Curriculum Specification
Bachelor of Engineering in Mechanical Engineering
(International Program/New Program 2021)

Name of Institution Silpakorn University
Campus/Faculty/Department Sanam Chandra Palace Campus/
Faculty of Engineering and Industrial Technology/
Department of Mechanical Engineering

Section 1 General Information

1. Curriculum Name

1.1 Curriculum xxxxxxxxxxxxxx

1.2 Curriculum Name

Thai หลักสูตรวิศวกรรมศาสตรบัณฑิต สาขาวิชาวิศวกรรมเครื่องกล (หลักสูตรนานาชาติ)

English Bachelor of Engineering Program in Mechanical Engineering (International Program)

2. Degree Title

Title of Degree and Major Field Given by Silpakorn University

Full Title in Thai วิศวกรรมศาสตรบัณฑิต (วิศวกรรมเครื่องกล)
Full Title in English Bachelor of Engineering (Mechanical Engineering)
Abbreviation in Thai วศ.บ. (วิศวกรรมเครื่องกล)
Abbreviation in English B.Eng. (Mechanical Engineering)

3. Major

None

4. Required Credit

The program requirement is to complete not less than 141 credit points.

5. Curriculum Characteristics

5.1 Curriculum Model 4 year Bachelor degree

5.2 Curriculum Name

- ☐ Academic Undergraduate Program
- ☐ Advanced Academic Undergraduate Program
- ☑ Professional or Practical Undergraduate Program
- ☐ Advanced Professional or Practical Undergraduate Program

5.3 Medium of Instruction English

5.4 Admission Requirements International students

5.5 Collaboration with Other University

This Program is a collaboration between Silpakorn University and Chengdu University, People Republic of China.

5.6 Degrees offered to the graduates

Degree in Engineering (Mechanical Engineering) from Silpakorn University and Engineering (Mechanical Design Manufacturing and Automation) from Chengdu University (If students meet all the requirements imposed by both institutions).

6. Curriculum Approval Process

6.1 The new curriculum 2021 will be effective from the first semester of the academic year 2021 onwards.

6.2 The curriculum was approved by Silpakorn University Academic Council at the meeting number 4/2564 on 27 April 2021

6.3 The curriculum was approved by Silpakorn University Council at the meeting ...../ ..... on .....

7. Expected Publicize Period

The curriculum will be published as a quality and standard course according to the 2010 Education Qualifications of Thailand for Bachelor of Engineering in the 2023 academic year.

8. Job opportunities for graduates

8.1 Mechanical Engineers working in various manufacturing industries

8.2 Academics and experts in mechanical engineering

9. Name, I.D. Number, title and degree of the person responsible for the curriculum

9.1 Mr. Saroj Pullteap

I.D. : x-xxxx-xxxxx-xx-x

Position: Associate professor

Education: Ph.D. (Optoelectronics Engineering)
Institut Nationale Polytechnique de Toulouse, Universitaire de Toulouse, France (2008)
M.Eng. (Control Systems and Instrumentation Engineering)
King Mongkut’s University of Technology Thonburi, Thailand (2002)
B.S.Tech.Ed. (Computer Technology)
King Mongkut's University of Technology North Bangkok, Thailand (1998)

9.2 Mr. Teerasak Hudakorn

I.D. : x-xxxx-xxxxx-xx-x

Position: Assistant professor

Education: Ph.D. (Mechanical Engineering)
Chiang Mai University, Thailand (2009)
M.Eng. (Mechanical Engineering)
Chiang Mai University, Thailand (2001)
B.Eng. (Mechanical Engineering)
Chiang Mai University, Thailand (1997)

9.3 Ms. Vichuda Mettanant

I.D. : x-xxxx-xxxxx-xx-x

Position: Assistant professor

Education: Ph.D. (Energy Technology)
King Mongkut's University of Technology Thonburi, Thailand (2019)
M.Eng. (Energy Management Technology)
King Mongkut's University of Technology Thonburi, Thailand (2004)
M.Eng. (Energy Technology)
Asian Institute of Technology, Thailand (2003)
B.Eng. (Mechanical Engineering) KasetsartUniversity (2000)

9.4 Ms. Yanting Ni

Passport : xxxxxxxxx

Position: Associate professor

Education: Ph.D. (Mechanical Manufacturing and Automation)
Sichuan University, China (2013)
B.S. (Electronics Engineering)
Harbin Science and Technology University, China (2002)

9.5 Mr. Mao Tang

I.D. : xxxxxxxxxxxxxxxxx

Position: Associate professor

Education: M.E. (Mechanical Manufacturing and Automation)
Sichuan University, China (2003)
B.E. (Aircraft Design) Sichuan University, China (1997)

10. Teaching Venue

Classes will be conducted at Faculty of Engineering and Industrial Technology, Silpakorn University Sanam Chandra Palace campus for 2nd and 4th year students and at School of Mechanical Engineering (SME), Chengdu University, Sichuan Province, People's Republic of China for 1st and 3rd year students.

11. External Factors to Considered in Curriculum Planning

11.1 Economic Situation/development

According to the 20-year National Strategy Framework (2017-2036), the main national strategy for developing the country in order to achieve the Sustainable Development Goals (SDGs), this framework resulted in developing the 12th National Economic and Social Development Plan (2017-2021) and the reforming plans to reconstruct the country to be Thailand 4.0. These plans also describe the adaptation to a multi-centered global economy and also pay more attention to Asian countries, especially, Hong Kong, South Korea, Taiwan, Singapore, and other ASEAN countries, which will be the center of production industry of the world. Moreover, the economic integration of Thailand, such as FTA ASEAN-China, FTA ASEAN-Japan, FTA ASEAN-India and ASEAN community, Asia-Pacific Partnership Framework, effected directly to the economic and social development of Thailand. As a result of policies mentioned above, Thailand must prepare many resources, especially, human resources, and develop mechanisms to further align with the future integration. In addition, the preparation for education, technology and modern innovations is another important factor for such integration. These will ensure that the country have sufficient knowledge and understanding to support such development.

In addition, there are other big issues that affect Thailand. For instance, ASEAN community or "Free ASEAN" is another role of the integration of the countries including the 10 members of ASEAN and China, Japan, South Korea known as ASEAN+3. This coorperation is congruent with the European Community.This results in all 10 ASEAN countries getting closer as the same country. And the most important thing is that people in ASEAN member will be able to travel to each other without visa and be able to trade or carry out any activities more easily. This is a big revolution and Thailand must prepare to this new normal.

Furthermore, there is a chinese new strategy named “One Belt One Road” which has a goal to increase Chinese soft power via “Connectivity” and “Coorperation”. Chinese government uses this strategy as an important mechanism to promote the connectivity in various framework with ASEAN countries and to create good relationship between China and ASEAN countries. Education management should focus on the above issues and be aware of the changes in the world and the economy situation. These issues conform with National Education Plan 2017 – 2036 which mentions that education is one of the most important in social and culture community. The integration of the ASEAN Community has created a major change in Southeast Asia. Thai people need to learn and adapt to this changes in skills, knowledge, work performances and foreign languages in order to increase more roles to all framework coorperation. The current education must be adjusted to meet the production the development of manpower. The teaching and learning should concentrate on 21st century skills to improve knowledge and skills for daily living, professional career, economics and social development.

The Department of Mechanical Engineering, Faculty of Engineering and Industrial Technology, Silpakorn University realized the importance of sustainable curriculum development and cooperation from foreign university. We made the cooperation with School of Mechanical Engineering (SME), Chengdu University during 2018 -2019 and established Memorandum of Agreement: MOA, 2019. One of the agreement is to develop a double degree in Mechanical Engineering program. The student in this program will receive the Bachelor of Mechanical Engineering from Silpakorn University and Bachelor of Engineering (Mechanical Design Manufacturing and Automation) from Chengdu University. This program is the international program. The 1st year and 3rd year students will be teaching and learning in Chengdu University. The 2nd year and 4th year students will be teaching and learning in Silpakorn University. Expected amount of students in the first year of cooperation is 30 students. In this program, faculty members and other equipments from Silpakorn University and Chengdu University will be shared. It is useful for the growth of the education system in the ASEAN region as well as creating a sustainable collaboration network. This will be consistent with the education in the 21st century and the strategic plan of Silpakorn University which will be the knowledge transfer leader, building up a knowledge-based society, integration of expertise in arts and culture, social sciences and humanities, as well as science and technology.

11.2 Social and Cultural Situation and Development

The curriculum concerns about producing creative students according to the concept of Silpakorn University through various courses or programs in the university. Furthermore, the teaching and learning aim to encourage the Chinese students to learn Thai culture, including ethics, and morality in order to apply to everyday life whether in Thailand, China or other countries.

12. The effects mentioned in No. 11.1 and 11.2 on Curriculum development and its relevance to the Mission of the University / Institution

12.1 Curriculum Development

Due to the National Development Strategy and Plan with 20-year National Strategy Framework, the 12th National Economic and Social Development Plan (2017-2021) and Thailand 4.0 structure, Thailand policies focus on bringing creativity and innovation to create new strategy increasing the economic growth. Asian Economic Community (AEC) causes common market, production center, logistics, service, investment, and high mobility of professions. These impact to Thai economic situation and society directly. Therefore, the career of engineers is one of the most important professions used in daily life for the development of suitable technology, solving social problems and economic security to be able to compete on international level.

In addition, to meet the requirements of the government that focuses innovation in 10 S-Curve, such as robotic technology for modern production industries, the new curriculum has been created. This new curriculum, the Bechelor degree of Mechanical Engineering, that joined between Silpakorn University, Thailand and Chengdu University, People's Republic of China, aims to encourage and support students to have abilities to work professionally and to integrate the knowledge between Thailand and China that can raise the level of the quality of students. In addition, this program focus on promoting ethical use of technology to create engineers with ethics and morality in their own professional career. Therefore, it can be concluded that this program has a great opportunity of demands in labor market for both Thailand and China.

However, in program development, it is necessary to develop courses proactively that are efficient and able to meet the requirements of the entire Thai and China market. This program focuses on producing highly capability mechanical engineers. In addition, the curriculum development will focus on the integration of knowledge in all fields in order to meet the requirement of the university missions, national and international demand. This program will also be congruent with the Silpakorn University's mission of academic excellence which are Mission 1: Enhancing the capabilities of students to meet international quality standards, and Mission 2: Developing professional competencies and working across culture.

The Bachelor Degree of Mechanical Engineering, International Program of the Department of Mechanical Engineering, Faculty of Engineering and Industrial Technology, Silpakorn University, is an English program that focuses on producing mechanical engineers with the knowledge and skills in mechanical engineering. Students from this program could work both in national and international industries. The highlight of this program is that the teaching and learning will be taking place in the two countries, School of Mechanical Engineering (SME), Chengdu University, People's Republic of China and Faculty of Engineering and Industrial Technology, Silpakorn University, Thailand. This program is recognized as international academic co-operation. The students from this program can take advantages from two universities.The students who complete the degree from this program will receive the Bachelor of Engineering (Mechanical Design Manufacturing and Automation) from Chengdu University and Bachelor of Engineering (Mechanical Engineering) from Silpakorn University. The faculty members responsible for the program have the qualifications and expertise corresponding to the program. The course descriptions are up-to-date and congruent with the industry requirements. The curricula design focuses on promoting students' knowledge of modern technology in production business and energy technology. The program is designed to immerse students in English speaking environment to help them effectively develop their language skills which will greatly enhance their success in international business work.

12.2 Its relevance to the missions of the University/institute

In compliance with the mission of Silpakorn University and Faculty of Engineering and Industrial Technology to support the development of curriculum, the program aims to support the development of Thailand's economy, society and culture by producing qualified graduates and relevant research in mechanical engineering. It also seeks to conduct academic outreach program, and promote the Silpakorn University to international academic standards, as well as achieve community development.

13. Cooperation with other Departments of the University

None

14 **Cooperation with other University**

The courses that are taught by School of Mechanical Engineering (SME), Chengdu University, Sichuan Province, People's Republic of China

632 101	College Physics I	3(3-0-6)
632 102	Advanced Mathematics I	4(4-0-8)
632 103	Engineering Graphics I	4(4-0-8)
632 104	The Foundation of Modern Chemistry	1(1-0-2)
632 105	College Physics II	3(3-0-6)

632 106	Advanced Mathematics II	5(5-0-10)
632 107	Engineering Graphics II	2(2-0-4)
632 108	Engineering Materials	2(2-0-4)
632 151	Fundamentals of Computers	3(2-2-5)
632 171	College English I	3(3-0-6)
632 172	College English II	3(3-0-6)
632 173	Ideological and Moral Cultivation and Basic Law	2(2-0-4)
632 301	Engineering Calculation Method	2(2-0-4)
632 311	Comprehensive Training of Mechanical Design	1(0-3-0)
632 331	Fundamentals of Control Engineering	2(2-0-4)
632 332	Fundamentals of Electromechanical Transmission Technology	1(1-0-2)
632 333	Mechatronic System Design	3(3-0-6)
632 341	Fundamental of Mechanical Manufacturing	3(3-0-6)
632 342	Hot Working Training	1(0-3-0)
632 343	Mechanical Manufacturing Training	1(0-3-0)
632 344	Production Exercitation	1(0-3-0)
632 345	Comprehensive Training of Mechanical Manufacturing Process	1(0-3-0)
632 346	Comprehensive Practical Training for Advanced Manufacturing Technology	1(0-3-0)
632 511	Design of Manufacturing Equipment	1(1-0-2)
632 512	Modern Design Method and Application	2(2-0-4)
632 531	Motor Control and PLC	3(3-0-6)
632 532	Principles of Micro-computer	2(2-0-4)
632 533	Numerical Control Technology and Programming	1(1-0-2)
632 572	Introduction of the Classical Culture of China	2(2-0-4)
632 573	Military Theory	1(1-0-2)
632 574	Mental Health Curriculum	1(1-0-2)
632 575	Outline of Chinese Modern History	2(2-0-4)
632 579	Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics	4(4-0-8)
632 581	Freshman’s Fostering Education	1(1-0-2)
632 582	Entrepreneurship Theory and Practice	1(1-0-2)
632 583	The Fundamental Tenets of Marxism	3(3-0-6)

Section 2 Specific Information of the Curriculum

1. Philosophy, Significance and Objectives of the Curriculum

1.1 Philosophy

The Bachelor of Engineering Program in Mechanical Engineering aims to create and develop international mechanical engineers to be a person with knowledge and expertise in mechanical engineering and apply the modern technology to their professional with morality and ethics.

1.2 Significance

The Bachelor of Engineering Program in Mechanical Engineering is an collaborative program between Silpakorn University and Chengdu University. It is designed to facilitate development of knowledge in mechanical engineering design and manufacturing, and industrial automation in both Thailand and China.

The modern technology in mechanical engineering has been introduced into the Thai industry to make the production more efficient, less negative impact on the environment, and more productive. The knowledge of mechanical engineering including energy management, energy conservation and automation engineering arising from new technology has been developed recently.

Nowadays, the People's Republic of China has been developed in research and new technology in mechanical engineering which is essential for modern production system and advance energy system, while Thailand has the strength in modern skills and will be the gateway to Cambodia-Laos-Myanmar-Vietnam (CLMV). This program will be the co-operation between the two countries to produce mechanical engineers to serve the needs of the industry in both Thailand and China. The students who complete the Bachelor degree in Mechanical Engineering (International Program) from the Faculty of Engineering and Industrial Technology, Silpakorn University will also get the Bachelor of Engineering (Mechanical Design Manufacturing and Automation) from Chengdu University, the People's Republic of China.

1.3 Objectives and program learning outcomes

1.3.1 Objectives

(1) To produce engineering graduates who have knowledge, abilities and skills to work in the field of mechanical engineering.

(2) To produce engineering graduates who have knowledge, abilities and skills in manufacturing and automation up to international standards.

(3) To produce engineering graduates who have social responsibility, ethics, environmental awareness, and creativity.

4) To produce engineering graduates with good communication and team-working skills.

1.3.2 Program Learning Outcomes (PLOs)

At the end of this program, successful students will be able to:

No.	Program Learning Outcomes (PLOs)	Cognitive Domain (Knowledge) (Bloom's Taxonomy (Revised))						Psychomotor Domain (Skills)	Affective Domain (Attitude)
		R	U	Ap	An	E	C	S	At
Generic Learning Outcomes									
PLO1	Explain meaning and value of art and creativity.		✓						
PLO2	Discuss meaning of cultural diversity.		✓						
PLO3	Identify basic knowledge about business operation and basic skills for entrepreneur.		✓						
PLO4	Communicate with objectives in various contexts.			✓					
PLO5	Choose appropriate information and communication technology according to purpose of use with media and information literacy.			✓					
PLO6	Acquire and apply new knowledge as needed by using appropriate learning strategies.			✓					✓

No.	Program Learning Outcomes (PLOs)	Cognitive Domain (Knowledge) (Bloom's Taxonomy (Revised))						Psychomotor Domain (Skills)	Affective Domain (Attitude)
		R	U	Ap	An	E	C	S	At
PLO7	Function effectively on a team whose members together create a collaborative and inclusive environment, and work with discipline, punctuality, honesty, and personal, social and environmental responsibility.			✓					✓
PLO8	Use creativity to create works or operate projects.			✓					
PLO9	Analyze and plan systematically for problem solving or innovation design.				✓				
Subject Specific Learning Outcomes									
PLO10	Recognize ethical and professional responsibilities in engineering situations.								✓
PLO11	Apply knowledge of mathematics, science, and engineering to solve mechanical engineering problems.			✓					

No.	Program Learning Outcomes (PLOs)	Cognitive Domain (Knowledge) (Bloom's Taxonomy (Revised))						Psychomotor Domain (Skills)	Affective Domain (Attitude)
		R	U	Ap	An	E	C	S	At
PLO12	Design a system, component, or process in either thermal or mechanical systems areas to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.			✓				✓	✓
PLO13	Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.				✓				

1.3.3 The relationship between the program objectives and program learning outcomes (PLOs)

Objectives of the program	Program learning outcomes (PLOs)												
	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11	PLO 12	PLO 13
1. To produce engineering graduates with knowledge, abilities and skills to work worldwide in the field of mechanical engineering.		✓	✓						✓		✓		✓
2. To produce engineering graduates with knowledge, abilities and skills in manufacturing and automation up to international standards.						✓			✓			✓	✓
3. To produce engineering graduates having social responsibility, ethics, environmental awareness, and creativity.	✓							✓		✓			
4. To produce engineering graduates with good communication and team-working skills.				✓	✓		✓						

2. Development Plan

Development Plan/Change	Strategy	Evidence/Indicator of Success
1. To revise curriculum continuously every 5 years according to labor market demands	1. To obtain feedbacks on the characteristics, knowledge and skills of graduates to improve upon the curriculum	1. TQF 5, TQF 7 2. Summary of stakeholders' needs 3. Academic meeting report 4. Employers' satisfaction survey results 5. Students' teaching evaluation
2. To ensure the quality of teaching and learning activities within 2 year	1. To enhance a faculty's teaching techniques through faculty trainings and seminars 2. To monitor and improve faculty's teaching performance	1. Survey of faculty's training needs 2. A summary of new teaching techniques deployment 3. Teaching evaluation records with continuous improvement goal
3. To improve students' soft skills		
3.1 To be capable of working and are well-prepared to work in the international environment.	1. To continually find partner universities abroad to collaborate on a student exchange program.	1. Number of graduates who work in leading manufacturing companies abroad. 2. Number of full-time and exchange overseas students. 3. The average English test score of the graduates.
3.2 To be capable of creating innovations, and have entrepreneurial skills.	1. To offer Entrepreneurship courses to students. 2. To organize an internal innovation contest for the current students to participate.	1. Number and quality of students' innovations submitted to the internal innovation contest. 2. Number of and feedbacks from students taking entrepreneurship courses.

Section 3 Educational Management System, Curriculum Implementation and Structure

1. Educational Management System

1.1 System

The academic year is divided into 2 regular semesters of at least 15 weeks each. Education system is managed in binary system which comprises two semesters under the ministry of education, ministrial announcement of Standard Criteria for Undergraduate Degree Curriculum 2015 and/or any revised version.

1.2 Summer Semester Management

The summer session is offered with at least 8-week per semester. However, the offering depends on the consideration of the program committee.

1.3 Credit Equivalent to Semester System

None

2. Curriculum Implementation

2.1 Academic Semester

First Semester: August-December
Second Semester: January-May
Summer Semester: June-July

2.2 Entry Requirement

Applicants must be a high school graduate (or equivalent) with a science major according to academic qualifications by the Ministry of Education of the People's Republic of China.

2.3 Problems Experienced by New Students Encounter Upon the Beginning of the Program

2.3.1 Students may have different levels of proficiency in English and often are not effective in communication skills.

2.3.2 Students may have adaptation problems for university study and environment.

2.4 Suggestions for improvement as stated in 2.3

2.4.1 Classes on English will be provided to improve skills

2.4.2 All the students will learn IELTS deliberately for 320 hours in the first year

2.4.3 An Orientation will be conducted new students. It shall include the introduction of program goals and suitable study techniques and time management skills.

2.4.4 Advisors from School of Mechanical Engineering (SME), Chengdu University and Department of Mechanical Engineeirng, Silpakorn University will be appointed as mentors to work with students who regularly encounter the previously mentioned issues.

2.4.5 Activities about Thai culture and Thai language will provide to the students.

2.5 Five-Year Plan for Student Recruitment and Graduation

Year	Number of Students in Academic Years				
	2021	2022	2023	2024	2025
First Year	30	30	30	30	30
Second Year		30	30	30	30
Third Year			30	30	30
Fourth Year				30	30
Total	30	60	90	120	120
Expected Number of Graduates				30	30

2.6 Teaching System

[✓] Classroom Mode

[ ] Print-based Distance Education

[ ] Broadcast-based Distance Education

[ ] E-learning-based Distance Education

[✓] Internet-based Distance Education

[ ] Others (please specify)

2.7 Credit Transfer

The credit transfer and the cross-university registration must meet Silpakorn University Rules and Regulations for undergraduate's degree 2017 (Appendix A) and/or any revised version.

3 Curriculum and Lecturers

3.1 Curriculum

3.1.1 Number of Credits

Total number of credits (not less than)	141	credits

3.1.2 Curriculum Structure

General Education Courses (not less than)	**30**	**credits**
Required General Education Courses	25	credits
Elective General Education Courses (not less than)	5	credits
Specific Courses (not less than)	**105**	**credits**
Engineering Core Courses	24	credits
Major Compulsory Courses	77	credits
Major Elective Courses (not less than)	4	credits
Free Electives (not less than)	**6**	**credits**
Total credits per program (not less than)	**141**	**credits**

3.1.3 Courses

3.1.3.1 Courses code 6-digit codes indicates that there are 2 sets of codes.

1. The first 3 digits indicate the departments responsible for implementation of courses:

   600 indicates Faculty of Engineering and Industrial Technology.

   632 indicates Bachelor of Mechanical Engineering Program (International Curriculum), Faculty of Engineering and Industrial Technology.

2. The last 3 digits indicate the course codes:

   The first digit indicates the year of study.

   1 = First-Year courses

   2 = Second-Year courses

   3 = Third-Year courses

   4 = Fourth-Year courses

   5 = Selective courses for Third-Year and Fourth-Year students

   The second digit indicates the course category.

   0 = Courses related to basic for engineering, physics, chemistry, and mathematics

   1 = Courses related to mechanics, dynamic system, machinery and machine design

   2 = Courses related to thermodynamics, fluids and energy

   3 = Courses related to mechatronics, electricity and automatic control

4 = Courses related to mechanical manufacturing

5 = Courses related to computer

6 = Courses related to internship, seminar and project

7, 8 and 9 = Courses related to other fields such as languages, entrepreneurship, social science, etc.

The last digit indicates the order of the course offered in each course category to avoid repetition.

3.1.3.2 Credit Calculation

Lecture course that takes lecture or discussion for no less than 15 hours per one regular semester equal to 1 credit

Practicum course that takes training or experiment for no less than 30 hours per one regular semester equal to 1 credit

Internship or field training that takes training for no less than 45 hours per one regular semester equal to 1 credit

To do a project or any other educational activity as assigned which takes no less than 45 hours of that project or activity per one regular semester equal to 1 credit

In each course, the criteria for calculating credits from number of lecture hours (L), practicum hours (P) and hours that students must study on their own outside of study hours (S) per week divided by 3, which has the following methods

$$\text{Number of Credits} = \frac{L + P + S}{3}$$

The credit specified in each course is composed of four numbers.

The first number (outside brackets) is the total number of credits.

The second, third and fourth (in brackets) are as follows:

The second number is the number of lecture hours per week.

The third number is the number of practicum hours per week.

The fourth number is the number self-study hours per week.

3.1.3.3 Courses

General Education Courses (not less than) 30 credits are as follows;

1) Required General Education Courses 25 credits

Social and life skills

600 201	Creativity in World of Technology and Engineering I	1(0-3-0)
600 202	Creativity in World of Technology and Engineering II	1(0-3-0)
632 151	Fundamentals of Computers	3(2-2-5)
632 428	Renewable Energy Technology	3(3-0-6)

Languages

632 171	College English I	3(3-0-6)
632 172	College English II	3(3-0-6)
632 271	Communicative English for Engineering	3(3-0-6)
632 473	Technical English for Engineering	3(3-0-6)

Social responsibilities

632 173	Ideological and Moral Cultivation and Basic Law	2(2-0-4)

Entrepreneurship

632 471	Innovation-Driven Entrepreneurship	3(3-0-6)

2) Elective General Education Courses (not less than) 5 credits

Social and life skills

632 572	Introduction of the Classical Culture of China	2(2-0-4)
632 574	Mental Health Curriculum	1(1-0-2)
632 575	Outline of Chinese Modern History	2(2-0-4)
632 581	Freshman's Fostering Education	1(1-0-2)

Languages

632 576	Thai Language for Life Development	3(3-0-6)
632 577	Thai Usage for Communication and Retrieval	3(3-0-6)
632 584	Chinese for Careers	3(3-0-6)

Social responsibilities

632 573	Military Theory	1(1-0-2)
632 579	Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics	4(4-0-8)
632 583	The Fundamental Tenets of Marxism	3(3-0-6)

Entrepreneurship

632 578	Basic Marketing and Finance for Entrepreneurs	3(3-0-6)
632 582	Entrepreneurship Theory and Practice	1(1-0-2)

Specific Courses (not less than) 105 credits are as follows;

1) Engineering Core Courses 24 credits

632 101	College Physics I	3(3-0-6)
632 102	Advanced Mathematics I	4(4-0-8)
632 103	Engineering Graphics I	4(4-0-8)
632 104	The Foundation of Modern Chemistry	1(1-0-2)
632 105	College Physics II	3(3-0-6)
632 106	Advanced Mathematics II	5(5-0-10)
632 107	Engineering Graphics II	2(2-0-4)
632 108	Engineering Materials	2(2-0-4)

2) Major Compulsory Courses 77 credits

632 201	Engineering Mathematics	2(2-0-4)
632 202	Complex Function and Integral Transformation	2(2-0-4)
632 211	Statics and Solid Mechanics	2(2-0-4)
632 212	Dynamics and Machinery	2(2-0-4)
632 213	Machine Design	2(2-0-4)
632 214	Statics and Solid Mechanics Laboratory	2(0-4-2)
632 215	Dynamics and Machinery Laboratory	2(0-4-2)
632 216	Machine Design Laboratory	1(0-2-1)
632 221	Thermodynamics	3(3-0-6)
632 222	Fluid Mechanics	1(1-0-2)
632 223	Heat Transfer	2(2-0-4)
632 224	Fluid Mechanics Laboratory	1(0-2-1)
632 225	Heat Transfer Laboratory	1(0-2-1)
632 231	Electrical and Electronic Engineering	2(2-0-4)
632 232	Fluid Transmission and Control	1(1-0-2)
632 233	Fluid Transmission and Control Laboratory	2(0-4-2)
632 234	Electrical and Electronic Engineering Laboratory	1(0-2-1)
632 241	Comprehensive Practical Training for Engineering Drawing	3(0-6-0)
632 242	Comprehensive Practical Training for Machines and Mechanisms	3(0-6-0)
632 251	Application of Computer Engineering	2(0-4-2)
632 301	Engineering Calculation Method	2(2-0-4)
632 311	Comprehensive Training of Mechanical Design	1(0-3-0)

632 331	Fundamentals of Control Engineering	2(2-0-4)
632 332	Fundamentals of Electromechanical Transmission Technology	1(1-0-2)
632 333	Mechatronic System Design	3(3-0-6)
632 341	Fundamental of Mechanical Manufacturing	3(3-0-6)
632 342	Hot Working Training	1(0-3-0)
632 343	Mechanical Manufacturing Training	1(0-3-0)
632 344	Production Exercitation	1(0-3-0)
632 345	Comprehensive Training of Mechanical Manufacturing Process	1(0-3-0)
632 346	Comprehensive Practical Training for Advanced Manufacturing Technology	1(0-3-0)
632 411	Mechanical Vibration	2(2-0-4)
632 421	Internal Combustion Engine and Gas Turbine	2(2-0-4)
632 422	Power Plant Engineering	2(2-0-4)
632 423	Air Conditioning and Refrigeration	2(2-0-4)
632 424	Design of Thermal Systems and Energy Management	3(0-6-3)
632 425	Internal Combustion Engine and Gas Turbine Laboratory	1(0-2-1)
632 426	Power Plant Engineering Laboratory	1(0-2-1)
632 427	Air Conditioning and Refrigeration Laboratory	1(0-2-1)
632 431	Measurement for Mechanical Engineering	2(2-0-4)
632 432	Microcontroller and Embedded System	3(0-6-3)
632 433	Measurement for Mechanical Engineering Laboratory	1(0-2-1)
632 461	Mechanical Engineering Project I	1(0-3-0)
632 462	Mechanical Engineering Project II	2(0-6-0)

3) Major Elective Courses (not less than) 4 credits

632 511	Design of Manufacturing Equipment	1(1-0-2)
632 512	Modern Design Method and Application	2(2-0-4)
632 531	Motor Control and PLC	3(3-0-6)
632 532	Principles of Micro-computer	2(2-0-4)
632 533	Numerical Control Technology and Programming	1(1-0-2)
632 571	Selected Topics in Mechanical Engineering	1(1-0-2)

Free Elective Courses (not less than) 6 credits

Students can select elective courses provided by the program and other elective courses provided by Silpakorn University or Chengdu University. In the latter case, the selected elective courses must be approved by Faculty of Mechanical Engineering, Silpakorn University or School of Mechanical Engineering (SME), Chengdu University.

3.1.4 Study Plan

Year 1/ First Semester

Code	Subject	Number of Credits (L – P – S)
632 101	College Physics I	3(3-0-6)
632 102	Advanced Mathematics I	4(4-0-8)
632 103	Engineering Graphics I	4(4-0-8)
632 104	The Foundation of Modern Chemistry	1(1-0-2)
632 171	College English I	3(3-0-6)
632 173	Ideological and Moral Cultivation and Basic Law	2(2-0-4)
.....	General Education Elective Course(s)	2
Total		19

Year 1/ Second Semester

Code	Subject	Number of Credits (L – P – S)
632 105	College Physics II	3(3-0-6)
632 106	Advanced Mathematics II	5(5-0-10)
632 107	Engineering Graphics II	2(2-0-4)
632 108	Engineering Materials	2(2-0-4)
632 151	Fundamentals of Computers	3(2-2-5)
632 172	College English II	3(3-0-6)
.....	Free Elective Course(s)	1
Total		19

Remark: Classes will be conducted at School of Mechanical Engineering (SME), Chengdu University, Sichuan Province, People's Republic of China.

Year 2/ First Semester

Code	Subject	Number of Credits (L – P – S)
600 201	Creativity in World of Technology and Engineering I	1(0-3-0)
632 201	Engineering Mathematics	2(2-0-4)
632 211	Statics and Solid Mechanics	2(2-0-4)
632 212	Dynamics and Machinery	2(2-0-4)
632 214	Statics and Solid Mechanics Laboratory	2(0-4-2)
632 215	Dynamics and Machinery Laboratory	2(0-4-2)
632 221	Thermodynamics	3(3-0-6)
632 222	Fluid Mechanics	1(1-0-2)
632 224	Fluid Mechanics Laboratory	1(0-2-1)
632 251	Application of Computer Engineering	2(0-4-2)
632 271	Communicative English for Engineering	3(3-0-6)
Total		21

Year 2/ Second Semester

Code	Subject	Number of Credits (L – P – S)
600 202	Creativity in World of Technology and Engineering II	1(0-3-0)
632 202	Complex Function and Integral Transformation	2(2-0-4)
632 213	Machine Design	2(2-0-4)
632 216	Machine Design Laboratory	1(0-2-1)
632 223	Heat Transfer	2(2-0-4)
632 225	Heat Transfer Laboratory	1(0-2-1)
632 231	Electrical and Electronic Engineering	2(2-0-4)
632 232	Fluid Transmission and Control	1(1-0-2)
632 233	Fluid Transmission and Control Laboratory	2(0-4-2)
632 234	Electrical and Electronic Engineering Laboratory	1(0-2-1)
632 241	Comprehensive Practical Training for Engineering Drawing	3(0-6-0)
632 242	Comprehensive Practical Training for Machines and Mechanisms	3(0-6-0)
Total		21

Year 3/ First Semester

Code	Subject	Number of Credits (L – P – S)
632 311	Comprehensive Training of Mechanical Design	1(0-3-0)
632 331	Fundamentals of Control Engineering	2(2-0-4)
632 332	Fundamentals of Electromechanical Transmission Technology	1(1-0-2)
632 341	Fundamental of Mechanical Manufacturing	3(3-0-6)
632 342	Hot Working Training	1(0-3-0)
632 343	Mechanical Manufacturing Training	1(0-3-0)
632 344	Production Exercitation	1(0-3-0)
.....	Major Elective Course(s)	2
.....	Free Elective Course(s)	4
Total		16

Year 3/ Second Semester

Code	Subject	Number of Credits (L – P – S)
632 301	Engineering Calculation Method	2(2-0-4)
632 333	Mechatronic System Design	3(3-0-6)
632 345	Comprehensive Training of Mechanical Manufacturing Process	1(0-3-0)
632 346	Comprehensive Practical Training for Advanced Manufacturing Technology	1(0-3-0)
.....	Major Elective Course(s)	1
.....	General Education Elective Course(s)	3
.....	Free Elective Course(s)	1
Total		12

Remark: Classes will be conducted at School of Mechanical Engineering (SME), Chengdu University, Sichuan Province, People's Republic of China.

Year 4/ First Semester

Code	Subject	Number of Credits (L – P – S)
632 421	Internal Combustion Engine and Gas Turbine	2(2-0-4)
632 422	Power Plant Engineering	2(2-0-4)
632 423	Air Conditioning and Refrigeration	2(2-0-4)
632 425	Internal Combustion Engine and Gas Turbine Laboratory	1(0-2-1)
632 426	Power Plant Engineering Laboratory	1(0-2-1)
632 427	Air Conditioning and Refrigeration Laboratory	1(0-2-1)
632 431	Measurement for Mechanical Engineering	2(2-0-4)
632 433	Measurement for Mechanical Engineering Laboratory	1(0-2-1)
632 461	Mechanical Engineering Project I	1(0-3-0)
632 471	Innovation-Driven Entrepreneurship	3(3-0-6)
Total		16

Year 4/ Second Semester

Code	Subject	Number of Credits (L – P – S)
632 411	Mechanical Vibration	2(2-0-4)
632 424	Design of Thermal Systems and Energy Management	3(0-6-3)
632 428	Renewable Energy Technology	3(3-0-6)
632 432	Microcontroller and Embedded System	3(0-6-3)
632 462	Mechanical Engineering Project II	2(0-6-0)
632 473	Technical English for Engineering	3(3-0-6)
.....	Major Elective Course(s)	1
Total		17

3.1.5 Course Descriptions

General Education Courses

600 201 Creativity in World of Technology and Engineering I 1(0-3-0)

Identity of technologists and engineers graduating from Silpakorn University. Case studies and activities for idea generation in technology and engineering using basic thinking tools.

600 202 Creativity in World of Technology and Engineering II 1(0-3-0)

Case studies and activities for problem solving in technology and engineering using systematic processes. Future work skills for creative technologists and engineers.

632 151 Fundamentals of Computers 3(2-2-5)

Basic methods of program design. Thinking methods and application ability of using computers to deal with problems. Three basic structures of programs and structured programming methods. Several typical algorithms. Use of C programming language to develop various applies programs. Foundation for further study of other related courses. Hands-on programming ability, computer debugging and running program ability.

632 171 College English I 3(3-0-6)

Learning and cultivating basic cross-cultural communication and communication skills, and basic listening skill such as predicting words or contents in pre-listening stage, identification of main information, capturing of cohesive words, etc. Understand VOA and BBC's Special English News, as well as short academic lectures and professional courses with average speed and standard pronunciation. Finding the main idea or the key point record, in order to write a brief summary. Asking and answering questions and answers on topics and main ideas that are not clearly heard in lectures and news. Strengthening basic speaking skills, such as being able to exchange information and opinions in understandable English, using various questioning skills and expressing agreement and opposition and other discussion strategies. Making short and simple statements on professional related topics. Responding to various questions or comments. Adopting appropriate conversational skills in group discussions. Strengthening basic English reading skills, such as skipping, skimming, context inference, careful reading and extensive reading. Developing basic translation skills on simple sentences and short paragraphs, and laying a foundation for further participation in international competition and cooperation in this major.

632 172 College English II 3(3-0-6)

Building on secondary school English and college English I. Further developing listening and speaking skills for future study, work and social communication. Enhancing students' vs autonomous learning ability and comprehensive cultural literacy so as to meet the needs of China's social development and international communication with an emphasis on basic cross-cultural communication skills and various strategies for listening to academic lectures, speaking skills at the basic stage, such as exchanging more complicated information and more persuasive messages. Reading short English academic articles related to their major and writing short academic articles, using methods such as definition, classification, enumeration, cause analysis, and comparison. Further developing basic translation skills on authentic reading selections of reasonable length.

632 173 Ideological and Moral Cultivation and Basic Law 2(2-0-4)

Focusing on Xi Jinping's new era of socialism with Chinese characteristics with the education of correct world outlook, outlook on life, values, morality and rule of law as the main contents.

632 271 Communicative English for Engineering 3(3-0-6)

Reading articles and writing summaries. Interpretation of idioms. Report writing. Professional written communication correspondence letters and memorandum, curriculum vitae, and professional verbal communication including job application, oral presentation, and job interview.

632 428 Renewable Energy Technology 3(3-0-6)

Meaning of renewable energy. Converting renewable energy to thermal and electrical energy. Solar, wind, hydro, and biomass energy. Case studies of renewable energy resources. Selection and management of renewable energy.

632 471 Innovation-Driven Entrepreneurship 3(3-0-6)

Essential skills for entrepreneurs. Awareness of the legal, business, managerial, creative, analytical and interpersonal skills relevant to starting and running a new venture.

632 473 Technical English for Engineering 3(3-0-6)

Speaking, listening, reading and writing for technical applications. Reading of scientific and technological articles and publications. Explanation of procedures, charts, graphs and tables. Abstract and article writing.

632 572 Introduction of the Classical Culture of China 2(2-0-4)

Deepen students' understanding of the traditional chinese culture, noble patriotism. Helping to cultivate and establish lofty aspirations and life pursuit, sublimate humanistic quality, and improve taste in being a human being and doing things. Explore the new connotation of training high-quality applied talents in Chengdu University.

632 573 Military Theory 1(1-0-2)

Guide students to establish correct world outlook, outlook on life and values, helping students to master necessary military theoretical knowledge, and help students improve their comprehensive quality.

632 574 Mental Health Curriculum 1(1-0-2)

Basic knowledge of mental health and basic skills to maintain mental health, and/or establish mental health awareness, guide students to recognize and identify psychological abnormalities, and learn to adjust their psychological state, so as to promote the improvement of students' psychological quality.

632 575 Outline of Chinese Modern History 2(2-0-4)

Historical process of social development, revolution, construction and reform in modern China and its internal regularity. History and national conditions of the country, and how history and the people chose Marxism, the Communist Party of China, the socialist road and the reform and opening up.

632 576 Thai Language for Life Development 3(3-0-6)

Learning Thai Language. Reading analysis. Listening for main ideas. Presentation of ideas. Development of sustainable life skills in the information society.

632 577 Thai Usage for Communication and Retrieval 3(3-0-6)

Thai language skills for communication. Study resources. Online information and database search techniques. Evaluating the credibility of data sources.

632 578 Basic Marketing and Finance for Entrepreneurs 3(3-0-6)

Importance of marketing and finance for new entrepreneurs. Marketing concepts. Marketing mechanism. Marketing planning. Finance concepts. Financial planning. Financial forecasts. Fundraising. Importance of financial risk management.

632 579 Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics **4(4-0-8)**

Scientific meaning, formation and development process. Scientific system. Historical position. Guiding significance. Basic viewpoints and line. Principles and policies for the construction of socialism with Chinese characteristics of Mao Zedong Thought. Deng Xiaoping Theory. Important thought of "Three Represents". Scientific concept of development. Xi Jinping's new era of socialism with Chinese characteristics.

632 581 Freshman's Fostering Education **1(1-0-2)**

Cultivating high-quality innovative talents and leaders with all-round development of morality, intelligence, physique and aesthetics and global competitiveness based on adaptive education, with habitual cultivation as the core, multi-party joint efforts as the key, and the exertion of self-potential as the driving force. Helping freshmen to establish good self-management and self-learning awareness. Stimulating deep confidence, emotion and strength support. Developing good cognitive, thinking, learning and behavior habits, and promoting all-round development and growth.

632 582 Entrepreneurship Theory and Practice **1(1-0-2)**

Overview of entrepreneurship. Environment of entrepreneurship. Principles of entrepreneurship. Preparation of entrepreneurship. Design of entrepreneurship. Procedures of entrepreneurship and guidance of entrepreneurship practice including establishment of small enterprises, survival strategy of small enterprises, development strategy of small enterprises, establishment of agricultural enterprises, establishment of small manufacturing enterprises, establishment of small shops, establishment of catering service enterprises, and establishment of construction and transportation enterprises.

632 583 The Fundamental Tenets of Marxism **3(3-0-6)**

The specific teaching objectives specifically required by "Introduction to Basic Principles of Marxism" including systematic Marxist theoretical education focusing on the Marxist world outlook and methodology.

632 584 Chinese for Careers **3(3-0-6)**

Principles of basic Chinese alphabets; practice of listening, speaking, reading and writing with vocabulary about occupations; studying of at least 300 Chinese alphabets; language structures and simple forms of sentences.

Specific Courses

632 101 College Physics I 3(3-0-6)

Foundation of various natural sciences and engineering technologies focusing on mechanics theory, optical theory, thermal and fluid theory, electromagnetism, and atomic structure theory.

632 102 Advanced Mathematics I 4(4-0-8)

Basic concepts of limit, derivative and integral in calculus. Basic calculation skills. Relatively skilled mathematical operation ability, abstract thinking ability, logical reasoning ability, spatial imagination ability and self-study ability, especially the ability to comprehensively apply, analyze and solve practical problems.

632 103 Engineering Graphics I 4(4-0-8)

Common contents in technical drawing specifications and standards, basic theory and application of orthographic projection method, and common expression methods of mechanical drawing. Basic ability of drawing and reading mechanical drawings and thinking in spatial images. Cultivate students' serious and responsible work attitude and rigorous and meticulous work style.

632 104 The Foundation of Modern Chemistry 1(1-0-2)

Basic knowledge in the field of chemistry, master various chemical reaction laws and material structures, the relevant knowledge in the field of material chemistry, and the basic knowledge for the students of mechanical major.

632 105 College Physics II 3(3-0-6)

Foundation of various natural sciences and engineering technologies including mechanics theory, optical theory, thermal and fluid theory, electromagnetism and atomic structure theory.

632 106 Advanced Mathematics II 5(5-0-10)

Basic concepts, theories and operation skills of multivariate function calculus (partial derivative, total differential, multiple integral, curve integral and surface integral of multivariate function, etc.), vector algebra and spatial analytic geometry, infinite series, etc. Necessary mathematical foundation for learning subsequent courses and further acquiring knowledge of other disciplines.

632 107 Engineering Graphics II 2(2-0-4)

Structure and proportion of standard parts and common parts, and stipulate the drawing method. Part drawings and assembly drawings.

632 108 Engineering Materials 2(2-0-4)

Basic knowledge of metal crystallography, classification of iron-carbon alloy, relationship between microstructure and properties, classification and application of heat treatment, brand and heat treatment process of engineering materials, and basis for material selection of engineering materials. General situation and related fields of engineering materials, relationship between engineering materials and manufacturing, material forming technology, machining technology and advanced manufacturing technology.

632 201 Engineering Mathematics 2(2-0-4)

Two basic contents: linear algebra, probability theory and mathematical statistics. Classical theory of linear relation in algebra. Probability theory and mathematical statistics. Regularity of random phenomena from the quantitative side.

632 202 Complex Function and Integral Transformation 2(2-0-4)

Concept and expression of complex number. Complex number operation. Complex plane point set. Concept of limit continuity of complex variable function. Concept of analytic function. Discrimination of analytic function. Cauchy Integral Theorem and Its Extension. Cauchy Integral Formula. Higher Order Derivative Formula.

632 211 Statics and Solid Mechanics 2(2-0-4)

Force systems. Resultants. Equilibrium of particles and rigid bodies. Fluid statics. Centroid and moment of inertia. Forces and stresses. Stress-strain relationship. Stresses in beams, shear force and bending moment diagrams. Deflection of beams. Torsion of shafts. Buckling of columns. Mohr’s circle and combined stresses. Failure criterion.

632 212 Dynamics and Machinery 2(2-0-4)

Kinematics and kinetics of particles and rigid bodies. Newton’s second law of motion. Work and energy. Impulse and momentum. Basic mechanisms, linkages, and joints. Kinematics, position, velocity, and acceleration analysis. Dynamic force analysis of mechanical devices. Cams and followers. Gears and gear trains. Mechanical systems. Balancing of rotating and reciprocating mechanisms.

632 213 Machine Design 2(2-0-4)

Fundamentals of mechanical machine design. Properties of materials. Theories of failure. Design of simple machine elements including rivets, welding works, screw fasteners, power screws, keys and pins, shafts, springs, couplings, gears, bearings, brakes, clutches, belts and chains. Design projects.

632 214 Statics and Solid Mechanics Laboratory 2(0-4-2)

Experiments in beam deflection and balancing. Fundamentals of destructive testing of engineering materials. Tensile test. Compressive test. Torsion test. Bending test. Hardness test. Impact test. Non-destructive flaw test by ultrasonic detector.

632 215 Dynamics and Machinery Laboratory 2(0-4-2)

Experiments in mechanical engineering emphasizing applied mechanics, dynamic and gyroscopic systems.

632 216 Machine Design Laboratory 1(0-2-1)

Projects on machine design. Documentations and presentations of the projects

632 221 Thermodynamics 3(3-0-6)

First and second laws of thermodynamics and Carnot cycle. Energy. Entropy. Basics of heat transfer and energy conversion.

632 222 Fluid Mechanics 1(1-0-2)

Fluid properties. Fluid statics. Momentum and energy equations. Continuity equation and motion. Similitude and dimensional analysis. Steady incompressible flow.

632 223 Heat Transfer 2(2-0-4)

Introduction and modes of heat transfer. Thermal conductivity. Basic equations of heat conduction. One and two dimensional steady-state heat conduction. Transient conduction. Basic concepts and analysis of heat convection. Relations between heat transfer and different types of fluid flow. Radiation heat transfer. Heat exchangers and heat transfer enhancement. Boiling and condensation. Applications of heat transfer.

632 224 Fluid Mechanics Laboratory 1(0-2-1)

Experiments related to fluid mechanics, flow measurements, friction loss in pipes, fans, single pump, series and parallel pumps, pelton turbine.

632 225 Heat Transfer Laboratory 1(0-2-1)

Experiments in mechanical engineering emphasizing thermodynamics, heat conduction, free and forced heat convection, heat radiation, tubular heat exchanger.

632 231 Electrical and Electronic Engineering 2(2-0-4)

Semiconductor devices. DC power supply. Electric power distribution system. Direct current circuit. Single phase and three phases alternating current circuit. Three-phase circuits. Basic principles of electrical transformers. Electrical machines. Motor controlling circuits. Generators. Transmission line system. Design of electric power and illuminating systems. Prevention of power system failure.

632 232 Fluid Transmission and Control 1(1-0-2)

Physical principles of hydraulic systems. Hydraulic devices. Symbols in circuit diagrams. Production control and distribution of compressed air. Pneumatic devices. Electro-pneumatic control devices. Pneumatic-hydraulic control devices. PLC devices.

Basic knowledge of fluid mechanics. Working principle, characteristics, and function of hydraulic components in the hydraulic system. Analyzing the working principle of the hydraulic system and eliminate system faults, and independently design a simpler hydraulic system. Working principle, characteristics and function of various hydraulic components in the hydraulic system. Choosing hydraulic components. Basic characteristics of each hydraulic basic circuit and criteria for selections. Analyzing method of hydraulic system. Independent analyzing simple hydraulic system. Laying a good professional foundation for engaging in hydraulic transmission and control related work in the future.

632 233 Fluid Transmission and Control Laboratory 2(0-4-2)

Design for basic pneumatic circuits. Symbols of pneumatic circuits. Sequence of pneumatic circuits. Simple pneumatic circuit diagrams of single and double acting cylinder. Speed control circuits.

632 234 Electrical and Electronic Engineering Laboratory 1(0-2-1)

Characterization of semiconductor devices. Simulation and Implementation of DC power supply. Three-phase circuits simulation and experiments. Transformer testing. Motor assembly and disassembly. Motor controlling experimentation. Electrical generator coupling. Relations between controlling circuits and power circuits. Reading of electrical drawings. Electrical instruments. Electrical measurements.

632 241 Comprehensive Practical Training for Engineering Drawing 3(0-6-0)

Training process: steps of surveying and mapping of mechanical parts, analyzing and solving practical engineering and technical problems. Measuring and drawing the parts and assemblies of the reducer: structure of the reducer and its internal parts, basis for subsequent mechanical design and manufacturing related courses; Drawing method of part drawing: drawing part drawing sketches and working drawings according to surveying and mapping data; Drawing method of assembly drawing, and determining the relative positional relationship and matching relationship between parts according to the reducer model to draw the assembly drawing, surveying and mapping work.

632 242 Comprehensive Practical Training for Machines and Mechanisms 3(0-6-0)

Basic principles and methods of mechanical principles. Design of mechanical motion scheme. Mechanical innovation design. Analysis and design of various mechanisms in engineering practice by using computers. Expressing the problem-solving process and the final results of practical training. Using the existing commercial software or programming language to solve various problems of training problems. Writing design instructions with standardized format and no principle errors in content.

632 251 Application of Computer Engineering 2(0-4-2)

Theories and knowledge of computer-aided 3D modeling, assembly, engineering drawing, and engineering analysis. Using three-dimensional design software to solve, calculate and analyze the design in the field of mechanical engineering. Improving in designing and manufacturing mechanical products and equipment.

632 301 Engineering Calculation Method 2(2-0-4)

Basic knowledge of calculation methods. Basic theories and methods of calculation. Scientific calculation and basic algorithm analysis. Analyzing and solving problems with mathematical thoughts. Types of errors in engineering calculation. Numerical stability of engineering calculation algorithms and some principles of numerical algorithms. Lagrange Interpolation, Newton Interpolation, Hermite Interpolation and Spline Interpolation. Least square methods. Newton-Cotes formula of numerical integration, complex quadrature formula, Romberg algorithm and numerical differential calculation method. Numerical solution of nonlinear equations: dichotomy, iterative method, Newton iterative method and chord cutting method.

632 311 Comprehensive Training of Mechanical Design 1(0-3-0)

Skills to use in design materials manuals, standards, specifications, atlas, and experience estimation for mechanical design. General design methods of general mechanical parts. Mechanical transmission devices and simple machinery. Applying the relevant knowledge designing general mechanical structures. Laying the necessary foundation for subsequent professional equipment design, complex mechanical design and graduation design. Innovative ability and team spirit, and good academic thoughts and work style.

632 331 Fundamentals of Control Engineering 2(2-0-4)

Basic concepts, theories and methods of automatic control. Ways and means of feedback principle to solve problems related to actual engineering control. Systematic methods to analyze and solve problems. Professional foundation for future electromechanical system design and analysis.

632 332 Fundamentals of Electromechanical Transmission Technology 1(1-0-2)

Composition, basic working principle, characteristics, application and selection of typical electromechanical components of the electromechanical transmission control system. Designing and manufacturing electromechanical systems related to electromechanical control and factory electrical technology.

632 333 Mechatronic System Design 3(3-0-6)

Composition of mechatronics system. Design of mechanical system components, microcomputer control system and its interface design methods.

632 341 Fundamental of Mechanical Manufacturing 3(3-0-6)

Basic principles of metal cutting and become familiarized with common machining methods. Types, structures, and characteristics of commonly used cutting tools. Working principles, transmission characteristics, and typical structures of common machine tools. Basic principles of workpiece positioning. Basic principles of dimensional chains. Scope of application of commonly used cutting tools, select and utilize them. Design features and methods for typical fixtures on commonly used machine tools. Formulation methods and steps in machining processing procedures. Comprehensive analysis of mechanical parts processing errors and surface quality. Positioning methods and errors of common clamping structures. Process dimensional chain and assembly dimensional chain. Technological advancement and development trends of the machinery industry, up-to-date knowledge of advanced manufacturing techniques and methods.

632 342 Hot Working Training 1(0-3-0)

Manufacturing process of mechanical parts. Basic engineering knowledge and common engineering terminologies. Work of machinery businesses in terms of production organization, technical management, quality assurance system, and total quality management. Training to engage in engineering technical work with awareness of safety, environmental protection, competition, innovation, along with rigorous, practical working style. Technological advancement and development trends of the machinery industry, up-to-date knowledge of advanced manufacturing techniques and methods. Basic structural features, working principles, scope of application, and operation methods of the main equipment used in the mechanical manufacturing process. Selecting processing methods and conducting process analysis for simple parts. Preparation and production of processing regulations for simple parts. Selecting appropriate instruments to inspect the products. Writing technical documents, design specifications, internship reports, internship summary, and experiment reports in a standardized format and without errors of principle in content.

632 343 Mechanical Manufacturing Training 1(0-3-0)

Actual production. Production technology and management knowledge. Basic quality training for engineers. Basic process of mechanical manufacturing and production. Basic technology and operation flow of turning, milling and fitter. Purpose, significance, task, process and central teaching resources of engineering training. Concept of safety first. Solid basic skills. Engineering knowledge system, preliminary innovation consciousness. Thinking ability and management concept.

632 344 Production Exercitation 1(0-3-0)

Rules and regulations of students' internship companies. Students' internship tasks. Writings or drawings to correctly describe the working principles and basic structure of at least one mechanical or electromechanical products or at least one item of equipment or tooling within the company or organization chosen for internship. Current advanced design and manufacturing methods and theoretical knowledge of the machinery industry. Upcoming development trend of the machinery industry, and basic skills necessary for the machinery industry. Factory production tasks, scale, organization & management system, and process overview. Mechanical process for typical parts and components, as well as the process flow, equipment, and main features of semi-finished blanks manufacturing. Completing a written internship report in which the training process and project implementation process are elaborated and summarized in detail.

632 345 Comprehensive Training of Mechanical Manufacturing Process 1(0-3-0)

Practical session for fundamental mechanical manufacturing technology involving several other relevant subjects such as Engineering Drawing, Mechanical Principles, Tolerance and Technical Measurement, Mechanical Design, Production Internship, etc. Comprehensive applying the relevant knowledge and acquiring basic skills for independently formulating mechanical manufacturing process instruction and tooling and fixture's structural design.

632 346 Comprehensive Practical Training for Advanced Manufacturing Technology 1(0-3-0)

This course is an important practical step that allows students to comprehensively and systematically learn about the basic principles and methods of advanced manufacturing technology. The course mainly trains students to be able to apply advanced manufacturing technology methods and procedures to engineering problems, develop their practical and innovative design skills.

632 411 Mechanical Vibration 2(2-0-4)

Systems with one degree of freedom. Torsional vibration. Free and forced vibration. Methods of equivalent systems. Systems with several degrees of freedom. Methods and techniques to reduce and control vibration.

632 421 Internal Combustion Engine and Gas Turbine 2(2-0-4)

Fundamentals of internal combustion engine. Performance and testing of engines. Thermodynamics for ideal air-fuel cycles. Fuels and combustion. Ignition systems. Supercharging and scavenging equipment. Spark-ignition and compression-ignition engines. Lubrication. Theories and operating principles of gas turbine engines. Energy interchanges and Mechanical aspects of turbine design. Centrifugal compressor and Axial flow compressors. Regenerator. Applications of gas turbine engines in industry.

632 422 Power Plant Engineering 2(2-0-4)

Steam power cycle. Gas power cycle. Energy conversion theory and availability concept. Fuel and combustion analysis. Fuel flash point evaluation. Components of steam, gas turbine and internal combustion engine power plants. Combined cycle and cogeneration. Hydropower plants. Nuclear power plants. Instrumentation and control. Power plant economics and environmental impacts. Engineering ethics, laws and regulations related to power plant engineering.

632 423 Air Conditioning and Refrigeration 2(2-0-4)

Properties of moist air. Psychometric properties and processes of air. Air conditioning criteria. Cooling load estimation. Air conditioning equipment. Various types of air conditioning system. Design of air condition and ventilation systems. Air distribution and duct system design. Ventilation systems design. Refrigerants and refrigerant selection. Refrigerant piping design. Air conditioning control system. Noise and vibration control. Fire safety in air conditioning systems. Water–based fire protection systems. Indoor air quality. Energy efficiency in air conditioning systems. Refrigeration and heat pump cycles. Introduction to refrigeration. Theoretical and actual refrigeration processes. Multi-pressure refrigeration processes. Refrigerant and lubricating oils. Refrigeration load calculations. Compressors, condensers, evaporators, expansion devices and refrigerant level measurement and control devices. Refrigeration system control. Valves. Electrical control and monitoring system. Refrigeration piping and vessel design. Safety systems.

632 424 Design of Thermal Systems and Energy Management 3(0-6-3)

Engineering design procedures. Design of workable systems. Appropriate equipment selection for thermal systems. Equation fitting. Mathematical modeling and simulation of thermal processes. Optimization techniques for thermal systems. Energy conservation potential in electrical and thermal systems. Energy saving by energy management system. Energy audits. Economic analysis for thermal system design and energy management. Engineering ethics, laws and regulations related to engineering design and energy management.

632 425 Internal Combustion Engine and Gas Turbine Laboratory 1(0-2-1)

Experiments related to exhaust gas calorimeter, heating value evaluation by bomb calorimeter, and fuel flash point evaluation.

632 426 Power Plant Engineering Laboratory 1(0-2-1)

Explanation of energy conversion theory and availability. Experiments in fuel and combustion analysis. Explanation and experiments in components of steam, gas turbine, internal combustion engine power plants. Experiments in combined cycle and cogeneration, hydro power plants, nuclear power plants. Power plant economics and environmental impacts calculation.

632 427 Air Conditioning and Refrigeration Laboratory 1(0-2-1)

Experiments related to air conditioning system, refrigeration and heat pump.

632 431 Measurement for Mechanical Engineering 2(2-0-4)

Fundamentals of instruments and measurements. Technical specifications of measuring instruments. Sensitivity, accuracy and uncertainty. Applications of statistical analysis and data improving. Operating principles of mechanical and electrical instruments. Mechanical and electrical measurements. Data acquisition and storage.

632 432 Microcontroller and Embedded System 3(0-6-3)

Structures and architecture of single-chip microcomputers. Assembly language programming. Analog to digital conversion. Digital to analog conversion. Industrial control device interfacing. System design project.

632 433 Measurement for Mechanical Engineering Laboratory 1(0-2-1)

Introduction of mechanical and electrical measuring instruments. Uncertainty in electrical measurements. Characterization of sensitivity, resolution, accuracy of electrical and mechanical instruments. AC and DC circuit measurements. Introduction of simulation software (LABVIEW, LTSPICE). Data acquisition studying, including of simulation and experiments.

632 461 Mechanical Engineering Project I 1(0-3-0)

Preparing a literature review report on the topic related to students' mechanical engineering project. Selecting a project topic and a project advisor. Preparing a project proposal containing rationale and importance of the topic, objectives, scope, theoretical framework, literature review, project methodological procedures, and schedule. Reporting and presenting the research project orally.

632 462 Mechanical Engineering Project II 2(0-6-0)

Conducting research or producing engineering design focusing on the topic presented earlier in Mechanical Engineering Project I. Analyzing and concluding. Reporting and presenting the research project orally.

632 511 Design of Manufacturing Equipment 1(1-0-2)

Basic theoretical knowledge and methods of mechanical manufacturing equipment design, including design methods, processes and steps of machine tools for metal cutting.

632 512 Modern Design Method and Application 2(2-0-4)

Advanced design and manufacturing theories and methods in the mechanical industry. Development status and trend of technologies and methods involved in specific engineering problems. Choosing two-dimensional or three-dimensional computer-aided design or analysis software to express the design (or analysis) results of engineering problems, or program to solve engineering problems.

632 531 Motor Control and PLC 3(3-0-6)

Basic theory and knowledge of commonly used control motors and PLC control, and understand the structure, working principle, application and composition of control systems of control motors and PLC. Selection and control of control motors. Characteristics and Application of PLC I/O Ports. Basic instructions and applications of commonly used PLC. Drawing method and basic skills of ladder diagrams. Programming of basic control links. Drawing method of flow charts and the conversion of ladder diagrams.

632 532 Principles of Micro-computer 2(2-0-4)

Application of single chip microcomputer technology in mechatronics products and industrial control. Principle and structure of single chip microcomputer. Instruction system, structure principle, interface technology, and the basic skills of developing and designing the application system of single chip microcomputer. Laying foundation for students to engage in industrial control, mechatronics product development and design, and embedded system development and design in the future.

632 533 Numerical Control Technology and Programming 1(1-0-2)

Basic knowledge of numerical control system, numerical control principle, interpolation principle, detection principle, and numerical control machine tools. Basic concepts of numerical control programming, the contents, steps and methods of numerical control programming. Programming instructions and program formats of commonly used CNC machine tools. Basic ability of NC programming which lays a good theoretical foundation for engaging in NC machining and other aspects.

632 571 Selected Topics in Mechanical Engineering 1(1-0-2)

Topics of current interest and/or innovations in mechanical engineering.

3.2 Full Name, I.D. Number, Title and Degree of Lecturers.

3.2.1 Full time Lecturers of the Curriculum

No	Title, Full name, I.D. Number	Degree, Field, Institute, Graduate Academic Year	Average Teaching Load (hours/ week/ academic year)	
			At Present	New Curriculum
1.	Associate professor Dr. Saroj Pullteap x-xxxx-xxxxx-xx-x	Ph.D. (Optoelectronics Engineering) Institut Nationale Polytechnique de Toulouse, Universitaire deToulouse, France (2008) M.Eng. (Control Systems and Instrumentation Engineering) King Mongkut's University of Technology Thonburi, Thailand (2002) B.S.Tech.Ed. (Computer Technology) King Mongkut's Institute of Technology North Bangkok, Thailand (1998)	10	31
2.	Assistant professor Dr.Teerasak Hudakorn x-xxxx-xxxxx-xx-x	Ph.D. (Mechanical Engineering) Chiang Mai University, Thailand (2009) M.Eng. (Mechanical Engineering) Chiang Mai University, Thailand (2001) B.Eng. (Mechanical Engineering) Chiang Mai University, Thailand (1997)	10	29

No	Title, Full name, I.D. Number	Degree, Field, Institute, Graduate Academic Year	Average Teaching Load (hours/ week/ academic year)	
			At Present	New Curriculum
3.	Assistant professor Dr. Vichuda Mettanant x-xxxx-xxxxx-xx-x	Ph.D. (Energy Technology) King Mongkut's University of Technology Thonburi, Thailand (2019) M.Eng. (Energy Management Technology) King Mongkut's University of Technology Thonburi, Thailand (2004) M.Eng. (Energy Technology) Asian Institute of Technology, Thailand (2003) B.Eng. (Mechanical Engineering) Kasetsart University (2000)	10	36
4.	Associate professor Dr. Yanting Ni x-xxxx-xxxxx-xx-x	Ph.D. (Mechanical Manufacturing and Automation) Sichuan University, China (2013) B.S. (Electronics Engineering) Harbin Science and Technology University, China (2002)	16-	16
5.	Associate professor Mao Tang x-xxxx-xxxxx-xx-x	M.E. (Mechanical Manufacturing and Automation) Sichuan University, China (2003) B.E. (Aircraft Design) Sichuan University, China (1997)	12	12

3.2.2 Full Time Lecturers

No	Title, Full name, I.D. Number	Degree, Field, Institute, Graduate Academic Year	Average Teaching Load (hours/ week/ academic year)	
			At Present	New Curriculum
1.	Associate professor Dr. Saroj Pullteap x-xxxx-xxxxx-xx-x	Ph.D. (Optoelectronics Engineering) Institut Nationale Polytechnique de Toulouse, Universitaire deToulouse, France (2008) M.Eng. (Control Systems and Instrumentation Engineering) King Mongkut's University of Technology Thonburi, Thailand (2002) B.S.Tech.Ed. (Computer Technology) King Mongkut's Institute of Technology North Bangkok, Thailand (1998)	10	31
2.	Assistant professor Dr. Teerasak Hudakorn x-xxxx-xxxxx-xx-x	Ph.D. (Mechanical Engineering) Chiang Mai University, Thailand (2009) M.Eng. (Mechanical Engineering) Chiang Mai University, Thailand (2001) B.Eng. (Mechanical Engineering) Chiang Mai University, Thailand (1997)	10	29
3.	Assistant professor Dr. Vichuda Mettanant x-xxxx-xxxxx-xx-x	Ph.D. (Energy Technology) King Mongkut's University of Technology Thonburi, Thailand (2019) M.Eng. (Energy Management Technology) King Mongkut's University of Technology Thonburi, Thailand (2004) M.Eng. (Energy Technology) Asian Institute of Technology, Thailand (2003) B.Eng. (Mechanical Engineering) Kasetsart University (2000)	10	36

No	Title, Full name, I.D. Number	Degree, Field, Institute, Graduate Academic Year	Average Teaching Load (hours/ week/ academic year)	
			At Present	New Curriculum
4.	Associate professor Dr. Yanting Ni x-xxxx-xxxxx-xx-x	Ph.D. (Mechanical Manufacturing and Automation) Sichuan University, China (2013) B.S. (Electronics Engineering) Harbin Science and Technology University, China (2002)	16	16
5.	Associate professor Mao Tang x-xxxx-xxxxx-xx-x	M.E. (Mechanical Manufacturing and Automation) Sichuan University, China (2003) B.E. (Aircraft Design) Sichuan University, China (1997)	12	12
6.	Assistant professor Dr. Thibodin Sansawang x-xxxx-xxxxx-xx-x	Ph.D. (Thermal Technology) King Mongkut's University of Technology Thonburi, Thailand (2010) M.Eng. (Thermal Technology) King Mongkut's University of Technology Thonburi, Thailand (2001) B.Eng. (Mechanical Engineering) Chiang Mai University, Thailand (1995)	10	28
7.	Assistant professor Supachai Wasananon x-xxxx-xxxxx-xx-x	M.Eng. (Thermal Technology) King Mongkut's University of Technology Thonburi, Thailand (2006) B.Eng. (Mechanical Engineering) Chiang Mai University, Thailand (1995)	10	29

No	Title, Full name, I.D. Number	Degree, Field, Institute, Graduate Academic Year	Average Teaching Load (hours/ week/ academic year)	
			At Present	New Curriculum
8.	Assistant professor Noppong Sritrakul x-xxxx-xxxxx-xx-x	M.Eng. (Mechanical Engineering) King Mongkut's University of Technology North Bangkok, Thailand (2007) B.Eng. (Mechanical Engineering) Chiang Mai University, Thailand (1998)	10	30
9.	Assistant professor Sivapong Phetsong x-xxxx-xxxxx-xx-x	M.Eng. (Mechanical Engineering) King Mongkut's Institute of Technology North Bangkok, Thailand (2004) B.Eng. (Mechanical Engineering) King Mongkut's Institute of Technology North Bangkok, Thailand (1998)	10	29
10.	Assistant professor Dr. Thosapon Katejanekarn x-xxxx-xxxxx-xx-x	D.Eng. (Energy Technology) Asian Institute of Technology, Thailand (2008) M.S. (Civil Engineering) University of Colorado, USA (2000) B.Eng. (Mechanical Engineering) Chulalongkorn University, Thailand (1994)	10	27
11.	Assistant professor Dr. Nitipong Soponpongpipat x-xxxx-xxxxx-xx-x	Ph.D. (Mechanical Engineering) Chiang Mai University, Thailand (2008) M.Eng. (Mechanical Engineering) Chiang Mai University, Thailand (2000) B.Eng. (Mechanical Engineering) Chiang Mai University, Thailand (1994)	10	30

No	Title, Full name, I.D. Number	Degree, Field, Institute, Graduate Academic Year	Average Teaching Load (hours/ week/ academic year)	
			At Present	New Curriculum
12.	Associate professor Dr. Kasama Sirisomboon x-xxxx-xxxxx-xx-x	Ph.D. (Mechanical Engineering) Sirindhorn International Institute of Technology Thammasat University, Thailand (2008) M.Eng. (Energy Technology) King Mongkut's University of Technology Thonburi, Thailand (2000) B.Eng. (Mechanical Engineering) Khon Kaen University, Thailand (1997)	10	35
13.	Assistant professor Jarut Kunanoppadol x-xxxx-xxxxx-xx-x	M.B.A. (Finance and Banking) Ramkhamhaeng University, Thailand (2012) M.Eng. (Mechanical Engineering) Chiang Mai University, Thailand (2004) B.Eng. (Mechanical Engineering) Chiang Mai University, Thailand (2001)	10	33
14.	Assistant professor Pongsiri Jaruyanon x-xxxx-xxxxx-xx-x	M.Eng. (Mechanical Engineering) Chiang Mai University, Thailand (2003) B.Eng. (Mechanical Engineering) Chiang Mai University, Thailand (1993)	10	29
15.	Assistant professor Dr. Kittisak Khuwaranyu x-xxxx-xxxxx-xx-x	Ph.D. (Mechanical Engineering) Chulalongkorn University, Thailand (2009) M.Eng. (Mechanical Engineering) Chulalongkorn University, Thailand (2004) B.Eng. (Mechanical Engineering) King Mongkut's University of Technology Thonburi, Thailand (2000)	10	33

No	Title, Full name, I.D. Number	Degree, Field, Institute, Graduate Academic Year	Average Teaching Load (hours/ week/ academic year)	
			At Present	New Curriculum
16.	Dr. Nat Thuchayapong x-xxxx-xxxxx-xx-x	Ph.D. (Mechanical Engineering) Chiang Mai University, Thailand (2012) M.Eng. (Mechanical Engineering) Chiang Mai University, Thailand (2008) B.Eng. (Mechanical Engineering) Chiang Mai University, Thailand (2005)	10	29
17.	Assistant professor Dr. Nattawut Tharawadee x-xxxx-xxxxx-xx-x	Ph.D. (Mechanical Engineering) Chiang Mai University, Thailand (2013) M.Eng. (Mechanical Engineering) Chiang Mai University, Thailand (2008) B.Eng. (Mechanical engineering (Manufacturing)) Mahasarakham University, Thailand (2006)	10	34
18.	Assistant professor Dr. Porametr Arromdee x-xxxx-xxxxx-xx-x	Ph.D. (Mechanical Engineering) Sirindhorn International Institute of Technology Thammasat University, Thailand (2012) M.Eng.Sc. (Mechanical Engineering Science) The University of New South Wales, Australia (2006) B.Eng. (Mechanical Engineering) Sirindhorn International Institute of Technology Thammasat University, Thailand (2005)	10	37

No	Title, Full name, I.D. Number	Degree, Field, Institute, Graduate Academic Year	Average Teaching Load (hours/ week/ academic year)	
			At Present	New Curriculum
19.	Assistant professor Dr. Weeranut Intagun x-xxxx-xxxxx-xx-x	Ph.D. (Mechanical Engineering) Chiang Mai University, Thailand (2013) M.Eng. (Energy Engineering) Chiang Mai University, Thailand (2009) B.Eng. (Agricultural Engineering) Maejo University, Thailand (2006)	10	33
20.	Assistant professor Dr. Chatthanon Bhothikhun x-xxxx-xxxxx-xx-x	Ph.D. (Mechanical Engineering) Chulalongkorn University, Thailand (2015) M.Eng. (Mechanical Engineering) Chulalongkorn University, Thailand (2010) B.Eng. (Mechanical Engineering) Chulalongkorn University, Thailand (2005)	10	31

3.2.3 Guest Lecturers

The list of guest lecturers will be announced before each semester.

4. Detail of Practicum

None

5. Requirements for Project or Research Work

5.1 Brief Description

This program requires students to conduct project/research on a topic that is up to date and under interest of the students. The students will learn to explain theories applied in their project/research and plan scopes of their project/research that can be completed in time under recommendations of the advisors.

5.2 Standard Learning Outcomes

By the end of the course, each project group of students will be able to understand systematic research process, conduct simple research, prepare and submit a project report, and present a summary of the project to public.

5.3 Time Frame

Year 4/First Semester- Year 4/Second Semester

5.4 Credits

3 credits

5.5 Preparation

5.5.1 A project advisor is assigned to each student project group.

5.5.2 Each team of students and their advisor agree on a regular meeting schedule.

5.5.3 The project advisor gives advices for project topic selection and research process.

5.6 Assessment Process

5.6.1 The academic staffs of the program specify the assessment criteria of the subjects.

5.6.2 Project advisor and students decide on the project topic.

5.6.3 The project assessment committee including the academic staffs from Chengdu University and Silpakorn University evaluates progress of the project/research through a project report and presentation in the format and period set by the program.

5.6.4 The project assessment committee reports the evaluation results in the form set by the program.

5.6.5 Project advisor and students evaluate learning outcomes together by consultation.

5.6.6 Students take an oral exam and get evaluated by the project assessment committee.

Section 4 Learning Outcome, Teaching Strategies and Evaluation

1. Student Specific Characteristics Development

Specific Qualifications	Strategies and Activities of Student
1. Having solid foundation in mechanical engineering for applying in real situations and working as a mechanical engineer	Including courses covering all foundationaltopics in mechanical engineering
2. Being skillful in manufacturing automation	1) Having training sessions related to manufacturing automation 2) Assigning homework and term projects for courses related to manufacturing automation 3) Having project courses in 4th Year
3. Being creative	1) Having courses related to creativity 2) Assigning term projects where students decide by themselves what solutions to be developed for solving engineering problems
4. Having moral and engineering ethics	1) Explaining relations of various subjects with society, environment, rules, laws, and social responsibility 2) Arranging activities for moral and ethical development
5. Having good communication skills in English	1) Requiring all communication in classes, homework, presentations, and exams to be in English in 2nd Year and 4th Year 2) Requiring students to present their term projects in English 3) Including courses in technical writing and communication
6. Being global citizen with knowing values of Thai culture	Having activities to introduce Thai culture, Thai history, culture diversity, and global citizenship

2. Program learning outcomes

Program Learning Outcomes (PLOs)	Teaching Strategies	Assessment Strategies
Generic Learning Outcomes		
PLO1 Explain meaning and value of art and creativity.	1. Learning from artists and experts in various fields of arts, studying artworks, ideas and creativity processes to be able to understand value and beauty of nature, art, and creativity. 2. Self-learning through online system/technology.	1. Assessing the students' ability based on real situations by various tools and methods such as discussion, Q&A, presentation by assigning students to explain ideas and creating process of various types of art; and describe values and beauties of nature, art and creativity 2. Assessing the students' ability according to correctness, completeness, and clearness of the students' explanations.
PLO2 Discuss meaning of cultural diversity.	1. Learning from lecture, case studies, simulations and real situations. 2. Activities that develop knowledge and concerns of cultural diversity. 3. Self-learning through online system. 4. Discussion about cultural diversity in simulated and real situations.	1. Assessing the students' ability based on real situations by various tools and methods such as paperexamination, practical examination, and oral examination. 2. Observing of students' behaviors during discussion of cultures diversity that affects communication and social interaction.Then, assessing the students' ability according to correctness, completeness, and clearness of the students' explanations.

Program Learning Outcomes (PLOs)	Teaching Strategies	Assessment Strategies
PLO3 Identify basic knowledge about business operation and basic skills for entrepreneur.	1. Using competency-based learning by emphasizing on integrated knowledge, discussion of ideas about marketing and entrepreneurship. 2. Using problem based learning, studying from field trips at companies and case study from success companies.	Assessing the students' ability based on real situations by various tools and methods such as group discussion, group activities, problem solving activities, self-evaluation, evaluation from team mate, and evaluation from field trip reports.
PLO4 Communicate with objectives in various contexts.	1. Using active learning, demonstration method, simulation, and playing games. 2. Self-learning through online system.	1. Assessing the students' ability based on real situations by various tools and methods such as paper examination, practical examination, and oral examination. 2. Observing of students' behaviors during activity participation.
PLO5 Choose appropriate information and communication technology according to purpose of use with media and information literacy.	1. Using active learning. 2. Self-learning through online system. 3. Encouraging students to synthetize data and information, then applying with judgement and creativity.	Assessing the students' ability based on real situations by self-assessment behavior, by classmate, paper examination, practical examination, assignment evaluation, media usability with moral.
PLO6 Acquire and apply new knowledge as needed by using appropriate learning strategies.	1. Encouraging self-directed learning for live long learning and self-improvement for the well-being, physical, mental and social. 2. Promoting self-learning through online/technology system.	Behavior observation, learning design and planning, learning responsibility, learning progressive self-assessment between and end of semester by paper examination, portfolio or integrate knowledge to everyday life.

Program Learning Outcomes (PLOs)	Teaching Strategies	Assessment Strategies
PLO7 Function effectively on a team whose members together create a collaborative and inclusive environment, and work with discipline, punctuality, honesty, and personal, social and environmental responsibility.	Teaching and learning to build up teamwork, for example; project-based learning, problem-based learning, leadership and follower development, responsibilityand problem solving.	Group activities assessment from real situation, assessing learners' practicability while doing learning activities and learning outcome.
PLO8 Use creativity to create works or operate projects.	1. Project-based learning on creative thinking, creative works and new idea development, productivity, and innovation. 2. Educational management by encouraging learners to use creativity and new idea in the design of their work, in-class activities or projects with critical thinking, connection and reflection of creativities and aesthetics. Creativities and project execution can be done in and out of the classroom.	Productivities, activities or project evaluation start from topics set up, planning, execution, revision and presentation. Behavior observation, teamwork, self-accessment, classmate assessment, must be determined by idea origination, favorable and aesthetics.
PLO9 Analyze and plan systematically for problem solving or innovation design.	Student center teaching by problem-based, Analysis practice and reasonable and systematic teaching design.	Behavior observation, self-assessment, classmate or group assessment, for example, planning, problem solving design, or innovative design, analysis and problem solving by planning or innovation.

Program Learning Outcomes (PLOs)	Teaching Strategies	Assessment Strategies
Subject Specific Learning Outcomes		
PLO10 Recognize ethical and professional responsibilities in engineering situations.	1. Lecture of engineering ethic. 2. Writing an essay of engineering ethics. 3. Describing of importance of engineering ethics with appropriate case study or engineering practice. 4. Assigning the importance of engineering ethics that effected to social and profession 5. Assigning the case studies of engineering practice with engineering ethics	1. paper-based examination. 2. Evaluating the accuracy, completeness and clarity of explaining the importance of engineer ethics with situations related to engineering practice. 3. Assessing on the practice chosen by the student, case studies related to engineering practice in accordance with engineer ethics. 4. Behavior observation during project assignments and training.
PLO11 Apply knowledge of mathematics, science, and engineering to solve mechanical engineering problems.	1. Lecture on fundamental scientific knowledge for solving engineering problems. 2. Defining engineering problem and ask students to apply the theory or scientific principles for solving the problems. 3) Assigning the appropriate quantity and quality problem to solve with engineering knowledge.	1. Evaluating from a given engineering solution test by applying basic knowledge of science and engineering. 2. Evaluating from the work assigned to solve engineering problems.

Program Learning Outcomes (PLOs)	Teaching Strategies	Assessment Strategies
PLO12 Designa system, component, or process in either thermal or mechanical systems areas to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.	1. Lecture on fundamental scientific knowledge for solving mechanical engineering problems. 2. Defining mechanical engineering problem and ask students to apply the theory or scientific principles for solving the mechanical engineering problems. 3. Assigning the appropriate quantity and quality oe mechanical engineering problem to solve with engineering knowledge. 4. Assigning the mechanical engineering problem to solve with computer software.	1. Evaluating from a given mechanical engineering solution which applied basic knowledge of science and engineering. 2. Evaluating from the work assigned to solve mechanical engineering problems. 3. Evaluating from the work assigned to solve mechanical engineering problems with computer software.
PLO13 Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	1. Lecture and demonstration. 2. Assigning problem to individual or group to design mechanical parts or specimen with recommendation. 3. Assigning problem to individual or group to design mechanical parts or specimen by computer software.	1. Evaluating from a given mechanical engineering parts or specimen which applied basic knowledge of science and engineering 2. Evaluating from mechanical design procedure and presentation 3. Evaluating from mechanical part or specimen design by computer aided design.

The relationship between Program Learning Outcomes (PLOs) and Thailand Qualifications Framework (TQF)
Generic Learning Outcomes/Subject Specific Learning Outcomes

Thailand Qualifications Framework (TQF) Learning Outcomes / *Program Leaning Outcomes (PLOs)*	*1. Morality and Ethics*					*2. Knowledge*					*3. Intellectual Skills*					*4. Interpersonal Skills and Responsibility*					*5. Skills in numerical analysis, communication and information technology application*				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
PLO1 Explain meaning and value of art and creativity.	✓													✓											
PLO2 Discuss meaning of cultural diversity.		✓	✓													✓									
PLO3 Identify basic knowledge about business operation and basic skills for entrepreneur.						✓																			
PLO4 Communicate with objectives in various contexts.																✓								✓	
PLO5 Choose appropriate information and communication technology according to purpose of use with media and information literacy.																							✓		
PLO6 Acquire and apply new knowledge as needed by using appropriate learning strategies.				✓						✓		✓		✓	✓			✓							

Thailand Qualifications Framework (TQF) Learning Outcomes / *Program Leaning Outcomes (PLOs)*	*1. Morality and Ethics*					*2. Knowledge*					*3. Intellectual Skills*					*4. Interpersonal Skills and Responsibility*					*5. Skills in numerical analysis, communication and information technology application*				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
PLO7 Function effectively on a team whose members together create a collaborative and inclusive environment, and work with discipline, punctuality, honesty, and personal, social and environmental responsibility.		✓	✓														✓		✓	✓					
PLO8 Use creativity to create works or operate projects.														✓			✓								
PLO9 Analyze and plan systematically for problem solving or innovation design.													✓					✓							
PLO10 Recognize ethical and professional responsibilities in engineering situations.				✓	✓																				
PLO11 Apply knowledge of mathematics, science, and engineering to solve mechanical engineering problems.						✓	✓		✓				✓								✓		✓		✓

Thailand Qualifications Framework (TQF) Learning Outcomes / *Program Leaning Outcomes (PLOs)*	*1. Morality and Ethics*					*2. Knowledge*					*3. Intellectual Skills*					*4. Interpersonal Skills and Responsibility*					*5. Skills in numerical analysis, communication and information technology application*				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
PLO12 Designa system, component, or process in either thermal or mechanical systems areas to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.				✓				✓		✓	✓			✓						✓	✓				✓
PLO13 Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.											✓	✓	✓									✓			

Note : Indicating the symbol ✓ in the cell of the table that having relationship between the Program learning outcomes (PLOs) and the Thailand Qualifications Framework (TQF) Learning Outcomes

Curriculum mapping of learning outcomes

The learning outcomes of each domain are as follows:

1. **Morality and Ethics**
   (1) Understanding and being appreciated in Thai culture, and concerning in values of the system of morality, ethics, sacrifice and honesty.
   (2) Having self-discipline, punctuality, self and social responsibility, as well as respecting the rules and regulations of organization and society.
   (3) Having leadership and followership, being able to work as a group, being able to resolve conflicts orderly, being respectful to the rights of others, being open-minded, as well as being respectful to human dignity.
   (4) Being able to analyze and assess the impact of applying engineering knowledge to people, organizations, society and environment.
   (5) Having academic and professional ethics, and responsibilities as a professional person, including understanding the social context of the engineering profession in each field of study from past to present.
2. **Knowledge**
   (1) Having basic knowledge and understanding in Mathematics, Science, Engineering and Economics for implementation in engineering and related work, and for creation the technological innovations.
   (2) Having knowledge and understanding in core principles of both theoretical and practical specifically in engineering.
   (3) Being able to integrate knowledge in the studied field with other related field of knowledge.
   (4) Being able to analyze and solve problems with appropriate methods including using suitable tools such as computer programs, etc.
   (5) Being able to apply knowledge and skills in their field of study in applying and solving problems in real work.
3. **Intellectual skills**
   (1) Having good judgment thoughts.
   (2) Being able to collect, study, analyze and summarize problems and needs.
   (3) Being able to think, analyze and solve engineering problems systematically including using obtained data to make decisions efficiently.
   (4) Having the imagination and flexibility in applying the relevant knowledge appropriately in the development of innovation or building up the original knowledge creatively.
   (5) Being able to search for information and seek additional knowledge by themselves for lifelong learning and keeping up with the transformation of knowledge and new technologies.

4. Interpersonal Skills and Responsibility

(1) Being able to communicate with various groups of people, being able to converse in both Thai and foreign languages effectively, and being able to use knowledge in their professional field to communicate with society appropriately.

(2) Being able to initiate the issue of solving the creative situation both in personally and collectively, and to express a reasonable position for both of oneself and groups including helping and facilitating in solving various situation problems.

(3) Being able to plan and take responsibility for the development of their own learning consistent to their knowledge in professional field continuously.

(4) Knowing their roles, duties and responsibilities in work assigned to them both in individual and group work, being able to adapt and work with others as a leader and follower effectively, and being able to act themselves appropriately with their responsibility.

(5) Having awareness of responsibility in safety at work and environment preservation.

5. Skills in numerical analysis, communication and information technology application

(1) Having good computer skills for work in related field of the profession.

(2) Having skills in mathematical information analysis or applied statistics implementation for solving any related problems constructively.

(3) Being able to apply modern information and communication technology appropriately and efficiently.

(4) Being able to communicate the information through speaking, writing and interpreting using symbols.

(5) Being able to use calculation tools and engineering tools for professional practice in the related engineering field.

Curriculum Mapping Distributed by Course and PLOs : Program Learning Outcomes
Generic Learning Outcomes/Subject Specific Learning Outcomes

Course Code/Name of Course	PLOs : Program-Level Learning Outcomes												
	Generic Learning Outcomes									Subject Specific Learning Outcomes			
	1	2	3	4	5	6	7	8	9	10	11	12	13
General Education Courses													
600 201 Creativity in World of Technology and Engineering I	●						●	●					
600 202 Creativity in World of Technology and Engineering II							●	●	●				
632 151 Fundamentals of Computers											●		
632 171 College English I		●		●									
632 172 College English II		●		●									
632 173 Ideological and Moral Cultivation and Basic Law										●			
632 271 Communicative English for Engineering				●									
632 428 Renewable Energy Technology						●							
632 471 Innovation-Driven Entrepreneurship			●		●								
632 473 Technical English for Engineering				●									
632 572 Introduction of the Classical Culture of China		●											
632 573 Military Theory							●						
632 574 Mental Health Curriculum						●	●						
632 575 Outline of Chinese Modern History	●	●											
632 576 Thai Language for Life Development				●		●							
632 577 Thai Usage for Communication and Retrieval				●	●								

Course Code/Name of Course	PLOs : Program-Level Learning Outcomes												
	Generic Learning Outcomes									Subject Specific Learning Outcomes			
	1	2	3	4	5	6	7	8	9	10	11	12	13
632 578 Basic Marketing and Finance for Entrepreneurs			●										
632 579 Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics									●				
632 581 Freshman's Fostering Education						●							
632 582 Entrepreneurship Theory and Practice			●										
632 583 The Fundamental Tenets of Marxism									●				
632 584 Chinese for Careers				●									
Specific Courses													
632 101 College Physics I											●		
632 102 Advanced Mathematics I											●		
632 103 Engineering Graphics I											●		
632 104 The Foundation of Modern Chemistry											●		
632 105 College Physics II											●		
632 106 Advanced Mathematics II											●		
632 107 Engineering Graphics II											●		
632 108 Engineering Materials											●		
632 201 Engineering Mathematics											●		
632 202 Complex Function and Integral Transformation											●		
632 211 Statics and Solid Mechanics											●		
632 212 Dynamics and Machinery											●		

Course Code/Name of Course	PLOs : Program-Level Learning Outcomes												
	Generic Learning Outcomes									Subject Specific Learning Outcomes			
	1	2	3	4	5	6	7	8	9	10	11	12	13
632 213 Machine Design											●	●	
632 214 Statics and Solid Mechanics Laboratory											●		
632 215 Dynamics and Machinery Laboratory											●		
632 216 Machine Design Laboratory											●	●	
632 221 Thermodynamics											●		
632 222 Fluid Mechanics											●		
632 223 Heat Transfer											●		
632 224 Fluid Mechanics Laboratory											●		
632 225 Heat Transfer Laboratory											●		
632 231 Electrical and Electronic Engineering											●		
632 232 Fluid Transmission and Control											●		
632 233 Fluid Transmission and Control Laboratory											●		
632 234 Electrical and Electronic Engineering Laboratory											●		
632 241 Comprehensive Practical Training for Engineering Drawing												●	
632 242 Comprehensive Practical Training for Machines and Mechanisms												●	
632 251 Application of Computer Engineering											●	●	
632 301 Engineering Calculation Method											●		
632 311 Comprehensive Training of Mechanical Design												●	

Course Code/Name of Course	PLOs : Program-Level Learning Outcomes												
	Generic Learning Outcomes									Subject Specific Learning Outcomes			
	1	2	3	4	5	6	7	8	9	10	11	12	13
632 331 Fundamentals of Control Engineering												●	
632 332 Fundamentals of Electromechanical Transmission Technology												●	
632 333 Mechatronic System Design												●	
632 341 Fundamental of Mechanical Manufacturing												●	
632 342 Hot Working Training													●
632 343 Mechanical Manufacturing Training													●
632 344 Production Exercitation												●	
632 345 Comprehensive Training of Mechanical Manufacturing Process												●	
632 346 Comprehensive Practical Training for Advanced Manufacturing Technology												●	
632 411 Mechanical Vibration											●		
632 421 Internal Combustion Engine and Gas Turbine											●		
632 422 Power Plant Engineering										●	●		
632 423 Air Conditioning and Refrigeration											●		
632 424 Design of Thermal Systems and Energy Management									●	●		●	
632 425 Internal Combustion Engine and Gas Turbine Laboratory											●		
632 426 Power Plant Engineering Laboratory											●		

Course Code/Name of Course	PLOs : Program-Level Learning Outcomes												
	Generic Learning Outcomes									Subject Specific Learning Outcomes			
	1	2	3	4	5	6	7	8	9	10	11	12	13
632 427 Air Conditioning and Refrigeration Laboratory											●		
632 431 Measurement for Mechanical Engineering											●		
632 432 Microcontroller and Embedded System											●		
632 433 Measurement for Mechanical Engineering Laboratory											●		
632 461 Mechanical Engineering Project I							●		●				●
632 462 Mechanical Engineering Project II								●		●			●
632 511 Design of Manufacturing Equipment												●	
632 512 Modern Design Method and Application												●	
632 531 Motor Control and PLC												●	
632 532 Principles of Micro-computer											●		
632 533 Numerical Control Technology and Programming											●		
632 571 Selected Topics in Mechanical Engineering											●		

Remark : Symbol "●" means courses are managed and assessed whether learners have reached the Program Learning Outcomes (PLOs) and verification process of students' achievement results is also cond

Curriculum Mapping and PLOs : Program Learning Outcomes
Classified According to the Required Course in Generic Learning Outcomes and Subject Specific Learning Outcomes

Year/Course Code /Course title	Credits	PLOs : Program-Level Learning Outcomes												
		Generic Learning Outcomes									Subject Specific Learning Outcomes			
		1	2	3	4	5	6	7	8	9	10	11	12	13
First Year														
632 101 College Physics I	3(3-0-6)											U		
632 102 Advanced Mathematics I	4(4-0-8)											U		
632 103 Engineering Graphics I	4(4-0-8)											Ap		
632 104 The Foundation of Modern Chemistry	1(1-0-2)											Ap		
632 105 College Physics II	3(3-0-6)											Ap		
632 106 Advanced Mathematics II	5(5-0-10)											Ap		
632 107 Engineering Graphics II	2(2-0-4)											Ap		
632 108 Engineering Materials	2(2-0-4)											Ap		
632 151 Fundamentals of Computers	3(2-2-5)											Ap		
632 171 College English I	3(3-0-6)		U		Ap									
632 172 College English II	3(3-0-6)		U		Ap									

Year/Course Code /Course title	Credits	PLOs : Program-Level Learning Outcomes												
		Generic Learning Outcomes									Subject Specific Learning Outcomes			
		1	2	3	4	5	6	7	8	9	10	11	12	13
632 173 Ideological and Moral Cultivation and Basic Law	2(2-0-4)										At			
Second Year														
600 201 Creativity in World of Technology and Engineering I	1(0-3-0)	U						At	Ap					
600 202 Creativity in World of Technology and Engineering II	1(0-3-0)							At	Ap	An				
632 201 Engineering Mathematics	2(2-0-4)											Ap		
632 202 Complex Function and Integral Transformation	2(2-0-4)											Ap		
632 211 Statics and Solid Mechanics	2(2-0-4)											Ap		
632 212 Dynamics and Machinery	2(2-0-4)											Ap		
632 213 Machine Design	2(2-0-4)											Ap	Ap	
632 214 Statics and Solid Mechanics Laboratory	2(0-4-2)											Ap		
632 215 Dynamics and Machinery Laboratory	2(0-4-2)											Ap		

Year/Course Code /Course title	Credits	PLOs : Program-Level Learning Outcomes												
		Generic Learning Outcomes									Subject Specific Learning Outcomes			
		1	2	3	4	5	6	7	8	9	10	11	12	13
632 216 Machine Design Laboratory	1(0-2-1)											Ap	S, At	
632 221 Thermodynamics	3(3-0-6)											Ap		
632 222 Fluid Mechanics	1(1-0-2)											Ap		
632 223 Heat Transfer	2(2-0-4)											Ap		
632 224 Fluid Mechanics Laboratory	1(0-2-1)											Ap		
632 225 Heat Transfer Laboratory	1(0-2-1)											Ap		
632 231 Electrical and Electronic Engineering	2(2-0-4)											Ap		
632 232 Fluid Transmission and Control	1(1-0-2)											Ap		
632 233 Fluid Transmission and Control Laboratory	2(0-4-2)											Ap		
632 234 Electrical and Electronic Engineering Laboratory	1(0-2-1)											Ap		
632 241 Comprehensive Practical Training for Engineering Drawing	3(0-6-0)												Ap	

Year/Course Code /Course title	Credits	PLOs : Program-Level Learning Outcomes												
		Generic Learning Outcomes									Subject Specific Learning Outcomes			
		1	2	3	4	5	6	7	8	9	10	11	12	13
632 242 Comprehensive Practical Training for Machines and Mechanisms	3(0-6-0)												Ap	
632 251 Application of Computer Engineering	2(0-4-2)											Ap	Ap	
632 271 Communicative English for Engineering	3(3-0-6)				Ap									
Third Year														
632 301 Engineering Calculation Method	2(2-0-4)											Ap		
632 311 Comprehensive Training of Mechanical Design	1(0-3-0)												S, At	
632 331 Fundamentals of Control Engineering	2(2-0-4)												Ap	
632 332 Fundamentals of Electromechanical Transmission Technology	1(1-0-2)												Ap	
632 333 Mechatronic System Design	3(3-0-6)												Ap	
632 341 Fundamental of Mechanical Manufacturing	3(3-0-6)												Ap	

Year/Course Code /Course title	Credits	PLOs : Program-Level Learning Outcomes												
		Generic Learning Outcomes									Subject Specific Learning Outcomes			
		1	2	3	4	5	6	7	8	9	10	11	12	13
632 342 Hot Working Training	1(0-3-0)													Ap
632 343 Mechanical Manufacturing Training	1(0-3-0)													Ap
632 344 Production Exercitation	1(0-3-0)												Ap	
632 345 Comprehensive Training of Mechanical Manufacturing Process	1(0-3-0)												Ap	
632 346 Comprehensive Practical Training for Advanced Manufacturing Technology	1(0-3-0)												S	
Fourth Year														
632 411 Mechanical Vibration	2(2-0-4)											Ap		
632 421 Internal Combustion Engine and Gas Turbine	2(2-0-4)											Ap		
632 422 Power Plant Engineering	2(2-0-4)										At	Ap		
632 423 Air Conditioning and Refrigeration	2(2-0-4)											Ap		
632 424 Design of Thermal Systems and Energy Management	3(0-6-3)									An	At		Ap, At	

Year/Course Code /Course title	Credits	PLOs : Program-Level Learning Outcomes												
		Generic Learning Outcomes									Subject Specific Learning Outcomes			
		1	2	3	4	5	6	7	8	9	10	11	12	13
632 425 Internal Combustion Engine and Gas Turbine Laboratory	1(0-2-1)											Ap		
632 426 Power Plant Engineering Laboratory	1(0-2-1)											Ap		
632 427 Air Conditioning and Refrigeration Laboratory	1(0-2-1)											Ap		
632 428 Renewable Energy Technology	3(3-0-6)						Ap, At							
632 431 Measurement for Mechanical Engineering	2(2-0-4)											Ap		
632 432 Microcontroller and Embedded System	3(0-6-3)											Ap		
632 433 Measurement for Mechanical Engineering Laboratory	1(0-2-1)											Ap		
632 461 Mechanical Engineering Project I	1(0-3-0)							Ap		An				An
632 462 Mechanical Engineering Project II	2(0-6-0)								Ap		At			An

Year/Course Code /Course title	Credits	PLOs : Program-Level Learning Outcomes												
		Generic Learning Outcomes									Subject Specific Learning Outcomes			
		1	2	3	4	5	6	7	8	9	10	11	12	13
632 471 Innovation-Driven Entrepreneurship	3(3-0-6)			U		Ap								
632 473 Technical English for Engineering	3(3-0-6)				Ap									

Remark : Courses are listed by the years of study and identified their expected learning outcomes according to Bloom's Taxonomy (Revised). The symbols used in the table are "R" for Remembering, "U" for Understanding, "Ap" for Applying, "An" for Analyzing, "E" for Evaluating, "C" for Creating, "S" for Psychomotor Domain (Skills), and "At" for Affective Domain (Attitude).

Expected Learning Outcomes at the end of Academic Year

Year	Expected Learning Outcomes at the end of Academic Year
1	By end of the 1st year, students should be able to - use knowledge of mathematics and science to solve basic engineering problems, - communicate effectively in classes.
2	By end of the 2nd year, students should be able to - use fundamental knowledge of mechanical engineering to solve mechanical engineering problems, - explain meaning and value of creativity and use basic thinking tools to create works or operate projects creatively, - use systematic processes for problem solving.
3	By end of the 3rd year, students should be able to - design a system, component, or process in mechanical systems to meet desired needs within realistic constraints and ethics, - discuss meaning of cultural diversity and impact of cultural diversity in workplaces.
4	By end of the 4th year, students should be able to - design a system, component, or process in either thermal or mechanical systems areas to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability, - choose appropriate information for engineering project, - recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts, - work in a team to develop and conduct experimentats, analyze and interpret data, and use engineering judgment to draw conclusions.

Section 5 Students Assessment Criteria

1. Regulations and criteria of grading systems

The evaluation and grading systems will be conducted in compliance with Silpakorn University Rules and Regulations for Graduate's degree 2017 (Appendix A) and/or any revised versions.

2. Student Assessment

Various ways of students assessment based on the achievement of learning outcomes.

2.1 In the evaluation of the course, students are assessed three times, before, during and at the end of the course. There are various assessment methods according to the learning outcome, for example, reports, training, group working, discussion, presentation, Q&A, questionnaire or interview etc.

2.2 Assessment of the student's academic performance based on the grade level by the Criterion Method. Students must be clearly informed the criteria for assessing of the the course during the first teaching and learning.

2.3 Rubical evaluation must be used.

2.4 Response to the student performance by announcing the in-class attendance score points and midterm results score points. And in case there are in-class presentation, response to the presentation must be informed.

2.5 Students can appeal the assessment results, which can be submitted documentsthrough the faculty's educational service.

3. Verification Process of Students' Achievement Results

3.1 Verification Process of Learning Standards during study

The verification process of learning standards of students is part of the internal quality assurance process for higher education institutions. The verification process ofstudents' achievement accoding to each course learning outcome are as follows.

(1) Considering student evaluation of teachers.
(2) Considering examination questions according to CLO(s)
(3) Analyzing grade distribution
(4) Interviewing some students in the class
(5) Interviewing the course instructor
(6) Examining course syllabus or teaching plans for each semester to ensure that course lecturers and administrators entirely indicate the practical course criteria and evaluation, including accurate measurement and assessment.
(7) Assessment of the students' Expected Learning Outcomes (ELOs) by the end of each academic year by various methods such as discussion, presentation, Q&A, questionnaire or interview.

3.2 Verification Process of Learning Standards after Graduation

Verification process of learning standards after graduation gives priority to and the mapping and monitoring of achievement of graduates in their respective careers. The results of the research will be used to improve and evaluate earning processes the faculty and curriculum. The following research methods and implementation could be operated:

(1) Employment of graduates, job searching period, opinion on the curriculum and confidence towards their careers.

(2) Assessment of graduates' job position and/or their career path.

(3) Assessment of graduates whose careers are related to their majors or other fields of study indicated in the curriculum. Assessment of graduates' opinions towards the improvement of curriculum and the process of learning and teaching.

(4) Satisfactory verification via surveying employers' satisfaction of graduates, through interviews and questionnaires.

(5) Assessment of external experts opinions towards the curriculum. Assessment of guest lecturers' opinions towards readiness of students and other qualifications, concerning learning processes and their knowledge.

4. Graduation Criteria

4.1 According to the regulations of undergraduate degree of the Silpakorn university, 2017 (Appendix A) and/or revised version if any.

4.2 Undergraduates student of the Bachelor of Engineering Program in Mechanical Engineering (international program) from the department of mechanical engineering must have a minimum of 141 credits accumulated in the course, obtained the GPA level of all subjects in the compulsory and elective courses in this program at least 2.00, and obtained the GPA level of major compulsory and major elective courses in the specific course category.

4.3 Undergraduates student of the Bachelor of Engineering Program in Mechanical Engineering (international program) from the department of mechanical engineering must attend activities to introduce Thai culture, Thai history, culture diversity, and global citizenship not less than 48 hours.

Section 6 Lecturer Development

1. Preparation for New Lecturers

1.1 The orientation for new lecturers aims to provide information of the program, policy of the university, the faculty, the department and the curriculum.

1.2 New lecturers will be guided by of the department and faculty upon start of work.

1.3 New lecturers will be given the chance to enhance their knowledge and develop ways to gain more experience in accordance with teaching and conducting research through an internal and external research funding. There are chances of funding for classroom research, research for publication in the acceptance database such as ISI or SCOPUS and participating in national and international academic conferences. Lecturers will be allowed to take leaves of absence to enrich their work experience.

2. Knowledge and Skills Development for Lecturers

2.1 Development, Measurement and Assessment of Teaching Skills

(1) Lecturers will be given opportunities to enhance knowledge and gain more experience in order to develop their teaching capability through research and further studies.

(2) There will also be updated teaching skills and methods by in-house or external training.

(3) Lecturers will be encouraged to do in-class research in order to construct a new body of knowledge, solve problems and improve teaching methods.

2.2 Developments of research skills

(1) Academic staff will be participating in academic service activities for the community and society related to knowledge and morality building.

(2) To encourage lecturers to produce various academic works, such as textbooks or academic papers published in both national and international journals or conferences.

(3) To encourage lectures to be promoted to higher academic rank through research fund from internal or external funding agencies.

Section 7 Quality Assurance

1. Supervision Standards

The mechanical engineering curriculum is revised to meet Outcome Based Education. The program structure is designed and develops to align with the Thai Qualification Framework (TQF1) for Higher Education as basic standard, which is composed of General Education, Required and Free Elective courses. The details of the curriculum are provided in TQF2 documents. It is revised every five academic years, by which the Mechanical Engineering program has set up a curriculum committee to develop and improve the curriculum based on stakeholders' requirement. Stakeholders are identified as academic faculty, current students, alumni, high school students and employers. The curriculum committee meets on a regular basis to review stakeholder's inputs and evaluate courses.

The details of the course structure have been documented in TQF3. The quality of the curriculum and courses is monitored throughout the period of implementation by the student and instructor's self-evaluations through TQF5 and TQF7. Minor changes can be made in TQF3 to improve the teaching and learning together with the adoption of outcome based education.

The curriculum member will be managed in accordance with the curriculum committee to control the number of lecturers responsible for the curriculum, qualifications of course lecturers, and qualifications of instructors. This committee is advised by the Board of Curriculum Committee of Faculty of Engineering and Industrial Technology. Also there will be internal and external audit checks set by the Quality Assurance Committee.

The curriculum member conduct meetings to determine the responsibilities of course instructors to cover implementation of curriculum standards control and internal quality assurance at the curriculum level, divided as the following.

1.1 Curriculum member involve ACT 1, Standard Control, according to Curriculum Standard (2015) to handle the curriculum to meet the internal educational quality assurance system.

1.2 Curriculum member have implement and collect the annual report including the assessment and results of operations in each component of the Internal Audit report for TQF7 of the program.

2. Graduates

2.1 Graduates of the program must be qualified based on the program learning outcomes and the five domains related to the Qualifications Framework. This includes ethical and moral development, knowledge, cognitive skills, interpersonal and responsibility, numerical analysis, communication and information technology.

2.2 Curriculum member survey the employment/continuing education of graduates is carried out within 1 year after graduation.

2.3 Curriculum member survey of the rate of employment in the field of study for a period of 1 year after graduation.

2.4 Curriculum member the level of satisfaction of graduate employers with the overall quality of the graduates within 1 year after graduation

3. Students

3.1 Program admission

First year students will enroll the program through CDU system to meet the annually target plan at Chengdu University. The student intake policy, amission criteria, and admission procedures will be shown clearly and up-to-date according to the requirement of AUN-QA.

3.2 Academic guidance and general counselling services for students

The faculty shall provide an academic advisor to each student in the orientation. The department of mechanical engineering shall appoint the academic advisor and introduction for the first time (2^{nd} year) students who come to study in Silpakorn University.

3.3 Graduation

The faculty has a system for checking the number of credits. For students who submit their documents to graduate, the faculty will check whether students have completed all of the courses specified in the program. If it is not complete, it will inform the students.

3.4 Student right to file complaints

Students have the right to see their exam papers and access details of course evaluation. This can be notified through an announcement. This announcement guides students the procedure of asking permission to see their exam papers and details of course evaluation. Students have the right to submit any requirement form or complain directly to the faculty through email, comment box, and www.reg.su.ac.th before receiving their GPA.

4. Management of Lecturers

4.1 Recruitment of new Lecturers

(1) Lecturers must possess qualifications in accordance with Silpakorn University Act (2015)

(2) Lecturers should understand the purposes, goals, and the expected learning outcomes of the program.

(3) The lecturers need to be knowledgeable and be able to teach and evaluate student performance.

(4) The lecturers must be recruited based on results from qualification assessment and interviews. This will be considered by the program committees, the administration of Faculty of Engineering and Industrial Technology, and the administration of university. Lecturers need to understand the purposes and goals of curriculum including the visions of university.

4.2 Full time lecturers of the program should join the meeting in the minute of curriculum development, teaching and learning, assessment and approval of all subjects, to collect the information for the further development, and to find the ways of ensuring the quality of both the curriculum and students.

5. Curriculum, Learning and Teaching, Student Evaluation

5.1 Before the semester start, the head of department must approve TQF3 by advise of curriculum committee. TQF3 must present techniques, course materials and teaching methodology and evaluation for students. TQF5 must be submitted to the department at the end of the semester to show the evaluation of the course.

5.2 Lecturers or academic support staff should survey students' need and satisfaction towards teaching and learning during the semester. Results of the survey will be used to improve teaching techniques and the curriculum.

5.3 An annual curriculum operation plan will be developed for following up.

5.4 The curriculum committee should periodically set up meeting to follow up on curriculum operations, and use the results to improve teaching techniques, student assessment and its processes, and the curriculum.

5.5 The curriculum shall be major revised at least every five years to keep the program up-to-date.

5.6 Lecturers should use a variety of assessment methods to achieve the expected learning outcomes and the teaching and learning objectives.

5.7 Lecturers should show the assessment and assessment-appeal policies to students and the policies should be valid, reliable, and fiar.

5.8 Lecturers should send feedback of assessment to students in time to ensure the achievement of the expected learning outcomes of the program and its courses.

6. Teaching and Learning Resources Management

6.1 Budget Allocation and Management

The Department of Mechanical Engineering will allocate sufficient budget for all necessary resources, for example, laboratory instruments and maintenance cost which required by the curriculum committee. This will include resources for the provision and development of supporting factors in pursuit of continuous management of teaching and learning.

6.2 Existing teaching resources

The following teaching resources are up-to-date, readily available, and can be deployed effectively, including;

(1) Classroom buildings, research labs and doctoral student rooms including equipment used by Department of Mechanical Engineering or Faculty of Engineering and Industrial Technology.

(2) Books, textbooks, journals and academic papers used by the University's Library and by related resource units. At the faculty level, there are books, specialized textbooks and equipment used to support teaching and learning. In addition, they can also research information from the libraries of other organizations via the university's IT network. At present, there are books and journals at the Central Library of Silpakorn University, Sanam Chandra Palace Campus:

Thai books	331,258	items
English books	198,600	items
Thai journals	504	items
English journals	198	items
Electronic data based system	17	items

(3) Classrooms with up-to-date teaching materials and facilities for efficient teaching.

(4) Laboratories with computers, facilities, computer network, and special software for students to develop their mechanical engineering skills.

(5) Staff who look after teaching materials, teaching facilities and practical research study.

(6) Modern library with adequate facilities, effective electronic information search systems, and annual sale of Thai and English books, textbooks, and journals on topics related to Mechanical Engineering.

7. Key Performance Indicators

Key Performance Indicators of the curriculum

Type of Indicators: Process

Benchmark/ Evaluation Criteria: Level

Key Performance Indicators	2021	2022	2023	2024	2025
(1) At least 80% of all full-time lecturers in each program have to participate in meetings aimed to set up plans, follow up and review curriculum operations.	X	X	X	X	X

Key Performance Indicators	2021	2022	2023	2024	2025
(2) The program must contain details of the curriculum in compliance with TQF2, which is associated with theThai Qualifications Framework or the standards of the Program. (if applicable)	X	X	X	X	X
(3) The program must have course specifications and field experience specifications (if applicable) according toTQF3 of all courses before the start of each semester.	X	X	X	X	X
(4) Instructors must report on all subjects they are teaching and their respective field experiences (if applicable) according to TQF5 and TQF6 within 30 days after the end of each semester.	X	X	X	X	X
(5) The curriculum performance report must be accomplished in compliance with TQF7 within 60 days after the end of an academic year.	X	X	X	X	X
(6) Subject verification for students' achievement must be conducted according to learning standards indicated inTQF3 and TQF4 (if any) for at least 25 percent of courses offered each academic year.	X	X	X	X	X
(7) The subjects found in study plan, teaching/learning activities and strategies, and learning outcome assessmentare developed and improved according to the outcomes based on performance report (TQF7) of the previous year.		X	X	X	X
(8) Every new instructor (if any) has to participate in the orientation and be advised on teaching and learning preparations.	X	X	X	X	X
(9) Every full-time lecturer has to participate in either academic and/or professional development activities at least once a year.	X	X	X	X	X
(10) At least 50 per cent of the teaching assistants (if any) receive academic or professional development annually.	X	X	X	X	X

Key Performance Indicators	2021	2022	2023	2024	2025
(11) The average score of previous students' satisfaction and new graduates towards the curriculum quality must be at least 3.5 out of 5.				x	X
(12) The average score of employers' satisfaction towards new graduates must be at least 3.5 out of 5.					x
Total key performance indicators (of item no. 1-5) (items) for each year	5	5	5	5	5
Total key performance indicators (items) for each year	9	10	10	11	12

Evaluation Criteria

A curriculum that meets the standards of Thai Qualifications Framework must qualify for the following conditions: (1) the compulsory performance indicators (numbers 1-5) must pass beyond expectations and (2) the total number of performance indicators must reach their goal by no less than 80 percent each year.

Academic Year	Curriculum that process the standards following Thai Qualification Framework
2021	Must achieve the compulsory indicators of Article 1-5 and achieve 9 indicators in total.
2022	Must achieve the compulsory indicators of Article 1-5 and achieve 10 indicators in total.
2023	Must achieve the compulsory indicators of Article 1-5 and achieve 10 indicators in total.
2024	Must achieve the compulsory indicators of Article 1-5 and achieve 11 indicators in total.
2025	Must achieve the compulsory indicators of Article 1-5 and achieve 12 indicators in total.

Section 8 Evaluation and Improvement of the Program

1. Measurement of Teaching Efficiency

1.1 Evaluation of Teaching Strategies

(1) An evaluation shall include meetings between lecturers and the curriculum committee. These meetings should aim at exchanging ideas and opinions towards teaching strategies, and invitations of teaching experts to give lectures.

(2) Lecturers may ask for comments and suggestions on their respective teaching strategies from other lecturers.

(3) An evaluation of students' learning should include students' performance, assignments and midterms and final examination results.

(4) An evaluation of teaching based on student learning or performance shall be conducted through questionnaires and informal conversations between lecturers and students at the end of the semester.

(5) Midterm and final examination test must be approve by the curriculum committee before proceed.

1.2 Evaluation of Lecturer's Skills in Using Teaching Strategies

(1) Students shall evaluate each lecturer's performance at the end of every semester.

(2) The curriculum committee shall evaluate lecturers' performance through classroom observation. Teaching methods, activities, assignments given by students.

(3) An evaluation of students' learning shall include regular observation of their performance, assignments and exam results.

2. Evaluation of the Overall Curriculum

The Faculty of Engineering and Industrial Technology will plan evaluation strategies in advance and will review whether learning outcomes are in accordance with academic standards. The department will also specify detailed curriculum descriptions, course descriptions and graduation criteria. Curriculum committee and lecturers must be responsible for the evaluation of their own courses according to the strategies of the Department of Mechanical Engineering.The curriculum will be major revised for every 5 years to update curriculum structure and course descriptions. Department of Mechanical Engineering will provide the information from alumni, entrepreneur and related stakeholder to the curriculum committer. The internal audit committee is appointed by the university council as as auditors. The curriculum assessment must be completed within the academic years.

3. Evaluation of the Program

There will be an annual internal quality assurance conducted by an appointed internal audit committee. The standard for evaluation will be based on the AUN-QA and TQF. The qualification of auditors must be according to the university regulations. All curriculums must be periodically updated and the evaluation for curricular development must be executed every 5 years.

4. Revision of Evaluation Results and Improvement Plan

4.1 Revising Courses

(1) Lecturer evaluates instructional assessment materials provided by the student after program instruction ends. Improvement of these strategies must be accomplished by the next semester/academic year.

(2) In case of identified problems, the course shall be updated immediately. Minor modifications in the course will take place and will have no effect on the course structure as a whole.

4.2 Revising the entire curriculum

An overhaul of the curriculum pertains to major changes that would affect the structure of the curriculum and therefore should be carried out every 5 years at the termination of each cycle of the curriculum. This is done to make the curriculum more relevant and for it to respond to the demands of prospective employers of graduates. The process for this undertaking shall be as follows:

(1) The evaluation committee compiles a report on the assessment of the curriculum and points out issues that need improvement.

(2) The newly revise curriculum must be approved by qualified external committee to review and give comments on the curriculum. The external committee will appointed by the university council.

(3) Submit the newly revised curriculum to the academic and curriculum review committees for deliberation before proposing it to the University Council for final approval.

Appendix

A Silpakorn University regulation regarding undergraduate Degree level, 2017

B Full – time faculty academic works and teaching experiences

C Appointment of subcommittee for curriculum development

D Consistency table of Program Learning Outcomes (PLOs) with Course Learning Outcomes (CLOs)

E Memorandum of Understanding between Chengdu University and Silpakorn University

F Curriculum comparison between Bachelor of Engineering in Mechanical Engineering (International Program/New Program 2021) and the 2010 Education Qualifications of Thailand for Bachelor of Engineering