

All Course Descriptions

1. General Education

Category: Global and Social Literacy Category

TU101 Thailand, ASEAN, and the World 3 (3-0-6)

Study of significant phenomena around the world, in the ASEAN region and in Thailand in terms of their political, economic and sociocultural dimensions. This is done through approaches, theories and principles of social science research via discussion and raising examples of situations or people of interest. The purpose of this is to create a perspective of diversity, to understand the complexity of global interrelationships, to build a global mindset and to be able to challenge old paradigms and open up a new, broader worldview.

TU109 Innovation and Entrepreneurial Mindset 3 (3-0-6)

Risk assessment and creating new opportunities. Thinking and planning as an entrepreneur. Decision making and entrepreneurial venture development. Business communication for delivering concept or initiative in an efficient, effective and compelling manner. Social shared value creation.

Category: Aesthetics and Communication Skills

EL 105 English Communication Skills 3 (3-0-6)

Development of English communication skills, including listening, speaking, reading and writing. Practice of language, vocabulary and expressions used in academic and social contexts.

LAS101 Critical Thinking, Reading, and Writing 3 (3-0-6)

Development of critical thinking through questioning, analytical, synthetic and evaluation skills. Students learn how to read without necessarily accepting all the information presented in the text, but rather consider the content in depth, taking into account the objectives, perspectives, assumptions, bias and supporting evidence, as well as logic or strategies leading to the author's conclusion. The purpose is to apply these methods to students own persuasive writing based on information researched from various sources, using effective presentation techniques.

TU102 Life & Aesthetics 3 (3-0-6)

The course investigates aesthetic and fundamental elements of art and built environment. These include appreciation in value and meaning, analyses and criticisms, and connections to lives and social contexts.

TU106 Creativity and Communication **3 (3-0-6)**

Creative thought processes, with critical thinking as an important part, as well as communication of these thoughts that lead to suitable results in social, cultural and environmental contexts, at personal, organisational and social levels.

Category: Mathematics, Science and Technology

TU155 Elementary Statistics **3 (3-0-6)**

The nature of statistical problems, review of descriptive statistics, probability, random variables and some probability distributions (binomial, poisson and normal), elementary sampling and sampling distributions, estimation and hypotheses testing for one and two populations, one-way analysis of variance, simple linear regression and correlation, chi-square test.

TU156 Introduction to Scientific Programming **3 (3-0-6)**

Basic computer programming and problem solving useful for scientists, mathematicians and engineers, using MATLAB and Python. Emphasizing the systematic development of algorithms and programs. Iteration. Functions. Arrays. Image processing and robotics.

TU103 Life and Sustainability **3 (3-0-6)**

This course provides an introduction to the importance of life-cycle systems perspectives in understanding major challenges and solutions to achieving more sustainable societies in this changing world. Students will learn about the relationship between mankind and the environment in the context of energy and resource use, consumption and development, and environmental constraints. Furthermore, an examination of social conflict and change from the life-cycle perspective will be used to develop an understanding of potential solution pathways for sustainable lifestyle modifications.

TU107 Digital Skill and Problem Solving **3 (3-0-6)**

Basic computational thinking skill for solving problems and developing new social and economic opportunities. Efficient access and search for information. Information reliability evaluation. Filtering and managing information systematically. Ethical digital usage and professional online communication.

Category: Well-being and Future Skills

EL296 Academic English for Science Disciplines 1 **3 (3-0-6)**

Development of English listening, speaking, reading, and writing skills for scientific academic purposes. Practice of summarizing, giving definitions,

describing processes, giving instructions, explaining cause and effect relationships, and describing compare and contrast relationships.

TU108 Self Development and Management **3 (3-0-6)**

Coping with and adaptation to university life. Development of social skill and emotional intelligence. Self- understanding and planning for the future. Personality and social etiquette. Lifelong learning. Learning to live harmoniously and respectfully with others and the society. Holistic healthcare.

Category: Social Service and Hands-On Learning

TU100 Civic Engagement **3 (3-0-6)**

Instillation of social conscience and awareness of one's role and duties as a good global citizen. This is done through a variety of methods such as lectures, discussion of various case studies and field study outings. Students are required to organise a campaign to raise awareness or bring about change in an area of their interest.

2. Basic Science and Mathematics

SC113 General Biology **3 (3-0-6)**

Biological concepts of flora and fauna in daily life, principles, structures, and basic metabolic processes of organisms at molecular, cell, tissue, organ, system, and individual levels, structures and functions of nucleic acids in genetic inheritance, genetics, reproduction, animal behavior, evolution, and ecology.

SC128 General Chemistry **3 (3-0-6)**

Atomic structure, Covalent Bonds, Representative and transition elements, Stoichiometry, Gases, Liquids and solutions, Solids, Thermochemistry, Chemical kinetics, Chemical equilibrium, Acids and bases and Electrochemistry.

SC135 General Physics **3(3-0-6)**

Principles of physics and applications; the subject covers topics in mechanics, fluids, thermodynamics, vibrations and waves, electricity and magnetism, electromagnetic waves, optics and modern physics.

SC163 General Biology Laboratory **1 (0-3-0)**

Disciplinary course(s): Parallel degree/ Dual degree SC113

Experiments related to the contents in SC113

SC173 Fundamental Chemistry Laboratory **1 (0-3-0)**

Prerequisite: have taken SC123 or SC128 or taking SC123 or SC128 in the same semester

Experiments related to the contents in SC123 and SC128

SC185 General Physics Laboratory **1 (0-3-0)**

Laboratory practices involving measurement and errors, mechanics, waves, electricity, optics and modern physics.

MA209 Calculus and Elementary Differential Equations **3 (3-0-6)**

Prerequisite : Have earned credits of MA218

Limits and continuity of functions of several variables, partial derivatives and the interpretation in geometry, higher order partial derivatives, implicit partial differentiation, the chain rule, total differentials and its applications, maxima and minima of functions of two variables and its applications, first and second order differential equations, method for determining general solutions and particular solution of differential equations and the application in modeling of scientific problems, matrices, solution of system of linear equations, eigenvalues, eigenvectors, systems of differential equations and its applications.

Note : There is no credit for students who are currently taking or have earned credits of MA219

MA218 Calculus for Science 1 **3 (3-0-6)**

Limits and continuity of functions, derivatives of algebraic functions and transcendental functions, the chain rule, derivative of implicit functions, higher order derivatives, applications of derivative, differential and its applications, antiderivatives, indefinite integrals, techniques of integration, definite integral and geometric applications of integral, infinite series.

Note: There is no credit for students who are currently taking or have earned credits of MA111 or MA211 or MA216 or AM101

3. Core Courses

BEB 100 Principle of Analytical Chemistry **4 (3-3-6)**

Classification of analytical method, analytical process, chemical preparation, gravimetric analysis, volumetric analysis, significant figure, introduction to data analysis, data variation, data comparison, method validation and verification and application of statistic software.

BEB 101 Organic Chemistry for Biochemical Industry 4 (3-3-6)

Prerequisite: Have registered of SC123 or SC128

Chemical structure related to acid-base. Stereochemistry. Reaction mechanisms. Nomenclature of organic compound. Nucleophilic and electrophilic substitution. Hydrocarbon compounds, alcohols, ethers, aromatic and polycyclic aromatic hydrocarbons, aldehydes, ketones, carboxylic acids and derivatives, carbohydrates, lipids, amino acids and proteins. Importance of organic compounds in biochemical industries.

BEB 140 Basic Engineering Skill Training 1 (0-3-0)

Valve, fitting, and tube in industries. Tube selection, tube bending, and tube installation in industries. Thread system. Valve and fitting selection. Types and selection of pressure regulator. Rubber hose and material selection. Corrosion in industrial tube system. Piping process diagram and measuring tools in industries.

BEB 200 Inorganic Chemistry for Biochemical Industry 4 (3-3-6)

Fundamental of crystal structures, energy and chemical bonding. Principles of coordination chemistry. Structure of solid surface, types of adsorptions, surface-active agents, surface analytical techniques. Introduction to catalytic chemistry, homogeneous and heterogeneous catalyst. Preparation and characterization of inorganic compounds, role of catalyst in catalytic reactions and application in biorefinery industries.

BEB 220 Biochemistry and Microbial Physiology 4 (2-6-4)

Cell and organelles. Structure, function, and metabolism of carbohydrate, amino acid, protein, nucleic acid. Gene expression and regulation. Isolation, screening and identification of microorganism. Metabolism and regulation of microorganism growth.

BEB 221 Industrial Microbiology and Fermentation Technology 4 (2-6-4)

Role of industrial microbiology, growth and production profile in microorganism. Cultivation technology for laboratory and industrial process. Microorganism maintenance. Microbial strain improvement. Major microbial product for industry.

BEB 240 Basic Principle in Engineering Calculation in Chemical Process 3 (3-0-6)

Principle of chemical engineering calculations. Stoichiometry and material balance with and without chemical reactions. Energy balances using chemical and phase equilibrium data, physical property data, and thermodynamic data.

Solving material and energy balance problems, unsteady-state material and energy balances.

BEB 241 Unit Operation in Biochemical Industry I 3 (3-0-6)

Fluid static and its applications. Fluid dynamics and basic equations of fluid flow, flow of incompressible fluids in pipelines and thin layers. Flow of compressible fluids, fluid transporting devices, and fluid measuring devices. Characteristic and properties of particulate solid, size reduction, mixing, mechanical separation of solid from fluid, sieve tray, filtration, precipitation, centrifugation, fluidization, evaporation, drying, adsorption and crystallization.

BEB 242 Unit Operation in Biochemical Industry II 3 (3-0-6)

Heat conduction, heat convection, heat radiation, double pipe heat exchangers, shell and tube heat exchangers, plate heat exchangers, condenser, evaporator. Principle of distillation, gas absorption, liquid-liquid extraction, leaching.

BEB 243 Unit Operation Laboratory in Biochemical Industry 1 (0-3-0)

Laboratory in Unit operation in an industries related in biochemical industry

BEB 290 Industrial Training 1 (0-3-0)

An internship related to the student's program of study with total working hour more than 240 h

BEB 300 Instrumental Analysis 4 (3-3-6)

Sampling plan and sample preservation, sample preparation, principle of spectroscopy, ultraviolet-visible, infrared spectroscopy, and X-ray fluorescence (UV-VIS, FTIR, and XRF), principle and application of liquid chromatography (HPLC), gas chromatography (GCMS), thermal analysis (TGA/DSC).

BEB320 Industrial Enzyme Technology 3 (2-3-4)

Structure and chemical properties of enzyme. Nomenclature and classification of enzyme. Enzyme catalytic mechanism. Enzyme kinetics. Inhibitors and inhibition of enzyme. Immobilization of enzyme. Regulation of enzyme activities and enzyme production. Purification of enzyme technology, Application of industrial enzyme

BEB 340 Engineering Thermodynamics 3 (3-0-6)

Law of thermodynamics, enthalpy, entropy, free energy, Carnot cycle, heating and cooling systems. Thermodynamics of pure substances and

mixtures, free energy at physical and chemical equilibria, phase stability and phase transition, phase diagram, chemical potential.

BEB 341 Mathematics for Biochemical Industry 2 (2-0-4)

Mathematical method for industrial problem solving. Mathematical modeling for physical state, momentum transfer, energy transfer, mass transfer, and reaction. Solving common differential equations, partial differential equation, and finite differences by numerical analysis technique.

BEB342 Chemical and Biochemical Reactor Design 3 (3-0-6)

Elements of reaction kinetics. Kinetics of heterogeneous catalytic reactions. Transport processes of chemical reaction system with solid catalyst. Gas-solid and gas-liquid reactions. Batch and semibatch reactors, plug flow reactor, fixed bed catalytic reactors, non-ideal flow patterns and material balance models. Fluidized bed and transport reactors, multi-phase flow reactors, fermentation, growth kinetics, aeration, bioreactor design and scale-up.

BEB 343 Process Simulation Laboratory in Biochemical Industry 1 (0-3-0)

Application of computer programming for process simulation related in biochemical industries

BEB 360 Introduction to Biofuel and Biochemical Industry 2 (2-0-4)

Direction and situation of operation in biofuel and biochemical industries. Related process in biofuel and biodiesel industries, biomass power plant, biogas production, biochemical industries, bio-based chemical industries, bio-based material industries, oleochemical industries from plant oil or animal fat.

4. Required Course

Track 1 Cooperative Education Course

BEB 396 Pre-Cooperative Education 1 (1-0-3)

Pre-cooperative education in workplace. Preparation of job application documents. Job interview. Personality development. Science communication skills. Basic computer programming. Industrial safety.

BEB496 Cooperative Education I 6 (More than 450 h)

On the job training as a temporary employee according to the assigned project including report writing and presentation.

BEB 497 Cooperative Education II 6 (More than 450 h)

Prerequisite: Have earned credit of BEB 497

On the job training as a temporary employee according to the assigned project including integration in science, possibility of economic and environmental effect. Report writing and presentation for evaluation from advisor, supervision of the assigned person and committees.

Track 2 Integrated Research Course

BEB 386 Research Methodology

1 (1-0-3)

Database search, research planning, research proposal development, research methodology and regulations related to the conduct of research. Writing research report and research presentation.

BEB 406 Advanced Organic Chemistry for Biochemical Industries

3 (3-0-6)

Prerequisite: Have earned credits of BEB 101

Free radicals, alpha carbanion of carbonyl compounds and condensation. Molecular rearrangements, pericyclic reactions, syntheses and reactions of small ring, five- and six- membered ring heterocycles with one or more heteroatoms. Polycyclic heterocycles.

BEB 407 Introduction to molecular simulation

3 (3-0-6)

Concepts of molecular simulation, potential energy surface, intermolecular force and three- dimensional molecular models. Molecular mechanics, molecular dynamics simulation, biomolecular simulation. Hartree-Fock theory. Self- consistent field method, Basis function, problems and treatments of electron correlation. Density functional theory. Input preparation, calculation of molecular properties, analysis of simulation output, example of computational programs and some chemical and biochemical applications.

BEB 426 Biological Raw Material Pretreatment

3 (3-0-6)

Classification and types of biological raw material. Biological raw material pretreatment process and related technology. Physical, chemical and biological factors of pretreatment process. Analysis of biological raw material-pretreated structure. Use of pretreated-biological raw material. Economic evaluation and field trips.

BEB 427 Microbial Bioenergy and Biochemical

3 (3-0-6)

Recent developments microbial fermentation of biowastes. Strategies for improved microbial fermentation for the biodegradation of waste plastic and for the conversion of organic waste into bioenergy and biochemical. Principles of microbial process potential bioaugmentation. Genetically modified microorganisms. Co-digestion strategies. Feedstock pre-treatment strategies. Enzyme technologies. Hybrid technology approaches and field trips.

BEB 486 Special Project in Bioenergy and Biochemical Refinery Technology 1 3 (0-9-0)

Research and problems solving under supervision of supervisor, experimental and searching information from various sources. A report is required.

BEB 487 Special Project in Bioenergy and Biochemical Refinery Technology 2 3 (0-9-0)

Prerequisite: Have earned credit of BEB 486

Research and problems solving under supervision of supervisor, experimental and searching information from various sources. A report is required.

BEB 488 International Research Experience Training 1 3 (0-9-0)

Doing research abroad. Research and problems solving under supervision of foreign supervisor, experimental and searching information from various sources. A report is required.

BEB 489 International Research Experience Training 2 3 (0-9-0)

Prerequisite: Have earned credit of BEB 488

Doing research abroad. Research and problems solving under supervision of foreign supervisor, experimental and searching information from various sources. A report is required.

and complete at least 6 additional credits from the major elective courses offered by the Bioenergy Technology and Biochemical Processing Program, as detailed below:

5. Major Elective Course

BEB 306 Characterization techniques 3 (2-3-4)

Thermal analysis: thermogravimetric analysis (TGA), differential scanning calorimetry (DSC), dynamic-mechanical analysis (DMA); Spectroscopy: energy dispersive x-ray spectroscopy (EDX), x-ray photoelectron spectroscopy (XPS), infrared spectroscopy (IR); x-ray powder and single crystal diffraction (XRD); Electron microscopes: optical microscopy (OM), scanning electron microscopy (SEM), transmission electron microscopy (TEM), scanning probe microscopy (SPM), atomic force microscope (AFM); Elemental analysis and mass spectrometry, temperature programme techniques, oxygen demand measurement (TOC/BOD/COD), adsorption techniques, fuel testing.

BEB 307 Polymer chemistry 3 (3-0-6)

Commercial Synthesis of Important Polymers. Reaction and Manufacturing Process. Reaction Mechanism. Physical properties and characterizations. Crystalline and amorphous. Application of polymers.

BEB308 Polymer Processing 3 (3-0-6)

Physical basis related to polymer processing. Mixing process. Compression molding, transfer molding, injection molding, extrusion, film molding, foam molding, rotational molding. Other polymer processing techniques for plastics.

BEB 346 Fundamental of electrical and electronics devices 3 (2-3-4)

Basic electrical concepts, electrical units, classification of electricity, electrical safety, basic electronic circuits, electrical circuits, oscillator circuits, power amplifier circuits, electrical measuring instruments, functions of linear and non-linear electrical devices such as diode, transistor, operational amplifier, power supply, repairing of electronic circuits.

BEB 366 Economic and Ecological Design 3 (3-0-6)

Definition and principle of economic and ecological Design (Ecodesign). Environmental parameter, life cycle concept, stakeholder requirements, quality function deployment for environment technologies, environmental benchmarking. Eco-design improvement strategies, product improvement, Eco-label.

BEB 367 Life Cycle Assessment and Carbon Footprint for Biochemistry Industry 3 (3-0-6)

Principle and concept of life cycle assessment (LCA), green input, process improvement, products design, green logistics and market, green consumer and safe final disposal, carbon credits carbon footprint analysis, water footprint analysis, ecological footprint analysis.

BEB 368 Biofuel and Bio-based Material Production 3 (2-3-4)

Structure of biological raw material. Physical, chemical and biological properties of biological raw material. Production of biofuel and bio-based material by microorganism and biocatalyst. Properties of biofuel and bio-based material and their benefit.

BEB 369 Bioplastics 3 (3-0-6)

Classification of bioplastics derived from petroleum-based and bio-based bioplastics, synthesis of biodegradable polymers, applications, properties, testing of biodegradability, degradation of bioplastics. Green technology. Eco-

technology. Green labeled products. Environment protection, laws or rules related to environmental concern.

BEB387	Quality Control in Biochemical Industry	3 (3-0-6)
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Technology management, economic analyses, quality control, waste management, industrial safety, ethical standard of biochemical technologist and field trip.