

**Addis Ababa Institute of Technology  
School of Chemical and Bio-Engineering  
Food Engineering Graduate Program**

***ChEg 6222 Food Process Technology-II (3Cr. Hrs; 7ECTS)***

**Course Profile:** Food Process Technology-II, principally focuses on Dairy Products Processing Technology; Meat, Poultry and Eggs; Fish and Sea Foods Processing Technology; Byproduct utilization from dairy, meat, eggs, fish and marine/aquatic food products.

**The Learning Objectives includes Innovation, Excellence and Business Solutions for Poverty reduction.**

After successfully completing this course you should be able to describe the theoretical and practical process engineering principles of milk and meat products and byproducts processing. Over all the course focuses on cattle, camel, sheep and goats, poultry and eggs, fish and aquatic animals' products processing in terms of milk and meat value added products. These include topics such as dairy food chemistry; dairy microbiology and standards of raw milk and processed added value milk products; dairy processing technology principles and various milk products technology setups/unit operations; dairy engineering plant lay-out of dairy industry; packaging of fish, meat, eggs, sea foods and dairy products. Additionally, meat and milk processing unit operations and auxiliary processes also included. Meat, Poultry and Eggs Processing Technology; Aquatic Animals Processing Technology; Byproduct utilization from dairy, meat, eggs, poultry, fish and sea food products also included.

Understand the physico-chemical changes of food during processing, pasteurization and chilling process of foodstuffs and smoked and dried fish and meat product properties, understand the process efficiency, comprehend the process technology, practical understandings on specific food manufacturing operations. A comprehensive and well-founded knowledge in the field of study can be obtained by indulgent food quality improvement with food processing technologies greatly attributed as one of the key elements in advanced food processing engineering. Food processing has combined effects with process design, inactivation of microbes and enzymes on product quality, biochemical and functional properties of food products. Moreover, Food Process Engineering/Technology via value addition have critical impacts towards end product acceptability by consumers and commercialization. Currently, food manufacturing, products design and development, good manufacturing practices, food safety and quality management systems depend on Food Process technology/Engineering for evolving markets via commercial technology developments in the World food market.

The course comprises group and individual assignments (**Dairy/Fish and sea foods/Meat/Poultry and Eggs-Industries Engineering Layout (Dairy process engineering layout) drawn by E-DRAW MAX software 8.4; SuperPro Designer /ChemCad/Visio and etc software's**) on state-of-the-art food processing applications of with know-how on processing unit operations and mechanism of actions. The course encompasses assignments with labeled date of submission, and consists of industrial visits of Food manufacturing industries. The industry visit at Debrezeit Elfora slaughtering and meat processing industry; Hirut Milk Processing Plant at Chacha will be a compulsory to the course registered MSC candidates' and planned to support the theoretical background.

**Expected output:** Successfully completing this course will contribute to the recognition of your attainment of the graduate attributes towards to uphold **IN-DEPTH KNOWLEDGE OF THE FIELD OF STUDY** well equipped to pursue careers in the Universities, Regulatory agencies and specifically food industry, where your work can help to improve profit margins and increase market share. Basic knowledge on food processing towards in an increasing shelf-stability, post-harvest handling and product quality with their commercial applications and principles of operations as well as innovations in Food Process Engineering Conveyed. Ready to contribute to Ethiopian Agri-food Performance improvement in Terms of creating market Value.

**Course Outline**

*Instructor: Shimelis Admassu (Dr.Eng.)  
Professor*

- I. Milk Composition and its Physicochemical Properties**
  - 1.1 The composition and physical properties of whole milk
  - 1.2 Dairy physics and dairy chemistry
- II. Dairy Food Microbiology and Quality Standards**
  - 2.1 Milk microbiology and clean milk production
  - 2.2 Standards of raw milk and end products
- III. Fundamentals in Dairy Processing**
  - 3.1 Separation and standardization of milk and cream
  - 3.2 Dairy processing machineries and their working principles
  - 3.3 Pasteurized and sterilized milk manufacturing technology
  - 3.4 Butter and cream manufacturing principles
  - 3.5 Main processes of added value products in dairy manufacturing industries
- IV. Acidified Milk Products Processing**
  - 4.1 Cultured milk products processing technology
  - 4.2 Yogurt production process
  - 4.3 Kefir and acidophilus milk processing technology
- V. Cheese and Ice-Cream Manufacture**
  - 5.1 Cheese types /classification, composition, starter culture used for cheeses/
  - 5.2 Cheese processing technology
  - 5.3 Ice-cream manufacturing
- VI. Long-Life Milk Products Processing Technology**
  - 6.1 Sweetened condensed milk
  - 6.2 Milk powder
  - 6.3 Evaporated milk
- VII. By-products Utilization and Milk Imitations**
  - 7.1 Whey and whey utilization
  - 7.2 Milk imitations



## **VIII. Meat, Poultry and Eggs; Fish and Sea Foods Processing Technology**

- 8.1 Meat and meat products processing technology
  - 8.1.1 Canned meat, sausage, hot dog and other novel products
- 8.2 Poultry meat and eggs processing technology
- 8.3 Fish and sea foods processing technology principles

## **IX. Packaging of Dairy, Meat, Eggs, Fish and Marine Foods**

- 9.1 Packaging principles
- 9.2 Advanced packaging technologies

## **References (Recommended)**

- Barrie** Axtell and Peter Fellows. (2003). Setting up and running a small meat or fish processing enterprise. Opportunities in food processing series. Published by CTA. Wageningen. pp.200.
- Edgar Spreer.(1995). Milk and Dairy Product Technology. Marcel Dekker. Inc.483pp.(N.B!)
- Fatih** Yildiz.(2011). Development and manufacture of yoghurt and other functional dairy products. CRC Press Book, Taylor & Francis Group.pp.435.
- Fidel** Toldrá.(2007).Handbook of fermented meat and poultry. Blackwell publishing.pp.555.
- Gerhard** Feiner.(2006). Meat products hand book, practical science and technology. Woodhead publishing limited, Cambridge, England. pp.648.
- Gösta** Bylund. (1995). Dairy processing handbook.  $\alpha$  Tetra Pak processing system AB, Lund, Sweden . pp.436.
- Keith**, H. and Steinkraus.(2004). Industrialization of indigenous fermented foods.pp.796.
- Lambert, M.L.(1987). Modern Dairy Products, Composition, Food Value, Processing Chemistry, Bacteriology, Testing Imitation Dairy Products. Eurasia Publishing House, Ram Nagar, India.418pp.
- Leo** M.L and Nollert, Fidel Toldra.(2006). Advanced technologies for meat processing. CRC press, Taylor and Francis Group.pp.483.
- O'Connor**, C.B.(1993). Traditional Cheese Making Manual. International Livestock Center for Africa Addis Ababa, Ethiopia.43pp.



- O'Connor**, C.B.(1995). Rural Dairy Technology. ILRI Training Manual 1. ILRI (International Livestock Research Institute). Addis Ababa, Ethiopia.119pp.
- Ockerman**, H.W and Hansen, C.L.(2000). Animal by-product processing and utilization. CRC press, Taylor and Francis Group. pp. 511.
- Paul**, W.Allen, M.S.(1926). Industrila ferementations.pp.423.
- Peter Fellows** and Barrie Axtell.(2008). Setting up and running a small-scale dairy processing business. Opportunities in food processing series. Published by CTA. Wageningen. pp.188.
- Ramesh**, C.Chandan.(2006). Manufacturing yogurt and fermented milks. Blackwell publishing company. pp.364.
- Rhea Fernandes**.(2009). Microbiology handbook dairy products.pp.173.
- Robertson, G.L.(2006). Food Packaging Principles and Practice. 2<sup>nd</sup> edition, CRC Press Book, Taylor & Francis Group.550pp.
- Se-Kwon Kim**.(2011). Marine medicinal foods. Elsevier Inc.pp.466.
- Smith**, S.J.(2006). Food Processing Principles and Applications. Blackwell Publishing.pp.511
- Sukumar De. (1983). Outline of Dairy Technolgy. Oxford University press.539pp.
- Tamime**, A.Y.(2006). Fermented milks. Blackwell publishing company. pp.262.
- Van den Berg, J.C.Y.(1988). Dairy Technology in the Tropics and Subtropics. Pudoc Wageningen. The Netherlands.
- Walstra**, T.J., Geurts , A.Noomen , A.Jellema, and M.A.J.S.van Boekel (1999). Dairy Technology: Principles of Milk Properties and Processes. Marcel Dekker Publisher.727pp.

**Any general Dairy Process Technology/Meat, Poultry and Egg; Fish and Sea foods/ Food Process Technology Textbook** will probably contain majority of the topics covered during lectures. Students are encouraged to confine reference options based on the scope of the material covered in the class rooms and industry visits.

**Exams:** There will be **Mid** and Final **Examinations which might** include 20% and 40% of the final course grade; respectively.



***Practical Laboratory products design and development (by group/individual) with Term papers of individual/group report with presentations:*** Students are expected to write specific term paper based on the course content focused on national, regional and International new products processing techniques. Need to submit at least two individual assignments with the specified schedule and oral presentation. Product development and assignments includes a total of 35% of the final course grade. Regular attendance is desirable.

***Grading:*** The performance of students will be scaled as per the Addis Ababa University new senate legislation policy for graduate program. Borderline cases will be considered on a case-by-case. Participations at industry visit, laboratory exercise with excellent class participation, motivation and alertness might be the key tools for resolution for borderline cases.

***Expectations:*** Every graduate class student should read the text from reference materials prior to lecture and **work very hard** as we proceed through the chapter. Furthermore, you should **Study methodically to keep hold of the knowledge and skill!**

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**I. Assignment (By group)**

**Title 1:** Review on the Development of Dairy Products Processing Industries of Developing (Kenya, India, Philippines and Vietnam) and Developed Countries (New Zealand, Australia, Russia and Brazil): The overall economic implications in terms of youth employment, entrepreneurship, agro-based processing and food and nutrition security: The lessons to be learnt and the directions for Africa and Ethiopia.

In the assignment focus on: The key growth strategies, Inclusive and sustainable development platforms, key success indicators and roadmaps for Business development strategies and Business Models useful for Africa/Ethiopia.

**Cut-off date for submission: May 1<sup>st</sup> week, 2020**



## II. Dairy Product Design and Development Project (Practical)

**Key:** Choose only one title and workout at Food Engineering Laboratory (AAiT, AASTU), or Dairy processing industry: Need to carry-out straightaway

1. Cheese (Mozzarella, Provolone, Ricotta, Cheddar Cheese) Processing
2. Yoghurt Processing
3. Whey beverage
4. Kefir
5. Milk Powder Manufacturing
6. Ice-cream and Frozen Dessert Processing
7. Butter Oil and Ghee Production
8. Fermented dairy products (Traditional African or Asian type)
9. Fish and Fish Sauce Processing
10. Smoked Fish
11. Fermented Sausage Processing (Dry or Semi-dry fermented sausages'): Poultry or Beef
12. Eggs processing
13. Aquatic Shrimps processing
14. Any type of Business oriented product (eg. Pasteurized milk with Chocolate flavor).

The assignment embraces laboratory experiment, lab report on the specific project and defense for the same.

**Cut-off date for submission: May 4<sup>th</sup> week, 2020**

## III. Assignment (The Title for Review should much with the assignment no.2)

1. Chesses processing (Specific product type)
2. Yoghurt processing (Specific product type)
3. Milk Powder Manufacturing
4. Ice-cream or Frozen Dessert Processing
5. Butter Oil and Ghee Manufacturing
6. Fermented dairy products
7. Fish and Fish Sauce Processing
8. Smoked Fish Processing
9. Fermented Sausage Processing (Choose Dry or Semi-dry fermented sausages'): Poultry or Beef
10. Eggs processing
11. Aquatic Shrimps processing
12. Any type of Business oriented product (eg. Pasteurized milk with Chocolate flavor).



**The assignment embraces the following key elements:**

- ☑ Basic process Engineering principles and flow diagram for each product using 2-D/3-D
- ☑ Processing plant operation as turnkey plant and process line for each product with Dairy plant engineering layout using **E-draw max, ChemCad, Auto Cad, Microsoft Visio or Super Pro Designer or the latest technology version.**
- ☑ Product packaging material selection;
- ☑ Product safety and quality;
- ☑ Potential chemical and microbiological defects of the product;
- ☑ Quality control unit /Instrumentations;
- ☑ Summary and recommendation;
- ☑ Presentation

**Cut-off date for submission: May 4<sup>th</sup> week, 2020**

#### **IV. Cutting-edge Research in Dairy Processing**

The assignment explores thematic research areas which are specific to process technology II course outlines. The title can consist of current advancement or technology transfer relevant to the course descriptions and should be as peer-reviewed/ research article with Abstract, Materials & methods, Data analysis, Results and Discussions, Conclusion and Reference Citation Style.

1. Find and choose a single scientific research article (review paper) on advanced processing technology, engineering principles, quality and product diversification, industrialization of indigenous fermented dairy/fish/meat products and emerging or novel technologies in dairy/meat/fish/poultry industry depending on your interest of topics.
2. Submit the research article together with your critical review/findings. Moreover, discuss the Journal article outcome in class.
3. Propose suitable researchable area in food processing technology (dairy, fish and meat products processing) as product diversification via adaptive technology/ engineering concepts/ novel systems which might help you as option for **Msc thesis proposal while exploring the course work and industrial visit**. If there is an interest of original knowledge contribution in Ethiopian/Sub-Saharan Africa Food Processing Sector. Thus, hard thinking is an unavoidable to **recommend a potential research title**.

**Cut-off date for submission: June 1<sup>st</sup> week, 2020**

