1. **FST 3102 FOOD ANALYSIS**
2. COURSE INSTRUCTOR:Mr. George W. Kulaba [B.Sc. Chemistry; M.Sc. Chemistry; PGDE; PGDCS.]
3. COURSE TYPE:

Core course for Year III B.Sc. Food Science & Technology

1. COURSE STRUCTURE:

Course is 3 credit units (3 CU): 2 lecture hours and 2 practical hours per week for 15 study weeks; [i.e. 30 lecture hours & 30 practical hours, *equivalent to 45 contact hours*].

1. COURSE DESCRIPTION:

Sampling and sample preparation. Routine and reference methods for analysis of carbohydrates, fats, proteins, vitamins, minerals, acid and water content, water activity. Application of instrumental analytical methods and procedures: spectroscopy, chromatography, electrophoresis and microscopy in food analysis. Determination of physical properties of foods. Rheological and viscosity measurements. Detection of food adulteration and presence of toxic substances.

1. COURSE OBJECTIVES

*At the end of the course, students should:*

1. Be familiar with the current state of knowledge on food composition
• Identify reasons for determining composition and characteristics of food
• Be able to locate the available food composition databases
• Appreciate the role of food analysis in food standards and regulations for the manufacture and sale of food products
• Apply statistical principles to solve food problems (sampling and data evaluation)

2. Understand the principles behind analytical techniques associated with food
• Identify the various principles used to determine moisture, carbohydrate, lipid, proteins, ash, mineral, and vitamin content of a food
• Be able to describe the principles behind measurement of food acidity and food fibre

3. Know methods of selecting appropriate analytical techniques when presented with a practical problem
• Identify factors to be considered when selecting a method of analysis
• Be able to independently research scientific information
• Be able to discuss the pros and cons of classical methods

4. Demonstrate practical proficiency and teamwork in a food analysis laboratory
• Be able to acquire skills and abilities for conducting proximate analyses
• Learn to work in groups e.g. cooperate with others in performing analytical tests.
• Be able to write concise laboratory reports

5. Be able to use library resources pertaining to food analysis
• Identify publications in which standard methods of food analyses are found
• Familiarize with academic and professional journals in the field
• Recognize principles used in current analytical investigations
• Be able to acquire skills in correct referencing techniques• Critique new techniques in the literature

6. Demonstrate proficiency in the understanding and applications of various instrumental analytical techniques
• Describe the scope, principles, instrumentation and uses of chromatographic, electrophoretic and spectrometric analyses as applied to food.

• Grasp what food rheology is, how it is determined and how it is used to understand and evaluate structure and texture in food products: Explain different rheological properties of foods, select appropriate rheological testing for a given food structure and interpret rheological data in terms of food properties

• Define properties that can be evaluated using thermal analysis and evaluate thermal analysis data
• Identify methods/techniques which can serve to detect adulteration and presence of selected toxic substances

1. RECOMMENDED READING LIST
2. Nielsen S.S. 1998. Food Analysis. Chapman & Hall, Aspen Publishers Inc., Mary land.
3. Skoog, D.A. West, D.M and Hoker, F.J. 1991. Fundamentals of Analytical Chemistry. Saunders college publishers, Philodelphia.
4. Pomeranz, Y. and Meloan C.E. 1996. Food Analysis : theory and practice. Chapman & Hall Inc. N.Y
5. Nielsen, S.S. 2003. Food Analysis Laboratory Manual. Chips Ltd, USA.
6. A.O.A.C. Official Methods of Analysis, current ed. Association of Official Analytical Chemists, Arlington, VA.
7. Official Methods of Analysis, 17th edn. A.O.A.C. Association of Official Analytical Chemists, Arlington, VA.
8. Kirk, R.S. and Sawyer, R. (eds.). 1991. Pearson’s Composition and Analysis of Foods. 9th edn. Longman Group UK Ltd.
9. Meloan, C.E. and. Pomeranz, Y. 1973. Food Analysis Laboratory Experiments. AVI Publishing Company, Westport, CT.
10. Joslyn, M.A. 1970. Methods in food analysis: physical, chemical and instrumental methods of analysis. Academic Press, New York, San Francisco, London.
11. Stewart, K.K. and Whitaker, J.R. (eds.). 1984. Modern Methods of Food Analysis. AVI Publishing Company, Westport, CT.
12. Gould, W.A. 1977. Food Quality Assurance. AVI Publishing Company, Westport, CT.
13. James, C. S. 1995. Analytical chemistry of foods; Blackie Academic & Professional.
14. Blanshard, J.M.V. and P. Lillford, (Eds.). 1987. Food Structure and Behaviour. Academic Press, London.
15. Bourne, M.C. 1982. Food Texture and Viscosity: Concept and Measurement. Academic Press, New York.
16. DeMan, J.M. 1976. Rheology and Texture in Food Quality.. AVI Pub. Co., Westport CN.
17. Moskowitz, H.R. 1987. Food Texture: Instrumental and Sensory Measurement. M. Dekker, New York.
18. Muller, H.G. 1973. An Introduction to Food Rheology. Heinemann, London.
19. Peleg, M. and E.B. Bagley. 1983. Physical Properties of Foods. AVI Pub. Co., Westport CN.
20. Rao, M.A. 1999. Rheology of fluid and semisolid foods: Principles and Applications. Aspen Publishers, Gaithersburg, MD.
21. Sherman, P. 1979. Food Texture and Rheology. Academic Press, New York.
22. COURSE CONTENT, METHODS OF INSTRUCTION, TOOLS AND EQUIPMENT REQUIRED

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| **TOPIC** | **CONTENT** | **METHOD OF INSTRUCTION / Time allocated** | **TOOLS / EQUIPMENT NEEDED** |
| 1. Introduction | * Course overview
* Rationale for food composition knowledge and food analysis
* Food standards and food regulations
* Classification of quantitative methods of analysis
* Steps in a typical quantitative chemical analysis.
* Terminology: Sample, analyte, assay, determine, analyse and qualitative Vs quantitative analysis
* Choice and validity of analytical method : Criteria for choice of food analysis methods; Validity of the method; Official methods of analysis
* Types and sources of errors
* Sampling and sample preparation
* Statistical evaluation of analytical data
* Overview of analytical separations/ elimination of interferences: precipitation, extraction, chromatography (ion exchange), electrophoresis; Use of a masking agent; Use of standard addition protocol
* Standard solution
* Lab overview: Guidelines, safety, and report; Review of basic operation
 | Interactive lecture, audio/visuals, small and large group directed discussions and writing assignments  (6 hrs). | Chalk /Markers Blackboard/White boardLCD projector, Computer |
| 2. Moisture determination  | * Importance of the moisture assay
* Forms of water in solids
* Moisture contents of various foods
* Factors to be considered when selecting a method for moisture analysis
* Over- or under-estimation of the moisture content of a food being tested
* Moisture determination by loss on drying, distillation, and chemical reaction
* Direct and indirect moisture methods
 | Interactive lecture, audio/visuals, small and large group directed discussions and writing assignments/exercises ( 2hrs); Experimentation and Laboratory exercises (3 hrs);Seminar topics | LCD projector and Computer for power point presentation;Lab equipment, materials and chemicals for experiments |
| 3. Ash and mineral analysis  | * Importance of the assay
* Ash determination by wet digestion and dry ashing
* Sources of error in decomposing and dissolving the sample
* Ash soluble or insoluble in acid or water and alkalinity of ash
* Mineral determination

  | Interactive lecture, audio/visuals, small and large group directed discussions and writing assignments/exercises (2 hrs); Experimentation and Laboratory exercises (3 hrs);Seminar topics | LCD projector and Computer for power point presentation;Lab equipment, materials and chemicals for experiments |
| 4. Lipid analysis  | * Why are we interested in analysis of lipids?
* Factors to be considered when selecting a method for lipid analysis
* Lipid determination using Soxhlet, Goldfish, and other methods
* Supercritical fluid extraction and accelerated solvent extraction techniques
* Fat characterization: Physical properties, iodine value, saponification number, acid value/free fatty acids, oxidation, hydrolysis, peroxide value, oxidation tests.
* Analysis of lipid fractions: GLC, HPLC, TLC
 | Interactive lecture, audio/visuals, small and large group directed discussions and writing assignments/exercises (2 hrs); Experimentation and Laboratory exercises (3 hrs);Seminar topics | LCD projector and Computer for power point presentation;Lab equipment, materials and chemicals for experiments |
| 5. Protein analysis  | * Why analyse for protein?
* Protein content of some foods
* Factors to be considered when selecting a method for protein analysis
* Protein content from nitrogen content and conversion factors
* Protein determination by Kjedahl, combustion, and other methods
* Protein separation and characterization: Why?; pH precipitation, size fractionation, salt precipitation, electrophoresis, affinity and ion-exchange chromatography
* Amino acid analysis
* Protein quality
 | Interactive lecture, audio/visuals, small and large group directed discussions and writing assignments/exercises (2hrs); Experimentation and Laboratory exercises (6 hrs);Seminar topics | LCD projector and Computer for power point presentation;Lab equipment, materials and chemicals for experiments |
| 6. Carbohydrate analysis | * Why analyse for carbohydrates?
* Determination of reducing sugars
* Physical and enzymatic methods used to measure sucrose in food products
* Enzymatic determination of starch
* Crude fibre, acid detergent fibre and neutral detergent fibre determinations
* AOAC and Englyst-Cummings methods for determination of dietary fibre
* Analysis for individual sugars: HPLC, GLC, PC
 | Interactive lecture, audio/visuals, small and large group directed discussions and writing assignments/exercises (2 hrs); Experimentation and Laboratory exercises (3 hrs);Seminar topics | LCD projector and Computer for power point presentation;Lab equipment, materials and chemicals for experiments |
| 7. Acidimetry | * pH and titratable acidity
* Methods of measuring titratable acidity and pH
* Preparation of standard acids and bases
* Buffer solutions
* Acidity of foods
 | Interactive lecture, audio/visuals, small and large group directed discussions and writing assignments/exercises (2 hrs); Experimentation and Laboratory exercises (3 hrs);Seminar topics | LCD projector and Computer for power point presentation;Lab equipment, materials and chemicals for experiments |
| 8. Vitamin analysis  | * Importance
* Sample preparation
* Methods

 􀁺 Principles  􀁺 Food applications | Interactive lecture, audio/visuals, small and large group directed discussions and writing assignments/exercises (2 hrs); Experimentation and Laboratory exercises (3 hrs);Seminar topics | LCD projector and Computer for power point presentation;Lab equipment, materials and chemicals for experiments |
| 9. Application of modern instrumental techniques of analysis. | * General advantages and disadvantages of using instruments and special techniques in the analysis of foods
* Theory and practice of molecular and atomic spectrometry

 􀁺 Basic principles of spectrochemical analysis 􀁺 UV-Visible and Fluorometry 􀁺 AAS, AES and ICP-AES* Theory and practice of chromatographic techniques

 􀁺 Basic principles of chromatography 􀁺 HPLC (Liquid chromatography)  􀁺 Super critical fluid chromatography 􀁺 GSC/GLC(Gas chromatography)* Theory and practice of electrophoresis
* Thermal Analysis: principles, use of differential scanning calorimetry in food analysis.
* Rheology of Food: principles, practical applications in food analysis
* Colour Analysis: general principles, spectroscopic techniques for evaluation of colour.
* Methods for detection of food adulteration and presence of toxic substances.
 | Interactive lecture, audio/visuals, small and large group directed discussions and writing assignments/exercises (8 hrs);Laboratory exercises and study visits to external analytical laboratories e.g. Government Chemist, UDA, UIRI. (6 hrs) | LCD projector and Computer for power point presentation;Transport facilities; Lab equipment and chemicals |
| 11. Review & Seminar | * Assigned seminar topics in groups of 3 to 5 students (team work)
* Review summary
 | Oral group presentations and submission of written group reports by learners; Discussions ; Questions and answers(6 hrs) | Chalkboard /White board;LCD projector and Computer for power point presentation; Flip charts |

1. SUMMARY OF TIME NEEDED

Interactive lectures covering theory 30 hrs

Laboratory, Seminar 30 hrs

1. OVERALL COURSE EVALUATION

Continuous Assessment Test 20%

Class practicals, exercises, Write-ups 20%

University examination 60%