meat and Fish Processing at Undergraduate level and have done FPV 811			
3	**Learning outcomes** **Knowledge outcomes** Students will be taking this course at a Dairy processing industry Specifically, students will be able to: a) have an understanding of the status of Dairy processing industry in Nigeria; b) understand the effect of different processing techniques on quality of milk; c) describe the production stages in value added dairy products; d) evaluate quality parameters of milk and milk products; e) understand the principle and application of Total Quality Management in Milk Industry;			

	Skills Outcomes The students will be able to: a) Pasteurize, sterilize and homogenize milk for preservation purposes; b) develop value added products from milk; c) evaluate the quality parameters of milk and value added products using simple experiment; d) use the by-products recovered from milkprocessing for other uses; e) carry out quality checks on milk different uses;
4	**Subject aims** The module is designed to expose students to real time activities in the dairy processing industry. They will be under the supervision of an industry based personnel and the University based supervisor making scheduled visits. **Course Contents** Students will learn the following: a. Status of dairy industry in Nigeria and West Africa. b. Pasteurization, Homogenization and Standardization of milk, c. Manufacture of condensed milk, milk powder, cheese, ice-cream, cream, butter, ghee, Lactone, malted and flavoured beverages, lactose, evaporated and dried products, d. evaluation of quality parameters of milk and value Added products, e. packaging and storage of milk and value added products. f. Substitutes for milk and milk products. g. Fortification and enrichment of milk. h. development of probiotic and lactose free Milk Products i. Total Quality Management in Dairy Industry.
5	**Teaching methods** Hands on practical, case studies and discussions.
6	**Assessment methods** c. Group work - 40%; d. Practical report - 60%
7	**This module is used in the following degree programmes as well** N/A
8.	**Responsibility for module** WAMCO Friesland Plc and Dr. O.P. Sobukola
9	**Other information** **Suggested Further Readings** a. Rathore, N.S. et al. (2008). Fundamentals of Dairy Technology- Theory & Practices. Himanshu Publ b. Walstra et al. (2006). Dairy Science and Technology. 2nd Ed. Taylor & Francis. c. Web, B.H. et al. (1987). Fundamental of Dairy Chemistry. 3rd Ed. AVI Publ.

	d. Walstra et al. (1999). Dairy Technology. Marcel Dekker. **Related Academic Journals** -Journal of Dairy Science (Elsevier) -International Journal of Dairy Science -Dairy Science and Technology (Springer) -International Journal of Food Science and Technology (Wiley) **Important Note:** This course is a 2-unit course based on the credit system in use in Nigeria. Students are however, expected to devote a total of 120 hours of learning to the course, including participation in 30 hours of practicals, and 90 hours of self-study (assigned reading, personal studies, assignments, group work and hands-on practice). Hence, the course is of 4.0 ECTS credit equivalent.

RESEARCH METHODOLOGY AND BIOSTATISTICS					
Module code FPV 813	**Student workload** 180 hours	**Credits** 6.0 ECTS credits	**Semester** First Semester	**Frequency** One time in each First Semester	**Duration** 15 Weeks

1	**Types of courses** a) Class Work b) Seminars c) Students' Presentation	**Contact hours** 45 hours	**Independent study** 135 hours	**Class size** Avg of 20 (Max 40)
2	**Prerequisites for participation** a) Participation in the course is compulsory for all students admitted for M.AgSE b) Participation is subject to confirmation of student registration for the course c) Basic knowledge of Applied statistics at the first degree			
3	**Learning outcomes** After the completion of this course, the Students will: a. understand some basic concepts of research and its methodologies b. identify appropriate research topics to solve identified problems in the food industry c. select and define appropriate research problem and parameters d. prepare a project proposal (to undertake a project) e. organize and conduct research (advanced project) in a more appropriate manner F. Analyze and interpret data f. write a research report and thesis g. write a research proposal (grants)			

4	**Subject aims** The aim of the module is to 1) Expose students to how to carry out research, collect data, analyse and interpret data 2) Equip students with the skills of sampling and experimental designs, methods of collecting data, questionnaire design and testing 3) Make students to be able to develop a research proposal that may be associated with his or her thesis **Course Contents** a. Research Methodology: Meaning, objectives, types, significance and methods of research, b. Definition and identification of a research problem c. Population and sample – types of statistical data – collection and classification of data – Frequency distribution – Diagrammatic Representation of data. d. Study of relationship between variables – correlation: Simple, Partial, Multiple Correlation (three variables); Regression – Simple, Multiple (three Variables). e. Basic concept of hypothesis testing - Type I and type II errors. Tests based on Means & Proportions on Normal. Two way analysis of variance (RBD), LSD, - Multiple comparison tests (DMRT, Bonferonni, Dunnett's).– t test for independent samples, paired samples, F test two sample variances: One-way ANOVA, two-way ANOVA, Correlation & Regression(three variables). f. Framing Proposal for acquiring grants: g. Writing executive summary.
5	**Teaching methods** Class lectures, case studies, field practical/group work, assigned readings and discussions.
6	**Assessment methods** Continuous Assessment Tests (20%), Assignment (10%) and Examination (70%)
7	**This module is used in the following degree programmes as well** N/A
8.	**Responsibility for module** Dr. O.P. Sobukola
9	**Other information** **Recommended Text** a) Fundamentals of Research Methods: Economic, Environmental and Social Issues. Edited by Okuneye Peter Adebola. Published by Livelihoods Support and Development Centre (SLIDEN Africa), Nigeria 2016 b) Philip CashTino Stanković Mario Štorga (2016): Experimental Design Research: Approaches, Perspectives, Applications. Switzerland : Springer,

	c) John W. Creswell (2002). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. Published July 23rd 2002 by SAGE Publications, Inc d) Nicholas Walliman (2010) . Research Methods: The Basics e) Dooley, David. 2001. Social research methods. 4th ed. Upper Saddle River, NJ: Prentice Hall. 385p. f. Gurumani N. (2010). Scientific thesis writing and paper presentation. MJP Publishers. g. Vijayalakshmi G. (2009). Research methods. MJP Publishers. h. Gurumani N. (2010). Introduction to biostatistics. MJP Publishers.
	Important Note This course is a 3-unit course based on the credit system in use in Nigeria. Students are however, expected to devote about 180 hours to learning of the course content, including participation in 45 hours of course lectures and demonstrations, and 135 hours of self-study (assigned reading, personal studies, assignments, group work and hands-on practice using specific software to analyse data). Hence, the course is of 6.0 ECTS credit equivalent.

FOOD BUSINESS MANAGEMENT AND ENTREPRENEURSHIP					
Module code FPV 814	**Student workload** 120 hours	**Credits** 4.0 ECTs	**Semester** Second Semester	**Frequency** One time in each Second Semester	**Duration** 15 weeks

1	**Types of courses**	**Contact hours**	**Independent study**	**Class size**
	a) Class Work b) Seminars c) Students' Presentation	30 hours	90 hours	Avg of 20 (Max 40)

2	**Prerequisites for participation** Participation in the course is optional for student admitted for M. AgSE Participation is also always subject to confirmation of student registration for the course. Students must have taken Food Business Management at Undergraduate level
3	**Learning outcomes** On successful completion of this course students will be able to demonstrate knowledge and understanding of: a. entrepreneurship and the relationship between entrepreneurs, owner-managers; Inventors and innovators; b. the rise and development of the concept of business venturing; c. the business venture process; d. the criteria for the development of a successful business plan. e. the evolution of the bricks and clicks and subsequent multi-channel model and beyond that into contemporary mobile and tablet environments;

	f. the latest innovations in multichannel retailing; g. the practical implications of implementing an online store. i. the transformational impact of digital technology on marketing in the Digital Age; j. the continuing importance of customer engagement and the compelling value proposition; k. the rapidly evolving relationship between marketing and innovation processes; l. the impact and potential of new technologies to measure and predict customer decisions; m. awareness of ethics and social responsibility arising from digital and neuro-technologies; **Skills** Having successfully completed this module you will be able to: a. analyze and interpret approaches and attitudes to enterprise, entrepreneurship, and business venturing; b. evaluate, analyse, understand and interpret the activities involved in business venturing; c. develop evaluative, research and investigative skills; d. converse with key stakeholders about issues relevant to the development of a new Venture; e. understand opportunity recognition, development and evaluation of business ventures in a variety of contexts. f. evaluate various online retail strategies; g. analyse case studies; h. evaluate the opportunities and challenges of contemporary e-retailing; i. analyse the implications for retailers of changing customer behaviour; j. evaluate and apply digital and neuro-marketing principles and techniques; k. critically analyse and evaluate marketing concepts and approaches.
4	**Subject aims** The aim of the module is to a. Equip students with basic knowledge of the principles and concepts of Business management of food industry b. Equip students with the basic skills of venturing into Business c. Develop students' to be able to engage in online retailing of Food products d. Prepare students to be able to adapt new marketing concepts **Course Contents** a. Management peculiarities of food industries. Marketing concept and marketing mix. b.Food business law. c. Preparation of feasibility studies for food – based industries. d. Business analysis, financial and cost analyses, technology selection, marketing analysis, product management, food safety and regulation, waste management in food industries, proposal preparation, general management and project management, management of information system. e. The Evolution of E-Commerce in the Retail Industry, Behind the Web Store: The Challenges of Infrastructure and Fulfilment, Constructing the Web Store and Consumer behaviour. f. The evolving role of mobile and social commerce.

	g. Understand how digital technologies have shaped the evolution of contemporary marketing, h. Describe the major waves of digital technology and their contributions to practice. i. Recognise the major techniques and actual systems used in integrated e-marketing
5	**Teaching methods** Lectures, sharing of materials via learning tools, case studies, group work, individual presentations, and discussions
6	**Assessment methods** Individual Presentations, Group Assignments, Continuous Assessment, Summative Assessment, Written end-of-the-semester examination Continuous Assessment Tests (20%), Assignment (10%) and Examination (70%)
7	**This module is used in the following degree programmes as well** N/A
8	**Responsibility for module** Dr. A.A. Adebowale/Dr. Clestina Omohinmi
9	**Other information** **References** a. Spinelli Jr., S. and Adams, R (2012). New Venture Creation: Entrepreneurship in 21st Century. b. Wickham, P. A. (2006). Strategic Entrepreneurship. c. Kuratko & Hodges (2001). Entrepreneurship: A Contemporary Approach. d. Chell E (2001). Entrepreneurship: Globalisation, Innovation and Development. e. Barringer, B.R. and Ireland, R.D. (2010). Entrepreneurship: Successfully Launching New Ventures. f. Bridge, S., O'Neill, K. and Cromie, S. (2003). Understanding Enterprise, Entrepreneurship and Small Business. g. Strauss, J., and Frost, R. (2011). E-Marketing. h. Levy, M, and Barton, W. (2012). Retailing Management. i. Solomon, M. (2007). Consumer behaviour : buying, having, and being. j. Paul, P, Olson, K (1999). Consumer behaviour and marketing strategy. k. Lindstrom, M (2008). Buyology. l. C&PCravens & Piercy (2006). Strategic Marketing. m. Ryan, D. and Jones, C (2009). Understanding Digital Marketing. n. Chaffey, D. and Smith, P.R (2008). eMarketing excellence. o. C&H Capon with MacHulbert (2009). Managing Marketing in the 21st Century.

	2.0 Important Note: This course is a 2-unit course based on the credit system in use in Nigeria. Students are however, expected to devote a total of 120 hours of learning to the course, including participation in 30 hours of course lectures and demonstrations, and 90 hours of self-study (assigned reading, personal studies, assignments, group work and hands-on practice). Hence, the course is of 4.0 ECTS credit equivalent.

TECNIQUES IN FOOD ANALYSIS						
Module code FPV 815		**Student workload** 120 hours	**Credits** 4.0 ECTS	**Semester** First Semester.	**Frequency** One time in each First Semester	**Duration** 15 Weeks
1	**Types of courses** a) Class Work b) Students' Presentation d case studies		**Contact hours** 30 hours	**Independent study** 90 hours	**Class size** Avg of 10 (Max 20)	
2	**Prerequisites for participation** a) Participation in the course is compulsory for all students admitted for M.AgSE b) Participation is subject to confirmation of student registration for the course c) Must have taken Food Analysis and Food Chemistry as courses at Undergraduate level					
3	**Learning outcomes** After the completion of this course, the Students will: a. Describe and use principal analytical methods used for quantifying the composition and reactions of food components b. Interpret and report data derived from chemical experiments/analysis in a meaningful way c. Apply basic statistical methods to sampling/testing and the analysis of experimental data d. Learn basic methods of instrumental evaluation, including when certain methods might be used, the type of data derived, and how that data might be used in decision-making e. Choose appropriate analytical techniques for foods and when/how to use them in a food processing environment/situation such as Quality Assurance &/Quality Control					

4	**Subject aims** The aim of the module is to a. Learn the basic principles of sample preparation for analysis b. Understand the principles used in techniques such as chromatography and spectrometry analyses of foods c. acquire laboratory skills required for performing a range of chemical and physicochemical analyses of food components d. understand the methods used to assess the accuracy and precision of the analytical techniques performed in lab **Course Contents** a. Food Regulations and Standards - Sampling methods - Sample preparation for analysis; Official Methods of Food Analysis. b. Moisture in foods - determination by different methods – determination of ash content of foods, determination of dietary fiber and crude fiber. c. Determination of Total fat in foods by different methods; Analysis of oils and fats for physical and chemical parameters, Quality standards, and adulterants; different methods of determination of protein and amino acids in foods; determination of total carbohydrates, starch, disaccharides and simple sugars in foods. d. Basic Principles- Spectrophotometric analysis of food additives and food Components -IR Spectroscopy in online determination of components in foods; AAS and ICP-AES in mineral elements and toxic metals analysis; e. Chromatographic Techniques- Basic principles and types of: Paper chromatography, thin layer chromatography, column chromatography, Ion exchange chromatography, HPTLC, HPLC, UHPLC, GC,GC-MS, Types of detectors ,Uses and applications of chromatographic techniques.
5	**Teaching methods** Class lectures, case studies, group work, assigned readings and discussions.
6	**Assessment methods** The course is evaluated through various combinations of methods: final examinations, term papers, and oral presentations, individual study and group work This course will be graded as follows: Assignments 10%, Test(s) 20% Final Examination 70%
7	**This module is used in the following degree programmes as well** N/A
8.	**Responsibility for module** Prof. M.A. Idowu and Dr. (Mrs) G.O. Olatunde
9	**Other information** **Recommended materials** a. Nielsen, S. Suzanne (Ed.) (2010). Food Analysis. 4th edition, Springer, New York

	b. Fung, D.Y.C. and Matthews, R. (1991): Instrumental Methods for Quality Assurance in Foods, Marcel Dekker, Inc. New York. c. Skoog, D.A., Holler, F.H. and Nieman (1998): Principles of Instrumental Analysis Saunders College Publishing, Philadelphia. d. Gruenwedel, D.W.; Whitaker, J.R. (editors) (1984): Food Analysis Principles and techniques, Volumes 1 to 8, Marcel Dekker, Inc., New York. e. Herschdoerfer, S.M. (ed) (1968 – 1987): Quality Control in the Food Industry, Vols. 1 to 4, Academic Press, London. f. Pomeranz, Y. and MeLoan, C.E. (1996): Food Analysis: Theory and Practice; 3rd Edition, CBS Publishers and Distributors, New Delhi. g. Wilson and John Walker, (2010), Principles and Techniques of Biochemistry and Molecular Biology Keith Wilson and John Walker, Cambridge University Press. Related Academic Journals a. Journal of Food Composition and Analysis (Wiley) b. Food Chemistry (Elsevier) c. Journal of Food Science (Wiley)
	Important Note This course is a 2-unit course based on the credit system in use in Nigeria. Students are however, expected to devote about 120 hours to learning of the course content, including participation in 30 hours of course lectures and demonstrations, and 90 hours of self-study (assigned reading, personal studies, assignments, group work and hands-on practice using econometric software to analyse data). Hence, the course is of 4.0 ECTS credit equivalent.

TOPICS IN RAW MATERIAL SOURCING					
Module code FPV 816	**Student workload** 120 hours	**Credits** 4.0 ECTs	**Semester** Second Semester	**Frequency** One time in each Second Semester	**Duration** 15 weeks

1	**Types of courses** a) Class Work b) Seminars c) Students' Presentation	**Contact hours** 30 hours	**Independent study** 90 hours	**Class size** Avg of 10 (Max 20)
2	**Prerequisites for participation** Participation in the course is optional for student admitted for M. AgSE Participation is also always subject to confirmation of student registration for the course.			
3	**Learning outcomes** On successful completion of this course students will be able to:			

	a. Define raw materials b. Understand different classes of food raw materials. c. Status of food and beverage industries in Nigeria. d. Key raw materials used in the food industries. e. Primary Agricultural raw materials and their availability. f. Methods for sourcing raw materials. g. Qualities of good sourcing agents h. Constraints and prospects of raw material sourcing agents i.
4	**Subject aims/contents** **Course Contents** - Raw materials source- implications in food processing. -Raw material needs of different sectors of the food industry. -Developments in local sourcing of raw materials in Nigeria's food industry. -Raw materials alternatives.
5	**Teaching methods** Project work, case studies, group work, lectures and discussions
6	**Assessment methods** Individual Presentations, Group Assignments, Continuous Assessment, Written end-of-the-semester examination Continuous Assessment Tests (20%), Assignment (10%) and Examination (70%)
7	**This module is used in the following degree programmes as well** N/A
8	**Responsibility for module** Dr. A.O. Obadina and Dr. (Mrs.) O.E. Kajihausa
9	**Other information** **References**
	Important Note: This course is a 2-unit course based on the credit system in use in Nigeria. Students are however, expected to devote a total of 120 hours of learning to the course, including participation in 30 hours of course lectures and demonstrations, and 90 hours of self-study (assigned reading, personal studies, assignments, group work and hands-on practice). Hence, the course is of 4.0 ECTS credit equivalent.

FOOD LAWS, LEGISLATION AND POLICY						
Module code FPV 817		**Student workload** 120 hours	**Credits** 4.0 ECTs	**Semester** First Semester	**Frequency** One time in each First Semester	**Duration** 15 weeks
1	**Types of courses** a) Class Work b) Seminars c) Students' Presentation		**Contact hours** 30 hours	**Independent study** 90 hours	**Class size** Avg of 10 (Max 20)	
2	**Prerequisites for participation** Participation in the course is optional for student admitted for M. AgSE Participation is also always subject to confirmation of student registration for the course. Sttudent must have successfully completed Food Additives, Safety and Toxicology at Undergraduate level.					
3	**Learning outcomes** On completion of the learning event the student should be able to: a. Explain food laws, its philosophy and evolution. b. Define food standards, statutory regulations/legislation and codes of practices. c. Demonstrate deep understanding of the international regulations and requirements for food exports and/or imports e.g. EU regulations, FDA, etc. d. Describe international, regional and national legislations on pesticide applications and residues in foods e.g access to pesticides, regulatory control of pesticides. e. Describe the various international conventions on pesticides regulations and use e.g. The Rotterdam Convention, The Stockholm Convention, The Basel Convention f. Understand the basic principles of policy formulation and implementation and conceptual frameworks in agricultural policy processes. g. Understand and describe participatory appraisal of community food and nutrition. h. Demonstrate learning and apply principles of nutritional surveillance to access the nutritional status and needs of a community. i. Understand the several agricultural policy and programs gaps in the nation's quest for food and nutrition security						
4	**Subject aims/contents** **Course Contents** a. Food law, its philosophy and development. b. Food standards, codes to practice and statutory regulations. c. Food export and regulations. Legislations on food additives. d. Toxic substances in food. Detoxification of food and avoidance of contamination. e. Legislation on pesticide application to food raw materials and products.					

	f. Food, Nutrition and Economic development. g. Conceptual framework for food policy development. h. Food and Nutritional situation appraisal. Policy formulation and implementation. i. Organization and coordination, monitoring and evaluation of food and nutrition policy. j. Review of Agricultural Policy in Nigeria
5	**Teaching methods** project work, case studies, group work, lectures, discussions
6	**Assessment methods** Individual Presentations, Group Assignments, Continuous Assessment, Written end-of-the-semester examination Continuous Assessment Tests (20%), Assignment (10%) and Examination (70%)
7	**This module is used in the following degree programmes as well** N/A
8	**Responsibility for module** Prof. T.A. Shittu and Dr. A.A. Adebowale
9	**Other information** **References** a. FSSAI (2011). Food safety and standards (Food product standards and Food Additives) regulation. b. Neal D. Fortin. (2009). Food regulation, Wiley Publishers. c. Naomi Rees. David Watson. (2000). International standards for food safety, Aspen Publications. d. Assuring food safety and quality. (2012). FAO Food and Nutrition Manual., FAO publications, Rome. Related Academic Journals
	Important Note: This course is a 2-unit course based on the credit system in use in Nigeria. Students are however, expected to devote a total of 120 hours of learning to the course, including participation in 30 hours of course lectures and demonstrations, and 90 hours of self-study (assigned reading, personal studies, assignments, group work and hands-on practice). Hence, the course is of 4.0 ECTS credit equivalent.

PROCESS AND PLANT DESIGN FOR THE FOOD INDUSTRY					
Module code FPV 818	**Student workload** 120 hours	**Credits** 4.0 ECTs	**Semester** Second Semester	**Frequency** One time in each Second Semester	**Duration** 15 weeks

1	**Types of courses**	**Contact hours**	**Independent study**	**Class size**
	a) Class Work	30 hours	90 hours	Avg of 10 (Max 20)

	b) Seminars c) Students' Presentation			
2	**Prerequisites for participation** Participation in the course is optional for student admitted for M. AgSE Participation is also always subject to confirmation of student registration for the course. Student must have successfully completed Food Plant Design and Pilot Demonstration at Undergraduate level			
3	**Learning outcomes** On completion of the learning event the student should be able to: a. Be able to conduct feasibility studies leading to optimal food plant design from technical and economic perspectives b. Have clear idea of how manufacturing scale relate with process/plant design task, economics of the process as well as food business management. c. Be skilful to act as a good team member and coordinate activities in any food process and food plant design task d. Acquire advanced skill in writing business proposal or technical report proposing establishment of a food plant e. Be knowledgeable in determining plant safety issues attached to any defined food plant operation			
4	**Subject aims/contents** **Course Contents** a. Principles of process design including material and energy balance, b. flow sheeting, utilities systems, equipment specification and materials selection. c. Technical and economic aspects of plant design. d. Optimization of process and plant design. e. An independent investigation of a food processing system.			
5	**Teaching methods** project work, case studies, group work, lectures, discussions			
6	**Assessment methods** Individual Presentations, Group Assignments, Continuous Assessment, Written end-of-the-semester examination Continuous Assessment Tests (20%), Assignment (10%) and Examination (70%)			
7	**This module is used in the following degree programmes as well** N/A			
8	**Responsibility for module** Prof. T.A. Shittu and Dr. A.A. Adebowale			

9	**Other information** **References** Plant design and economics for chemical engineers by Max S. Peters., Klaus D. Timmerhaus.4th ed. McGraw-Hill Publishers
	Important Note: This course is a 2-unit course based on the credit system in use in Nigeria. Students are however, expected to devote a total of 120 hours of learning to the course, including participation in 30 hours of course lectures and demonstrations, and 90 hours of self-study (assigned reading, personal studies, assignments, group work and hands-on practice). Hence, the course is of 4.0 ECTS credit equivalent.

ADVANCED QUALITY MANAGEMENT					
Module code FPV 819	**Student workload** 120 hours	**Credits** 4.0 ECTs	**Semester** First Semester	**Frequency** One time in each First Semester	**Duration** 15 weeks

1	**Types of courses**	**Contact hours**	**Independent study**	**Class size**
	a) Class Work b) Seminars c) Students' Presentation	30 hours	90 hours	Avg of 10 (Max 20)

2	**Prerequisites for participation** Participation in the course is optional for student admitted for M. AgSE Participation is also always subject to confirmation of student registration for the course. Student must have successfully completed Food Plant Design and Pilot Demonstration at Undergraduate level
3	**Learning outcomes** On completion of the learning event the student should be able to: a. Decipher the interrelationship between quality assurance and control as well as establishment of quality management systems b. Define physical, chemical and biological qualities of food as well quality factors influencing consumer acceptability and safety. c. Demonstrate deep understanding of the principles and concepts of total quality management systems/techniques, operational quality control and practical quality enhancement strategies in the food industry. d. Have a good grasp of statistical quality control tools such as control charts and limits, Hoshin management theories, regression modelling and optimization functions/equations. e. Exposed to recent development in international, regional and national quality certification, monitoring and enforcement e.g. ISO, codex Alimentarius, Standard Organization of Nigeria (SON) f. Describe the effect of various food processing, packaging and preservation techniques on

	nutritional, microbiological and sensory qualities of foods. Determination of yield, record keeping GAP, GMP, and GHP in food processing and handling. g. Demonstrate learning and apply principles of Hazard Analysis Critical Control Points (HACCP), microbiological criteria and the use of microbiological analysis to monitor food quality and safety. h. Understand the principles and techniques of food plant sanitation e.g. Cleaning in Place (CIP) techniques.
4	**Subject aims/contents** **Course Contents** a. Evolution of quality concepts, customer focus, total quality management, operational quality management, quality control and quality improvement. b. Evolution of quality management methodologies, i.e. statistical technique, Hoshin management. c. Quality function deployment, standards on quality management system i.e. ISO 9000 Standard. d. Effects of raw material quality and the various types of food processing on yield and quality of product. e. Sanitation in the food industry.
5	**Teaching methods** project work, case studies, group work, lectures, discussions
6	**Assessment methods** Individual Presentations, Group Assignments, Continuous Assessment, Written end-of-the-semester examination Continuous Assessment Tests (20%), Assignment (10%) and Examination (70%)
7	**This module is used in the following degree programmes as well** N/A
8	**Responsibility for module** Dr. A.A. Adebowale and Dr. (Mrs.) A.T. Omidiran
9	**Other information** **References** a. Hubbard, Merton R. Statistical quality control for the food industry/Merton R. Hubbard—3rd ed. Kluwer Academic / Plenum Publishers b. Food process modelling. Edited by LMM Tijskens, MLATM Hertog and BM Nicola. Published 2001, Woodhead Publishing Limited and CRC Press LLC c. Ronald H. Schmidt and Gary E. Rodrick. Food Safety Handbook. A John Wiley & Sons Publication Relevant Academic Journals -Journal of Food Quality Preference
	Important Note:

	This course is a 2-unit course based on the credit system in use in Nigeria. Students are however, expected to devote a total of 120 hours of learning to the course, including participation in 30 hours of course lectures and demonstrations, and 90 hours of self-study (assigned reading, personal studies, assignments, group work and hands-on practice). Hence, the course is of 4.0 ECTS credit equivalent.

STUDENTS WORKLOAD AND COURSE DESCRIPTION FOR PhD. AgSE IN FOOD PROCESSING AND VALUE ADDITION PROGRAM

ADVANCES IN STATISTICAL METHODS IN FOOD PROCESSING					
Module code FPV 902	**Student workload** 180 hours	**Credits** 7.0 ECTs	**Semester** Second Semester	**Frequency** One time in each Second Semester	**Duration** 15 Weeks

1	**Types of courses**	**Contact hours**	**Independent study**	**Class size**
	a) Class Work b) Seminars c) Practicals	75 hours	135 hours	Avg of 10 (Max 20)

2	**Prerequisites for participation** a) Participation in the course is compulsory for all students admitted for PhD.AgSE b) Participation is subject to confirmation of student registration for the course c) Participation is subject to being a graduate of M.AgSE (FPV) or MSc (Food Science and Technology).
3	**Learning outcomes** By the end of the course the student will: 1) be familiar with the application of statistical procedures in Food processing 2) know the main concepts of descriptive statistics such as analysis of difference, test of significance, correlation and regression 3) know how to carry out sensory analysis and analyse the data as well as relationship between sensory and instrumental data 4) able to formulate, estimate, and test complete instrumental data 5) be able to use appropriate experimental design for product formulation and analyse the data 6) be familiar with principles of statistical quality control and its importance in the food industry; 7) know the use and limitations of control charts in food quality control; 8) know of possibilities and limitations of different multivariate methods in food product design; 9) familiar with the use of response surface methodology in food product design as well mixture design in ingredient selection
4	**Subject aims/ Contents** Applications of statistical procedures in food processing, Descriptive statistics, Analysis of differences, Types of significance test, Association, correlation and regression and Experimental design. Sensory and consumer data: Introduction, The quality and nature of sensory and consumer data, Experimental design issues, Consumer data (sensory and survey), Trained panel sensory

	data, Analysis of relationships. Instrumental data: Introduction, Quality and nature of instrumental data, Sampling and replication, Experimental design issues, Statistical analysis of instrumental data, Chemical analysis applications, Analysis of relationships. Food product formulation: Introduction, Design application in food product development, Single ingredient effects, Two or more ingredients, Screening of many ingredients, Formulation by constraints. Statistical quality control: Introduction, Types of statistical quality control, Sampling procedures, Control charts, Acceptance sampling. Multivariate applications: Introduction, Multivariate methods and their characteristics, Multivariate modes, Relationship of consumer preference with sensory measures Principal component analysis, Chemometrics, Partial least square, Response surface methodology, Mixture design, Fractal analysis, Cluster analysis, ANN and Fuzzy logic
5	**Teaching methods** Class lectures, case studies, group work, assigned readings and discussions.
6	**Assessment methods** The course is evaluated through various combinations of methods: final examinations, term papers, and individual study and group work This course will be graded as follows: Assignments 10%, Test(s) 20%, Oral presentation 20% Final Examination 50%
7	**This module is used in the following degree programmes as well** Nil
8.	**Responsibility for module** Dr. O.P Sobukola and Dr. (Mrs.) A.T. Omidiran
9	**Other information** **1. Recommended materials**
	2. Important Note This course is a 3-unit course based on the credit system in use in Nigeria. Students are however, expected to devote a total of 180 hours of learning to the course, including participation in 75 hours of course lectures and practicals, and 135 hours of self-study (assigned readings, personal studies, assignments, group work and hands-on practice using statistical software to analyse data and prepare the report). Hence, the course is of 7.0 ECTS credit equivalent.

ADVANCES IN FOOD PROCESSING TECHNOLOGY

Module code	Student workload	Credits	Semester	Frequency	Duration
FPV 903	210 hours	7.0 ECTS	First Semester	Once in each First Semester	15 Weeks

1	Types of courses	Contact hours	Independent study	Class size
	a) Class Work b) Seminars c) Practicals	75 hours	135 hours	Avg of 10 (Max 20)

2 Prerequisites for participation

a) Participation in the course is compulsory for all students admitted for PhD.AgSE

b) Participation is subject to confirmation of student registration for the course

c) This unit builds upon and extends the theoretical foundations laid in Food Processing and Preservation Technology.

3 Learning outcomes

On successful completion of the course, students should be able to

a) understand the status of application of emerrging technologies in Food processing

b) Identify the equipment and explain behind the application of high pressure processing in reduing microbial population during meat product processing

c) have knowledge of application of hurdle technoogy in food processing

d) know the techniques involved in the use of ultrasonic processing in development and preservation of food products

e) better understanding of the principle and application of high intensity light in food processing

f) Apply the principle of pulsed electric field intreatment of food materials

g) Understand and be able to apply the principle of cold plasma technology in Food processing

4 Subject aims/ Contents

Emerging technology in food processing- Active and intelligent packaging, membrane technology, high pressure processing, pulsed electric field intensity, Ultra sound. Supercritical fluid extraction: Concept, property of near critical fluids. Application of SCFE in food processing. Microwave and radio frequency, IR drying: Definition, Advantages, mechanism of heat generation, inductive heating in food processing and preservation. Application in food processing: microwave blanching, sterilization and finish drying. Hurdle technology: Types of preservation techniques and their principles, concept of hurdle technology and its application.

High Pressure processing: Types of equipment, mechanism of microbial inactivation. Effect of HPP on meat products, jam. Ultrasonic processing: Properties of ultrasonic, types of equipment, effect of ultrasonic treatment on microbial inactivation of food products etc. High intensity light generation system, Application of high intensity light in food processing, Pulse electric field-mechanism of inactivation, PEF generation system, PEF treatment chambers, Mechanism of ohmic heating and its application in liquid food processing, Principle of cold plasma technology and its generation systems

	and its application. Nanotechnology: Principles and its applications in foods.
5	**Teaching methods** Class lectures, case studies, practical/group work, assigned readings and discussions.
6	**Assessment methods** This course will be graded as follows: Assignments 10%, Test(s) 20%, Oral presentation 20% Final Examination 50%
7	**This module is used in the following degree programmes as well** Nil
8.	**Responsibility for module** Prof. T.A. Shittu
9	**Other information** **Recommended materials** a. Barbosa-Canovas (2002). Novel Food Processing Technologies. CRC. b. Dutta, A.K. and Anantheswaran, R.C. (1999). Hand Book of Microwave Technology for Food Applications. Frame, N.D. (Ed.). (1994). The Technology of Extrusion Cooking. Blackie. Gould, G.W. (2000). New Methods of Food Preservation. CRC. Related Academic Journals -Journal of Food Processing and Preservation (Wiley) -Annals of Food Processing and Preservation (JSciMed Central) -Journal of Food Processing & Technology (OMICS International) -Journal of Food Science and Technology (Springer) - International Journal of Food Science and Technology (Wiley)
	2. Important Note This course is a 3-unit course based on the credit system in use in Nigeria Students are however, expected to devote a total of 210 hours of learning to the course, including participation in 75 hours of course lectures and practicals, and 135 hours of self-study (assigned readings, personal studies, assignments, group work and hands-on practice using statistical software to analyse data and prepare the report). Hence, the course is of 7.0 ECTS credit equivalent.

SUSTAINABLE FOOD AND BIO-PROCESSING

Module Code:	Student workload	Credits (according to ECTS)	Semester	Frequency	Duration
FPV 904	120 hours	6.0	First Semester	Once every academic session by the Second Semester	15 Weeks

1	Types of courses	Contact hours	Independent study	Class size
	a) Class Work b) Tutorial Classes c) Students' Presentation	30 hours	90 hours	Avg. of 10 (Max 20)

2 Prerequisites for participation

Graduate-level knowledge of statistics, mathematical economics, and econometric methods, demonstrated by achieving at least 50% pass in relevant Master's level courses.

3 Learning outcomes

After successful completion of this course students are expected to be able to:
- prepare Sankey diagrams for heat and mass, in food and bioprocess systems;
- apply pinch analysis to relatively complex (continuous) production systems, identify options for improvement and synthesize the optimal exchanger network;
- prepare Grassmann diagrams for exergy flow and destruction in food and bioprocess systems;
- analyse process systems with exergy analysis, identify thermodynamic efficiencies locally or globally, and relate this to practical issues and options for improvement;
- suggest improvements both in unit operations and in larger-scale production systems;
- synthesize an overall vision on process efficiency and limitation and possibilities for improvement of sustainability in production processes.

4 Subject aims/contents

Challenges of producing high quality food products from environmentally friendly and efficient natural resources in Nigeria and West Africa; Factors affecting choice of production methods; Application of new milder methods resulting in efficient use of raw materials and enhancement of product distribution; use of alternative ingredients for similar existing products and its effect on better use of land, energy and water; evaluation of existing and new processing technologies for optimal use of resources; use of different instruments to evaluate and sustain process system design (from large scale supply chain, factory level, down to product and unit operation level) on efficient use of raw materials, energy, and water; use of Sankey diagrams to visualize mass, water and energy balances over complex systems; fundamental concepts of the quality of different stream (exergy) using Grassman diagrams.

5 Teaching methods

Lectures; assigned reading, critique and replication (hands-on practice using local data) and discussions.

6 Assessment methods

Performance in the course will be assessed by a combination of assignments (10%), a Mid Semester Test

	(15%), a term paper (25%) and a final examination (50%). .
7	**This module is used in the following degree programmes as well** Nil
8	**Responsibility for module** Dr. O.P. Sobukola and Dr. (Mrs.) Celestina Omohinmi
9	**Other information** **References** **Important Note** This course is a 3-unit course based on the credit system in use in Nigeria. It is delivered through 45 hours of class lectures and demonstrations. Students are however, expected to devote about 180 hours to learning of the course content, including participation in 45 hours of course lectures and demonstrations, and 135 hours of self-study (assigned reading, personal studies, assignments, group work and hands-on practice using econometric software to analyse data). Hence, the course is of 6.0 ECTS credit equivalent.

ADVANCES IN DAIRY AND FOOD PACKAGING					
Module code FPV 905	**Student workload** 210 hours	**Credits** 7.0 ECTS	**Semester** First Semester	**Frequency** One time in each First Semester	**Duration** 15 Weeks

1	**Types of courses** a) Class Work b) Practicals c) Students' Presentation	**Contact hours** 75 hours	**Independent study** 135 hours	**Class size** Avg of 10 (Max 20)
2	**Prerequisites for participation** Participation is subject to confirmation of student registration for the course Participation is subject to undersgraduate knowledge of Dairy Science and Packaging Technology as well as postgradute knowledge of Advanced Food Packaging			

3	**Learning outcomes** After the completion of this course, the Students will be able to: a) understand the current status of food packaging in Nigeria and West Africa b) select proper packaging material and conduct test on the packaged product c) understand the processes involved in packaging dairy, convenience foods and meat products d) explain the principle involved in modified atmosphere packaging (MAP) and controlled atmosphere packaging (CAP) e) understand the principle and technology involved in using microwavable, biodegradable and edible packages for meat, poultry and dairy products f) know the stages involved in industrial packaging of food materials g) understand how to prevent shock damage to packaged food materials especially during transportation h) appreciate safety issues of different packaging materials
4	**Subject aims/contents** **Course Contents** Status of current packaging in Nigeria and West Africa; types of packaging materials; criteria for selection of proper packaging; testing of packaging materials. Adhesives; graphics; coding, and labeling used in food packaging. Protective packaging of foods; packaging of food products sensitive to oxygen, light, moisture; active packaging; special problems in canned foods. Packaging of dairy products; packaging of convenience foods, packaging of meat and poultry: Modified atmosphere packaging, controlled atmosphere packaging, shrink and stretch Packaging. Retort pouch technology, microwavable, biodegradable, and edible packages. Industrial packaging: unitizing, palletizing, containerizing, distribution systems for packaged foods including prevention of shock damage to articles during transportation; Safety aspects of packaging materials; sources of toxic materials and migration of toxins into food materials..
5	**Teaching methods** Lectures, sharing of materials via learning tools, global scenarios on packaging concepts, review of journal articles, practicals, group work, individual presentations, and discussions
6	**Assessment methods** Individual practical test/Assignments 20%, paper presentations (20%), Final Examination 60%
7	**This module is used in the following degree programmes as well** Nil
8	**Responsibility for module** Prof. M.A. Idowu
9	**Other information** **a) References** Ahvenainen, R. (2001). Novel Food Packaging Techniques. CRC. Crosby, N.T. (1981). Food Packaging Materials. App. Sci. Publ. Mahadeviah, M. and Gowramma, R.V. (1996). Food Packaging Materials. Tata McGraw Hill. Painy, F.A. (1992). A Handbook of Food Packaging. Blackie.

	Palling, S.J. (1980). Developments in Food Packaging. App. Sci. Publ. Rooney, M.L. (1988). Active Food Packaging. Chapman & Hall. Sacharow, S. and Griffin, R.C.(1980). Principles of Food Packaging. AVI Publ. Related Academic Journals
	2. Important Note This course is a 3-unit course based on the credit system in use in Nigeria. Students are however, expected to devote a total of 210 hours of learning to the course, including participation in 75 hours of course lectures and practicals, and 135 hours of self-study (assigned readings, personal studies, assignments, group work and hands-on practice using statistical software to analyse data and prepare the report). Hence, the course is of 7.0 ECTS credit equivalent.

TECHNOLOGY OF PROCESSED MEAT					
Module Code: FPV 906	**Student workload** 210 hours	**Credits** (according to ECTS) 7.0	**Semester** Second Semester	**Frequency** Once every academic session by the Second Semester	**Duration** 15 Weeks

1	**Types of courses** a) Class Work b) Practical c) Students' Presentation	**Contact hours** 75 hours	**Independent study** 135 hours	**Class size** Avg of 10 (Max 20)
2	**Prerequisites for participation** Participation is subject to confirmation of student registration for the course Graduate-level knowledge of Livestock processing for M.AgSE graduates			
3	**Learning outcomes** After the completion of this course, the Students will be able to: a) Explain the handling, transportation and storage of meat to enhance quality b) Select and apply appropriate processing methods for the intended value added products from meat c) Expand the frontier of knowledge through evidence-based research in meat products development d). understand and apply the use of appropriate procedures, materials and formulations in the development of functional meat products e) know and apply the new methods applicable for decontamination of meat			
4	**Subject aims**			

	The aim of the module is to a. Equip students with sound knowledge of the theoretical and practical applications of a wide array of processing methods for meat including smoking, cooking, value addition, canning, curing etc. b. Prepare students for a successful research career in the area of value addition to meat to meet specific nutritional needs. **Course Contents** Meat: Handling, transportation and storage. Curing of meat: Curing ingredients and curing methods. Meat smoking: Purpose, production, deposition of smoke on meats, methods of smoking, liquid smoke preparation and its application. Meat cookery and cooked meat products. Meat cooking: Sausages, classification, fermented meat products, sausage formulations, casings, extruders & additives. Herbs, spices & condiments in processed meats. Types of cured &smoked meats. Reduced & low fat meat products. Canned meat formulations, restructured meat products, procedures, raw materials & formulations. Development of functional meat products. Cold storage, food freezing of meat. Quality control and sanitation. Sensory analysis of meat, New developments in decontaminating raw meat. Visits to the meat industries.
5	**Teaching methods** Lectures, practicals, assigned readings of scientific publications applying various processing methods to meat, group work, individual presentations, and discussions.
6	**Assessment methods** Assignments & Quizzes (20%), Practical Report & Presentation (20%) and Final Examination (60%)
7	**This module is used in the following degree programmes as well** Nil
8	**Responsibility for module** Prof. S.O. Awonorin and Dr. (Mrs.) O.E. Kajihausa
9	**Other information** **References** a. Sahoo, J and Chatli, M. K. (2016). Textbook on meat, Fish and Poultry Technology, Daya publ., New Delhi. b. Collins, D.S. and Huey, R.J. (2015). Gracey's meat Hygiene , John Wiley & Son Ltd, UK c. Sam, A.R, (2001). Poultry meat processing CRC Press Taylor & Francis Group d. Hui, Y.H. (2001). Meat Science and Applications. Marcel Dekker. e. Kerry, J. (2002). Meat Processing. Woodhead Publ. CRC Press. f. Levie, A. (2002). Meat Hand Book. 4th Ed. AVI Publ. g. Mead, M. (2004). Poultry Meat Processing and Quality. Woodhead Publ. Related Academic Journals **2. Important Note**

	This course is a 3-unit course based on the credit system in use in Nigeria. Students are however, expected to devote a total of 210 hours of learning to the course, including participation in 75 hours of course lectures and demonstrations, and 135 hours of self-study (assigned readings, personal studies, assignments, group work and practicals). Hence, the course is of 7.0 ECTS credit equivalent.

ADVANCES IN RESEARCH METHODOLOGY					
Module code FPV 907	**Student workload** 180 Hours	**Credits** 4.0 ECTs	**Semester** First Semester	**Frequency** One time in each First Semester	**Duration** 15 Weeks

1	**Types of courses** a) Class work b) Hands–on Practical c) Students' Presentation	**Contact hours** 30 hours	**Independent study** 90 hours	**Class size** Avg. of 10 (Max 20)
2	**Prerequisites for participation** a) Participation in the course is compulsory for all students admitted for PhD.AgSE b) Participation is subject to confirmation of student registration for the course c) Basic statistics, knowledge of computer and research methods			
3	**Learning outcomes** **General Competence** On successful completion of the course, students should be able to a. has advanced knowledge of the research process b. identify research problems from practical problems c. Write research questions and hypotheses d. has advanced knowledge of data collection techniques relative to Food Processing and Value Addition e. has advanced understanding of quantitative and qualitative methodologies and their applications **Skills** Upon successful completion of the course, the student will be able to: a. construct a problem statement and evaluate it is soundness b. utilise quality assurance techniques to create sound research proposals c. construct and evaluate a methodology to answer the problem statement d. apply statistical analysis and mathematical modelling techniques on data e. set up a research laboratory to conduct problem based research			
4	**Subject aims/ Contents** Basic concepts of research, Planning and organization of experiments for data acquisition and analysis. Type of research methods, experimental designs, equipment and principles underlying their uses. Scientific periodicals and literature related to the subject. Form and style of writing			

	research papers, review articles, research reports and thesis. Selection of research problem and preparation and submission of research projects. Interpretation and evaluation of research data, considerations and requirements for setting up a research laboratory.
5	**Teaching methods** Group work, lectures, discussion, Scenario technique, practical demonstrations.
6	**Assessment methods** Continuous Assessment Tests, Home-works, term paper presentations, practical and examination
7	**This module is used in the following degree programmes as well** N/A
8.	**Responsibility for module** All Academic Supervisors on the programme
9	**Other information** **Recommended materials** a. Cochran, W.G. and Cox, G.M. (1957). Experimental Designs. 2nd Ed. John Wiley. b. Dean, A.M. and Voss, D. (1999). Design and Analysis of Experiments. Springer. c. Federer, W.T. (1985). Experimental Designs. MacMillan. d. Fisher, R.A. (1953). Design and Analysis of Experiments. Oliver & Boyd. e. Creswell, J. W. (2018). Research design: Qualitative, quantitative and mixed methods approaches. 5th Ed. Thousand Oaks, CA: Sage. Related Academic Journlas -International Journal of Food Engineering -Journal of Food Process Engineering (Wiley) -Journal of Food Processing and Preservation (Wiley) -Journal of Food Engineering (Elsevier)
	2. Important Note This course is a 2-unit course based on the credit system in use in Nigeria. Students are however, expected to devote about 180 hours to learning of the course content, including participation in 30 hours of course lectures and demonstrations, and 90 hours of self-study (assigned reading, personal studies, assignments, group work and hands-on practice using statistical softwares to analyse data). Hence, the course is of 4.0 ECTS credit equivalent.

FOOD LEGISLATIONS, STANDARD AND SAFETY QUALITY MANAGEMENT SYSTEMS						
Module code FPV 908		**Student workload** 180 hrs	**Credits** (according to ECTS) 6.0 ECTS	**Semester** 1st. Sem.	**Frequency** Each First Semester	**Duration** 15 Weeks
1	**Types of courses** a) Class Work b) Seminars c) Students' Presentation		**Contact hours** 45 hours		**Independent study** 135 hours	**Class size** Avg of 10 (Max 20)
2	**Prerequisites for participation** Participation is subject to confirmation of student registration for the course					
3	**Learning outcomes** After the completion of this course, the Students will be able to: a) consider and understand the Nigerian legal system in relation to food safety. b) have an overview of food safety regulations in Nigeria and West Africa. c) understand the concept of food safety issues in Nigeria and the role of different government agencies d) understand the concept of International standards as in relation with food materials. e) know the concept of shelf life of foods and well as how to determine shelf stability of food products. f) identify and understand different food safety management systems application in the food distribution chain. (g) Learn the importance of safety audits in relation with food (n) describe recent historical and current trends in barriers to international trade.					
4	**Subject aims** The aim of the module is to: a. Sensitize the students about the Nigerian and International legal system involving food safety regulations. b. Create awareness on International standards and food safety issues c. Emphasize in the students the need to imbibe the culture of some practises such as GMP, GHP, Food sfaety plan etc d. Sharpen the knowledge and skills of students in application of HACCP and the role of FAO, WHO and other international organizations in food safety **Course Contents** Introduction to food - its nutritional, technological and safety aspects. Introduction to Nigerian legal system, an overview of food regulations in Nigeria. Food safety and standards act and role of NIS, SON, NAFDAC. Various food plant inspection bodies and legislations. International Standards: Codex Alimentarius: Structure of organization, standards related to Nigerian foods. Introduction to food safety: definition, food safety issues, factors affecting food safety, importance of safe foods. Shelf life of food products: factors affecting shelf life and methods to check the shelf life. Good					

	Hygienic Practices (GHP), Good Manufacturing Practices (GMP), Food Safety Plan, Food Safety Management Risk Analysis. Traceability, food product recall. Food safety Management Systems: ISO 22000: Importance of implementing a HACCP system and how it can be applied to various products, develop a HACCP plan including a HACCP team, produce product workflow diagrams for a range of products and their verification processes etc. Audits: Introduction, objectives, documentation, responsibilities, management review, audit certification and its importance etc. ISO 14000: Introduction, various standards among 14000 series, certification and its importance, various clauses of 14001. ISO 17025 - General requirements for the competence off testing and calibration laboratories. World Trade Organization (WTO), Sanitary and Phytosanitary Measures and Technical Barriers to Trade, Food and Agriculture Organization (FAO), World Health Organization (WHO), World Animal Health Organization, Export – Import of Food.
5	**Teaching methods** Lectures, sharing of materials via learning tools, global scenarios on agricultural topics, case studies, group work, individual presentations, and discussions
6	**Assessment methods** Individual Presentations, Group Assignments, Continuous Assessment, Summative Assessment, Written end-of-the-semester examination Individual Assignments 10%, Test(s) 10%, Policy paper presentation (10%), Final Examination 70%
8	**Responsibility for module** Prof. Luke O. Okojie
9	**Other information** **References** a. FSSAI (2011). Food safety and standards (Food product standards and Food Additives) regulation. b. Neal D. Fortin. (2009). Food regulation, Wiley Publishers. c. Naomi Rees. David Watson. (2000). International standards for food safety, Aspen Publications. d. Assuring food safety and quality. (2012). FAO Food and Nutrition Manual., FAO publications, Rome. Related Academic Journals
	Important Note: This course is a 3-unit course based on the credit system in use in Nigeria. Students are however, expected to devote a total of 210 hours of learning to the course, including participation in 45 hours of course lectures and demonstrations, and 135 hours of self-study (assigned readings, personal studies, assignments, group work and hands-on practice using statistical software to analyse data and prepare the report). Hence, the course is of 6.0 ECTS credit equivalent.

ADVANCES IN EXPERIMENTAL DESIGN

Module code	Student workload	Credits	Semester	Frequency	Duration
FPV 909	120 hours	4.0 ECTS	Second Semester	One time in each Semester	15 Weeks

	Types of courses	Contact hours	Independent study	Class size (Potential)
1	a) Class Work b) Seminars c) Students' Presentation	30 hours	90 hours	Avg. of 10 (Max 20)

2 Prerequisites for participation

Basic knowledge of design of experiments and research methodology

3 Learning outcomes

After the completion of this course, the Students will:

a) have mastered how to design an experiment to solve problem based research using appropriate techniques;

b) be able to competently interpret results of different experimental techniques

4 Subject aims

The aim of the module is to make students to be self-sufficient in:

1. skills required for design of experiments, selection of appropriate designs, formulating mathematical models, theories and principles using appropriate experimental techniques;
2. hypotheses formulation for experimental design and data analysis;
3. analytical result interpretation and statistical inferences using appropriate methods.

Course Contents

Need for designing of experiments, characteristics of a good design. Basic principles of designs-randomization, replication and local control. Uniformity trials, size and shape of plots and blocks; Analysis of variance; Completely randomized design, randomized block design and Latin square design. Factorial experiments, (symmetrical as well as asymmetrical). orthogonality and partitioning of degrees of freedom, Confounding in symmetrical factorial experiments, Factorial experiments with control treatment. Split plot and strip plot designs; Analysis of covariance and missing plot techniques in randomized block and Latin square designs; Transformations, crossover designs, balanced incomplete block design, resolvable designs and their applications ~ Lattice design, alpha design - concepts, randomization procedure, analysis and interpretation of results. Response surfaces. Experiments with mixtures.

5 Teaching methods

Lectures, material sharing via learning tools, case studies, group work, individual presentations and discussions

6 Assessment methods

	Grading scale:- Individual Presentation 30%, Group Assignments 10%, examination-60%
7	**This module is used in the following degree programmes as well** N/A
8	**Responsibility for module** Dr. O.P. Sobukola and Engr. K. Adegoke
9	**Other information** **1. Suggested Further Readings** a. Cochran, W.G. and Cox, G.M. (1957). Experimental Designs. 2nd Ed. John Wiley. b. Dean, A.M. and Voss, D. (1999). Design and Analysis of Experiments. Springer. c. Federer, W.T. (1985). Experimental Designs. MacMillan. d. Fisher, R.A. (1953). Design and Analysis of Experiments. Oliver & Boyd.
	2. Important Note This course is a 2-unit course based on the credit system in use in Nigeria. Students are however, expected to devote about 120 hours to learning of the course content, including participation in 30 hours of course lectures and demonstrations, and 90 hours of self-study (assigned reading, personal studies, assignments, and group work). Hence, the course is of 4.0 ECTS credit equivalent.

ADVANCES IN TECHNOLOGY OF FROZEN FOODS						
Module code FPV 910		**Student workload** 120 hours	**Credits** 4.0 ECTS	**Semester** Second Semester	**Frequency** One time in each Semester	**Duration** 15 Weeks
1	**Types of courses** a) Class Work b) Seminars c) Students' Presentation		**Contact hours** 30 hours	**Independent study** 90 hours	**Class size (Potential)** Avg. of 10 (Max 20)	
2	**Prerequisites for participation** Basic knowledge of Food Freezing and Cold Storage					
3	**Learning outcomes** After the completion of this course, the Students will: a) understand of glass transition and factors responsible during food freezing b) know and understand the different microbes associated with frozen foods and their effects on food quality c) be able to determine freezing times of different food materials using different techniques d) understand the recent innovative methods involved in Food freezing e) be able to access the quality and safety of frozen dairy, meat, and egg products f) understand some basic principle of chemical measurements of frozen foods g) be competent in analysing the sensory properties of frozen food materials h) know the principle and carry out shelf life prediction of frozen foods using various available models i) understand the underlining principle of frozen food package and the application different packaging materials					
4	**Subject aims** The aim of the module is to make students to be self-sufficient in: 1. skills required for selecting the most appropriate freezing methods, quality and safety assessment, sensory evaluation, packaging materials and shelf life prediction of frozen foods; **Course Contents** Glass transitions in frozen foods and biomaterials, Microbiology of frozen foods, Thermo-physical properties of frozen foods, freezing loads and Freezing time calculation, Innovations in freezing process. Freezing methods and equipment, Cold store design and maintenance, Transportation of frozen foods, Retail display equipment and management, Household refrigerators and freezers, Monitoring and control of the cold chain. Quality and safety of frozen dairy products. Quality and safety of frozen meat and meat product, Quality and safety of frozen poultry and poultry products,					

	Safety and quality of frozen fish, Shellfish, and related products, Quality and safety of frozen eggs and egg products. Chemical Measurements, Sensory analysis of frozen foods, Foodborne illnesses and detection of pathogenic microorganisms, Shelf-life prediction of frozen foods. Introduction to frozen food packaging, Plastic packaging of frozen foods, Paper and card packaging of frozen foods, packaging of frozen foods with other materials.
5	**Teaching methods** Lectures, material sharing via learning tools, case studies, group work, individual presentations and discussions
6	**Assessment methods** *Grading scale*:- Individual Presentation 30%, Group Assignments 10%, examination-60%
7	**This module is used in the following degree programmes as well** N/A
8	**Responsibility for module** Dr. O.P. Sobukola/Prof. S.O. Awonorin
9	**Other information** **Suggested Further Readings** 1. Erickson, M.C. and Hung, Y.C. () *Quality in Frozen Foods* 2. Legaretta. I.G. (). *Handbook of Frozen Foods* 3. Kennedy, C.J. (). *Managing Frozen Foods* CBS, New Delhi Related Academic Journals -International Journal of Food Engineering -Journal of Food Engineering (Elsevier) -International Journal of Food Science and Technology (Wiley)
	2. Important Note This course is a 2-unit course based on the credit system in use in Nigeria. Students are however, expected to devote about 120 hours to learning of the course content, including participation in 30 hours of course lectures and demonstrations, and 90 hours of self-study (assigned reading, personal studies, assignments, and group work). Hence, the course is of 4.0 ECTS credit equivalent.

ADVANCES IN FOOD ADDITIVES AND PRESERVATIVES

Module code	Student workload	Credits	Semester	Frequency	Duration
FPV 911	120 hours	4.0 ECTS	Second Semester	One time in each Semester	15 Weeks

	Types of courses	Contact hours	Independent study	Class size (Potential)
1	a) Class Work b) Seminars c) Students' Presentation	30 hours	90 hours	Avg. of 10 (Max 20)

2 Prerequisites for participation

Basic knowledge of Food Additives and Chemical Toxicology

3 Learning outcomes

After the completion of this course, the Students will:

a) understand the concept of food additives and their roles in food processing

b) be able to classify and evaluate the safety of different additives in food

c) be able to explain and apply the concept of GRAS, tolerance level and toxic levels of different additives

d) understand the presence of naturally occurring food additives, their classification, roles in food processing as well as health implications

e) be able to access the quality and safety of frozen dairy, meat, and egg products

f) understand some natural and synthetic colours used in food processing and the impact they have on health of consumers

g) be competent in aaplcation of preservatives of various types in food processing

h) know the principle and carry out application of antioxidants and chelating agents in food processing

i) understand the underlining principle of use of different stabilizers and thickners during food processing

4 Subject aims

The aim of the module is to make students to be self-sufficient in:

1. skills required for selecting the most appropriate additives of various types in achieving different purposes during food processing;

Course Contents

Introduction- what are food additives, role of food additives in food processing, functions, classification, intentional and unintentional food additives, toxicology and safety evaluation of food additives, beneficial effects of food additives/toxic effects, food additives generally recognized as safe (GRAS), tolerance levels and toxic levels in foods-LD 50 values of food additives. Naturally occurring food additives, classification, role in food processing, health implications, food colors, natural and synthetic food colors, types, their chemical nature and their impact on health. Preservatives, what are preservatives, natural preservation, chemical preservatives, their chemical action on foods and human system, Antioxidants and chelating agents, their role in foods, types of

	antioxidants – natural and synthetic, chelating agents, their mode of action in foods with examples. Surface active agents, their mode of action in foods with examples, stabilizers and thickeners with examples and their role in food processing, bleaching and maturing agents, examples of bleaching agents, what is maturing, examples of maturing agents and their role in food processing. Starch modifiers, chemical nature, their role in food processing, buffers- acids and alkalis, examples, types, their role in food processing, Sweeteners, what are artificial sweeteners and non-nutritive sweeteners, their health implications, role in food processing Flavoring agents, natural and synthetic flavors, examples and their chemical nature, role of flavoring agents in food processing, Anti-caking agents, their role in food processing, Humectants- definition, their role in food processing.
5	**Teaching methods** Lectures, material sharing via learning tools, case studies, group work, individual presentations and discussions
6	**Assessment methods** *Grading scale*:- Individual Presentation 30%, Group Assignments 10%, examination-60%
7	**This module is used in the following degree programmes as well** N/A
8	**Responsibility for module** Prof. M.A. Idowu/Dr. (Mrs.) G.O. Olatunde
9	**Other information** **Suggested Further Readings** 1. WHO (2004). Evaluation of certain Food Additives and Contaminants. Published by WHO 2. Schrenk, D. and Cartus, A. (2017). Chemical Contaminants and Residues in Foods. Woodhead Publishing. 3. Semir, O. (2016). Methods of Analysis of Food Components and Additives. CRC Press 4. Branen, A.L., Davidson, P.M., Salminen, S. and Thorngate, J.H. (2001). Food Additives. Published by Mercel Dekker 5. Baines, D. and Seal, R. (2018). Natural Food Additives, ingredients and flavouring. Elsevier Science and Technology. Related Academic Journals -Food Additives and Contaminants (Taylor and Francis) -International Journal of Food Contamination -International Journal of Food Science and Technology (Wiley)
	2. Important Note This course is a 2-unit course based on the credit system in use in Nigeria. Students are however, expected to devote about 120 hours to learning of the course content, including participation in 30 hours of course lectures and demonstrations, and 90 hours of self-study (assigned reading, personal studies, assignments, and group work). Hence, the course is of 4.0 ECTS credit equivalent.

<table>
<tr><th colspan="6">ADVANCES IN PHYSICAL AND ENGINEERING PROPERTIES OF FOODS AND BIOMATERIALS</th></tr>
<tr><td>Module code
FPV 912</td><td>Student workload
120 hours</td><td>Credits
4.0 ECTS</td><td>Semester
Second Semester</td><td>Frequency
One time in each Semester</td><td>Duration
15 Weeks</td></tr>
<tr><td>1</td><td colspan="2">Types of courses
a) Class Work
b) Seminars
c) Students' Presentation</td><td>Contact hours
30 hours</td><td>Independent study
90 hours</td><td>Class size (Potential)
Avg. of 10 (Max 20)</td></tr>
<tr><td>2</td><td colspan="5">Prerequisites for participation
-To be able to take this course, the students must be a graduate of Food Science and Technology and must have taken courses such as Food Engineering Applications and Unit Operation in Food Processing</td></tr>
<tr><td>3</td><td colspan="5">Learning outcomes
After the completion of this course, the Students will be able to:
-Describe and distinguish what physical and engineering properties of Food and biomaterial are, there importance and how they affect Food Processing Operations
-Demonstrate deep understanding of different properties of Foods such as physical, surface, functional, mechanical, thermal, electrical and optical
-Describe phase transition in these properties during Food Processing operation
-Describe the concept of sampling and sampling methods
-Describe in details the principle and techniques used in measuring these properties and they affect the overall quality of final products</td></tr>
<tr><td>4</td><td colspan="5">Subject aims
The aim of the module is to make students to be self-sufficient in:
1. skills required for selecting the most appropriate food materials based on their properties prior to processing using any food processing operations
Course Contents
- Topics involve concept in physical and engineering properties of food and biomaterials, i.e. physical characteristics, surface, functional, mechanical, thermal, electrical and optical properties.
-Phase transition of properties of Food during processing
-Measurements and application of these properties to food processing system including harvesting, handling, processing, storage and quality evaluation.
-Practical application in relevant food processing operation</td></tr>
<tr><td>5</td><td colspan="5">Teaching methods
Lectures, material sharing via learning tools, case studies, group work, individual presentations and</td></tr>
</table>

	discussions
6	**Assessment methods** *Grading scale*:- Individual Presentation 30%, Group Assignments 10%, examination-60%
7	**This module is used in the following degree programmes as well** N/A
8	**Responsibility for module** Prof. S.O. Awonorin/Engr. K. Adegoke
9	**Other information** **Suggested Further Readings** 1. Sahin, S. and Sumnu, S.G. (2006). Physical Properties of Foods. Springer, U.S.A. 2. McGuire J. (2005). Surface properties. In M.A. Rao, S.S.H. Rizvi & A.K. Datta (Eds.), *Engineering Properties of Foods*, 3rd ed. (pp. 679–702). Boca Raton: CRC Press Taylor & Francis. Related Academic Journals -International Journal of Food Engineering -Journal of Food Engineering (Elsevier) -International Journal of Food Science and Technology (Wiley)
	2. Important Note This course is a 2-unit course based on the credit system in use in Nigeria. Students are however, expected to devote about 120 hours to learning of the course content, including participation in 30 hours of course lectures and demonstrations, and 90 hours of self-study (assigned reading, personal studies, assignments, and group work). Hence, the course is of 4.0 ECTS credit equivalent.

ADVANCES IN INDUSTRIAL OF FOODS						
Module code FPV 913		**Student workload** 120 hours	**Credits** 4.0 ECTS	**Semester** Second Semester	**Frequency** One time in each Semester	**Duration** 15 Weeks
1	**Types of courses** a) Class Work b) Seminars c) Students' Presentation		**Contact hours** 30 hours	**Independent study** 90 hours	**Class size (Potential)** Avg. of 10 (Max 20)	
2	**Prerequisites for participation** -To be able to take this course, the students must be a graduate of Food Science and Technology and must have taken courses such as Food Engineering Applications, Unit Operations in Food Processing, Heat and Mass Transfer, and Engineering Thermodynamics					
3	**Learning outcomes** Upon completion of the learning event in this course, students should be able to: -Define Food drying and describe its role in Food quality, safety and availability -Describe the effect of different drying techniques available for specific Food materials and also the principle involved in each -Describe concept of thermodynamic properties of air-water mixture and Food materials during drying and how it affects quality and safety -Define and understand the principle of equilibrium moisture contents and its role in drying of Food materials -Define drying kinetics and its importance in Food quality determination -Identify and apply common mathematical drying models to describe and predict drying efficiency of a particular Food material -Identify and classify industrial dryers into different categorizes and their major applications -Identify, describe and apply recent innovations in drying to very sensitive Food material					
4	**Subject aims** The aim of the module is to make students to be self-sufficient in: 1. skills required for selecting the most appropriate drying methods for food materials based on their properties prior to processing **Course Contents** - Fundamental principles of drying – thermodynamic properties of air-water mixtures and moist solids, -equilibrium moisture content, drying kinetics and mathematical modeling of drying process; -classification and selection of industrial dryers; dryers for particulate solids, slurries and sheet-form materials; drying of selected food products: grains, fruits, vegetables and meat products; -innovation in drying technologies					

5	**Teaching methods** Lectures, material sharing via learning tools, case studies, group work, individual presentations and discussions
6	**Assessment methods** *Grading scale*:- Individual Presentation 30%, Group Assignments 10%, examination-60%
7	**This module is used in the following degree programmes as well** N/A
8	**Responsibility for module** Prof. L.O. Sanni/Dr. O.P. Sobukola/Dr. (Mrs.) O.E. Kajihausa
9	**Other information** **Suggested Further Readings** 1. Baker, C.G.J. (1997). Industrial Drying of Foods. Published by Blackie Academic and Professional, London, UK. 2. Fellows, P. (2000). Food Processing Technology-Principles and Practice. Published by Woodhead Publishing, Cambridge, England. 3. Jangam, S.V., Law, C.L. and Mujumdar, A.S. (2010). Drying of Foods, Fruits and Vegetables (Volume 1). Related Academic Journals -Drying Technology (Taylor and Francis) -International Journal of Food Engineering -Journal of Food Engineering (Elsevier) -International Journal of Food Science and Technology (Wiley)
	2. Important Note This course is a 2-unit course based on the credit system in use in Nigeria. Students are however, expected to devote about 120 hours to learning of the course content, including participation in 30 hours of course lectures and demonstrations, and 90 hours of self-study (assigned reading, personal studies, assignments, and group work). Hence, the course is of 4.0 ECTS credit equivalent.