## General Education Courses

### 1. Language Courses

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- **BG 1001 English I**
  - Lower intermediate academic English, with activities to foster reading, writing, listening and speaking skills in English through communicative activities in a meaningful academic context.

- **BG 1002 English II**
  - Prerequisite: BG 1001 English I
  - Intermediate academic English, reinforcing fluency and grammar with task-driven oral and writing exercises, developing vocabulary and sentence writing skills with combined reading comprehension exercises and writing practice.

- **BG 2000 English III**
  - Prerequisite: BG 1002 English II
  - Advanced English for academic and career purposes, emphasizing organization of ideas and clarity of expression and understanding.

- **BG 2001 English IV**
  - Prerequisite: BG 2000 English III
  - Advanced English for academic and career purposes, emphasizing critical and analytical skills, and formulating logical and coherent opinions.

### 2. Social Science Courses

- **6 Credits**
BG 2403 Introduction to Economics 3(3-0-6) Credits

Basic economic principles and analysis of the economic environment in consumption, production and economic exchange. Analysis of economic decision making of consumers and producers; price mechanism, demand and supply analysis; product and factor markets, the aggregate demand and aggregate supply analysis, GNP and NI measurement of the whole economy.

GE 2202 Ethics 3(3-0-6) Credits


3. Humanities Courses 6 Credits

GE 1202 General Psychology 3(3-0-6) Credits

Various psychological theories and factors, processes and conditions that form one’s characters, behaviors, attitudes, and emotions.

GE 2101 World Civilization 3(3-0-6) Credits

Development of human society, rise and fall of civilizations, achievements and heritages of Western and Eastern civilizations since ancient time in order to understand their roots and their impacts on modern societies.

4. Science and Mathematics Courses 6 Credits

BG 1201 Statistics I 3(3-0-6) Credits

Descriptive statistics, probability theory and inferential statistics, summarizing of data in tables and graphs, computation of descriptive statistics, rules of probability, probability distributions, confidence interval estimate of population parameters, and hypothesis testing.
SC 2151 Introduction to Microcomputer Application 3(3-0-6) Credits

Structure and characteristics of microcomputers, and the techniques of applying microcomputer technology, focus on software packages such as word processing, spreadsheet, database management systems, etc. The course will cover current technologies as well as future trends.

Specialized Courses

(a) Core Courses

BS 1001 General Chemistry 3(3-0-6) Credits

Fundamental chemistry, atomic theory and electronic structure of atom, bonding theory, stoichiometry, periodic table as a survey of representative and transition elements and periodic properties, gas and kinetic theory of gas, acids/bases chemistry including acid base chemical equilibrium, oxidation-reduction and basic thermodynamics.

BS 1002 General Chemistry Laboratory 1(0-3-1) Credit

Prerequisite or Corequisite: BS 1001 General Chemistry

Safety in laboratory and use of basic chemical instrument, experimentation techniques in measurement and accuracy, molecular structure, chemical reactions, determination of pH of solution and titration, relative quantity, colligative properties of solution, techniques and basic theory in qualitative analysis.

BS 1005 Principles of Biology 3(3-0-6) Credits

Life, prokaryotic and eukaryotic cell structure and functions of organelle in the cells, cell division, and gamete production, pattern of inheritance, gene expression, energy and photosynthesis, study of animal cells and plant cells, ecology, behavioral science and evolution.

BS 1006 Biology Laboratory 1(0-3-1) Credit

Prerequisite or Corequisite: BS 1005 Principles of Biology

Laboratory corresponding to BS1005 Principles of Biology, general concepts of microscope usage, plant and animal cell structure, somatic cell division including the production of reproductive cells, energy and photosynthesis.
**BS 1007 Organic Chemistry** 3(3-0-6) Credits

Fundamental theories of organic chemistry involving the classification of organic compounds according to their functional groups, nomenclature and structure, reactions of organic molecules including synthesis and reaction mechanisms.

**BS 1008 Organic Chemistry Laboratory** 1(0-3-1) Credits

*Prerequisite or Corequisite: BS 1007 Organic Chemistry*

Safety in laboratory and use of apparatus, physical characteristics of organic substances e.g. melting point, boiling point, solubility, and analytical techniques of organic substances e.g. separation, purification, and techniques used for the identification of functional groups in organic compounds.

**BS 1101 Calculus I for Bioscience** 3(3-0-6) Credits

Changing of value with respect to factors, differentials, second and higher order differential, and basic differentiation, basic integration, indefinite and definite integration, and higher order integration, applications of basic calculus, i.e. sketching the curves, optimization, surrounded area by curves, volume of geometrics and calculus questions.

**BS 1102 Calculus II for Bioscience** 3(3-0-6) Credits

*Prerequisite: BS 1101 Calculus I for Bioscience*

Multivariable function, changing of value of multivariable function with respect to factors, chain rules for multivariable function, partial derivative and its application; 3-D geometrics function by rectangular coordinate, cylindrical coordinate and spherical coordinate; evaluation of the area and volume of those 3-D geometric shapes, principles of vector in mathematics including basic vector operations, transition of general vector and vector-valued function, velocity, acceleration, direction of an objects, tangent vector, and normal vector, described by vector-valued function, and line integral.
BS 1201 Physics for Bioscience  
3(3-0-6) Credits

Basic knowledge of physics including units, vector, force and motion, Newtonian motion, work and energy, conservation of energy and momentum, fluids mechanics, internal energy and fundamental heat transfer, thermodynamics, waves and sound, electricity and magnetism, light and color and introduction to advance physics for bioscience.

BS 1202 Physics Laboratory for Bioscience  
1(0-3-1) Credit

Prerequisite or Corequisite: BS 1201 Physics for Bioscience

Laboratory course corresponding to BS1201 Physics for Bioscience.

BS 2004 Analytical Chemistry  
3(3-0-6) Credits

Prerequisite: BS 1001 General Chemistry

Quantitative chemical analysis, steps involved in the preparation and analysis of a sample, analysis techniques using gravimetric and volumetric methods; especially, acid-base titration, precipitation titration, redox titration as well as spectroscopy methods.

BS 2005 Analytical Chemistry Laboratory  
1(0-3-1) Credit

Prerequisite or Corequisite: BS 2004 Analytical Chemistry

Chemistry analysis exercises emphasizing on quantitative chemical analysis of chemical samples by combining theories and techniques, including chemical sample preparation and analysis techniques using gravimetric and volumetric methods, especially acid-base titration, precipitation titration, redox titration technique.

BS 2006 Basic Biochemistry  
3(3-0-6) Credits

Prerequisite: BS 1007 Organic Chemistry
Structure, function and metabolism of biomolecules including carbohydrates, lipids, amino acids, protein and nucleic acids, characteristics, classification and functions of proteins, enzymes and vitamins, the introduction to gene regulation and genetic engineering.

BS 2007 Basic Biochemistry Laboratory 1(0-3-1) Credits

Prerequisite or corequisite: BS 2006 Basic Biochemistry

Laboratory corresponding to BS 2006 Basic Biochemistry, preparation of buffers, analysis of biomolecules properties, use of laboratory equipment and instruments.

BS 2008 Physical Chemistry 3(3-0-6) Credits

Prerequisite: BS 1001 General Chemistry

Unit conversions, physical properties of gas and kinetic theory of gas, energy and work, the first law of thermodynamics, entropy, the second and third laws of thermodynamics, free energy and applications of thermodynamics.

BS 2011 Introduction to Microbiology 3(2-3-5) Credits

Prerequisites: BS 1005 Principles of Biology and BS 1006 Biology Laboratory

Overview of microbiology in both theoretical and practical aspects, eukaryotic and prokaryotic microorganisms, viral biology, growth and metabolisms of microorganisms, microbial genetic, classification and identification of microbes, roles of microbes to human, environment and in the industries and corresponding laboratory sessions.

BS 2012 Genetics 3(2-3-5) Credits

Co-requisite: BS 2011 Introduction to Microbiology
Principles of classical genetics, Mendel's principles, exception of Mendel, sex determination, sex linkage and chromosome mapping, molecular genetics which includes the structure and functions of DNA, DNA replication, transcription, translation, control of gene expression and extrachromosomal inheritance, and the study of evolutionary genetics, quantitative and qualitative genetics, and corresponding laboratory sessions.

BS 2013 Engineering Drawing for Bioscience 1(0-3-1) Credit

Basic and standard of drawing, lettering, applied geometry, theory and technique of orthographic drawing, pictorial drawing, dimensioning, section view, and assembly drawing

BT 2011 Introduction to Biotechnology 3(3-0-6) Credits

Prerequisite: BS 2006 Basic Biochemistry or
Co-requisite: BS 2011 Introduction to Microbiology

Introduction and historical perspective of biotechnology, the relationship between traditional biotechnology and modern biotechnology, examples of application drawn from agriculture, medicine, and molecular biotechnology, commercial dimension of the discipline of biotechnology in market place.

BT 3013 Introduction to Bioprocessing Engineering 3(3-0-6) Credits

Prerequisites: BS 1102 Calculus II for Bioscience and
BS 2008 Physical Chemistry

Introduction to chemical engineering principles importance of understanding bioprocess operation and bioreactor design, unit conversions, material and energy balances, fluid flow, heat and mass transfer, reaction kinetics, and bioreactor operation.
BT 3015 Industrial Fermentation

Prerequisite: BS 2011 Introduction to Microbiology

Selection of microbial culture, and the use of microorganism for the production of industrial products, food products, enzymes, antibiotics and organic compounds, cultural improvement, emphasizing on the metabolic regulation of the pathways that generate fermentation products from yeast and other microbial fermentations, and genetic manipulation of industrial microorganisms, and corresponding laboratory sessions.

BT 3016 Enzyme Technology

Prerequisite: BS 2006 Basic Biochemistry

Structure and functions of enzymes, including enzyme kinetics, regulation and inhibition, effect of pH and temperature, production and extraction of enzymes by means of mechanical, physical or chemical disruption of plant, animal or microbial cells, techniques such as purification, immobilization and isolation of enzymes as catalysts, and corresponding laboratory sessions.

BT 3017 Principles of Research

Introduction to research methodology, experimental design, hypothesis generation, literature review, collection and analysis of the data, use of spreadsheet packages to perform statistical analysis, summarizing and writing a research report, presentation, and ethical principles of a researcher.

(b) Major Required Courses

AI 3201 Biological Material and Biodegradation

Prerequisites: BS 1005 Principles of Biology and BS 1006 Biology Laboratory

Properties and mechanisms of biodeterioration in natural materials important in Agro-industry, techniques used in assessing the extent and causes of deterioration, damage reduction strategy and technique, including biodeterioration in the environment, and corresponding laboratory sessions.

AI 3202 Introduction to Agro-Industry

Prerequisites: BS 1001 General Chemistry and
BS1005 Principles of Biology

Meaning and importance of agro-industry to the economy of the country, factors and composition of agro-industry, types of agro-industrial products and the value adding processes.

Al 3203 Instrumentation and Control in Agro-Industrial Process 3(2-3-4) Credits

Prerequisites: BS 1001 General Chemistry,

BS 1201 Physics for Bioscience and

BS 1202 Physics Laboratory for Bioscience

Principles and application of instruments involved in biotechnology and their variation in control system, their roles in production efficiency and stability and their application in research, the application of mathematics and physics models to convert the signal and the control system in Agro-Industry, and corresponding laboratory sessions.

Al 3204 Processing of Agricultural Products I 3(2-3-4) Credits

Prerequisite: Al 3202 Introduction to Agro-Industry

Chemical, physical and biological properties and characteristics of agricultural raw materials, factors and processing principles for converting agricultural raw materials into industrial products. This course is also combined with laboratory sessions.

Al 3205 Biochemical Engineering 3(3-0-6) Credits

Prerequisites: BS 2006 Basic Biochemistry and

BS 2011 Introduction to Microbiology

Applications of biological organisms and their enzymes in the bioprocesses and the enzyme technology, bioprocess economics, applied enzyme kinetics, fermentation kinetics, metabolic stoichiometry, transport phenomena, sterilization techniques, bioreactor design and operation, upstream and downstream processes and optimization in the process scale up.

Al 3206 Agro-Industry Management and Marketing 3(3-0-6) Credits

Prerequisite: BG 2403 Introduction to Economics
Basic principles of marketing and management which can be applied to use with agricultural products. The topics include environmental factors in Agro-industry, consumer’s buying behavior, marketing research, product development, pricing strategy, distribution channel, and promotion strategy in with the examples and the case studies of agro-industrial products.

**AI 3207 Unit Operation of Agro-Industry I**

*3(2-3-5) Credits*

*Prerequisite: BT 3013 Introduction to Bioprocess Engineering*

Concepts and principles of engineering for various unit operations in agro-industry, topics include pumps, heat exchangers, evaporators, dryers, refrigerators, boilers, retorts, and size reduction equipment, and corresponding laboratory sessions.

**AI 3208 Standards and Regulations of Agricultural Products**

*2(2-0-4) Credits*

*Prerequisite: AI 3202 Introduction to Agro-Industry or FT 3101 Introduction to Food Technology*

Legal and scientific issues involved in the national and international regulations of agricultural products and foods, philosophy underpinning the application of regulation statutes, roles and responsibilities of Thai FDA and international organizations e.g. WTO and its agreements etc., Food Act B.E. 2522, food standards, Codex, risk analysis, and nutrition labeling and sources of information necessary for communication with government and public are also included.

**AI 4208 Processing of Agricultural Products II**

*3(2-3-4) Credits*

*Prerequisite: AI 3204 Processing of Agricultural Products I*

Processing methods of agricultural products into food products and non-food products including fruit and vegetable, cereal, meat, milk, rubber, wood and textile and packaging of the products, and corresponding laboratory sessions.

**AI 4209 Unit Operation for Agro-Industry II**

*3(2-3-5) Credits*

*Prerequisite: AI 3207 Unit Operation for Agro-Industry I*
concepts and principles of engineering for various unit operations in separation processes which include distillation columns, extractors, adsorption columns, absorption towers, membrane separators, crystallizers, filters, and centrifuges, and corresponding laboratory sessions.

**AI 4211 Fermentation Process**  
3(2-3-5) Credits

*Prerequisite: AI 3205 Biochemical Engineering*

Principles of isolation, modification and storage techniques of industrial microorganisms, nutrients needed for microbial growth and media optimization, optimization and control processes during upstream, fermentation and downstream processes in batch, continuous and fed batch bioreactors, and corresponding laboratory sessions.

**AI 4213 Agro-Industrial Quality Control**  
3(2-3-5) Credits

*Prerequisite: BG 1201 Statistics I*

Agro-industrial production as a systematic and controllable process, acceptance sampling plans for analysis and control of quality, quality management, quality control, quality assurance and quality improvement, quality assurance systems, Total Quality Management and ISO series within food factory, and corresponding laboratory sessions.

**AI 4218 Agro-Industrial Product Development**  
3(2-3-5) Credits

*Prerequisite: AI 4208 Processing of Agricultural Product II*

New products and product development system for Agro-industry in laboratory and industry, generation and screening of new product ideas, design of product concept, product design specifications, prototype development and process development, sensory testing and testing of consumer acceptability, shelf life evaluation, launching of new products and evaluation of launch and hand-on experience in laboratory.

**AI 4290 Special Project**  
3(0-9-0) Credits

A project involving an aspect of Agro-Industry, design of the study, collection and analysis of experimental data under the faculty member’s supervision. A written report and presentation of the research work in a seminar is compulsory.
Al 4291 Field Trip 1(0-3-0) Credit

Visit to food or Agro-Industrial production facilities to view specific aspects of food processing and management, written report of the tour is required.

Al 4292 Seminar 1(0-2) Credit

Method in preparation and performing a scientific presentation, demonstration of scientific research paper presentation from veteran speakers in the field of biotechnology, food technology and agro-industry. Each student is required to present a selected paper of interest from scientific journals.

Al 4294 Internship Non-credit (300 Hours)

Practical training in Agro-Industry or biotechnology related industry, government sector and/or academic institute of no less than 300 hours to develop skills and confidence after graduation.

(C) Major Elective Courses

Al 4212 Tissue Culture Techniques and Application 3(2-3-5) Credits

Prerequisites: BS 1005 Principles of Biology and BS 1006 Biology Laboratory

Techniques and physiological basis of plant tissue culture used in research and industry, commercial laboratories culture media, organogenesis, somatic embryogenesis and micropropagation, and corresponding laboratory sessions.

Al 4215 Agro-Industry Preservation and Packaging 3(2-3-5) Credits

Prerequisite: Al 4208 Processing of Agricultural Product II

Reasons and factors relating to raw material and product spoilage, storage and preservation methods, principles of packaging that include packaging materials used in transportation and distribution, their properties, forms and applications, and corresponding laboratory sessions.

Al 4216 Fiber Technology 3 (2-3-5) Credits
Prerequisite: AI 4208 Processing of Agricultural Products II

Principles in production of natural fiber, sources of raw material, processing methods used in Fiber Technology, research and development of natural fiber and application as agro-industrial, and corresponding laboratory sessions.

AI 4217 Essential Oil Technology 3 (2-3-5) Credits

Prerequisite: BS 2006 Basic Biochemistry

Composition, physical and chemical characteristics of essential oils, sources of raw material, extraction, purification and use of essential oils, and corresponding laboratory sessions.

AI 4219 Sugar Technology 3 (2-3-5) Credits

Prerequisites: BS 2006 Basic Biochemistry and

AI 4208 Processing of Agricultural Product II or

FT 4108 Industrial Food Processing II

Chemical and physical properties of sugar, sugar processing and by-products from sugar industry, quality control and development of new sugar products to be used in other industries, and corresponding laboratory sessions.

AI 4220 Post Harvest Technology 3(2-3-5) Credits

Prerequisites: BS 2006 Basic Biochemistry and

AI 4208 Processing of Agricultural Product II or

FT 4108 Industrial Food Processing II

Principles underlying physiological changes in fresh agricultural produces, harvesting methods and post harvest technology to handle the post harvested crops in order to maintain the crop qualities or to delay the changes involved in deterioration of the crop qualities and, corresponding laboratory sessions.
AI 4221 Alcoholic Beverage Technology 3(2-3-5) Credits

Prerequisite: BT 3015 Industrial Fermentation

Current technologies used in production of alcoholic beverage, and monitoring of impact of fermentation variables on microbial performance and product quality, distillation principles and practices, production technology of brandy, whiskey, rum, vodka, gins, and other distilled beverages, characteristics of raw materials, fermentation, distillation, and aging, manufacturing processes used in alcoholic beverages production, research development involving the use of biotechnology for the purpose of yield, solving quality related problems and stimulation innovation, an introduction to management, marketing and economics of most of the alcoholic beverages, review market segmentation and explore alternative, social policy formation, and corresponding laboratory sessions.

AI 4222 Water and Waste Management 3(2-3-5) Credits

Prerequisite: BS 2011 Introduction to Microbiology

Water and waste management starting from good preparation of raw material for industry, clean technology, waste controlling, and water management of downstream process to reduce sources of pollution, and corresponding laboratory sessions.

AI 4223 Waste and By-product Utilization 3(2-3-5) Credits

Prerequisite: BS 2011 Introduction to Microbiology

Principles and practical issues for using of waste and by-products from industry to find optimum method to produce products from those waste materials, and corresponding laboratory sessions.

AI 4226 Plant Breeding Technology 3(2-3-5) Credits

Prerequisites: BS 2012 Genetics and AI 3202 Introduction to Agro-Industry

Life cycle of monocotyledons and dicotyledons, sexual and asexual reproduction of plant, factors affecting plant growth, plant cultivation techniques and seed storage technology, mechanisms of germination, seed selection, techniques for sexual and asexual propagation. The course also includes the study of plant genetic, inheritance,
germplasm bank, the use of genetic engineering to create new plant species and also industrial seed production techniques, and corresponding laboratory sessions.

**AI 4232 Secondary Metabolites of Plant Cells**  
3(2-3-5) Credits

*Prerequisites: BS 2006 Basic Biochemistry and BS 2007 Basic Biochemistry Laboratory*

Use of plant cells for production of secondary metabolism products such as alkaloid, monoterpenes, biopolymer, antimicrobial agents and flavors products. The course will also discuss on metabolic regulation of the desired products, genetic manipulation of plant cells with different techniques e.g. recombinant DNA and protoplast fusion techniques, and corresponding laboratory sessions.

**AI 4233 Pulp and Paper Technology**  
3(3-0-6) Credits

*Prerequisite: AI 4208 Processing of Agricultural Products II*

Basic knowledge in pulp and paper science and technology, pulping process, pulp bleaching, paper processing, coating of paper, use of non-fibrous additives, measurement of pulp and paper quality, paper recycling process, water treatment in the pulp and paper mill, and new technology in pulp and paper processing.

**AI 4234 Wood Technology**  
3(3-0-6) Credits

*Prerequisite: AI 4208 Processing of Agricultural Products II*

Types of wood, natural properties of wood, mechanical properties and degradation, basic principles of wood preservation, processing of wood and commercial uses for wood products as well as safety and quality control in wood manufacturer.

**AI 4235 Rubber Technology**  
3(3-0-6) Credits

*Prerequisite: AI 4208 Processing of Agricultural Products II*

Chemical and physical properties of rubber, definition and basis concepts of Caoutechouc, rubber and elastomer, vulcanization, natural rubber latex and coagulation technology, manufacturing of industrial rubber latex sheets, block rubber and rubberized products and recent developments in the biotechnology associated with rubber technology.
AI 4236 Feed Manufacturing Technology 3(3-0-6) Credits

Prerequisite: AI 4208 Processing of Agricultural Products II

Production of feeds, nutritional requirement of economically important animals, the composition and nutrition characteristics of common feeds, feed formulation, economics of feeding programs for farm animals, plant layout design, selection of appropriate equipment, quality control, feed manufacturing management, safety and sanitation for feed manufacturing industry and also the application of biotechnology to improve quality of feeds.

AI 4237 Leather Product Technology 3(3-0-6) Credits

Prerequisite: AI 4208 Processing of Agricultural Products II

Leather and hide used for industrial purposes and their properties as well as processing technology of leather and hide, equipment and tools used in leather industry, waste and environmental management for leather manufacturer.

AI 4238 Mushroom Cultivation Technology 3(3-0-6) Credits

Prerequisite: BT 3015 Industrial Fermentation

Biology and cultivation of different types of mushroom that is economically important especially for human consumption, preparation of starter culture, support materials and media preparation and sterilization, environmental control for fruiting body formation, preparation of cultivation room or space, cultivation methods and also post harvest technology for mushroom, including mushroom diseases and prevention methods.

AI 4239 Selected Topic 3(2-3-5) Credits

Discussion and advanced study of a selected topic in the field of Agro-Industry, and corresponding laboratory sessions.

BS 4001 Ecology, Conservation and Environmentalism 3(3-0-6) Credits

Prerequisite: BS 1005 Principles of Biology
Biological productivity in ecosystem and limiting productivity and perturbation, interaction between species, factors in population growth and the ecological balance, protection activities of the environment from pollution or destruction concerning conservation, improvement and sustainability of natural resources.

**BT 3014 Microbial Physiology**
3(2-3-5) Credits

*Prerequisite: BS 2012 Genetics*

Microbial structures and functions to understand how physiology relates to microbial growth and survival. Bacteria are used as the primary model and are focused on the molecular aspect of cell growth, structure and functions, cell envelope, cellular metabolism and genetics, and corresponding laboratory sessions.

**BT 3018 Genetic Engineering**
3(2-3-5) Credits

*Prerequisites: BS 2006 Basic Biochemistry, BS 2007 Basic Biochemistry laboratory and BS 2012 Genetics*

Molecular biology and techniques of genetic engineering, application of enzymes, vectors, and host gene isolation, detection of recombinant genes, strategies of gene cloning, genomic libraries, cDNA synthesis, gene identification, application of genetic engineering, ethical issues in genetic engineering, and corresponding laboratory sessions.

**FT 3103 Food Microbiology**
3(2-3-5) Credits

*Prerequisite: BS 2011 Introduction to Microbiology*

Microorganisms in food safety and spoilage, their growth parameters, main characteristics of common food-borne pathogens e.g. bacteria, viruses, parasites and fungi, contamination routes and surviving in foods, subsequent diseases and possible means for controlling, a background to practically identify and examine the organisms, and corresponding laboratory sessions.

**FT 3108 Food Chemistry I**
3(2-3-5) Credits

*Prerequisites: BS 2004 Analytical Chemistry*
BS 2005 Analytical Chemistry Laboratory

BS 2006 Basic Biochemistry and

BS 2007 Basic Biochemistry Laboratory

Basic food components e.g. water, carbohydrate, protein and lipid, their chemistry governing properties and functions in different foods, changes of food components during processing and storing, chemical spoilages and prevention, and corresponding laboratory sessions.

FT 3109 Food Chemistry II 3(2-3-5) Credits

Prerequisite: FT 3108 Food Chemistry I

Chemistry of pigments, odor and food additives, factors affecting properties, functions, sources and mechanism in different foods, chemical reaction of enzymes, changes and contamination of toxic substances in foods, theory, selection, analysis techniques of food with scientific instrument, and corresponding laboratory.

FT 4115 Fruit and Vegetable Technology 3(2-3-5) Credits

Prerequisite: FT 4108 Industrial Food Processing II or AI 4208 Processing of Agricultural Products II

Chemical and physical structure of fruits and vegetables, post harvest changes and handling methods of fresh fruits and vegetables, and commercial processing methods for preservation of fruits and vegetables, advanced technologies in fruit and vegetable processing, and corresponding laboratory sessions.

FT 4117 Dairy Technology 3(2-3-5) Credits

Prerequisite: FT 4108 Industrial Food Processing II or AI 4208 Processing of Agricultural Products II

Milk production and quality in terms of composition, structure, properties and microbiology of milk, principles of commercial practices in processing of milk and dairy products, advanced technology used in dairy industries, and corresponding laboratory sessions.
FT 4121 Meat Poultry and Fishery Technology 3(2-3-5) Credits

Prerequisites: FT 3103 Food Microbiology

FT 3108 Food Chemistry I or

FT 4108 Industrial Food Processing II

Chemical and physical structure of animal muscles used for human consumption, postmortem changes in muscles and factors affecting the quality of muscle products, pigment development and changes in animal tissue, deterioration and spoilage of animal tissues during processing and storage, and production of different meat, poultry and fishery products, and corresponding laboratory sessions.

FT 4123 Food Sanitation 3(2-3-5) Credits

Prerequisite: FT 3103 Food Microbiology

Principles of cGMPs of food processing, plant layout, receiving raw material, food handling, warehouse controlling, cleaning, pest controlling, water treatment and personnel hygiene, theory and practices on principles of Hazard Analysis of Critical Control Points (HACCP) to produce safe food product; and corresponding laboratory sessions.

FT 4124 Lipid Technology 3(2-3-5) Credits

Prerequisites: BS 2006 Basic Biochemistry and

FT 4108 Industrial Food Processing II or

AI 4208 Processing of Agricultural Product II

Chemistry and biochemistry of triglycerides and related lipid substances, biosynthesis and degradation of lipids, industrial production of fats and oils including extraction, degumming, and refining, deodorization, crystallization, and hydrogenation, microbial and enzymatic modification of lipids, corresponding laboratory sessions involving with analytical methods and quality control of the edible fat and oil and their products.
FT 4126 Food Packaging 3(3-0-6) Credits

**Prerequisite:**  FT 4108 Industrial Food Processing II or AI 4208 Processing of Agricultural Products II

Chemical, physical and biological properties of packaging material, production techniques and quality control of food packages such as paper, glass, tin plate, plastic films, aluminum foil, laminates and composite materials, criteria in selecting proper package to extend shelf life of different types of food and current trends in development of food package.

FT 4127 Cereal Technology 3(2-3-5) Credits

**Prerequisite:**  FT 4108 Industrial Food Processing II or AI 4208 Processing of Agricultural Products II

Composition, structure and significance of various kinds of cereals, manufacturing technologies, quality control, storage of cereal and cereal products, and development of new products from cereal, and corresponding laboratory sessions.

FT 4132 Color and Flavor Technology 3(2-3-5) Credits

**Prerequisites:**  BS 2004 Analytical Chemistry and BS 2005 Analytical Chemistry Laboratory

Chemistry of various food colorants, their properties, physiological changes, measurement methods, and affecting factors, flavor chemistry, properties of flavor, development and extraction process of flavor from plants, animals, via food processing; and application of color and flavor in foods, and corresponding laboratory sessions.