



Bachelor of Engineering Program in Chemical Engineering
(International Program)
(2017 New Program)

Faculty of Engineering
King Mongkut's Institute of Technology Ladkrabang
(Approved by Federation of Professional)

**Bachelor of Engineering Program in Chemical Engineering
(International Program)
(2017 New Program)**

Name of Institution King Mongkut's Institute of Technology Ladkrabang
Faculty / Campus / College Faculty of Engineering
Department Chemical Engineering

Part 1: General Information

1. Program Title

Title : Bachelor of Engineering Program in Chemical Engineering
(International Program)

2. Degree and Field Title

Full Name : Bachelor of Engineering (Chemical Engineering)
Abbreviation : B.Eng. (Chemical Engineering)

3. Major or Minor subjects

None

4. Total Credits

At least 147 credits

5. Type of the Program

5.1 Type

- 4-Year Bachelor's Degree Program
- 5-Year Bachelor's Degree Program
- Others (Specify).....

5.2 Program Type

- Academic Bachelor's Degree Program
- 4-Year Academic Bachelor's Degree Program
- 5-Year Academic Bachelor's Degree Program
- Professional or Operational Program
- Advanced Professional or Operational Program

5.3 Language

- Thai
- Foreign language (specify the language).....English.....
- Thai and Foreign language (specify the language).....

5.4 Admission

- Only Thai students
- Only International students
- Both Thai and Foreign students

5.5 Collaboration with Other Institutes

- Program issued specifically by KMITL
- Cooperation with other institutions
 - ⇒ Institution name.....
 - ⇒ The form of cooperation.....
- Joint course with other institutions
 - ⇒ Institution nameCountry.....
 - ⇒ The form of joining.....
- Cooperate by the institute gives the degree
- Cooperate by the other institutes give the degree
- Cooperate by the student may receive a degree from two institutes (or more than 2 institutes)

5.6 Degree Conferment

- One Degree from KMITL
- Giving the degree more than one field (For example Dual degree)
- Others (Specify).....

6. Status of the Program and Consideration for the Authorization/Agreement

New Program. Course begins on August 2017.

The program has been endorsed by the Academic Committee of KMITL in its meeting

No...../.....

On.....

The program has been endorsed by the KMITL Council in its meeting

No...../.....

On.....

The course was certificated by.....

On.....

7. Expected Date for Thai Qualification Register (TQR)

Academic Year 2019

8. Career Paths

1. Chemical Engineer
2. Project Engineer
3. Process Technology Engineer
4. Production Engineer
5. Process Engineer
6. Technical Service Engineer
7. Design Engineer
8. Purchasing Engineer
9. Production Planning Engineer
10. Research and Development Engineer
11. Quality Assurance Engineer
12. Utilities Engineer
13. Safety Engineer
14. Entrepreneur

9. Instructor Details

Name - Surname (Academic Position)	Qualification (Field of study), Academic Year	University
1. Dr. Narisara Thongboonchoo	Ph.D. (Chemical and Biochemical Engineering), 2005 M.S. (Chemical Engineering and Petroleum Refining), 1998 M.Eng. (Chemical Engineering), 1993 B.S. (Industrial Chemistry), 1988	The University of Iowa, USA Colorado School of Mines, USA Chulalongkorn University King Mongkut's Institute Technology Ladkrabang
2. Asst. Prof. Dr. Apinan Namkanisorn (Chemical Engineering)	Ph.D. (Chemical Engineering), 2001 M.S. (Chemical Engineering), 1996 B.S. (Chemical Engineering), 1994	Lehigh University, USA Lehigh University, USA University of Minnesota, USA
3. Asst. Prof. Dr. Walairat Chandra- ambhorn (Chemical Engineering)	Ph.D. (Chemical Engineering), 2007 M.Eng. (Petrochemical Engineering), 2002 B.Eng. (Chemical Engineering) (Second Class Honor), 1998	The University of Manchester, UK King Mongkut's Institute Technology Ladkrabang Thammasat University
4. Asst. Prof. Dr. Kunlanan Kiatkittipong (Chemical Engineering)	Ph.D. (Chemical Engineering), 2012 B.S. (Chemical Technology), 2008	The University of New South Wales, Australia Chulalongkorn University
5. Dr. Wichitra Wongpromrat	Ph.Eng. (Chemical Engineering), 2016 Ph.D. (Engineering – Mechanics, Materials, Civil Engineering and Electrochemistry), 2015 M.Eng. (Chemical Engineering), 2012	King Mongkut's Institute Technology Ladkrabang University of Grenoble Alpes, Grenoble, France King Mongkut's Institute Technology Ladkrabang

Name - Surname (Academic Position)	Qualification (Field of study), Academic Year	University
	B.Eng. (Chemical Engineering), 2010	King Mongkut's Institute Technology Ladkrabang

10. Location of Study

- King Mongkut's Institute Technology Ladkrabang
 Off-site at.....

11. External situations of development Needed to be Considered for the Planning of the Program

11.1 Economic Situation/Development

At present, Thailand becomes a part of the ASEAN Economic Community which leads the country to develop Scientific and Technological Personnel for international competition. They must have the knowledge as well as ability and skills to communicate in English to meet a demand of liberalization on industrial structure and Economics. Furthermore, Chemical and Petrochemical Industries are important for earning a major income to Thailand and other countries in the ASEAN region. Also, the Global community has been aware of Energy Efficiency and Environmental Management. Therefore, it is important to manage limited resource for sustainability.

11.2 Social and Cultural Situation/Development

Borderless Communication, Information Accessing, Database Expanding, Lifelong Learning, Aged Society and Social Openness have led to immigration and cultural integration.

12. Effects from 11.1 and 11.2 on the Development of the Program and the Relation to the Mission of the Institute

12.1 Program Development

- The development of the program supports the needs of the country which are human resources, knowledge, and skills that related to Chemical and Petrochemical Industries or other related industries.

- The program is regularly revised to support the changes in Science and Technology that are accepted by International Standards.

- The development of the program aims to reach the goal in standardized learning outcomes of the Washington Accord.

12.2 Relation to the Mission of the Institute

The program prioritizes producing high-quality resources and innovation that are related to changes and benefits for society as well as participates in Technology, Economic, and Social Development of the country.

13. Relation (if any) with Other Programs Open in the Faculty / Other Departments of the Institute (i.e. Subjects open for the Service of the Faculties / Departments or to be Studied with Other Faculties / Departments)

13.1 Subjects/Subject Groups in the Program Available by Other Faculties / Departments / Programs

- General Education subjects
- Specific subjects
- Free electives

13.2 Subjects/Subject Groups in the Program Available and Required to be Studied by Other Faculties / Departments / Programs

None

13.3 Management

The program assigns responsible faculty instructors to collaborate with the representative from the department and other related faculty that teach subjects.

Curriculum and instructors

Curriculum

Total Credits **147 Credits**

Curriculum Structure

A. General Education Courses **30 Credits**

B. Specific Courses **111 Credits**

Compulsory Courses 108 Credits

Fundamental Science and Mathematics Courses 21 Credits

Fundamental Engineering Courses 24 Credits

Core Courses 57 Credits

Alternative Study Courses 6 Credits

Elective Courses 3 Credits

C. Free Elective Courses **6 Credits**

Subject in the curriculum

A. General Education Courses **30 Credits**

- Compulsory Courses 21 Credits

Code	Subject Credits	(Lecture/Practice/Self-study)
01006505	CREATIVE THINKING	3 (3-0-6)
01006506	CRITICAL THINKING	3 (3-0-6)
01006513	INTERPRETATION AND ARGUMENTS	4 (4-0-8)
01006514	INNOVATIVE COMMUNICATION	4 (4-0-8)
01006515	DESIGN METHODS FOR INNOVATIONS	4 (4-0-8)
01006520	LEADERSHIP AND PERSONAL DEVELOPMENT	3 (3-0-6)

- Compulsory Elective Courses 9 Credits

Code	Subject Credits	(Lecture/Practice/Self-study)
01006502	PROFESSIONAL ETHICS	3 (3-0-6)
01006503	INTRODUCTION TO PSYCHOLOGY	3 (3-0-6)
01006504	PHILOSOPHY OF SCIENCE	3 (3-0-6)
01006507	PERSONAL ECONOMICS	3 (3-0-6)
01006508	DIGITAL ECONOMY	3 (3-0-6)

01006509	ENGINEERING AND PUBLIC POLICY	3 (3-0-6)
01006510	INTRODUCTION TO ECONOMICS	3 (3-0-6)
01006511	THAI SOCIETY TO ECONOMICS	3 (3-0-6)
01006512	ASIAN STUDY	3 (3-0-6)
01006516	INNOVATION MANAGEMENT	4 (4-0-8)
01006517	LEAN STARTUP AND AGILE BUSINESS	4 (4-0-8)
01006518	EMERGING TRENDS IN ENGINEERING	1 (1-0-2)
01006519	INTRODUCTION TO ENVIRONMENTAL PRINCIPLES	3 (3-0-6)
01006521	MEDIATION FOR LIFE DEVELOPMENT	3 (3-0-6)
01006522	ENGLISH FOR SCIENCE AND TECHNOLOGY	3 (3-0-6)

- Alternative Study Courses

For students who have lower English skills than required level. Students have to these subjects without credit counts.

Code	Subject Credits	(Lecture/Practice/Self-study)
01006500	ACADEMIC LISTENING AND SPEAKING	4 (4-0-8)
01006501	ACADEMIC READING AND WRITING	4 (4-0-8)

B. Specific Courses

Compulsory Specific Courses 111 Credits

Fundamental Science and Mathematics Subjects 21 Credits

Fundamental Science Courses 12 Credits

Code	Subject	Credits (Lecture/Practice/Self-study)
01006702	PHYSICS I	4 (3-3-8)
01006703	PHYSICS II	4 (3-3-8)
01006708	CHEMISTRY	4 (3-3-8)

Fundamental Mathematics Courses 9 Credits

Code	Subject	Credits (Lecture/Practice/Self-study)
01006710	INTRODUCTION TO CALCULUS	3 (3-0-6)
01006711	ADVANCED CALCULUS	3 (3-0-6)
01006712	DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA	3 (3-0-6)

Fundamental Engineering Courses 24 Credits

Code	Subject	Credits (Lecture/Practice/Self-study)
01006801	INTRODUCTION TO ENGINEERING PROGRAMMING	3 (2-2-5)
01006802	ENGINEERING DRAWING	3 (2-2-5)
01006803	ENGINEERING MECHANICS	3 (3-0-6)
01006804	ENGINEERING MATERIALS	3 (3-0-6)
01006805	INDUSTRIAL INTERNSHIP	0 (0-45-0)
01366201	PRINCIPLE CALCULATIONS IN CHEMICAL ENGINEERING	3 (3-0-6)
01366202	THERMODYNAMICS	3 (3-0-6)
01366203	DESIGN AND ANALYSIS OF EXPERIMENTS	3 (3-0-6)
01366301	CHEMICAL PROCESS INSTRUMENTATION	3 (3-0-6)

Core Courses 57 Credits

Code	Subject	Credits (Lecture/Practice/Self-study)
01366101	ORGANIC CHEMISTRY	3 (3-0-6)
01366102	ORGANIC CHEMISTRY LABORATORY	1 (0-3-2)
01366204	CHEMICAL ENGINEERING THERMODYNAMICS	3 (3-0-6)
01366205	INTRODUCTION TO CHEMICAL ENGINEERING AND MULTIDISCIPLINARY ENGINEERING	3 (3-0-6)
01366206	FLUID DYNAMICS	3 (3-0-6)
01366207	HEAT AND MASS TRANSFER	3 (3-0-6)
01366208	BIOCHEMISTRY	3 (3-0-6)
01366209	ANALYTICAL INSTRUMENTATION AND ANALYSIS	3 (3-0-6)
01366210	ANALYTICAL CHEMISTRY LABORATORY	1 (0-3-2)
01366302	SEPARATION PROCESSES	3 (3-0-6)
01366303	CHEMICAL ENGINEERING LABORATORY 1	1 (0-3-2)
01366304	CHEMICAL ENGINEERING LABORATORY 2	1 (0-3-2)
01366305	CHEMICAL ENGINEERING KINETICS AND REACTOR DESIGN	3 (3-0-6)
01366306	WASTE TREATMENT AND POLLUTION CONTROL	3 (3-0-6)
01366307	PROCESS SIMULATORS IN CHEMICAL ENGINEERING	3 (2-2-5)
01366308	PROCESS EQUIPMENT DESIGN	3 (3-0-6)
01366309	PROCESS DYNAMICS AND CONTROL	3 (3-0-6)
01366310	SAFETY IN CHEMICAL ENGINEERING	3 (3-0-6)

01366311	ENGINEERING ECONOMICS AND DECISION TOOLS FOR BUSINESS	3 (3-0-6)
01366312	PROCESS OPERATIONS AND BUSINESS INFORMATION	3 (3-0-6)
01366313	PLANT VISIT	1 (0-3-2)
01366314	PRE-PROJECT	1 (0-3-2)
01366401	CHEMICAL ENGINEERING PLANT DESIGN	3 (3-0-6)

Elective Courses 3 Credits

Selected from following subjects

Code	Subject	Credits (Lecture/Practice/Self-study)
01366501	TRANSPORT PHENOMENA	3 (3-0-6)
01366502	AIR POLLUTION AND CONTROL	3 (3-0-6)
01366503	SELECTED TOPICS IN ENERGY AND ENVIRONMENT	3 (3-0-6)
01366504	PETROCHEMICAL TECHNOLOGY	3 (3-0-6)
01366505	PETROLEUM REFINERY ENGINEERING	3 (3-0-6)
01366506	RUBBER AND ELASTOMERS TECHNOLOGY	3 (3-0-6)
01366507	GREEN CHEMICAL PRODUCTS AND PROCESSES	3 (3-0-6)
01366508	COMPUTER-AIDED DESIGN AND MANUFACTURING (CAD/CAM)	3 (3-0-6)
01366509	APPLIED NUMERICAL METHODS IN CHEMICAL ENGINEERING	3 (2-2-5)
01366510	CORROSION	3 (3-0-6)
01366511	SELECTED TOPICS IN CHEMICAL ENGINEERING	3 (3-0-6)
01366512	BIOCHEMICAL ENGINEERING	3 (3-0-6)

Alternative Study Courses 6 Credits

Alternative Study is divided into 3 choices. Students can choose one of the choices appropriate for themselves. 6 Credits as follow.

1. Special Project

Code	Subject	Credits(Lecture/Practice/Self-study)
01366402	CHEMICAL ENGINEERING PROJECT 1	3 (0-9-0)
01366403	CHEMICAL ENGINEERING PROJECT 2	3 (0-9-0)

2. Cooperative Education

Code	Subject	Credits (Lecture/Practice/Self-study)
01006301	COOPERATIVE EDUCATION	6 (0-45-0)

3. Study Aboard or Overseas Training

This alternative study is divided into 2 choices which are Study Aboard or Overseas Training. Students have to choose one of the choice.

Code	Subject	Credits (Lecture/Practice/Self-study)
	Transferred subjects from overseas education institute	6 Credits

(Students who chose Study Aboard can transfer credits from overseas education institute follow the institution announcement not over 6 credits)

Or

Code	Subject	Credits (Lecture/Practice/Self-study)
01006302	STUDY ABROAD	6 (0-45-0)

C. Free Elective Courses

6 Credits

In Free Elective Courses, students can complete any subjects in International Program offered by the institution.

Study Plan

1st Year, Semester 1

Code	Subject	Amount of credits
01006710	INTRODUCTION TO CALCULUS	3 (3-0-6)
01006702	PHYSICS I	4 (3-3-6)
01006708	CHEMISTRY	4 (3-3-8)
01006801	INTRODUCTION TO ENGINEERING PROGRAMMING	3 (2-2-5)
01006804	ENGINEERING MATERIALS	3 (3-0-6)
01006513	INTERPRETATION AND ARGUMENTS	4 (4-0-8)
01006500	(ESL) ACADEMIC LISTENING AND SPEAKING**Audits**	4 (4-0-8)
Total of credits		21

1st Year, Semester 2

Code	Subject	Amount of credits
01006703	PHYSICS II	4 (3-3-8)
01006711	ADVANCED CALCULUS	3 (3-0-6)
01006802	ENGINEERING DRAWING	3 (2-2-5)
01006803	ENGINEERING MECHANICS	3 (3-0-6)
01366101	ORGANIC CHEMISTRY	3 (3-0-6)
01366102	ORGANIC CHEMISTRY LABORATORY	1 (0-3-2)
01006514	INNOVATIVE COMMUNICATION	4 (4-0-8)
01006501	(ESL) ACADEMIC READING AND WRITING**Audits**	4 (4-0-8)
Total of credits		21

2nd Year, Semester 1

Code	Subject	Amount of credits
01006712	DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA	3 (3-0-6)
01366201	PRINCIPLE CALCULATIONS IN CHEMICAL ENGINEERING	3 (3-0-6)
01366202	THERMODYNAMICS	3 (3-0-6)
01366205	INTRODUCTION TO CHEMICAL ENGINEERING AND MULTIDISCIPLINARY ENGINEERING	3 (3-0-6)
01366206	FLUID DYNAMICS	3 (3-0-6)
01336208	BIOCHEMISTRY	3 (3-0-6)
01006506	CRITICAL THINKING	3 (3-0-6)
Total of credits		21

2nd Year, Semester 2

Code	Subject	Amount of credits
01366203	DESIGN AND ANALYSIS OF EXPERIMENTS	3 (3-0-6)
01366204	CHEMICAL ENGINEERING THERMODYNAMICS	3 (3-0-6)
01366207	HEAT AND MASS TRANSFER	3 (3-0-6)
01366209	ANALYTICAL INSTRUMENTATION AND ANALYSIS	3 (3-0-6)
01366210	ANALYTICAL CHEMISTRY LABORATORY	1 (0-3-2)
01006515	DESIGN METHODS FOR INNOVATIONS	4 (4-0-8)
01006505	CREATIVE THINKING	3 (3-0-6)
Total of credits		20

3rd Year, Semester 1

Code	Subject	Amount of credits
01366301	CHEMICAL PROCESS INSTRUMENTATION	3 (3-0-6)
01366302	SEPARATION PROCESSES	3 (3-0-6)
01366303	CHEMICAL ENGINEERING LABORATORY 1	1 (0-3-2)
01366305	CHEMICAL ENGINEERING KINETICS AND REACTOR DESIGN	3 (3-0-6)
01366306	WASTE TREATMENT AND POLLUTION CONTROL	3 (3-0-6)
01366312	PROCESS OPERATIONS AND BUSINESS INFORMATION	3 (3-0-6)
010065xx	(GEN-ED ELECTIVES)	3 (3-0-6)
Total of credits		19

3rd Year, Semester 2

Code	Subject	Amount of credits
01366304	CHEMICAL ENGINEERING LABORATORY 2	1 (0-3-2)
01366308	PROCESS EQUIPMENT DESIGN	3 (3-0-6)
01366309	PROCESS DYNAMICS AND CONTROL	3 (3-0-6)
01366310	SAFETY IN CHEMICAL ENGINEERING	3 (3-0-6)
01366311	ENGINEERING ECONOMICS AND DECISION TOOLS FOR BUSINESS	3 (3-0-6)
01366307	PROCESS SIMULATORS IN CHEMICAL ENGINEERING	3 (2-2-5)
01366313	PLANT VISIT	1 (0-3-2)
01366314	PRE-PROJECT	1 (0-3-2)
010065xx	(GEN-ED ELECTIVES)	3 (3-0-6)
Total of credits		21

3rd Year, Semester 2 (special semester)

Code	Subject	Amount of credits
01006805	INDUSTRIAL INTERNSHIP	0 (0-45-0)
Total of credits		0

4th Year, 1st Semester

Code	Subject	Amount of credits
	ALTERNATIVE STUDY	6 (X-X-X)
Total of credits		6

4th Year, 2nd Semester

Code	Subject	Amount of credits
01366401	CHEMICAL ENGINEERING PLANT DESIGN	3 (3-0-6)
013665xx	CHEMICAL ENGINEERING ELECTIVE COURSE	3 (3-0-6)
xxxxxxxx	FREE ELECTIVE COURSE	3 (X-X-X)
xxxxxxxx	FREE ELECTIVE COURSE	3 (X-X-X)
01006520	LEADERSHIP AND PERSONAL DEVELOPMENT	3 (X-X-X)
010065xx	(GEN-ED ELECTIVES)	3 (3-0-6)
Total of credits		18

NOTE From Enroll Plan of 4th Year students in 1st Semester and 2nd Semester. Students can enroll 1st Semester subjects in 2nd Semester and enroll 2nd Semester subjects in 1st Semester. (4th Year students have to enroll completely follow the study plan)

Total credits of the program 147 Credits

Course Description

A) General Education

01006500 ACADAMIC LISTENING AND SPEAKINGAudits** 0 (4-0-8)**
(4 credits, 3-hour lecture, 1-hour recitation)

PREREQUISITE: NONE

The course provides ESL students guidance and extensive practice in listening and speaking in academic and professional settings. Listening focuses on understanding spoken English in formats such as college lectures and news broadcasts. Note-taking tasks are also included to reinforce aural comprehension. Students learn to recognize organizational patterns. Students also practice outlining main ideas and supporting details through audio taped, videotaped and live presentations. Speaking focuses on increased fluency and communicative strategies used by native speakers in academic and professional settings.

01006501 ACADEMIC READING AND WRITINGAudits** 0 (4-0-8)**
(4 credits, 3-hour lecture, 1-hour recitation)

PREREQUISITE: NONE

This course is designed to improve the reading and writing skills of ESL students. Students receive practice on reading and vocabulary development. Reading practice will emphasize paraphrasing, summarizing, and the simple analysis of texts to identify main ideas and distinguish fact from opinion. Writing practice includes writing of simple and compound sentences, using compound tenses and correct word forms, word order, spelling, and punctuation. Students will also develop the ability to write varied, complex sentences and effective paragraphs in standard written English.

01006502 PROFESSIONAL ETHICS 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

This course introduces the theory and the practice of professional and engineering ethics, including code of conducts and regulations in academic, professional and technical fields. Students also learn about different approaches to ethical problems and examine real-life case studies, drawn from a variety of professional contexts. This course helps students develop skills and knowledge to manage and engage with ethical issues in their working lives.

01006503 INTRODUCTION TO PSYCHOLOGY 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

This course introduces a broad survey of psychological science including: sensation and perception; learning, memory, intelligence, language, and cognition; emotions and motivation; development, personality, health and illness, and social behavior. Students will study and discuss relations between the brain, behavior, and experience as well as learning the process of discovering new ideas and empirical results in the field.

01006504 PHILOSOPHY OF SCIENCE 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

The course provides a study of the thing we call "science", together with its nature and methodology. The topics cover the meaning of science, reality, the nature of scientific observations, scientific theories and their discovery and formation, scientific explanations and predictions, the problem of induction, scientific rationality, the nature of scientific knowledge, concepts of truth, hypothesis testing, hypothesis confirmation, hypothesis falsification, logic of scientific method, and scientific progress.

01006505 CREATIVE THINKING 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

This course explores approaches to "How might we proceed when confronted by problems, situations too ambiguous, complex, or messy or impossible to be addressed directly through logical strategies?" It seeks to increase the participants' understanding of creativity, to improve their creative problem-solving skills and to enhance their ability to promote these skills in others, in a variety of educational settings. Students participate in activities designed to help develop their own creativity, and discuss the creative process from various theoretical perspectives. Readings are on such topics as creative individuals, environments that tend to enhance creative functioning, and related educational issues. Discussions with artists, scientists and others particularly involved in the creative process focus on their techniques, and on ways in which creativity can be nurtured.

01006506 CRITICAL THINKING 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

This course explores issues about the nature and techniques of critical thought, viewed as a way to establish a reliable basis for our claims, beliefs, and attitudes about the world. We explore multiple perspectives, placing established facts, theories, and practices in tension with alternatives to see how things could be otherwise. Views about observation and interpretation, reasoning and inference, valuing and judging, and the production of knowledge in its social context are considered. Special attention is given to translating what is learned into strategies, materials, and interventions for use in students' own educational and professional settings.

01006507 PERSONAL ECONOMICS 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

This course introduces students to the concept of personal economics. Students will learn to apply the economic way of thinking to manage their scarce resources. Employs economic concepts to understand: financial planning and income management; saving and investing; stocks, bonds, and mutual funds; risk-return tradeoff and diversification; interest rates and credit.

01006508 DIGITAL ECONOMY 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

This course will develop and utilize economic principles to better understand and explain the expansion and integration of information and communications technologies into the global economies. It will provide an introduction to concepts and theories useful in analyzing economic aspects of the digital and information technology revolutions.

01006509 ENGINEERING AND PUBLIC POLICY 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

This course examines the processes of public and private decision making which affects the evolution of a technology. While technology has an important role in shaping today's society, the social forces often plays a central role in the evolution of a technology. This course will study an engineering-related technology and its related policies. Students will discuss the technological and institutional issues, their interaction, the possible need for public policy and the factors that govern the policy.

01006510 INTRODUCTION ECONOMICS 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

This course gives an overview of economics, covering basic concepts and theories of microeconomics and macroeconomics. Topics in microeconomics studied include demand and supply, price elasticities, consumer behavior theory, production and cost theory, and perfect and imperfect competitions. Macroeconomics topics studied include aggregate demand and supply, macroeconomic data (e.g. gross domestic product, national income, etc.), management of economic growth, inflation problems, unemployment problems, money and banking systems, fiscal and monetary policy, taxation, international trades, and exchange rates.

01006511 THAI SOCIETY AND CULTURE 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

This course covers a study of Thai social identity and culture, development and inheritance of Thai culture, evolution of Thai society, as well as relation of Thai society and culture to societies and cultures of other countries.

01006512 ASIAN STUDY 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

This course covers a study of an Asian country's language, social identity and culture. The course will discuss development and evolution of an Asian country, their economic prospect, cultural settings, societies and relations to the society and cultures of other countries.

01006513 INTERPRETATION AND ARGUMENTS 4 (4-0-8)
(4 credits, 3-hour lecture, 1-hour recitation)

PREREQUISITE: NONE

This course provides the study of interpreting and analyzing written and visual arguments. Students will learn to identify the underlying values, definitions, and assumptions in those arguments. The students also learn how to synthesize a multiplicity of competing perspectives, and to articulate fundamental disagreements between those perspectives. Ultimately, students will advance their own contributions to discussions in engineering, business innovations, and technology studies.

01006514 INNOVATIVE COMMUNICATION 4 (4-0-8)
(4 credits, 3-hour lecture, 1-hour recitation)

PREREQUISITE: NONE

This course provides the study and practice of different communication skills including technical, professional and creative writing; infographics design; and delivering presentation. The students will study relevant techniques and learn to combine a range of skills in order to effectively communicating technical or specialized concepts. They will be able to explore and translate the benefit, the uniqueness, and the credibility of innovative ideas to a target audience.

01006515 DESIGN METHODS FOR INNOVATIONS 4 (4-0-8)

(4 credits, 3-hour lecture, 1-hour recitation)

PREREQUISITE: NONE

This course consists of structural design process to create innovative products or services. The students will study the process to gather trends and information such as global direction, public opinions, technology, business, society and economic; learn how to extract context of interested area to find opportunities; study the processes used to gather behaviors, generate intense understanding about areas that lead to innovative concepts, produce innovative solutions and finally offering innovative products and services.

01006516 INNOVATION MANAGEMENT 4 (4-0-8)

(4 credits, 3-hour lecture, 1-hour recitation)

PREREQUISITE: NONE

This course introduces students to the concepts of innovative thinking and innovation management practices. This course prepares students with the insights and instruction necessary to successfully lead worldwide enterprises or local ventures. Covered topics include organization, strategy planning, policy development, communities, research and development and product management. Students are exposed to issues that challenged real-world organizations. Students will learn best practices used by engineering leaders who successfully develop commercially viable products and services, create efficient operating processes, manage profitable organizations, and transform companies into industry leaders.

01006517 STARTUP AND AGILE BUSSINESS 4 (4-0-8)

(4 credits, 3-hour lecture, 1-hour recitation)

PREREQUISITE: NONE

This course covers the basic principles of lean startup and agile business practice. Students will learn how to create an innovation accounting system to build products that meets customer demands; find the easiest and fastest ways to build minimum viable products to reduce time-to-market; learn tactics for improvement and measure customers' needs such as experimenting landing pages, A/B tests, MVPs on real customers; study how to implement an agile culture in business environments and learn how to develop business structures in order to keep the business functioning on constantly-moving units.

01006518 EMERGING TRENDS IN ENGINEERING 1 (1-0-2)
(1 credits, 1-hour lecture)

PREREQUISITE: NONE

This course consists of a series of lectures given by different faculty members and distinguished speakers from the academic and industries. The lectures are designed to provide students a good understanding of each curriculum structure and the courses in each subject areas. Students will be introduced to emerging trends in Engineering and the relevance of our courses. New courses and research opportunities will be presented, including the faculty's research fields. The course also discusses basic learning and working ethics and prepares students career-making skills. Pass/Fail, required to graduate.

01006519 INTRODUCTION TO ENVIRONMENTAL PRINCIPLES 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

This course provides students general principles of environmental engineering and science. Basics of the physical processes involved in the interactions between water, soil, climate, and vegetation. Natural and human activity as it impacts the environment, weather and climate, pollution.

01006520 LEADERSHIP AND PERSONAL DEVELOPMENT 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

This course provides students fundamental skills for success in careers and team environments. The course will cover topics such as goal setting, career Skills, leadership skills, teamwork, effective communication, and public speaking. Learning methods will consist of hands on activities and projects, group work, lecture, discussion, reading, writing, and presenting.

01006521 MEDITATION FOR LIFE DEVELOPMENT 3 (3-0-6)
(3 credits, 3-hor lecture)

PREREQUISITE: NONE

This course introduces theory and practice of meditation including : meaning of meditation, objectives, methods, the beginning, process characteristics of reciting and meditating, benefits of meditation, meditation resistances and applying meditation in daily life, meditation as related to education and working purposes, objectives, methods, characteristics of the states of absorption (jhana) and insight knowledge (Nana), fundamental knowledge about insight meditation (Vipassana), differences between foundation meditation (Summata) and insight meditation (Vipassana), layout of foundation meditation (Summata) and insight meditation (Vipassana), insight mediation as related to world population.

B) Specific Subjects

Fundamental Science and Mathematics Subjects

01006702 PHYSICS I 4 (3-3-8)
(4 credits, 3-hour lecture, 3-hour lab)

PREREQUISITE: NONE

This course covers basic physics and mechanics including a study of motion, space and time, kinematics, Newton's law of motion, forces, energy and momentum, work, power, conservation laws, systems of particles, linear momentum, circular motion, rotation, torques, harmonic oscillation and gravitation.

01006703 PHYSICS II 4 (3-3-8)
(4 credits, 3-hour lecture, 3-hour lab)

PREREQUISITE: 01006702 PHYSICS I

This course provides the physical science required to analyze electrical and electronic devices. Covered topics include electrostatics and electromagnetics, electric field and potential, conductors, insulators, capacitors, dielectrics, electric current, electric circuits, magnetic fields and electromagnetism.

01006708 CHEMISTRY 4 (3-3-8)

(4 credits, 3-hour lecture, 3-hour lab)

PREREQUISITE: NONE

This course provides a study of fundamental principles of chemistry and its applications. The subject matter includes principles of atomic structure, intermolecular forces and bonding, chemical reactions, kinetics, thermodynamics, and equilibrium. Relevant examples will be drawn from such areas as environmental, materials, and biological chemistry.

01006710 INTRODUCTION TO CALCULUS 3 (3-0-6)

(3 credits, 3-hour lecture)

PREREQUISITE: NONE

Function, Limit, Continuity and their applications, Mathematical induction, Introduction to derivative, Differentiation, Applications of derivative, Definite integrals, Antiderivative integration, Application of definite integral, Indeterminate forms, Improper integrals, Numerical integration, Sequences and series of numbers, Taylor series expansions of elementary functions vector analysis.

01006711 ADVANCED CALCULUS 3 (3-0-6)

(3 credits, 3-hour lecture)

PREREQUISITE: 01006710 INTRODUCTION TO CALCULUS

Functions of several variables and their applications, Vector algebra in three dimensions, Polar coordinates, Calculus of real - valued functions of two variables, Differentiation and integration of real - valued and vector - valued functions of multiple real variables, Introduction to line integrals, Lines, planes and surfaces in three-dimensional space, Calculus of real - valued functions in three-dimensional space, Principal theory for applications such as Green's theorem, divergence theorem, Gauss theorem, Stokes theorem, etc.

01006712 DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA 3(3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

Systems of linear equations and solutions. Vector and space, Matrices, Solution of linear equations by matrices, bases, orthonormal bases and applications in Fourier series, etc. Linear transformations: Laplace transformation, z-transformation Fourier transformation, complex function and transformation, Introduction to differential equations, linear and nonlinear differential equation, Ordinary differential equations, Application of ordinary differential equation for engineering problems, initial value problems.

Fundamental Engineering Subjects

01006801 INTRODUCTION TO ENGINEERING PROGRAMMING 3 (2-2-5)
(3 credits, 2-hour lecture, 2-hour lab)

PREREQUISITE: NONE

This course introduce basic concepts of computer programming such as elementary programming, data types, expressions, simple algorithms and problem solving involving sequential statements, conditionals and iterations. Students learn routines or methods as fundamental concepts and practice using strings, arrays, lists, maps or dictionaries, predefined libraries and classes, abstraction mechanisms and basic object oriented programming concepts. Students will practice related activities of software development life cycle such as system requirement analysis, debugging, testing and validation.

01006802 ENGINEERING DRAWING 3(2-2-5)
(3 credits, 2-hour lecture, 2-hour lab)

PREREQUISITE: NONE Lettering, orthographic projection, orthographic drawing and pictorial drawings, dimensioning and tolerancing, sections, auxiliary views and development, freehand sketches, detail and assembly drawings, basic computer aided drawing.

01006803 ENGINEERING MECHANICS 3(3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

Force systems, resultant, equilibrium, fluid statics, kinematics and kinetics of particles and rigid bodies, Newton's second law of motion, work and energy, impulse and momentum.

01006804 ENGINEERING MATERIALS 3(3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

Study of relationship between structures, properties, production processes and applications of main groups of engineering materials i.e. metals, polymers, ceramics and composites; phase equilibrium diagrams and their interpretation, mechanical properties and materials degradation.

01006805 INDUSTRIAL INTERNSHIP 0(0-45-0)
(0 credits)

PREREQUISITE: NONE

During their four-year selected studies, students are required to complete a short-term industrial placement within professional selected environments. It takes place during a summer period. This course allows students to put into practice under conditions reflecting their future activities and responsibilities. The work, carried out under the responsibility of the firm involved, is presented in a written report.

01366201 PRINCIPLE CALCULATIONS IN CHEMICAL ENGINEERING 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

The principles of chemical engineering calculations, material and energy balances with and without chemical reactions for steady state and unsteady state systems, systems with recycling, bypassing and purging, use of physical and chemical data, phase equilibrium, thermodynamic data for applications in chemical processes.

01366202 THERMODYNAMICS 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

An introduction to thermodynamics, energy, enthalpy, entropy, heat and work, intensive and extensive properties, specific property, reversible and irreversible processes, temperature and heat evaluation, gas pressure and gas temperature, ideal gas and real gas, gas laws, steam properties and steam table, the first and the second laws of thermodynamics and entropy, thermodynamics of flow processes, Carnot cycle, heat engine cycles, power and refrigeration cycles, thermodynamic analysis of processes, basic heat transfer and energy conversion.

01366203 DESIGN AND ANALYSIS OF EXPERIMENTS 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

The course provides knowledge about experimental designs, analysis, and interpretation of experimental data. Statistical methods such as descriptive statistics, sampling and sampling distribution, hypothesis testing, analysis of variance, regression analysis will be introduced. Principles of experimental design such randomization, replication, and local control will be covered. Experimental designs such as factorial design, fractional factorial design, response surface methodology, mixture design will be explored.

01366301 CHEMICAL PROCESS INSTRUMENTATION 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

Basic concept of measuring and control devices used in industrial process; process flow diagram: PFD; piping and instrumentation diagram: P&ID; process instruments used for measuring temperature, pressure, level, and flow; final control devices; industrial process control system; introduction to industrial process data communication.

Core Subjects

01366101 ORGANIC CHEMISTRY 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: 01006708 CHEMISTRY

This course is an introduction to the structures and chemical bonds of carbon compounds, types of organic reactions, free radical reactions, ionic reactions, stereochemistry, nomenclature and reaction of hydrocarbon compounds, benzene and benzene derivatives, alcohols, ethers, epoxides, aldehydes, ketones, carboxylic acids and carboxylic acid derivatives, phenol compounds, amine and azo dyes.

01366102 ORGANIC CHEMISTRY LABORATORY 1 (0-3-2)
(3 credits, 3-hour lab)

PREREQUISITE: 01006708 CHEMISTRY

Practice in reactions related to 01366101 Organic Chemistry

01366204 CHEMICAL ENGINEERING THERMODYNAMICS 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: 01366202 THERMODYNAMICS

A study of thermodynamic properties of fluids, solution thermodynamics, vapor-liquid equilibrium at low to moderate pressures, thermodynamic properties and VLE from equations of state, topics in phase equilibria and chemical reaction equilibria.

01366205 INTRODUCTION TO CHEMICAL ENGINEERING 3 (3-0-6)
AND MULTIDISCIPLINARY ENGINEERING
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

This course introduces beginning students to the field of chemical engineering as well as provides a course that would permit students to get good feel for chemical engineering and the essence of multidisciplinary engineering. New challenges and emerging industries for chemical engineers will be focused. A perspective on roles and career paths of chemical engineers in emerging industries will be covered. Tough chemical engineering curriculum, the core of engineering mind-set or systems thinking, ethics, the engineering CDIO process, professional communication skills, codes and standards are addressed.

01366206 FLUID DYNAMICS 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

Physical properties of fluids, fluid statics and its applications, types of fluids, fluid flow phenomena, basic equations of fluid flow and Bernoulli's equation, fluid friction in a steady one-dimensional flow, principles and calculations of pumps, compressors and turbines, flow of compressible fluids, flow passes immersed bodies and flow through porous media, transportation and metering of fluids, one-dimensional high-velocity gas flows and gas-liquid flow, design of unit operations for solid-fluid separations are delivered.

01366207 HEAT AND MASS TRANSFER 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: 01366206 FLUID DYNAMICS

Theories and applications of mass and heat transport phenomena, steady and unsteady heat conduction, convection and radiation heat transfer, types of heat exchangers, design and applications. Steady and unsteady diffusion, mass transfer coefficients simultaneous momentum and mass transfer, simultaneous heat and mass transfer are delivered.

01366208 BIOCHEMISTRY 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

Molecular basis and chemical principles pertinent to living systems, including eukaryotes, bacteria, and viruses. Structures, functions, and reactions of biomolecules including fats, oils, carbohydrates, lipids, amino acids, protein and nucleic acids and their biosynthetic pathways. Fundamental biological processes including energetics, metabolism, protein structure and enzyme function. Biochemical roles of vitamins, enzyme cofactors, hormones, drugs, antibiotics, and toxins. Introduction to gene regulation and genetic engineering.

01366304 **CHEMICAL ENGINEERING LABORATORY 2** **1 (0-3-2)**
(1 credits, 3-hour lab)

PREREQUISITE: 01366302 SEPARATION PROCESSES

Laboratory experiments on mass transfer and chemical reactors.

01366305 **CHEMICAL ENGINEERING KINETICS AND REACTOR DESIGN** **3 (3-0-6)**
(3 credits, 3-hour lecture)

PREREQUISITE: 01366204 CHEMICAL ENGINEERING THERMODYNAMICS

Applications of thermodynamic and kinetic fundamentals to the analysis and design of chemical reactors, types of reactors: single reactor and multiple reactor systems, isothermal and non-isothermal operation: homogeneous and introduction to heterogeneous reactors.

01366306 **WASTE TREATMENT AND POLLUTION CONTROL** **3 (3-0-6)**
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

Environmental pollutions: sources and characteristics of industrial waste and treatment methods; impact on environment; environmental quality standards. Air pollution: origin and fate of air pollutants; atmospheric dispersion; stationary and mobile sources; source control. Noise pollution: noise effects; noise control. Water pollution: pollution source; source control; Municipal water treatment; Wastewater treatment; disposal and reuse. Solid and hazardous waste management: characterization and classification; concepts of pollution prevention and waste minimization; waste treatment and disposal technologies.

01366307 **PROCESS SIMULATORS IN CHEMICAL ENGINEERING** **3 (2-2-5)**
(3 credits, 2-hour lecture, 2-hour lab)

PREREQUISITE: NONE

Applications of process simulators such as HYSYS, ASPEN, or PRO/II to study unit operations and chemical processes and to evaluate the process sensitivity and feasibility.

01366308 **PROCESS EQUIPMENT DESIGN** **3 (3-0-6)**
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

This is a partial capstone course which applies basic chemical engineering backgrounds (material and energy balances, thermodynamics, kinetics, unit operations, and process safety) in chemical process equipment design. Conceptual design and specifications of chemical process equipment, pumping system requirements and design for chemical processes, design of piping system and material selection, criteria of container and storage vessel design, design and construction of pressure vessels, selection of crushers, mills, grinders and conveyors, design of evaporators, design of fired process equipment, e.g., furnaces, boilers, preliminary specifications and design of heat exchangers, selection of mixers, criteria for distillation column and gas absorption design, reactor design and specifications, selection of separators. The role of failure in engineering design.

01366309 **PROCESS DYNAMICS AND CONTROL** **3 (3-0-6)**
(3 credits, 3-hour lecture)

PREREQUISITE: 01366303 SEPARATION PROCESSES

Mathematical models of chemical engineering systems, solution techniques and dynamics of these systems, introduction to automatic control, feedback control concept, stability analysis, frequency response and control system designs. Introduction to measurement and control instrument characteristics.

01366310 **SAFETY IN CHEMICAL ENGINEERING** **3 (3-0-6)**
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

Principles of industrial safety and loss control, process safety management, inherent safety, safety in laboratory, safety laws and codes for safety regulations, hazardous materials and conditions, toxicology, work place inspections; prevention and control of physical hazards, electrical hazards, mechanical equipment, steam and compressed gases, safety in storage and transport of chemicals and hazardous materials and their operations, toxic release, fires and explosions; designs to prevent fires and explosions, relief systems in liquids and gases services; principles of fire suppression, hazards identification, risk assessment, safety and emergency plans, emergency responses, occupational health and safety

management systems, safety inspections, incident management, accident investigations, human factors in process safety, inherent safer design and other principles; fundamentals of first aids.

01366311 ENGINEERING ECONOMICS AND DECISION TOOLS FOR BUSINESS 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

Introduction to accounting data and financial statements, equipment cost estimation and economic evaluation in chemical engineering plant design, economic evaluation for alternative selection and investment of chemical processes. Decision tools for business to deal with the impact of inflation, taxation, depreciation, financial planning, economic optimization, and project feasibility, as well as legal and regulatory issues.

01366312 PROCESS OPERATIONS AND BUSINESS INFORMATION 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

This course gives an insight in engineering process operations and management. It covers topics such as financial principles, engineering knowledge base, technology strategy, fundamentals of project engineering (,i.e., project development and engineering, project execution), sustainability challenges, enhancing efficiency and reliability, entrepreneurship, management of innovation, and best management practices. The focus of the course is the development of individual skills and team work. This is carried out through practical concepts such as problem solving and creativity, optimization, solutions under constraints, and return on failure.

01366313 PLANT VISIT 1 (0-3-2)
(1 credits)

PREREQUISITE: NONE

Overview of the chemical industries by visits to chemical plants.

01366314 PRE-PROJECT 1 (0-3-2)
(1 credits)

PREREQUISITE: NONE

Introduction to techniques of preparing project proposal; planning, working, solving problems by means of a project in a systematic way, report writing and presentation.

01366401 CHEMICAL ENGINEERING PLANT DESIGN 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: 01366302 PROCESS EQUIPMENT DESIGN,
01366303 SEPARATION PROCESSES

Conceptual design, general design considerations and selection, process design project of the chemical plants.

Elective Subjects

01366501 TRANSPORT PHENOMENA 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

A study of momentum, heat and mass transfer processes. Applications of continuity and equation of motions to solve transport problems and boundary layer theory.

01366502 AIR POLLUTION AND CONTROL 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

Air pollution legislations and regulations, effect of air pollution on respiratory system and others, e.g., acid rain, water bodies, soil, vegetation, and visibility, fate of pollutants in atmosphere, i.e., sources, reactions, transport, and sinks, formation and control of pollutants in combustion system, emission rate, atmospheric dispersion, capturing of gases and vapors, motion and capturing of particulate matters.

01366503 **SELECTED TOPICS IN ENERGY AND ENVIRONMENT** **3 (3-0-6)**
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

Selected topics of current interest in energy and environment assigned by staff.

01366504 **PETROCHEMICAL TECHNOLOGY** **3 (3-0-6)**
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

An introduction to petrochemical complexes, development of petrochemical industry in Thailand, natural gas, production and uses of synthesis gas, petrochemicals from methane, petrochemicals from n-paraffins, production of olefins, petrochemicals from ethylene, petrochemicals from propylene, petrochemicals from higher olefins, petrochemicals from benzyne, toluene, and xylenes, polyamide synthesis, polyester synthesis and polyurethane synthesis.

01366505 **PETROLEUM REFINERY ENGINEERING** **3 (3-0-6)**
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

A study of petroleum and natural gas reservoir, geology. Exploration and production of oil and gas, composition of petroleum, refinery and distillation processes, auxiliary processes and operations, chemical treatments, extraction process, refinery products and test methods, cracking and catalytic cracking, catalytic reforming, isomerization, hydrotreating, catalytic hydrocracking, visbreaking, coking, alkylation and product blending.

01366506 **RUBBER AND ELASTOMERS TECHNOLOGY** **3 (3-0-6)**
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

The study of classification and properties of elastomers, manufacturing of natural rubber and synthetic rubbers, compositions in rubber compounds, rubber vulcanization and processing methods of rubber products.

01366507 GREEN CHEMICAL PRODUCTS AND PROCESSES 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: NONE

This course covers concise overview and fundamentals of current interest in the area of green chemistry and green processing. The intent of this course is to describe green technology, environmentally preferable or green approaches to the design and development of processes and products. Evaluating and improving environmental performance of chemical processes. The green biorefiner concept. Biobased industry: economy, commercialization and sustainability. Concepts and challenges in sustainable chemical synthesis. Unit operations and pollution prevention.

01366508 COMPUTER-AIDED DESIGN AND MANUFACTURING (CAD/CAM) 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE: 01006802 ENGINEERING DRAWING

Introduces students to the use of computers in several extended areas of product design and manufacturing. These areas include computer-aided design and manufacturing (CAD/CAM); computer numerical control (CNC) operations and technology; and the use of simulation software for virtual prototyping for design/manufacturing.

01366509 APPLIED NUMERICAL METHODS IN CHEMICAL ENGINEERING 3 (2-2-5)
(3 credits, 2-hour lecture, 2-hour lab)

PREREQUISITE : 01006801 INTRODUCTION TO ENGINEERING PROGRAMMING

Applications of the principles of numerical methods and use of computer programming as a tool in chemical engineering calculations.

01366510 CORROSION 3 (3-0-6)
(3 credits, 3-hour lecture)

PREREQUISITE : NONE

The definitions and phenomena of corrosion, electrochemistry and reaction mechanisms, fundamentals of thermodynamics for corrosion, Pourbaix diagrams, kinetics of corrosion processes, types of corrosions, cathodic and anodic protections, coatings and inhibitors, corrosion testings, material selection.

2. Educative Education

01006301 COOPERATIVE EDUCATION 6 (0-45-0)
(6 credits)

PREREQUISITE: NONE

This course demands the student to work in an innovative company or a government/private organization, which is approved by the program committee for working on an innovative project for at least 16 weeks. The work of the student is under supervision of a faculty member, who is regarded as the student's supervisor. The student must report progress to the supervisor regularly. Upon completion, the student must prepare and deliver oral presentations describing the work from the program.

3. Study Abroad or Overseas Training

01006302 STUDY ABROAD 6 (0-45-0)
(6 credits)

PREREQUISITE: NONE

This course is reserved for students who participate in the study abroad program. Upon the completion of the program, the students must prepare and deliver oral presentations describing their experience from the program.