1. **FST 4202 PLANTATION & ESTATE CROPS TECHNOLOGY**
2. **COURSE INSTRUCTOR**

Mr. George W. Kulaba [B.Sc. Chemistry; M.Sc. Chemistry; PGDE; PGDCS.]

1. **COURSE TYPE**

Core course for Year IV 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**

Overview of coffee, cocoa, tea and sugar in Uganda. Pre- and Post-Harvest quality requirements for estate crops. Processing technologies for tea, coffee, cocoa and sugar cane. Quality Assurance in estate crops e.g. liquoring, tasting, physico-chemical tests, etc.

1. **COURSE OBJECTIVES**

At the end of the course, students should be able to:

1. Discuss current status, economic importance and factors affecting coffee, cocoa, tea and sugar cane production in Uganda.
2. Identify pre- and post harvest quality requirements for coffee, cocoa, tea and sugar cane.
3. Describe the desired processing equipment and outline processing technologies for coffee cocoa, tea and sugar.
4. Discuss methods of quality assurance in the industries and trade of coffee, cocoa, tea and sugar.
5. Discuss problems of by-produce or waste products from processing of estate crops and propose uses or suitable methods of handling, treating or disposal.
6. **RECOMMENDED READING LIST**

**Coffee**

1. Clifford, M.N and Willson, K.C. 1985. Coffee: Botany, Biochemistry and production of Beans and Beverage. Croom Helm, London, U.K.
2. Coste, R. 1992. Coffee: The plant and the product. Mac Millan, London, U.K.
3. Clark, R.J and Macrae, R. Coffee: Volume 1 Chemistry (1985);Volume 2 Technology (1987). Elsevier Applied science, UK.
4. Sivetz, M. and Desrosier, N.W. 1979. Coffee Technology. AVI, USA.

**Cocoa**

1. Piggott, J.R. and Peterson, A. 1994. Understanding natural flavours. Chapter 17

 pp 268 – 282. Blackie

1. Fowler, M.S. 1999. Cocoa beans: from tree to factory. In: Beckett, S.T., ed.

 Industrial chocolate Manufacture and Use. 3rd ed. Oxford: Blackwell Science,

 1999: 8–35.

1. Minifie, B.W. 1989. Chocolate, Cocoa and Confectionery – Science and

Technology. London: Chapman & Hall.

8. Wood, G.A.R.and Lass, R.A. 1985. Cocoa. Fourth edition. Longman

**Tea**

1. Willson, K.C. and Clifford M.N. 1992. Tea: cultivation to consumption. Chapman and Hall, UK.

**Sugar**

1. Baukou, V.C. 1982. Manufacture and refining of raw cane sugar. Elsewer, Amsterdam.
2. Jackson E.B. 1995. Sugar confectionery manufacture. Chapman and Hall, U.K
3. Mathur, L.B. Ram 1981. Handbook of sugar cane technology. Oxford and IBH, New Dehli.
4. Kordylas. J. Maud 1991. Processing and preservation of tropical and subtropical crops. Mac Millan.
5. Chen, J. C. P. 1985. Meade-Chen Cane Sugar Handbook. John Wiley

 and Sons, New York.

15. Lionnet , G. R. E. 1999. Sugar technology for students. Lang Fred,

 Durban.

16. Guilford L Spencer and George P. Made. 1993. Cane Sugar Hand Book*.* John

 Wiley and sons Inc. London

17. Hugott, E. 1986. Hand Book of Cane Sugar Engineering*.* Elsevier Publishing

 /Company, London.

18. Chen, C. 2001. The sugar refining — A manual for the design and refining

 facilities. John Wiley and Sons. London.

1. **COURSE CONTENT, METHODS OF INSTRUCTION, TOOLS AND EQUIPMENT REQUIRED**

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| **TOPIC** | **CONTENT** | **METHOD OF INSTRUCTION / Time allocated** | **TOOLS / EQUIPMENT NEEDED** |
| 1.Overview of coffee production, processing and marketing (locally and world-wide) | * Production statistics and occurrence
* Importance of coffee
* Commercial coffee varieties and their distinctive features or attributes
* The importance of coffee quality in the industry and trade of coffee
* Factors affecting coffee quality
* Production, processing and marketing systems in Uganda: contemporary issues
* OTA in coffee
 | Interactive lecture, audio/visuals, small and large group directed discussions and writing assignments (4 hrs); Seminar topics on coffee issues | Chalkboard /White board;LCD projector and Computer for power point presentation |
| 2. Coffee: Primary production  | * Objectives and rationale
* GAPs
* Coffee harvesting: Quality and safety requirements, GHPs
* Coffee growing regions, coffee types and coffee seasons in Uganda
* Coffee diseases and pests
 | Interactive lecture, audio/visuals, small and large group directed discussions and writing assignments (2 hrs);Field visit to verify (3 hrs) | Chalkboard /White board;LCD projector and Computer for power point presentation;Transport facilities |
| 3. Coffee: Primary(on-farm) processing  | * Methods of processing coffee

- Dry processing method: Operations; Advantages and disadvantages; Requirements for berry drying - Wet processing method: Advantages and disadvantages; equipment, operations, quality and safety requirements for pulping, fermentation, washing and parchment coffee drying.* Disposal of coffee factory wastes and effluents.
* On-farm coffee storage
 | Interactive lecture, audio/visuals, small and large group directed discussions and writing assignments/exercises (4 hrs);Study trip to coffee farm with wet-processing station(3 hrs) | Chalkboard /White board;LCD projector and Computer for power point presentation;Transport facilities |
| 4. Coffee: Secondary processing :  | * Coffee curing operations, equipment, and quality and safety requirements

 - Precleaning and hulling - Export sorting/grading and classifications* Storage and transportation
* Out-turn and capacity calculations
 | Interactive lecture, audio/visuals, small and large group directed discussions and writing assignments/exercises (4 hrs);Study trip to coffee hullery (processor factory) and an export – grading factory (6 hrs) | Chalkboard /White board;LCD projector and Computer for power point presentation;Transport facilities |
| 5. Coffee: Quality assurance  | * National Coffee Regulations
* Assessment of coffee quality
* Coffee grades and classification
* Sampling andTests for physical, olfactory and visual parameters: Coffee report form
* Chemical tests e.g. caffeine and OTA
* Liquoring (cupping) test
* Raw and roast bean defects, flavour and taste defects
* Sources of defectives
 | Interactive lecture, audio/visuals, small and large group directed discussions and writing assignments/exercises (4 hrs);Laboratory exercises and study visits to UCDA coffee quality control laboratories (3 hrs) | Chalkboard /White board;LCD projector and Computer for power point presentation;Transport facilities;Lab equipment to conduct chemical and physical testsand organoleptic tests on coffee samples as may be available at UCDA Labs. |
| 6. Cocoa production and processing technology  | * Overview and statistics
* Cultivation requirements.
* Operations, equipment and requirements for harvesting, fermentation and drying.
* Changes (biological, chemical, physical) taking place during fermentation and comparison of cocoa and coffee and tea fermentation.
* Importance of drying and roasting processes
* Products that can be made from cocoa
* Process of transforming cocoa beans into chocolate and other cocoa products
* Physical and chemical information on cocoa beans, butter, mass, powder and chocolate
* Flavour assessment/tasting and off flavours of chocolate.
 | Interactive lecture, audio/visuals, small and large group directed discussions and writing assignments/exercises (4 hrs);Laboratory exercises---analysis of cocoa products(3 hrs) ; study visit to cocoa farm and processing facility(3 hrs); Seminar topics on cocoa issues | Chalkboard /White board;LCD projector and Computer for power point presentation;Transport facilities; Lab equipment and chemicals |
| 7. Tea production, marketing ,processing technology and chemistry | * Overview of tea production trends (nationally and internationally), growing requirements and objectives in primary production
* Types of tea: green, oolong, black, white
* Chemistry of constituents
* Harvesting
* Black tea manufacture: Manufacturing process, chemistry and technology

-Orthodox Vs. CTC-Weathering/spreading-Rolling-Fermentation/oxidation-Drying-Sorting/grading-Packaging* Black tea quality assurance and marketing
* Grading of tea
* Green tea manufacture
* Instant tea manufacture
 | Interactive lecture, audio/visuals, small and large group directed discussions and writing assignments/exercises (4 hrs);Laboratory exercises—tea analysis (3 hrs); study visit to tea industry (3 hrs); Seminar topics on tea issues | Chalkboard /White board;LCD projector and Computer for power point presentation;Transport facilities; Lab equipment and chemicals  |
| 8. Sugarcane processing technology  | * Overview of sugar production in Uganda and the world
* Sugar cane cultivation requirements
* Harvesting requirements
* Chemistry and technology of sugar manufacture

- Flow chart for manufacture of granulated sugar-Energy and material balance of cane sugar process-Juice extraction, purification/clarification, concentration, and decolourisation -Crystallization, washing of sugar crystals and centrifugal separation -Drying and packaging* Sugar plant sanitation.
* By-products of sugar industry and their utilisation
* Sugar refining
* Uses of sugar
* Properties/ characteristics of Granulated sucrose, Liquid Sugars and Invert sugar
* Sugar analysis
 | Interactive lecture, audio/visuals, small and large group directed discussions and writing assignments/exercises (4 hrs);Laboratory exercises --- Analysis of sugar/sugar cane for TSS, pH, fibre, ash,polarization --Clarifications of raw juice --Inversion of sugar (3 hrs); Study visit to sugar industries (3 hrs); Seminar topics on sugar issues |  Chalkboard /White board;LCD projector and Computer for power point presentation;Transport facilities; Lab equipment and chemicals |
| 9. Review and seminar  | * Assigned seminar topics in groups of 3 to 5 students (team work)
* Review summary
 | Oral group presentations and submission of written 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, field work 30 hrs

1. **OVERALL COURSE EVALUATION**

Continuous Assessment Test 20%

Class practicals, exercises, Write-ups 20%

University examination 60%