DEBRE BERHAN UNIVERSITY

COLLEGE OF AGRICULTURE AND NATURAL RESOURCE SCIENCES

DEPARTMENT OF ANIMAL SCIENCES

CURRICULUM FOR MSc IN DAIRY SCIENCES AND TECHNOLOGY

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MAY, 2019

DEBRE BERHAN, ETHIOPIA

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1. Background

Ethiopia has huge potential for dairy production due to large number of cattle populations (57 million cattle), and high consumer demand for milk and milk products, which is attributed to human population growth, urbanization and increasing income (Habtamu *et al*., 2012). However, the current performance of the dairy sector in Ethiopia is very low. For instance, in Ethiopia indigenous cattle breed account for about 98% with an average milk production per cow per day of 1.35 liters (CSA, 2015), which is low even when compared to Eastern African countries. Nighty-eight percent of the annual milk production at national level comes from rural smallholder farmers that have difficulties of entering the formal milk market due to poor dairy infrastructures besides low milk production performance, the unhygienic milk handling and processing coupled with high temperature and absence of cooling facilities aggravated spoilage of milk in Ethiopia. Hence, the prevailing situations necessitate the introduction of appropriate interventions to enhance productivity of the dairy sub-sector to support the national economic development and increase wholesome food production to satisfy nutritional self-sufficiency.

The current scenario of low dairy sector productivity and the need to address an increasing demand for milk and dairy products calls for introduction of improved technologies for the development of the sector. The country has endorsed dairy sector development strategies aimed at increasing the number of improved milking cows, productivity of cows, per capita milk consumption and industrial processing of milk products. However, at present the numbers of Dairy Sciences and Technology professionals graduated from Ethiopian public Universities which are engaged to support the sector are far below the demand. Therefore, to keep up with the pace, training of qualified professionals at various levels in Dairy Sciences and Technology is one of the key strategies. Debre Berhan University is found in the greater dairy belt areas of the country, where lots of small-scale dairy farmers are operating and many large-scale dairy farms and processing plants are emerging. These initiates the department of Animal Sciences in Debre Berhan University to develop relevant curriculum for the opening of an MSc program in Dairy Sciences and Technology.

Need assessment study to open MSc program in Dairy Sciences and Technology was conducted at various Ethiopian public Universities, agricultural research institutes, minister offices and institutes. All of the respondents were in favor of opening the program. All of the interviewees in the representative organizations also strongly supported that opening of the program will contribute to

the achievement of the sectors growth plan. The assessment revealed that 99% of the organizations involved in the interview require trained manpower in the area of Dairy Sciences and Technology. Most of the stakeholders addressed in the study showed strong interests to support the program through promotion of students who will join the program, link the students to their organizations for educational visit and practical study, advising and examining students, provision of relevant learning and teaching materials, serving as guest lecturer, reviewing the curriculum and experience sharing. However, the major concerns raised by the respondents prior to open the program were capacity building for academic staff, building up of modern dairy farm and laboratory facilities (dairy microbiology, chemistry and processing), some of which are under way.

2. Staff Profile

The Department of Animal Sciences has a total of 25 academic staff including 8 assistant professors on duty: of which, 4 are PhD holders in Tropical Animal Production, Dairy Sciences, Animal Nutrition and Animal Production and Health, 3 DVM specializes in Animal Production and Health, Veterinary Public Health and Epidemiology, one in Animal Genetics and Breeding. In addition, the Department has also 6 PhD candidates on the study leave in different areas of specializations.

Table 1: Staff profile

No.	Name	Position	Specialization
1	Abebe Bereda (PhD)	Assist. Professor	Dairy Sciences
2	Mekete Bekele (PhD)	Assist. Professor	Tropical Animal Production (Meat)
3	Dereje Tadesse (PhD)	Assist. Professor	Animal Production and Health
4	Ahmed Hassen (PhD)	Assist. Professor	Animal Nutrition
5	Hulunim Gatew (MSc)	Assist. Professor	Animal Genetics and Breeding
6	Abebe Agonafer (DVM, MSc)	Assist. Professor	Veterinary Public Health
7	Kassahun Bekele (DVM, MSc)	Assist. Professor	Veterinary Epidemiology
8	Yohannes Mulunhe (DVM, MSc)	Assist. Professor	Animal Production and Health

3. Facilities

The department has trying to equip three laboratories for dairy processing, dairy microbiology and animal nutrition. However, the University has organized laboratories under the departments of Chemistry and Biology, that helps the program in teaching and learning processes until the department starts to utilize its own laboratories. The University has signed memorandum of understanding (MoU) with Misale Agro Industry PLC to attach students for practical study. Moreover, the University is located at close proximity to various organizations such as Debre Berhan Research Center, Addis Ababa University, Ethiopian Meat and Dairy Development Institute, Holleta Agricultural Research Center and various milk processing plants to utilize their laboratories and facilities. Reference books relevant for the program are available in the library. However, the program needs to acquire more additional books in hard and soft copies.

4. Program Objective

The program is aimed at producing competent graduates with skilled and attitude in the field of Dairy Sciences and Technology (DScT). It is also intended to train high level dairy professionals capable of designing and undertaking problem solving dairy research and development facilities.

5. Graduate Profile

The graduates of Master of Science in Dairy Sciences and Technology (DScT) will have a well - developed professional knowledge, skills and competencies on teaching, dairy extension, managing, research and consultancy on dairy farm and dairy processing plants. Upon completion of the Dairy Sciences and Technology (DScT) master's program, the graduates are expected to engage:

- In government, dairy research programs as advisors concerning dairy production, product development and process engineering.
- As teachers or lecturer of Dairy Sciences and Technology and related courses in technical and higher learning institutions.
- As leaders in dairy extension service to promote wholesome milk production and dairy products as source of food and income

- As private entrepreneurs to make business through milk production product value additions dairy products processing.
- Become researchers identify problems related to dairy and formulate practical solutions for the challenges. Conduct national and international research agenda that will enhance dairy sector in the country.
- As technical experts in developing various dairy products and to manage dairy processing plants.
- Formulate and advise policy strategies for sustainable development of dairy sector in the country.

6. Admission Requirements

The candidates must have completed Bachelors of Science degree in Animal Sciences, Animal and Range Sciences, Animal Production and Range Management, Animal Production and Technology, Veterinary Medicine, Dairy and Meat Technology, Food Sciences or other related sciences from accredited higher learning institutions. The students must have a minimum undergraduate cumulative grade point average of 2.0. Moreover, the applicants must pass the written entrance examination. The candidate should be supported by two letters of recommendation preferably from the candidates' previous academic institutions and employers. The students who may be admitted from fields of study other than those listed above, will be required to take some prerequisite courses from undergraduate program to compensate for the deficiencies based on the recommendations of the program coordinator, which shall be approved by the Department Graduate Council (DGC). The applicants should also avail a sponsorship letter showing that the research work shall be supported by their organization, if not; the applicants should sign an agreement of self-sponsorship. The points (in percentage) allotted to each admission criterion are given below if passed the entrance exam.

Table 1: Selection criteria

No.	Criteria when passed the entrance exam	%
1	CGPA	40
2	Entrance examination	50
3	Service year and work experience in dairy sector	10
	Total	100%

Note: Students who have CGPA of 4:00 points will get 40%, while students who have 2:00 points will obtain 20%. Female applicants will have additional five points and given priority if they get the same points as male applicants.

7. Assessment and Evaluation Methods

The course performances of the students will be regularly evaluated by written exam (mid and/or final) and assignments (term papers, laboratory works, reports and presentations). Grades will be based on a total point system, where points are earned from various assessment methods in addition to formal examinations. The quality of graduates Research Thesis must be evaluated by Board of examiners including internal and external evaluators. Each part of the Research Thesis: abstract introduction, statement of the problems, objectives, literature review, materials and methods, results, discussion, conclusions, recommendations and references besides the manner of presentation, confidence in the subject matter and ability of answering questions will be taken in to account for the final evaluation of the Research Thesis.

8. Grading Systems

The following letter grading system will be employed for all courses and Research Thesis are given in Table 2 and 3.

Table 2: Course grading system

Raw mark interval	Letter grade	Grade Points
[90, 100]	A+	4.00
[85, 90)	A	4.00
[80, 85)	A^-	3.75
[75, 80)	B+	3.50
[70, 75)	B	3.00
[65, 70)	B^-	2.75
[60, 65)	C+	2.50
[50, 60)	C	2.00
< 50	F	0.00

Table 3: Research Thesis grading system (based on the merit of the thesis and oral defense)

Mark ranges	Grade	Remark
[85, 100]	A+	Excellent
[75, 85)	A	Very good
[60, 75)	B+	Good
[50, 60)	B	Satisfactory
<50	C	Fail

Note: Evaluation weight (%) = 0.5 (External examiner's) + 0.35 (Internal examiner's) + 0.15 (Chairperson). A thesis that is defended and accepted may be rated ''Excellent", ''Very Good", ''Good" or ''Satisfactory" which may appear on the transcript but will not be used for calculation of the CGPA of the student. A rejected thesis shall be rated ''Fail".

9. Graduation Requirements

The MSc degree in Dairy Sciences and Technology is awarded to a student who satisfy the graduation requirements, passed in all examinations of courses in the program and successfully defended the Research Thesis. To be eligible for graduation, all candidates must fulfill the following requirements:

- The students must take 30 credit hours of course works and 6 credit hours of research works
- The candidates must score a Minimum Cumulative Grade Point Average (CGPA) of 3.00 with only one 'C' or two C^{+} but no 'D' and 'F' grades in any course taken
- MSc research thesis must be written, submitted and defended successfully, and letter of testimony from the supervisory committee attesting completion of the thesis write up is required.

10. Duration of the Study

Duration of the study for regular students must be two years (four semesters) and students above two years should be supported by strong evidence and approved by Department Graduate Committee (DGC). The first year is allocated for course works and proposal writing and presentation, while the second year is allotted for conducting and defending the research thesis. Students in non-regular program should complete their study within three years (six semesters), while summer students must complete the program in four years following commencement. For summer students, the first three summers are allocated for course works and proposal writing and presentation, while the first one and half years for extension program are allocated for course works and proposal writing and presentation and the remaining one year for conducting and defending the research thesis.

11. Assessment and Quality Assurance Mechanisms

The quality of teaching and learning will be ensured by availing relevant reference materials, farms and laboratory facilities. The quality of the curriculum shall be ascertained following the guidelines developed by the Ethiopian Higher Education Relevance and Quality Agency (HERQA). The curriculum should be reviewed every 5 years by including the opinions of stakeholders, instructors and students, and amendment will be made for the benefit of the program.

12. Degree Nomenclature

Master of Science in Dairy Science and Technology (የማስተርስ ሳይንስ ዲግሪ በወተት ሳይንስና ቴክኖሎጂ).

13. Course Code

Each course is coded by an abbreviation followed by three-digit numbers as follows:

- The abbreviation “DScT” refers to the initials of “Dairy Science and Technology”;
- The first digit refers to year in which the course is given, assuming 4 years of undergraduate study including preparatory class;
- The second digit refers to the course's serial number; and
- The third digit refers to the semester in which the course is given.

14.Total Courses

Table 4: Total course lists

Course code	Course title	Cr. Hr	Contact hours		
			Lecture	Tutorial/field demonstration	Lab
DScT511	Dairy Production and Management	3	2	1	0
DScT521	Dairy Chemistry	2	2	0	0
DScT531	Dairy Animal Nutrition	3	2	0	1
DScT541	Biostatistics	3	2	1	
DScT551	Dairy Processing Technologies (I)	2	1	0	1
DScT561	Milk in Human Nutrition (E)	2	1	0	1
DScT571	Food Science and Technologies (E)	2	1	0	1
DScT512	Dairy Microbiology	3	2	0	1
DScT522	Research Methodology and Scientific Paper Writing	2	1	1	0
DScT532	Reproductive and Lactation Physiology	2	2	0	0
DScT542	Dairy Processing Technologies (II)	3	2	0	1
DScT552	Dairy Business and Entrepreneurship	2	1	1	0
DScT562	Dairy Herd Health and Management	2	1	1	0
DScT572	Current Topics in Dairy Sciences and Technology	1	0	1	0
DScT611	MSc Research Thesis Proposal	P/F			
DScT621	Graduate Seminar	P/F			
DScT631	MSc Research Thesis	6	0	0	0

Note: One field demonstration is equivalent to one hour and one laboratory work equivalent to 3 hours and the courses are delivered on semester basis

15. Course Distribution by Year and Semester for Regular, Summer and Extension Program

16.1. Course lists for regular program

Table 5: Year I and Semester I

Course code	Course title	Credit hour
DScT511	Dairy Animal Production and Management	3(2+1)
DScT521	Dairy Chemistry	2(2+0)
DScT531	Dairy Animal Nutrition	3(2+1)
DScT541	Biostatistics	3(2+1)
DScT551	Dairy Processing Technologies (I)	2(1+1)
DScT561	Milk in Human Nutrition (E)	2(2+0)
DScT571	Food Science and Technologies (E)	2(1+1)
Total		15

E = Elective course: Students are required to take one elective course

Table 6: Year I and Semester II

Course code	Course title	Credit hour
DScT512	Dairy Microbiology	3(2+1)
DScT522	Research Methodology and Scientific Paper Writing	2(2+0)
DScT532	Reproductive and Lactation Physiology	2(2+0)
DScT542	Dairy Processing Technologies (II)	3(2+1)
DScT552	Dairy Business and Entrepreneurship	2(2+0)
DScT562	Dairy Herd Health and Management	2(1+1)
DScT572	Current Topics in Dairy Sciences and Technology	1(0+1)
Total		15

Table 7: Year II and Semester I

Course code	Course title	Credit hour
DScT611	MSc Research Thesis Proposal	P/F
DScT621	Graduate Seminar	P/F
DScT631	MSc Research Thesis	6
Total		7

16.2. Course lists for summer program

Table 8: Year I and Semester I

Course code	Course title	Credit hour
DScT511	Dairy Animal Production and Management	3
DScT521	Dairy Chemistry	2
DScT541	Biostatistics	3
DScT551	Dairy Processing Technologies (I)	2
Total		10

Table 9: Year II and Semester II

Course code	Course title	Credit hour
DScT531	Dairy Animal Nutrition	3
DScT512	Dairy Microbiology	3
DScT522	Research Methodology and Scientific Paper Writing	2
DScT561	Milk in Human Nutrition (E)	2
DScT571	Food Science and Technologies (E)	2
Total		10

E = Elective course: Students are required to take one elective course

Table 11: Year III and Semester III

Course code	Course title	Credit hour
DST532	Reproductive and Lactation Physiology	2
DScT552	Dairy Business and Entrepreneurship	2
DScT542	Dairy Processing Technologies (II)	3
DScT572	Current Topics in Dairy Sciences and Technology	1
DScT562	Dairy Herd Health and Management	2
Total		10

Table 12: Year IV and Semester IV

Course code	Course title	Credit hour
DScT611	MSc Research Thesis Proposal	P/F
DScT621	Graduate Seminar	P/F
DScT631	MSc Research Thesis	6
Total		7

16.3. Course lists for extension program

Table 13: Year I and Semester I

Course code	Course title	Credit hour
DScT511	Dairy Animal Production and Management	3
DScT541	Biostatistics	3
DScT531	Dairy Animal Nutrition	3
Total		9

Table 14: Year I and Semester II

Course code	Course title	Credit hour
DScT521	Dairy Chemistry	2
DScT551	Dairy Processing Technologies (I)	2
DScT512	Dairy Microbiology	3
Total		9

Table 15: Year I and Semester III

Course code	Course title	Credit hour
DScT522	Research Methodology and Scientific Paper Writing	2
DScT532	Reproductive and Lactation Physiology	2
DScT542	Dairy Processing Technologies (II)	3
DScT561	Milk in Human Nutrition (E)	2
DScT571	Food Science and Technologies (E)	2
Total		9

E = Elective course: Students are required to take one elective course

Table 16: Year II and Semester I

Course code	Course title	Credit hour
DScT552	Dairy Business and Entrepreneurship	2
DScT562	Dairy Herd Health and Management	2
DScT572	Current Topics in Dairy Sciences and Technology	1
DScT611	MSc Research Thesis Proposal	P/F
Total		5

Table 17: Year II and Semester II

Course code	Course title	Credit hour
DScT621	Graduate Seminar	P/F
DScT631	MSc Research Thesis	6
Total		7

16. Courses Objectives, Descriptions and Mode of Deliveries

DScT 511. Dairy Animal Production and Management (3 Credit hour)
Course objectives • To equip students with an overview of world dairy sector and principles of dairy cattle production and management (young stock, milking and dry cows and bulls)
Course descriptions • The course covers dairy cattle production systems, challenges and opportunities of dairy production, and milk production and consumption pattern in Ethiopia. Temperate and tropical dairy breeds of cattle. It also consists of dairy cattle housing, brief dairy animal nutrition and feeding, dairy cattle herd health, young stock and fertility management and reproduction. Stages of lactation. Bull selection and handling. Management activities: judging techniques of dairy animals and body condition scoring of dairy cows, dung scoring, milking procedure, hoof care and farm record keeping and economics. Dairy farm operations.
Course outline • An overview of world dairy sector • Dairy cattle housing • Dairy cattle feeding and nutrition • Young stock rearing (calves to heifers) • Milk production and delivery, milking procedures • Breeding and fertility management of dairy cattle • Record keeping and farm economics • Management practices: dairy cow judging, lactation curve, body condition scoring, dung scoring and hoof care management
Practical activities • Body condition scoring (BCS) • Milking procedures • Dung scoring • Dairy cattle judging techniques • Rumen scoring

Mode of delivery

- Lecture, group and individual assignments, dairy farm practices, presentations of practical activities and farm excursion

References

- Miller W.J. 1979. Dairy Cattle Feeding and Nutrition. ACADEMIC PRESS, INC
- Phillips C.J.C. 2001. Principles of Cattle Production. CABI Publishing
- John Moran. 2005. Tropical Dairy Farming: Feeding Management for Smallholder Dairy Farmers in the Humid Tropics. CSIRO PUBLISHING

DScT 521. Dairy Chemistry (2 credit hours)

Course objectives

- To familiarize with the basic sciences of physical and chemical properties of milk that are base for milk processing

Course descriptions

- Physical and chemical properties of cow, camel, goat and sheep milk), nutritive value of milk, chemistry of milk proteins (casein micelle, it's structure, casein composition, fractions, properties). Chemistry of milk lipids (composition and classification of milk lipids, significance, properties, structure of FG, chemistry of FGM, fatty acids and factors affecting fatty acid composition, phospholipids and their significance in dairy products, fat contents, rancidity and its control). Properties of lactose (significance of lactose in fermented milk and infant food, lactose intolerance). Minor milk constituents (minerals, vitamins and enzymes).

Course outline

- Basic physical and chemical properties of cow, goat, camel and sheep milk
- Composition and variability of milk
- Milk fat (factors that affect the fat content of bovine milk, classes of lipids in milk, fatty acids in milk fat, fat globule membrane, stability of the milk fat emulsion, influence of processing operations on the fat globule membrane and lipid deterioration)
- Protein (heterogeneity of milk protein, heat, some important properties of casein and whey protein, functional milk proteins)
- Lactose (nutritional aspects of lactose, Chemical and physical properties of lactose, heat,

- Minerals
- Vitamins (fat soluble vitamins and water-soluble vitamins)
- Enzymes (Indigenous enzymes of bovine milk and Exogenous enzymes in dairy technology)
- Physical properties of milk (Appearance, Density, Freezing point, Boiling point, Acidity and Titratable acidity)

Practical activities

- Determination of fat, protein, lactose, minerals using different techniques
- Milk freshness tests: Alcohol test**,** Clot-on-boiling test and Lactometer reading

Mode of delivery

- Lectures, assignments, laboratory exercise and presentations

References

- Fox P.F. and McSweeney P.L.H. 1998. Dairy Chemistry and Biochemistry Department of Food Chemistry University College Cork, Ireland
- Patrick F. Fox, Paul L.H. McSweeney, Timothy M. Cogan and Timothy P. Guinee. 2004. Cheese Chemistry, Physics and Microbiology. 3rd edition. Elsevier academic press
- Ramesh C. Chandan Arun Kilara. 2011. Dairy Ingredients for Food Processing. 1st edition. A John Wiley & Sons, Inc., Publication

DScT 531. Dairy Animal Nutrition (3 credit hours)

Course objectives

- To equip students with principles of dairy animal feeding and nutrition, ration formulation and feeding related disorders

Course descriptions

- Ruminant digestive system. Growth and development of rumen. Manipulation of rumen fermentation for improved utilization of available feed resources. Principles of dairy cattle nutrition and management and their application to economical feeding practices and computerized ration formulation. Current nutritional concepts pertaining to dairy animals Feed resources and feeding strategies. Antinutritional factors. Laboratory techniques for feed evaluation. Feed evaluation in ruminant nutrition: concepts and approaches. Nutrient requirements of different groups of dairy animals. Feeding systems for dairy animals at

different ages with different physiological status. Metabolic disorders in dairy cattle and their managements. Least cost locally available feed ration formulation and mixing (manually and computerized methods). Protein and carbohydrate metabolism. Feed quality and legislation.

Course outline

- Major feed resources in Ethiopia and their nutritional value
- Anatomy and physiology of the digestive systems of ruminants
- Nutrient requirements for dairy cattle: Energy, protein, minerals, vitamins and water
- Feed conservations methods
- Enhancement of nutritive value of feeds
- Least cost ration formulation for dairy cattle
- Antinutritional factors
- Evaluation of feed for dairy cattle
- Nutritional and metabolic disorders of dairy cattle
- Role of feed additives and enzymes

Practical activities

- Feed formulation (least cost) and analysis of feed composition
- Feed sampling and preparation
- Chemical composition of feed (DM, NDF, ADF, CP, CF etc)

Mode of delivery

- Lectures, laboratory exercises and presentation of laboratory results.

References

- Jimmy H. Clark. 2001. Nutrient Requirements of Dairy Cattle. 7th Edition, National Academy Press Washington, D.C

DScT 541. Biostatistics (3 Credit hour)

Course objectives

- To equip students with the experimental designs, data management, data analysis and interpretations

Course descriptions

- Principles of experimental design. Statistical Models and modeling; Complete and incomplete designs; higher order ANOVA; Parametric and non-parametric tests; Assumptions of ANOVA; Experimental deigns: Factorial design, Block design, Latin Square design, Split-plot-Design, repeated measures and unbalanced designs; Nested design; Linear and non-linear regression models; Correlations; Covariance analysis; logistic regression, Qualitative data analysis; Data management (such as data transformations); software applications (Excel, SAS, SPSS, and/or R).

Course outline

- Review of statistical concepts
- Data and variables
- Probability distributions
- Distribution of sample statistic
- Hypothesis testing
- Analysis of variance and covariance (ANCOVA)
- Analysis of frequency data (Chi-square test)
- Principles of experimental designs
- Commonly used experimental designs in Dairy Sciences and Technology (CRD, RCBD, Latin square designs, change-over (Switchover) design, nested design, repeated measures design and split plot design)
- Factorial experimentation (principles and treatment structures, main and interaction effects, two factors factorial experiment and three or more factors factorial experiments)
- Pairwise comparison between treatment means (LSD, DMRT, Tukey Test and Contrasts (planned comparisons))
- Correlation, linear regression and associated tests (simple and partial correlations, Simple and multiple linear regression)
- Nonlinear regression (logistic regression and odds ratio)

- Statistical software applications for data management and analysis (data organization and management and data analyzing using SPSS and/or SAS)

Practical activities

- Students are expected to install all the necessary software's of SAS, SPSS, and R and practice ANOVA, simple linear and multiple regression, correlation and logistic regression.

Mode of delivery

- Lectures, computer-based practice/exercises and interpretation of the outputs**.**

References

- Morris, T.R. 2002. Experimental Design and Analysis in Animal Sciences
- Kaps, M. 2004. Biostatistics for Animal Science
- Gomez, K.A. and Gomez, A.A. 1984. Statistical Procedures for Agricultural Research. 2nd ed. John Willey and Sons. Inc. New York
- Hoshand, A.R. 2004. Experimental Research Design and Analysis: A Practical Approach for Agriculture and Natural Science. CRC Press
- Snedecor Cochran. 1980. Statistical Methods. Iowa/Blackwell.

DScT 551. Dairy Processing Technologies (I) (2 Credit hour)

Course objectives

- To enable students with unit operations and basic technologies of milk processing (cream separation and yoghurt) and traditional milk products and HACCP

Course descriptions

- Basic unit operation in dairy processing. Traditional dairy products (Ethiopian cottage cheese, fermented milk (Irgo), Ethiopian traditional butter, ghee). Butter composition, types, basic principle and theories of butter making. Cream and related products: cream processing (separation, standardization, heat treatment, homogenization and quality of cream, factor affecting cream skimming efficiency). Membrane technology. Total Quality Management (TQM) and Hazard Analysis Critical Control Point (HACCP).

Course outline

- Role of milk processing
- Basic Unit Operations

- Ethiopian traditional milk products
- Cream and related products: cream processing (separation, standardization, heat treatment, homogenization and quality of cream).
- Packaging milk and milk Products
- Membrane filters (membrane technology, principles of membrane separation, separation limits for membrane and material transport through membrane)
- Hazard Analysis Critical Control Point (HACCP): determination of physical, chemical and biological; hazard analysis of given foodstuff, identification of all points or operation steps at which hazards may occur, identification of points critical to food safety (i.e., CCPs), implementation of control and monitoring procedures at CCPs; periodical review of food hazards, and CCPs, control and monitoring to ensure continued effectiveness

Practical activities

- Cream separation
- Yoghurt preparation (set and stirred yoghurt)
- Preparation of mother culture
- The students will be attached to processing plants or other related organizations for one week, and the candidates return with brief report, and make an individual or group presentation on the lessons learnt

Mode of delivery

- Lecture, assignment, group work, laboratory exercise and report

References

- Tamime A. Y. 2009. Dairy Fats and Related Products. A John Wiley & Sons, Ltd., Publication
- Gerrit Smi 2003 Dairy processing; Improving quality. Woodhead Publishing Limited and CRC Press LLC.

DScT561. Milk in Human Nutrition (E) (2 credit hours)

Course objective

- To equip student with theoretical knowledge of role of milk in human nutrition

Course descriptions

- Major milk constituents and their nutritional importance (camel, cattle, sheep and goat). Nutritive values of cheese, yoghurt, butter, ghee and cream. Human health benefit components in milk, cheese, butter, ghee, and cream

Course outline

- Major milk constituents and their nutritional importance (camel, cattle, sheep and goat)
- Nutritive values of cheese, yoghurt, butter, ghee and cream
- Human health benefit components in milk, cheese, butter, ghee, and cream

Mode of delivery

- Lectures, assignments and presentation

References

- Young W. Park and George F.W. Haenlein, 2013. Milk and Dairy Products in Human Nutrition. Production, Composition and Health. A John Wiley & Sons, Ltd., Publication

DScT571. Food Science and Technologies (E) (2 credit hours)

Course objective

- To equip with a comprehensive theoretical knowledge and practical skills of the biological, physical and engineering sciences to develop new food products, design innovative processing technologies, improve food quality and nutritive value, enhance the safety of foods and ensure the wholesomeness of our food of food.

Course descriptions

- Food science courses include food processing, food engineering, food analysis, food chemistry, food microbiology, nutrition, quality assurance, and commodity processing courses.

Course outline

- Unit operations for food processing plants
- Principles and techniques of food preservations

- Food quality and safety
- Food enzymology
- Food packaging

Practical activities

- Practice how to develop few common industrial food products
- Excursion to different food industries

Mode of delivery

- Lectures, laboratory exercise, assignments and presentation

References

- Romain Jeantet, Thomas Croguennec, and Pierre Schuck Gérard Brule. 2016. Handbook of Food science and Technology 1. Food Alteration and Quality.

DScT 512. Dairy Microbiology (3 Credit hour)

Course objectives

- To equip students with knowledge of spoilage, pathogenic and beneficial microorganisms related to dairy industry

Course descriptions

- Micrograms of milk and milk products, factors influencing the growth of bacteria, yeast and molds; spoilage and pathogenic microorganisms in milk and milk products; fermentative microorganisms of milk and their role in preservations and processing; history and taxonomy of starter cultures; microorganisms isolation, enumerations, and biochemical characterizations; starter organisms and their metabolism; starters propagation, preservation and applications; microorganisms of cheese ripening; growth inhibition of lactic acid bacteria, bacteriophage: sources, types and characteristics of phages associated with starters and control; probiotic cultures, health and nutritional benefits and growth in the intestine; genetics of starter cultures: plasmids and plasmid instability.

Course outline

- Microorganisms (yeasts, moulds, bacteria and viruses)

- Bacteria (morphology of bacteria, cell structure and functions of bacteria, spore formation, capsule formation, growth factors for bacteria (nutrients, water activity, temperature, oxygen, light and pH, and source for contamination of milk and milk products)
- The microbiology of raw milk (from the cow, environmental sources, the microflora of milking equipment its effects on raw milk)
- The influence of storage and transport microflora of raw milk
- The microbiology of cream and butter and cheese
- Probiotics and their application in dairy technologies
- Fungi: yeasts and molds (reproduction, growth factors and classification and their importance for dairy industry)
- Spoilage microorganisms (psychotropic microorganisms, mesophilic aerobic microorganism, yeast and moulds and coliforms)
- Pathogenic microorganisms (e.g. Listeria monocytogenes, Campylobacter, Enterococci, Salmonella and Escherichia coli O157:H7)
- Fermented milk (lactic fermentations, yeast-lactic fermentations, mold-lactic fermentations and microbiology of Starter Cultures)

Practical activities

- Sample collection and preparation
- Media preparation and enumeration of colonies AMBC, CC, YMC
- Isolation of pathogenic bacteria

Mode of delivery

- Lectures, laboratory exercise, assignments and presentation

References

- Richard K. Robinson. 2002. Dairy Microbiology hand book, 3rd edition, A John Wiley & Sons, Inc., Publication
- John F. T. Spencer and Alicia L. Ragout de Spencer 2001 Food microbiology protocols Humana Press Inc

DScT 522. Research Methodology and Scientific Paper Writing (2 Credit hour)

Course objectives

- To equip students with research methods and scientific writing papers (proposal development, citations, paraphrasing, rephrasing and incorporate the work of other authors in their own writing; and publication and peer reviewed journal identification and selection methods)

Course descriptions

- Research methods: experimental, survey, exploratory, etc. Setting research questions; sample size determination; research deigns; structure of research proposal. Structure or elements of scientific papers, writing styles and best grammars, Presentations of scientific papers through oral and written communication, Process steps in publications of peer reviewed articles, Ethics in scientific paper writing (e.g. plagiarism)

Course outline

- Writing research proposal (topic selection, analysis and statement of problems, literature review, objectives and methodology, grammars, citation and references qualities of research proposal)
- Manuscript writing (publication content, form and structure)
- Selecting journal for publications (features of reputable journals)
- Ethics of scientific paper
- MSc Research Thesis structure
- Power point preparation and presentation

Practical activities

- Proposal development (problem identification)
- Manuscript preparation
- Report writing and presentation

Mode of delivery

- Lecture, reading assignment, case study assignment and scientific paper presentation

References

- Abiy Zegeye, Alemayehu Worku, Daniel Tefera, Melese Getu, Yilma Sileshi. 2009 Introduction to Research Methods (Preparatory module for Addis Ababa University graduate programs). Graduate Studies and Research Office, Addis Ababa University

DScT 532. Reproductive and Lactation and Physiology (3 Credit hours)

Course objectives

- To equip students with sciences of reproduction, lactation physiology of dairy animals, milk synthesis and application of reproductive biotechnology tools in dairy animals so as to improve productivity

Course descriptions

- Reproductive systems - male and female reproductive systems of farm animals. Hormonal control of reproductive process-estrus cycle ovigenesis, spermatogenesis, fertilization, implantation, pregnancy, gestation and parturition. Artificial insemination, semen collection and processing, evaluation of male based on semen quality. Estrus synchronization, embryo transfer and other reproductive biotechnologies in dairy production. Physiological adaptation of dairy animals. Anatomy, physiology and endocrinology of the mammary gland emphasizing factors affecting milk yield and composition. Milk synthesis and production. Mechanisms of milk component secretion, including protein, lactose and fat metabolism. Disorders of the mammary gland (mastitis) and control strategies.

Course outline

- Growth and development of mammary gland
- Circulatory aspects of milk secretion
- Milk secretion (how is milk made)
- Milk letdown
- Hormonal regulation of milk letdown and synthesis (lactation)
- Factors affecting lactation and composition
- Intensity and persistency of lactation (lactation curve)
- Regression of mammary gland

Practical activities

- Semen collection, and handling (NAIC)

Mode of delivery

- Lectures and assignments

References

- Rowen D. Frandson, W. Lee Wilke and Anna Dee Fails. 1992. Anatomy and Physiology of farm animals 7th edition. A John Wiley & Sons, Inc., Publication

- Hafez ESE and Hafez B. 2006. Reproduction in farm animals 7th edition. A John Wiley & Sons, Inc., Publication
- Ian Cordon. 2004. Reproductive technologies in farm animals CABI publishing

DScT 542. Dairy Processing Technologies II (3 credit hour)

Course objectives

- To equip students with advanced dairy processing technologies with detail theoretical knowledge and practical skills.

Course descriptions

- Cheese making technology (history, principles of cheese making; factor affecting the quality of milk for cheese preparation; the origin, development and basic operation of cheese making; the production, action and application of rennet and coagulates; the formation of cheese curd; the production, application and action of lactic cheese starter culture; cheese ripening and flavor technology, characteristics of quality cheese, packaging materials and equipment. Butter making (cream separation, raw material, pasteurization, butch and continuous churning, recombined butter, spreadable butter, packaging, flavored and quality butter). Cultured milk product: general requirements of cultured milk production, yogurt (flavored yoghurt, factor affecting the quality of yoghurt, choice of milk standardization, milk additives, homogenization, heat treatment, choice of culture, culture preparation), stirred and set yoghurt manufacturing. Packaging of cultured products. Condensed and evaporated milk (history, physico-chemical changes taking place during manufacturing of condensed milk, heat stability of milk and condensed milk, methods of manufacturing of condensed milk, sweetened condensed milk and evaporated milk, packaging and storage), and dried milk products

Course outline

- Cheese making technology: quality milk for cheese manufacture; principles of cheese making; factor affecting the quality of milk for cheese preparation; the origin, development and basic operation of cheese making; the production, action and application of rennet and coagulates; the formation of cheese curd; the production, application and action of lactic cheese starter culture; cheese ripening and flavor technology, characteristics of quality cheese, packaging materials and equipment.

- Butter: cream separation, raw material, pasteurization, butch and continuous churning, recombined butter, spreadable butter, packaging, flavored and quality butter
- Fermented milk product: general requirements of cultured milk production, yogurt (flavored yoghurt, factor affecting the quality of yoghurt, choice of milk standardization, milk additives, homogenization, heat treatment, choice of culture, culture preparation), stirred and set yoghurt manufacturing.
- Condensed milk: sweetened condensed milk (raw material, quality of the raw material, heat stability of raw material, pre-treatment: standardization, heating; evaporation and homogenization, canning and sterilization and storage; sweetened condensed milk: evaporation, cooling and packing
- Milk powder: drying, uses of milk powder and production of milk powder

Practical activities

- Cheese making (e.g. gouda, mozerale, provolone, white cheese)
- Yoghurt making
- Butter preparation: traditional butter and table butter
- The students will be attached to processing plants or other related organizations for one to two weeks, and the candidates return with brief report, and make an individual presentation on the lessons learnt

Mode of delivery

- Lecture, laboratory activities, report from processing plant visit and term papers

References

- Tamime A.Y. 2010 Technology of Cheesemaking, 2nd Edition, A John Wiley & Sons, Ltd., Publication

DScT 552. Dairy Business and Entrepreneurship (2 Credit hour)

Course objectives

- To equip students with the knowledge, skill and attitude about dairy industry business, dairy value chain, business plan development, financial management and entrepreneurship.

Course descriptions

- Basic management principles applied to Dairy Sciences and Technology, industrial organizational control and management. Dairy value chain development and analysis. Business planning and entrepreneurship principles and application in dairy science and technology, dairy plant layout, inventory control and records, planning, budgeting; financial management in dairy industry. Planning and budgeting. Financial management in the dairy farms and industry.

Course outline

- Define entrepreneur and characteristics of entrepreneur
- Types of enterprise
- Success factors of entrepreneurs
- Starting dairy technology based new venture
- Farm management
- Dairy marketing and value chain
- Economics of dairy business
- Enterprise profitability analysis
- Enterprise budgeting and farm planning
- Entrepreneurial cycle (process of business development)
- Personal management
- Type of dairy business
- Business project proposal (service description, market analysis and marketing plan)
- Operations of dairy business startup
- Risks and insurance of business enterprise
- Nature of dairy farming and processing business

Practical activities

- Dairy farm economics analysis (identify weakness and strengthens of dairy business)

- Dairy business plan development (small and large-scale farm and processing)
- Collect and analyze successful dairy business story

Mode of delivery

- Lecture, term papers assignment and case study

References

- John Moran. 2009. Business management for tropical Dairy farmers. CSIRO Publishing

DScT 571. Dairy Herd Health and Management (2 Credit hours)

Course objective

- To identify dairy herd diseases causing agents, major diseases, epidemiology and clinical treatments and management principles.

Course descriptions

- Economical important infectious and parasitic diseases of dairy animals. Zoonotic diseases of public health importance. Prevention and control of mastitis in dairy herds. Non-infectious disease prevention and control in dairy animals.

Course outline

- Infectious diseases (prevention, transmission and treatments)
- Parasitic diseases
- Metabolic disorders and their management
- Mastitis, its prevention and control
- Calves: congenital conditions, calf diarrhea, salmonellosis, digestive disorders of calves, calf respiratory diseases
- Zoonotic diseases of dairy origin and control

Practical activities

- Farm visits
- Identify clinical signs of diseases
- Identification of some common dairy herd diseases

Mode of delivery

- Lectures, seminar presentation, reading assignments, laboratory reports and presentation

References

- Andrews A.H., Blowey R.W., Boyd H and Eddy R.G. 2004. Bovine Medicine Diseases and Husbandry of Cattle. 2nd edition, Blackwell science

DScT 582. Current Topics in Dairy Sciences and Technology (1 Credit hour)
Course objective • To equip the students with skills and knowledge about identifying the current topic in dairy science and technology and preparing scientific review manuscript, and presentation.
Course descriptions • Students will select current topics, submit it for approval by the Department Graduate Council and then review/assess and document current issues related to Dairy Science and Technology, submit their review and make public presentation.
Mode of delivery • Student review pertinent scientific articles and prepare review manuscript and finally make public presentation

DScT 611. MSc Research Thesis Proposal (P/F)
Course objective • To equip students with identification of researchable problems, appropriate research topic selection and writing MSc thesis proposal following scientific procedures
Course descriptions • Research topic selection in Dairy Sciences and Technology upon consultation with advisors, and should be submitted to the department for approval by Department Graduate Council. Identify gaps and designed strategies to fulfil these research gaps (defined clearly the statement of problems) and select appropriate methods and design. Review recent literatures. Make presentation and submit the approved MSc thesis proposal.
Mode of delivery • Proposal presentation

DScT 621. Graduation Seminar (P/F)
Course objective • To equip students with skills of presentation, quality power point slide preparation, and get important comments prior to their final MSc thesis defense.
Course descriptions • Students will be evaluated on their scientific power point slides preparation from their major MSc research thesis finding and presentations in front of the public audience
Mode of delivery • Presentation by the student

DScT 631. MSc Research Thesis (6 Credit hour)
Course objectives • To enable students to undertake MSc research thesis as per the approved MSc thesis proposal and then prepare and writeup the manuscripts using data collected in the area of Dairy Sciences and Technology
Course descriptions • The graduate student undertakes an independent original research on a topic relevant to their fields of specializations under supervision of advisors. The topic and plan of study is to be determined by the student and advisors and should be approved by the department. The research thesis prepares according to the guidelines of Debre Berhan University. The MSc research thesis should be submitted to the department and publicly defended.
Practical activities • Research experiment
Mode of delivery • Student public MSc research thesis defense