Sirindhorn International Institute of Technology
Thammasat University

UNDERGRADUATE
CATALOG
2023

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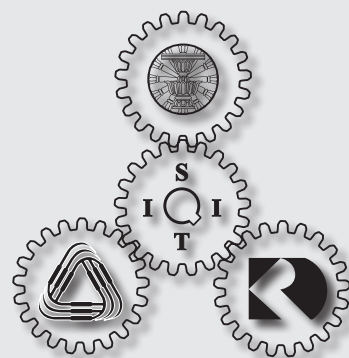Sirindhorn International Institute of Technology

Thammasat University

A LEADING TEACHING/LEARNING

AND RESEARCH INSTITUTE

SIRINDHORN INTERNATIONAL INSTITUTE OF TECHNOLOGY (SIIT)

SIIT at Rangsit

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SIIT at Bangkadi

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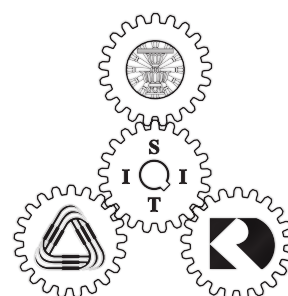
SIRINDHORN INTERNATIONAL INSTITUTE OF TECHNOLOGY THAMMASAT UNIVERSITY

VISION

To be a leading international institute of technology for both teaching/learning and research

MISSIONS

1. Primarily to produce high-quality bachelor's degree engineers and related technologists who are able to handle advanced industrial technologies and use English as a working language
2. To educate graduate students to be able to conduct high quality and innovative research in engineering and related technological development
3. To conduct research and development in engineering and related technologies relevant to teaching, modern industries, and societal needs

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Sirindhorn International Institute of Technology Thammasat University

During the 9th Japan-Thailand Joint Trade and Economic Committee Meeting held in Kobe, Japan in 1989, the delegates from the Japan Federation of Economic Organizations (Keidanren - now Nippon Keidanren) and the Federation of Thai Industries (FTI) realized that in order to enhance industrial development of Thailand, engineering programs, where all lecture and laboratory courses would be taught in English by highly qualified faculty members with doctoral degrees, needed to be established.

A cooperation agreement among Keidanren, FTI, and Thammasat University was reached in 1992 to establish bachelor's degree programs in engineering at Thammasat University with initial funds provided by Keidanren and FTI. After two years of successful operation, the "International Institute of Technology (IIT)" was founded on September 16, 1994. Her Royal Highness Princess Maha Chakri Sirindhorn graciously presided over the Cornerstone Laying Ceremony of a new building at the Rangsit Center of Thammasat University. His Majesty, the late King Bhumibol Adulyadej of Thailand, graciously granted the Institute a new name, "Sirindhorn International Institute of Technology (SIIT)," on June 28, 1996.

On October 2, 1997, Her Royal Highness Princess Maha Chakri Sirindhorn graciously presided over the Sirindhorn International Institute of Technology's Inauguration Ceremony of its name and building. In 1999, FTI provided a parcel of land with an existing building at Bangkadi Industrial Park (BKD) for SIIT's use for 30 years. In June 2001, the former Prime Minister Anand Panyarachun inaugurated a new building at Bangkadi for Information Technology and Computer Science programs.

Her Royal Highness Princess Maha Chakri Sirindhorn graciously presided over the inauguration of the Sirindhralai Building at Bangkadi on June 28, 2006. This new six-story building houses the School of Information, Computer, and Communication Technology (ICT), the School of Management Technology (MT), a library, a computer center, laboratories, and classrooms.

Backgrounds of the three founding organizations of Sirindhorn International Institute of Technology are briefly described as follows.

Thammasat University

Founded in 1934, Thammasat University was originally dedicated to the teaching of humanities and social sciences. The University has produced a large number of graduates who have greatly contributed to the development and progress of Thailand. Realizing the significant impact of science and technology on the country's economic growth, in the 1980's and 1990's Thammasat University initiated degree programs in engineering, technology, physical sciences, and medical sciences at its Rangsit Center, Pathum Thani.

The Japanese Business Federation (Nippon Keidanren)

Through the merger of several economic and industrial organizations, the Japan Federation of Economic Organizations (Keidanren) was established in August 1946. Keidanren was a private, non-profit economic organization representing virtually all branches of economic activities in Japan. Keidanren has maintained close contact with both public and private sectors at home and abroad, and endeavored, not only to find practical solutions to economic problems, but also to contribute to the sound development of economies of Japan and countries around the world.

In May 2002, Keidanren merged with Nikkeiren (Japan Federation of Employer's Associations) to become Nippon Keidanren (The Japanese Business Federation). Headed by internationally distinguished leaders of the Japanese business community, Nippon Keidanren plays an active and influential role towards the achievement of harmonious economic prosperity for all mankind.

The Federation of Thai Industries

Formerly known as the Association of Thai Industries (ATI), the Federation of Thai Industries (FTI) came into existence on December 29, 1987. It was a transformed body of ATI, which was created in 1967. FTI is an industrial private organization that brings together industrial leaders to promote Thailand's socioeconomic development. The main objectives of FTI are to represent Thai manufacturers at both national and international levels, to help promote and develop industrial enterprises, to work with the government in setting up national policies, and to offer consulting services to members.

FTI is a full-service organization that cooperates with the government to help mobilize Thai industries to reach international markets. It acts as a "match-maker" between foreign industrialists and Thai resources, which combine the financial strength, planning ability, and persuasive power of Thailand's industrialists.

Sirindhorn International Institute of Technology (SIIT) offers undergraduate and graduate programs which lead to the Bachelor of Engineering (BEng), Bachelor of Science (BSc), Master of Engineering (MEng), Master of Science (MSc), and Doctor of Philosophy (PhD) degrees. The bachelor's degree is offered in the following areas: business and supply chain analytics (BA), chemical engineering (ChE), civil engineering (CE), computer engineering (CPE), digital engineering (DE), electrical engineering (EE), industrial engineering and smart logistics (IE), and mechanical engineering (ME).

SIIT offers three master of engineering programs, namely, Master of Engineering Program in Artificial Intelligence and Internet of things, Master of Engineering Program in Engineering Technology and Master of Engineering Program in Logistics and Supply Chain Systems Engineering. It also offers Master of Science Program in Engineering and Technology, and a Doctor of Philosophy Program in Engineering and Technology.

At the present time, the Institute has established faculty member, student, and staff exchange programs with a number of universities in Asia, Australia, Europe, and North America. These programs allow, not only faculty members to collaborate with their counterparts in research projects, but also students to have an opportunity to take courses at those universities. Additionally, invitations to visit and teach SIIT courses are regularly extended to qualified foreign professors under such programs.

Although it is a unit of Thammasat University, SIIT is financially and administratively separate to a certain degree from the central university system. SIIT's policies and operations are guided and supervised by the Board of Trustees which consists of representatives from Thammasat University, FTI, and Nippon Keidanren, and scholars appointed by the university. In addition, the SIIT Academic Committee comprising reputable scholars in various fields, provides recommendations on rank promotions of faculty members and also reviews academic curricula. rank promotions of faculty members and also reviews academic curricula. The Institute, headed by the Director, consists of administrative divisions, a library and information services center, and Six academic schools.

Operations of SIIT are carried out at two locations: Rangsit Campus (at the Rangsit Center of Thammasat University) and Bangkadi Campus (at Bangkadi Industrial Park).

Rangsit Campus

Campus and Transportation

The Rangsit Center of Thammasat University (TU) is located at Km. 41 on Phaholyothin Road (northbound). The campus can be conveniently reached by car via a multi-lane divided superhighway (Phaholyothin), the Chaengwattana-Bangsai Expressway, and both outer East-Ring and West-Ring Highways. It can also be reached by buses No. 29, 39 (non air-conditioned), and 510 (air-conditioned). The nearest train station, Thammasat Station, is near the northwest corner of the Rangsit Campus.

Facilities

Buildings

Two five-story buildings and one four-story building are located at the SIIT Rangsit Campus. The first building is the main building with an area of 20,677 m^2, housing offices and classrooms. The first floor and a section of the second floor are mainly occupied by the Library and Information Services Center, with an excellent collection of up-to-date textbooks, magazines, and journals. SIIT's academic programs and faculty members' offices, as well as the Computer Center and administrative divisions, are located on the second, third, and fourth floors. Classrooms of various sizes are on the first, third, fourth, and fifth floors of the building.

The second SIIT building, adjacent to the first one, is a five-story advanced laboratory building with a total area of about 3,000 m^2. It was dedicated by Keidanren and FTI to SIIT on October 6, 1998. The Advanced Laboratory Building I houses laboratories for conducting senior projects of fourth-year students, research work of graduate students, and research projects of faculty members.

The third SIIT building, Edutivity, is a four-story building which is adjacent to the second one, with a total area of about 1,500 m^2. This building houses a student activities center and the office of the Building and Ground Division on the first floor, and classrooms of various sizes on the second, third, and fourth floors.

A new 8-story Advanced Laboratory Building II with a total area of approximately 7,000 m^2 is equipped with advanced laboratory and research equipment that are necessary for conducting advanced researchers by faculty members, graduate students and senior-year undergraduate students.

Computer Center

The SIIT Computer Center is located on the third floor of the main SIIT building. The center is equipped with personal computers in four separate rooms, two of which are used mainly for instruction on programming, mathematical problem solving, engineering graphics design, and professional report preparation, while the other rooms are used by students for general computing purposes. Up-to-date software packages are installed via servers on the local area network, allowing students to become proficient with their applications. The local area network system supports both academic and administrative chores which include the library's computer-based services, intranet, and the internal email system for faculty members and staff. There are a number of servers for academic purposes in various programs. The local area network is connected to the Internet via the Thammasat-Rangsit fiber optic backbone. Students, faculty members, and staff are provided with an individual email address and service. Wireless Internet (WiFi) is accessible from all areas of the SIIT buildings. A VPN service by which students can access SIIT's online system from their homes is also available. Information on the Institute can be viewed from the official web page at www.siit.tu.ac.th.

Library and Information Services Center

The Library and Information Services Center is located on the first and second floors of the main building. The Library has an excellent collection of textbooks (in science and engineering), conference proceedings, reports, technical magazines, and journals. Electronic access to several international databases is provided. The Library also has a computerized search system to assist students in locating their information sources.

Students who would like to study by themselves or in groups will find it convenient to study in the Library. Individual study area, which provide maximum privacy and minimum interference, located on the second floor. Co-learning space areas and group study areas where students can meet and discuss in groups are located on the first floor.

Furthermore, students can use the main TU library, which is also located at the university's Rangsit Center, for their study and literature searches on social sciences and humanities.

Infirmary

The SIIT infirmary room is situated on the ground floor of the main building. It is staffed during office hours by a fully qualified nurse. The nurse can assist with minor medical problems and, for more serious cases, can arrange a timely transfer to Thammasat University Hospital.

Hospitals

Thammasat University Hospital, located at the Rangsit Center, provides outpatient, inpatient, and emergency medical services, as well as other health care services such as X-ray, physical examination, and dental care. Physicians, nurses, and medical interns are available 24 hours a day. Students are eligible to receive discounts for room charges and services. There are also several private hospitals near the Navanakorn Industrial Estate, which is only a 5-minute drive from the Rangsit Center.

Student Activities Center

A student activities center is located on the first floor of the SIIT Edutivity Building. There is a range of facilities available for student to use including air-conditioned meeting rooms, and a food and drink area. Student activities are coordinated by the Student Committee under the supervision of the Deputy Director for Student Affairs and Alumni Relations. All student activities must conform to SIIT and TU regulations.

University Bookstore

The TU Bookstore at the Rangsit Center is well stocked with publications and magazines in both Thai and English languages. Textbooks used in individual courses can be purchased at the University Bookstore at competitive prices. Stationery and office supplies are also available.

Post Office

The Thammasat-Rangsit Post Office is located at the Duen Bunnag Building. The post office offers complete postal services such as regular mail service, express mail service (EMS), registered mail service, package service, and money orders during business hours.

Convenience Stores

Students living in the dormitories will find that shopping is quite convenient. Many convenience stores are located on campus, and nearby. At the Rangsit Campus of SIIT, there is a convenience store on the first floor of the Main Building.

Cafeterias and Canteens

Several cafeterias and canteens can be found throughout the Rangsit Center. A variety of food is offered by vendors at reasonable prices, both on weekdays and weekends. Adjacent to the SIIT buildings is a cafeteria which serves both SIIT students and students of the Faculty of Engineering.

Banking Services

For banking services such as cash withdrawal and balance inquiries, students can conveniently use the automated teller machines (ATMs) which are located at various locations on campus and at the SIIT main building. For full services, students can go to the on-campus branch offices of Bangkok Bank, Krung Thai Bank, and Thai Military Bank. Other banks with branches near the campus are Kasikorn Bank, Thanachart Bank, and Siam Commercial Bank.

Dormitories

The Rangsit Center has on-campus dormitories for male and female students. Over 6,200 living units are available to accommodate students, faculty members, and university staff. Within walking and short-driving distances, many private dormitories can be found. These are co-ed dormitories, as well as dormitories with separate buildings for male and female students. Air-conditioned units with bathrooms are also available.

Sport Facilities

The Rangsit Center has a wide range of sport facilities for students including swimming pools and practice fields for soccer, basketball, volleyball, and tennis, all of which are in the vicinity of the student dormitories. Areas for indoor sports such as badminton and table tennis are provided in the indoor gymnasiums. Students may also choose to exercise by biking, jogging, etc., especially in the morning since the air is very refreshing. In addition, the Rangsit Campus of SIIT has an outdoor basketball court in front of the main building.

Bangkadi Campus

Campus and Transportation

The Bangkadi Campus is located 14 kilometers from the Rangsit Campus on Tiwanon Road. The campus can be conveniently reached by SIIT shuttle bus (air-conditioned) or by bus No. 6249 (non air-conditioned).

Facilities

Buildings

In 1999, FTI, with co-operation from Toshiba Thailand Co., Ltd., and Mitsui & Co. (Thailand), Ltd., provided 5.6 rai (0.9 hectare) of land with an existing office building in the Bangkadi Industrial Park (BIP) for SIIT's use for a period of 30 years. Later, SIIT purchased two more parcels of land in the industrial park with areas of 4 rai (0.64 hectare) and 5 rai (0.8 hectare). The existing building was renovated and enlarged. The new building, which is called the IT&MT building, has a combined area of approximately 3,300 m^2. The Computer Science and Information Technology programs moved to these new facilities in June 2002.

Another 6-story building with an area of 6,452 m^2 was completed in October 2004. Her Royal Highness Princess Maha Chakri Sirindhorn graciously granted the use of the name "Sirindhralai" for this new building and graciously presided over the inauguration of this new building on June 28, 2006. It houses the School of Information, Computer, and Communication Technology (ICT), the School of Management Technology (MT), the Library and Information Services Center, the Computer Center, classrooms, and laboratories.

The third SIIT building is the SIIT Administration and Training Building, located in front of the Bangkadi Industrial Park on Tiwanond Road. It is a four-story building which aims to be a research and training center. The first floor is for car parking. Bangkok Bank is located on the second floor. On the upper floors, there are graduate student offices and research laboratories.

Computer Center

A Computer Center office is located on the second floor of the Sirindhralai building. It supervises and maintains two laboratories for instruction and students' use in mathematical and statistical problem solving, computer graphics, systems simulation, database applications and programming, computer networking, and general computing purposes. In addition, there are network access points in almost every room of the campus which connect to the Rangsit Campus of SIIT by a high-speed connection. Students can easily access the Internet either from their notebook computers, using wireless hotspots in every building, or from the computers in both the library and the computer laboratories.

Library and Information Services Center

The Library and Information Services Center at Bangkadi is located on the 3rd floor of the Sirindhralai Building. The library has an excellent collection of textbooks, technical books, conference proceedings, reports, technical magazines, and journals in the fields of electronics and communication, instrumentation and control systems, computer science, information technology, electrical engineering, digital engineering, engineering management, and management technology. Computer facilities are provided for accessing the library catalog database, online databases and full-text journals, and for self-study. The library also provides wireless facilities for students to access the Internet and online information. Co-learning space and group study areas are also provided, where students can meet and discuss in groups with smart technology devices.

Infirmary

The infirmary room is on the ground floor of the IT&MT building. A fully qualified nurse is in charge during weekdays to assist with minor medical problems and provide first-aid treatment.

Dormitory

The SIIT International Residence at Bangkadi has two five-story buildings, one for male residents and another for female residents. There are 72 rooms on the 2nd-5th floors, which can accommodate up to 144 residents. Common rooms, canteen, and a launderette are located on the first floor, with a convenience store nearby. In addition, free internet Wi-Fi is provided for the residents on the ground floor.

Cafeteria and Canteen

A variety of foods, snacks, and beverages are provided from vendors at reasonable prices at a cafeteria on the ground floor of the Sirindhralai building. Additionally, there is a coffee shop on the ground floor of the IT&MT building which serves snacks and beverages.

Sport Facilities

There is a soccer field behind the Sirindhralai building. In addition, an outdoor basketball court is located next to the SIIT International Residence. There is also a badminton gymnasium beside the dormitory buildings.

Student Life

SIIT students have many opportunities to participate in a variety of activities, both academic and extracurricular, to develop self-discipline, self-responsibility, professional attitudes, and for relaxation. The SIIT Student Committee and other student clubs, such as the Sports Club, Music and Chorus Club, Academic Club, and Volunteer Club, organize a wide range of programs and activities throughout the year. Additionally, individual academic programs have student clubs which collaborate with faculty members in academic related activities. Student activities are supervised by club advisors and the Deputy Director for Student Affairs and Alumni Relations.

SIIT provides a stimulating international learning atmosphere. All courses, both lecture and laboratory, are taught in English by foreign and Thai professors who have extensive overseas educational and work experiences. The number of international students at SIIT has been increasing due to SIIT's widely accepted reputation for quality education and faculty members. Students frequently receive lectures on a variety of topics by visiting professors from abroad, providing them exposure to new and emerging subjects. Academic exchange programs with selected universities in Australia, Belgium, France, Germany, Japan, Czech Republic, Denmark, Korea, the United Kingdom, Portugal, Taiwan, Switzerland, and Canada the United States of America have been established to provide qualified students with an opportunity for studying abroad.

SIIT Graduates

Graduates of SIIT receive a wide range of job offers due to their proficiency in English and their competency in technical knowledge. While most graduates work for government agencies, state enterprises, and private corporations, a large number have chosen to pursue graduate studies immediately after graduation. Examples of universities that have accepted SIIT graduates into their graduate programs are The University of Melbourne (Australia), University of New South Wales (Australia), RWTH Aachen University (Germany), Hokkaido University (Japan), Japan Advanced Institute of Science and Technology (Japan), Keio University (Japan), Kochi University of Technology (Japan), Kyoto University (Japan), Tohoku University (Japan), Tokyo Institute of Technology (Japan), University of Tokyo (Japan), Waseda University (Japan), Chalmers University of Technology (Sweden), Cambridge University (UK), Imperial College (UK), Oxford University (UK), University of Manchester Institute of Science and Technology-UMIST (UK), University of Nottingham (UK), University of Warwick (UK), Columbia University (USA), Georgia Institute of Technology (USA), Stanford University (USA), University of Colorado (USA), University of Michigan/Ann Arbor (USA), and University of Wisconsin/Madison (USA), Techniche Universitaet Muenchen, Germany. Several graduates have received scholarships for their graduate studies, such as the Thai Government Scholarships, Japanese Government Scholarships, a Fulbright Scholarship, and teaching/research assistantships from the universities where they enroll.

Admissions

Each year the Institute's faculty members and staff visit a number of high schools to provide information about the Institute, its admission procedures, academic programs, etc. The Institute also welcomes high school students and parents to visit the Institute. The Admission and Public Relations Division can help to arrange a meeting with faculty members and staff to discuss academic options for interested students.

For further information, contact: Admission and Public Relations Division
Sirindhorn International Institute of Technology (SIIT)
Thammasat University, Rangsit Campus
P.O. Box 22, Thammasat-Rangsit Post Office
Pathum Thani 12121, Thailand.
Tel: +66-2-986-9009~13, +66-2-986-9103~10
Fax: +66-2-986-9112~3
E-mail: admission@siit.tu.ac.th
Website: www.siit.tu.ac.th
Online Application: admissions.siit.tu.ac.th

Applicant's Qualifications

- Equivalent from other countries (grade 12 or equivalent).
- An applicant must not carry any seriously contagious disease, or any disease that would be detrimental to his/her education, or any mental disorder.

Admission Methods

A prospective student may apply for admission through one of the following methods:

1. Submission of Portfolio
2. TU Quota
3. General Direct Admission
4. SIIT Entrance Examination
5. Submission of National Test Scores:
   - GAT/PAT
   - Common 9 Subjects
6. Submission of Standardized Test Scores:
   - Scholastic Assessment Test I (SAT I or SAT II)
   - American College Testing (ACT)
   - General Certificate of Education (GCE), 'A' Level
   - International Baccalaureate (IB) Diploma
   - 6th Form
   - National Certificate of Educational Achievement (NCEA)
   - General Educational Development (GED)
   - General Scholastic Aptitude Test (GSAT)
   - Other national test scores announced by SIIT
7. Transfer from other accredited universities

Application

Applicants who wish to apply through the national university entrance selection process must follow the procedures set by the Office of the Higher Education Commission. Those who choose the other methods must complete the online applications by the deadlines and bring the required documents on the Interview date. Announcement of application periods are available on the SIIT website.

Interview

All candidates who have passed the written examination or the initial screening are interviewed by faculty members. The interview is conducted in English.

Period of Study

All bachelor's degree programs are for full-time students with a maximum period of study of 8 academic years.

Tuition and Educational Support Fees

Sirindhorn International Institute of Technology reserves the rights to revise the tuition and educational support fees and to establish new fees as may be required by increased costs of providing educational services.

Flat-Rate Tuition Fees for Undergraduate Students under the 2022 Undergraduate Curriculums Onwards

Semester	Conditions	Proposed Flat-Rate Tuition Fee (baht/semester)
Regular	1st - 8th Semesters	97,200
	9th Semester onwards	58,300
Summer	Register no more than 3 credits	12,100
	Register more than 3 credits	22,200

Damage Deposit   A deposit of 5,000 Baht is collected from a new student for damaged equipment and non-returned library books. The deposit, after deduction of damages caused by the student, is returned to the student when he/she graduates or leaves SIIT.

Matriculation Free   A one-time fee of 400 Baht is collected by TU as the matriculation fee.

Fine on Unpaid Fees   Any outstanding balance of the tuition and educational support fees will be charged a fine at the rate of 0.05% per day starting from the first day after the addition/withdrawal period and at the rate of 0.1% per day starting from the first day of the midterm exam.

Status Maintaining Fee   A fee of 5,000 Baht per semester is charged during a student's leave of absence.

Reinstatement Fee   A student who has resigned or has been dismissed due to non-academic reasons may apply for readmission. A fee of 2,500 Baht is charged for readmission, in addition to payment of any previous outstanding debt.

Late Registration Fee   A fee of 45 Baht per day is charged for late registration.

Students may be subject to other fees, such as a fee for late return of borrowed books, etc. For details, consult the Academic Services and Registration Division, Student Affairs and Alumni Relations Division, or Finance Division.

Tuition Fee Rates for External Students

1. Tuition fees for an external student who is also a degree student of SIIT:
   1.1 A graduate course   3,600   baht per credit
   1.2 An undergraduate laboratory course   4,590   baht per credit
   1.3 An undergraduate lecture course   3,370   baht per credit
2. Tuition fees for an external student who is a degree student of TU:
   2.1 A graduate course   3,600   baht per credit
   2.2 An undergraduate laboratory course   4,590   baht per credit
   2.3 An undergraduate lecture course   3,370   baht per credit
3. Tuition fees for an external student who is not a degree student of TU:
   3.1 A graduate course   4,500   baht per credit
   3.2 An undergraduate laboratory course   5,600   baht per credit
   3.3 An undergraduate lecture course   4,500   baht per credit

Financial Aid

Each year, the Institute has set aside a number of scholarships and awards for students who have demonstrated academic excellence, have strong financial needs, or both. In addition to these scholarships arranged by the Institute, the public/private sector and individuals have provided support through scholarships for students each year. The scholarship recipients are screened by a committee and selected on the basis of academic records, conduct, financial need, and conditions set by the scholarship donors.

Currently, the Institute receives scholarships and/or donations to the Sirindhorn Technology Scholarship Fund from individuals, institutions, and business corporations, for example:

Alumni Association of SIIT (ASIIT)	National Science and Technology Development
Ajinomoto Foundation	Agency (NSTDA)
Bangkok Bank PCL	Thanpuying Niramol Suriyasat Fund
Bank of Ayudhaya PCL	Prof. Fumio Nishino Fund
Fuji Electric Co., Ltd., Japan	Mrs. Kobkarn Wattanavrangkul
Mitsubishi UFJ Foundation, Japan	Prof. Dr. Somnuk Tangtermsirikul
Nippon Keidanren, Japan	SIIT Faculty Members

A scholarship recipient's academic progress is reviewed at the end of each semester to determine the recipient's continued eligibility for an award. For further information on scholarships, contact the Student Affairs and Alumni Relations Division.

Academic Policies and Procedures

Sirindhorn International Institute of Technology (SIIT), although independently administered and self financed, is an academic unit of Thammasat University. Graduates of the Institute receive Thammasat University degrees. Thus, students must comply with the policies and regulations set forth by Thammasat University. For more details, consult the student's academic advisor.

Students must successfully complete the required number of credits (set by each academic curriculum) and demonstrate their English proficiency to be eligible for graduation. Some students who do not possess sufficient background may be required to take additional courses not listed in the curriculum. Normally, it takes eight regular semesters (four years) to complete the requirements. The schedule of academic semesters is as follows:

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

Academic Regulations

Student Dress Code

All students are encouraged to wear Thammasat University (TU) uniforms, which are as follows:

1. Men's uniform:
   • Plain white shirt (shirt must be properly tucked in and sleeves must not be folded back)
   • Trousers in black or dark blue
   • Belt with TU belt buckle
   • Black shoes with socks
2. Women's uniform:
   • Plain white shirt with short sleeves (shirt must be properly tucked in)
   • Buttons: at the shirt seam binding (4 buttons) and shirt collar (1 button) using TU silver metal buttons
   • TU pin worn on the left side of shirt above the chest
   • Plain skirt in black or dark blue
   • Belt with TU belt buckle
   • Black shoes

A TU pin is a yellow "Thammajuk" with red lines, available at the University Bookstores. A TU belt buckle is a "Thammajuk" in a rectangular shape, also available at the University Bookstores.

In the case that it is inconvenient to wear a uniform, students may wear polite dress as follows:

Men
- Plain shirt with collar and short or long sleeves, properly buttoned and tucked in
- Trousers in dark color
- Shoes (sandals are not allowed during official hours on campus)

Women
- Plain shirt with collar and short or long sleeves
- Plain skirt in dark color
- Shoes (sandals are not allowed during official hours on campus)

Dress Code for Taking Examinations

- All SIIT undergraduate students are required to wear TU student uniforms or polite and tidy clothing.
- Students are required to wear cut shoes, sport shoes, or slingback shoes. Any color shoes are allowed.
- Failure to comply with this dress code will result in a deduction of student conduct score and other penalties.

Conduct Score and Disciplinary Actions

The conduct score and disciplinary actions are as follows:

The following disciplinary actions will be taken upon the cumulative deducted scores:

Sequence of Offence			Cumulative Deducted Score	Disciplinary Action
Gross Breaches of Discipline**	Smoking (Non-Smoking Area)	Improper Dress		
-	-	1	0	Action 1: Written warning 1, and may receive punishments as follows: - No permission to attend a class/laboratory or enter the library and no prompt service from SIIT faculty/staff members at the time of misconduct
-	-	2	10	Action 2: Written warning 2, and may receive punishments as follows: - No permission to attend a class/laboratory or enter the library and no prompt service from SIIT faculty/staff members at the time of misconduct - No consideration of scholarship/award for one or more semesters depending on the types of scholarships*
-	1	3	20	Action 3: Written warning 3, and may receive punishments as follows: - No permission to attend a class/laboratory or enter the library and no prompt service from SIIT faculty/staff members at the time of misconduct - No consideration of scholarship/award for one or more semesters depending on the types of scholarships* - No re-entry and/or re-admission to SIIT
-	2	4	40	Action 4: Written warning 4, and may receive punishments as follows: - No permission to attend a class/laboratory or enter the library and no prompt service from SIIT faculty/staff members at the time of misconduct - No consideration of scholarship/award for one or more semesters depending on the types of scholarships* - No re-entry and/or re-admission to SIIT - No grant of continuing scholarship - No issuing of recommendation letter and SIIT activity transcript
1	3	5	70 or more	Action 5: Written parole signed by the student and his/her guardian, and may receive punishments as follows: - No permission to attend a class/laboratory or enter the library and no prompt service from SIIT faculty/staff members at the time of misconduct - No consideration of scholarship/award for one or more semesters depending on the types of scholarships* - No re-entry and/or re-admission to SIIT - No grant of continuing scholarship - No issuing of recommendation letter and SIIT activity transcript

Remark: * - Start from the following semester upon having received a written warning of misconduct
- Not including a summer semester
** "Gross Breaches of Discipline" means unacceptable misconduct according to the TU Regulation on Student Discipline, B.E. 2564

The other offences which are not stated in the table above shall be considered on a case-by-case basis. If a student performs any gross breaches of student discipline including but not limited to cheating on any examination and receives a punishment of written parole and/or suspension, his/her conduct score will be reduced by 70 points. Other cases related to examinations shall be considered together with the examination regulation(s) for SIIT students. The consideration shall be done by the SIIT Executive Committee.

Registration for New Students

1. A successful applicant must possess all qualifications set by Sirindhorn International Institute of Technology.
2. A successful applicant must register in person as a TU student within 14 days from the start of the student's first academic semester.

   The successful applicant who cannot register during the registration period due to a special reason may register at a later time with the approval of the TU rector. However, the applicant must complete the entire process no later than the student's first academic semester. Otherwise, his/her rights to register as a student will be revoked.

3. A successful applicant who graduated from abroad must submit the graduation certificate to SIIT in person during the registration period.

   With the approval of the TU rector, the applicant who cannot submit the graduation certificate within the time limit may be able to submit the document no later than the student's first academic semester; otherwise, his/her rights to register as a student will be revoked.

4. If the qualification of the applicant has not met the regulations of Thammasat University and/or the documents submitted from the applicant have proven to be falsified, the registration of that applicant will be revoked.

Registration for Current Students

1. An undergraduate student is required to register for a minimum of 9 credits and a maximum of 22 credits in each regular semester. Registration for fewer than 9 credits is possible only for a student whose number of credits left for courses in the program requirement is less than the minimum of 9 credits or by the Director's approval due to a special reason, such as illness. A fourth year student may register for more than 22 credits with the Director's approval. The number of credits registered in the summer session shall not exceed 6 credits. However, a student who anticipates in graduating at the end of the current semester or with the director's approval may register for more than 6 credits but no more than 9 credits in the summer session.
2. A student must register during the scheduled period and follow the registration procedures set by the Institute.
3. Course registration must be approved by the student's academic advisor.
4. Late registration is subject to a fine of 45 Baht/day (including holidays), starting from the first day of classes. Course registration after the first 14 days of a semester will not be allowed.
5. A student who does not register for any courses in a regular semester has to file an applications for leave of absence to the academic program and pay a fee for maintaining his/her student status within the first 30 days of a semester. Otherwise, his/her student status will be revoked.
6. Registration for courses is considered incomplete unless fees have been paid by the specified date.
7. The number of students able to enroll in a course may be restricted due to some constraints, such as limited laboratory equipment and classroom size.

Auditing a Course

1. With permission from the instructor and the advisor, a student may audit a course without evaluation. However, the student must pay the tuition fee for the course.
2. Auditing may not be changed to a regular evaluation after the second week of a regular semester.
3. A grade report will bear "AUD" for the audited course after such a course is completed.
4. The number of credits for an audited course will be counted towards the upper limit of the number of credits allowed in a semester,
5. The credit(s) of an audited course will not be counted towards the total credit accumulation.
6. An audited course cannot be re-registered at a later time for formal evaluation unless there is a change in the student's study program that warrants the need for formal evaluation of the course.

Course Addition/Withdrawal

1. If authorized by the instructor and the advisor, a course addition must be processed within the first 14 days of a regular semester or within the first 7 days of a summer session. The addition of courses after the first 14 days of a regular semester or after the first 7 days of a summer session needs to receive an approval from the Director with provided reasons at least 14 days before the end of classes. In addition, the total hour of study has to meet the TU regulation.
2. If authorized by the instructor and the advisor, course withdrawal will result in one of the following cases:
    2.1 If a course is withdrawn within the first 14 days of a regular semester or within the first 7 days of a summer session, the academic record will not bear the title of such a course.
    2.2 If a course is withdrawn after the first 14 days of a regular semester or after the first 7 days of a summer session, but not later than the first 10 weeks of a regular semester or not later than the first 4 weeks of a summer session, the academic record will bear the title of the course and a W grade.
    2.3 Course withdrawal after the first 10 weeks of a regular semester or after the first 4 weeks of a summer session is not allowed. Withdrawal of courses after the first 10 weeks of a regular semester or the first 4 weeks for a summer session needs to receive an approval from the student's advisor and the Director with provided reasons at least 14 days before the end of classes. With approval from the director, the course will bear a W grade.
3. A course withdrawal that reduces the number of credits to less than 9 credits is prohibited.

Leave and Suspension

1. A student can apply for a leave of absence. This must be approved by the director on the condition that the student has an appropriate reason. However, a student cannot take leave during the first two semesters of his/her undergraduate study unless the Rector of Thammasat University approves the request.
2. A student cannot apply for leave for more than two consecutive semesters unless the Rector of Thammasat University specially permits it.
3. Leave will result in one of the following cases:
    3.1 If the first day of leave falls within the first 14 days of a regular semester or the first 7 days of a summer session, the academic record will not bear any of the titles of the registered courses.
    3.2 If the first day of leave falls after the first 14 days of a regular semester or the first 7 days of a summer session, but no later than the first 10 weeks of a regular semester or the first 4 weeks of a summer session, the academic record will bear W grades for all the courses registered in the current semester.
    3.3 A student can apply for leave after the first 10 weeks of a regular semester or the first 4 weeks of a summer session, but not later than 14 days prior to the end of a regular semester or a summer session only if there is an uncontrollable reason. A student or a student's trustworthy representative is required to submit an application for leave with credible evidence to the academic program. With approval from the Rector of Thammasat University, the course will bear a W grade.
4. A student who is suspended from studying during a semester due to a disciplinary cause will not be permitted to continue with the courses he/she registered for. This penalty will be recorded as "Suspended" on the student's academic record and changed to "Leave" after graduation. No grades or credits for the courses registered in that semester will be given. A suspended student must pay a fee to maintain his/her student status unless he/she has paid the educational support fees. A student who is permitted to take a leave or is suspended before paying the educational support fees must pay a fee for maintaining his/her student status.
5. Leave, suspension, or re-admission cannot be used as a reason to extend the maximum limit of 8 years to complete the degree requirements.

Reinstatement

1. A student who has been dismissed for a reason other than not meeting academic performance, such as failure to register within the time limit of a semester or not making a payment toward a debt owed to SIIT not over 2 years after the termination date, may make a request for reinstatement by submitting a request to the Academic Services and Registration Division. If approved, the semesters in which the student did not register are treated as semesters that the student has taken leave. To process the request, all previous outstanding debts, status maintaining fees, and reinstatement fees must be paid. Reinstatement has to be approved by the Rector of Thammasat University.
2. A student who has been resigned for no longer than 1 semester can make a request for reinstatement by submitting a request to the Academic Services and Registration Division. If approved, the semesters in which the student did not register are treated as semesters that the student has taken leave. To process the request, all previous outstanding debts, status maintaining fees, and reinstatement fees must be paid. Reinstatement has to be approved by the Rector of Thammasat University.
3. Leave of absence period shall be counted as study period.

Refund of Fees

1. A student who takes a leave of absence or resigns before the semester starts is entitled to a full refund of the education support and tuition fees.
2. A student who takes a leave of absence or resigns within the first 14 days of a semester is entitled to a half refund of the education support and tuition fees. A student taking a leave after the first 14 days of the semester will not receive any refund, but does not need to pay a fee to maintain his/her student status.
3. A student is entitled to a full refund if the course has been cancelled by the Institute. However, refunds for courses that are closed cannot be made if tuition payment is on a lump-sum basis.
4. A student who withdraws from a course within the first 14 days of a regular semester or within the first 7 days of a summer session is entitled to a half refund of the tuition fee of that course. However, refunds for courses that are closed cannot be made if tuition payment is on a lump-sum basis.
5. A student who withdraws from a course after the first 14 days of a regular semester or after the first 7 days of a summer session will not receive any refund for the tuition fee.
6. Students who have been suspended for the next semester due to a disciplinary cause, but have enrolled for courses and paid the tuition fee for the suspended semester shall be eligible for a full refund of the tuition fee. Students who wish to have a refund of fees according to clause 1 shall submit a request for the refund of fees to the faculty within 30 days from the opening date of a regular semester or a summer session. Failure to do so shall be considered as a forfeiture of rights.

Regulations on the Use of the Library

All students must observe the following Library's regulations:

1. Students are entitled to check out no more than 5 books from the library at any given time, and they must return the books within 7 days, starting from the check-out date.
2. Any student who returns a book(s) after the due date will be fined: 10 Baht/day per copy of a book, 20 Baht/hour per copy of a reserved book.
3. Students must reimburse the Institute for loss or damage of a book they have checked out from the library.
4. Gambling, smoking, and making excessive noise are strictly prohibited in the library.
5. Students are not permitted to remain in the library after the service hours. For more details, consult the librarian for the semester service hours.
6. As a deterrent measure, violators will not be entitled to receive any services from the library throughout the current semester.
7. In the case that students do not return a book within the due date and do not pay the fine for overdue books, they will not be allowed to check out any additional books

Academic Performance

1. The academic performance of students is evaluated using the grade point average (GPA) system. The following grades are used:

Grade	Point	Significance
A	4.0	Excellent
B+	3.5	Very Good
B	3.0	Good
C+	2.5	Almost Good
C	2.0	Fair
D+	1.5	Almost Fair
D	1.0	Poor
F	0.0	Failed

In some courses, such as practical training, an S (satisfactory) or U (unsatisfactory) grade is given. These grades have no point values. Therefore, they are not included in the calculation of semester and cumulative grade point averages (CGPA).

An "I" grade may be temporarily given for courses where coursework evaluations have not been completed, and it is not the student's fault. Issuance of this grade is very rare and must be based on circumstances that are beyond the control of the involved student.

The student with an "I" grade must be evaluated by the course instructor within 80 days after the semester ends. If a complete evaluation is not possible, the instructor must grade the student's performance based on his/her available scores obtained from previous evaluation assignments of the course. Beyond the 80-day period, if no grade is given by the instructor, the grade must be considered by the institute. In any case, the "I" grade must be removed within 90 days after the semester ends, otherwise a "W" grade is given.

2. ACC or EXE shall be used for courses from which students wish to be exempted by way of equivalence examinations ACC is given for credits that are counted toward the degree EXE is given for credits that are not counted toward the degree.
3. A student may retake a course in which he/she received a grade of D or D+. All the grades received in the same subject will be used for the calculation of the cumulative grade point average, but the credits will be earned only once.
4. An F grade will be counted as zero points and the course credits will be used for the calculation of both the semester and the cumulative grade point averages.
5. A compulsory course with either an F or a U grade must be retaken until a passing grade is obtained.
6. A student may choose to retake an elective course with either an F or a U grade or to take another course instead.
7. Only courses that are given at least a D grade or an S grade or "ACC" are counted towards earned credit accumulation.
8. In the case that a student is required to repeat a course or take another course as a substitute, the credit(s) of such a course will be accumulated only once.
9. A student who misses an examination due to an uncontrollable cause must immediately submit evidence stating the cause of his/her obstacle to the instructor and his/her advisor for initial consideration. If the matter is deemed adequate and approved by the instructor, the instructor and the advisor will submit the matter to obtain the director's approval for arranging an appropriate process in accordance with the SIIT Examination Regulations for SIIT students.

Warning and Probation Status

1. The Institute will evaluate the status of each student based on his/her academic performance at the end of every semester. Each student must maintain a CGPA of at least 2.00. Otherwise, he/she will be issued a "warning", "warning 1," "warning 2," or "probation" status in the following semester, wherever appropriate. Grades from the summer session are considered as a part of the second semester's grades. However, for students who are dismissed at the completion of the second semester, their registration for the following summer session will be void.

2. At the end of the first two semesters of his/her undergraduate study, the student under the "warning" status must possess a CGPA of at least 1.50. Otherwise he/she will be dismissed from the Institute.

3. A "warning" status will be issued in the following semester if the CGPA falls below 2.00 at the end of the student's first academic semester. A "warning 1" status will be issued in the following semester if the CGPA falls below 2.00 for the first time at the end of any academic semester other than the student's first academic semester. A "warning 2" status is issued in the following semester if a student is under the "warning 1" status and still cannot improve the CGPA to 2.00 or above.

4. If a student has a "warning 2" status and still possesses a CGPA below 2.00, he/she will be issued a "probation" status in the following semester which will be recorded in the student's academic record.

5. A student under the "probation" status must improve his/her CGPA to 2.00 or above by the end of that semester. Otherwise, he/she will be dismissed from the Institute.

6. If a student has completed all the courses required by the curriculum but his/her CGPA is below 2.00 but not less than 1.80, then he/she is allowed to continue taking courses for no more than 3 semesters (subject to a total time limit of 8 years for the entire enrollment) to improve the CGPA to 2.00 or above.

Class Attendance

Students are required to attend a class for not less than 70 percent of the total class periods throughout a semester. If the attendance is less than 70 percent, he/she may not be allowed to take the final examination of that course.

Transferred Credits

The credits can be transferred in accordance with the Thammasat University Undergraduate Studies Regulation and SIIT Announcement.

Application for Graduation

1. To qualify for graduation, a student must fulfill the course requirements of the curriculum with a minimum CGPA of 2.00, and demonstrate his/her English proficiency with:
   (1) IELTS score of not less than 6.0 (for students with ID's 58 onwards)
   (2) Institutional TOEFL score of not less than 500
   (3) TOEFL (Internet-Based Test-IBT) of not less than 61, or TOEFL (Internet-Based Test-IBT) Home Edition of not less than 61, or TOEFL (Paper-Based Test-PBT) of not less than 500
   (4) TOEIC score of not less than 650
   (5) TU-GET (Paper-Based Test-PBT) of not less than 500, or TU-GET (Computer-Based Test-CBT) of not less than 73
   (6) Cambridge B2 First score of not less than 173
   (7) Council of Europe's Common European Framework of Reference (CEFR) level B2, at least grade "B" for the following tests:
      • PTE Academic score at a Test Center of not less than 59
      • PTE Academic Online score of not less than 59
   (8) Passing the course GTS401 Intensive English Proficiency with "S"

In addition, the student must have been enrolled for no fewer than 7 regular semesters, except for transfer students.

2. A student may be exempted from the above English proficiency requirements in the following cases:

   2.1 A student who is a native English speaker from Australia, Canada, New Zealand, United Kingdom, or USA may be exempted from the above English proficiency requirements if he/she passes an interview by an SIIT interviewing committee consisting of 3 English native speaking instructors.

   2.2 The student has already achieved one of the above scores (in 1.) before the start of the student's first academic semester. This score must not be older than 2 years.

3. There are 2 levels for graduation with honors:

   (1) First Class Honors are awarded to students who have qualifications and possess no prohibited characteristics as stipulated in this section, and have achieved a cumulative grade point average of not less than 3.50 with a grade not lower than C for any course.

   (2) Second Class Honors are awarded to students who have qualifications and possess no prohibited characteristics as stipulated in this section as follows:

      (2.1) Have a cumulative grade point average of not less than 3.50 with a grade lower than C for some courses, and have received a cumulative grade point average for major courses of not less than 2.00.

      (2.2) Have a cumulative grade point average of not less than 3.25 with a grade not lower than C for any major course.

Students are eligible for graduation with honors if they have the following qualifications and possess no prohibited characteristics:

   1) Must complete all the study requirements for graduation within 4 years for the Bachelor's Program (4 Years).

   2) Ratio of equivalent or exempted courses must be no more than 25% of the total credits prescribed in the Study Program.

   3) Have never repeated any course.

   4) Have never received an 'F' or 'U' for any course.

   5) Have never been imposed with any disciplinary probation.

The period of study stipulated in 1) excludes any leave of absence, or the semester that the students are approved by the Dean, through the Faculty Board's or Rector's approval, of study or training elsewhere under a University's program or a program administered by other agency. However, such study or training must not be longer than one academic year.

4. Application for graduation must be submitted to the university within the first 14 days of the final semester (7 days of the summer session) in which an applicant expects to graduate.

5. If a student financially owes SIIT or the university, all his/her debt must be cleared before applying for graduation.

Degree Approval

   1. The Thammasat University Council normally approves degrees at the end of the first and second semesters, and the summer session.

   2. The university organizes a graduation ceremony once a year.

Academic Programs

SIIT offers international programs leading to Bachelor of Engineering (B.Eng.) and Bachelor of Science (B.Sc.) in the following fields:

B.Eng.
- Chemical Engineering
- Civil Engineering
- Computer Engineering
- Digital Engineering
- Electrical Engineering
- Industrial Engineering and Smart Logistics
- Mechanical Engineering

B.Sc.
- Business and Supply Chain Analytics

The structure and components of individual curricula of the undergraduate programs are listed below.

1. General Basic Courses
   1.1 Global Awareness and Social Literacy
   1.2 Aesthetics and Communication Skills
   1.3 Mathematics, Science, and Technology
   1.4 Holistic Well-Being and Skills for the Future
   1.5 Social Services and Experiential Learning

2. Major Courses/Core Courses
   2.1 Basic Courses/ Compulsory Courses/ Core Courses
   2.2 Specialized Courses/ Compulsory Elective Courses
   2.3 Elective Courses
   2.4 Field Experience Courses

3. Free Elective Courses

A practical training course is normally offered during the summer session of the third academic year of the curriculum. Students are placed at business corporations, government agencies, or industrial facilities to receive on-the-job training and to learn to adapt to the work environment.

Instead of the practical training course, students may be approved to enroll in an extended training program in the second semester of the fourth year, with continuation into the following summer session. During the training, students usually work on a project which addresses and solves a technical problem in industry.

SIIT has established student exchange programs with many foreign universities and organizations. Qualified students may take advantage of these programs. Students may request that credits of courses taken during the exchange period be transferred. In some cases, there is some financial assistance.

Details of the curriculum for each academic program are given in the following pages. For additional information, students may consult the individual programs.

Business and Supply Chain Analytics (BA)

Curriculum Outline

Business and Supply Chain Analytics (BA) Program covers general basic courses and three common foundations required for business Analytics, namely, Math, statistics and Science, Fundamentals of Technology and Analytics, and General Business and Management. After completing the second year of study, students choose to be specialized in one of the academic options offered by the BA Program. (The list of academic options to be offered to students is left to the discretion of SIIT.)

Examples of academic options are as follows:

Option I: Business Analytics (BA)
Option II: Supply Chain Analytics (SA)
Option III: Engineering Management (EM)
Option IV: Management Analytics (MA)

After completing their third year of study, students choose a study track based on their capability. These study tracks include: (1) Senior Project Track, (2) Overseas Exchange Track, (3) Extended Training Track, and (4) Startup Track. For more details on the academic options and study tracks, consult BA Program Coordinator.

Structure and Components

1) General Basic Courses		30	Credits
1.1	Global Awareness and Social Literacy	6	Credits
1.2	Aesthetics and Communication Skills	6	Credits
1.3	Mathematics, Science, and Technology	9	Credits
1.4	Holistic Well-Being and Skills for the Future	6	Credits
1.5	Social Services and Experiential Learning	3	Credits
2. Core Courses		**97**	**Credits**
2.1	Compulsory Courses	66	Credits
2.2	Compulsory Elective Courses	31	Credits
3. Free Elective Courses		**12**	**Credits**
Total		**139**	**Credits**

Details of the Curriculum

1. General Basic Courses — 30 Credits

1.1. Global Awareness and Social Literacy (2 courses) — 6 Credits
GTS231   TU109

1.2 Aesthetics and Communication Skills (2 courses) — 6 Credits
LAS101   TU106

1.3 Mathematics, Science, and Technology (3 courses) — 9 Credits
GTS123   GTS124   GTS131

1.4 Holistic Well-Being and Skills for the Future (2 courses) — 6 Credits
GTS101   TU108 or TU201 or TU202 or TU301

1.5 Social Services and Experiential Learning (1 course) — 3 Credits
TU100

2. Core Courses — 97 Credits

2.1 Compulsory Courses — 66 Credits

2.1.1 Math, Statistics and Sciences — 15 Credits
BAS130   BAS131   BAS230
BAS331   GTS113

2.1.2 Fundamental of Technology and Analytics — 18 Credits
BAS213   BAS240   BAS241
BAS340   BAS341   BAS357

2.1.3 General Business and Management — 33 Credits
BAS111   BAS210   BAS211
BAS212   BAS214   BAS215
BAS352   BAS411   BAS423
BAS441   GTS302   GTS303

2.2 Compulsory Elective Courses — 31 Credits

2.2.1 Special Study — 7 Credits

1) Senior Project Track
BAS300   BAS400   BAS401

2) Overseas Exchange Track
BAS300   BAS491   BAS492

3) Extended Training Track
BAS300   BAS402

4) Startup Track
BAS300   BAS403   BAS404

2.2.2 Option Courses — 24 Credits

1) Option I: Business Analytics
BAS360   BAS361   BAS362   BAS363
BAS364   BASxxx   BASxxx   BASxxx

2) Option II: Supply Chain Analytics
BAS350   BAS351   BAS353   BAS354
BAS356   BASxxx   BASxxx   BASxxx

3) Option III: Engineering Management
BAS321   BAS330   BAS351   BAS355
BAS358   BAS359   BAS361   BASxxx

4) Option IV: Management Analytics
BASxxx   BASxxx   BASxxx   BASxxx
BASxxx   BASxxx   BASxxx   BASxxx

BASxxx are technical electives selected from the list of technical electives (They must be different from courses taken previously).

Technical Elective courses (BAS35x to BAS39x)
BAS350   BAS351   BAS353   BAS354
BAS355   BAS358   BAS359   BAS360
BAS361   BAS362   BAS363   BAS364
BAS365   BAS366   BAS367   BAS368
BAS369   BAS371   BAS372   BAS374
BAS377   BAS380   BAS381   BAS382
BAS383   BAS384   BAS391   BAS392
BAS393   BAS394   BAS395   BAS396
BAS397   BAS398

3. Free Elective Courses — 12 Credits
Students may choose any free elective courses (not less than 12 credits in total) offered by SIIT or TU except:
1. General basic TU courses with course code 1xx.
2. Courses with contents similar to those of other courses in the curriculum that the students use for graduation.

Total Credit Requirement — 139 Credits

BA Curriculum : 139 Credits

First Year

Semester I

BAS111	Principles of Business and Management	3(3-0-6)
GTS101	Extended English in Practice	3(3-0-6)
GTS113	Finite Mathematics for Business Analytics	3(3-0-6)
GTS123	Introduction to Computers and Programming	3(2-3-4)
GTS131	Circularity for Sustainable Development	3(3-0-6)
TU108	Self Development and Management	3(3-0-6)
or		
TU201	Financial Literacy for Individuals	3(3-0-6)
or		
TU202	Complete Investment	3(3-0-6)
or		
TU301	Investment in the Stock Market	3(3-0-6)
	Sub-Total	**18(17-3-34)**

Semester II

BAS130	Calculus for Technologists	3(3-0-6)
BAS131	Statistical Methods for Managers	3(3-0-6)
BAS210	Principles of Marketing	3(3-0-6)
BAS215	Economics for Technologists	3(3-0-6)
TU100	Civic Engagement	3(3-0-6)
TU106	Creativity and Communication	3(3-0-6)
	Sub-Total	**18(18-0-36)**

Second Year

Semester I

BAS211	Fundamentals of Financial and Managerial Accounting	3(3-0-6)
BAS230	Introduction to Management Science	3(3-0-6)
BAS240	Data Analytics Programming	3(2-2-5)
GTS124	Artificial Intelligence and Applications	3(3-0-6)
GTS231	Law and Technology	3(3-0-6)
GTS302	Technical Writing	1(0-3-0)
GTS303	Communications in Business	2(2-0-4)
	Sub-Total	**18(16-5-33)**

Semester II

BAS212	Business Finance	3(3-0-6)
BAS213	Business Information Systems	3(3-0-6)
BAS214	Operations Management and Analytics	3(3-0-6)
BAS241	Applied Business Analytics and Optimization for Decision Making	3(2-2-5)
LAS101	Critical Thinking, Reading, and Writing	3(3-0-6)
TU109	Innovation and Entrepreneurial mindset	3(3-0-6)
	Sub-Total	**18(17-2-35)**

Third Year

Semester I

BAS331	Statistics for Data Science and Empirical Study	3(2-2-5)
BAS340	Machine Learning for Business Analytics	3(2-2-5)
BAS341	Database Systems and Applications	3(2-2-5)

Option I: Business Analytics (BA)

BAS360	Applied Data Analytics and Visualization Programming	3(2-2-5)
BAS361	Digital Transformation and Robotic Process Automation	3(2-2-5)
BASxxx	Technical Elective	3(x-x-x)
	Sub-Total	**18(x-x-x)**

Option II: Supply Chain Analytics (SA)

BAS350	Enterprise Planning and Control Systems	3(3-0-6)
BAS351	Management Optimization and Prescriptive Analytics	3(3-0-6)
BASxxx	Technical Elective	3(x-x-x)
	Sub-Total	**18(x-x-x)**

Option III: Engineering Management (EM)

BAS351	Management Optimization and Prescriptive Analytics	3(3-0-6)
BAS355	Simulation and Predictive Analytics	3(2-2-5)
BAS361	Digital Transformation and Robotic Process Automation	3(2-2-5)
	Sub-Total	**18(13-10-31)**

Option IV: Management Analytics (MA)

BASxxx	Technical Elective(s)	9(x-x-x)
	Sub-Total	**18(x-x-x)**

Semester II

BAS352	Supply Chain Management and Analytics	3(3-0-6)
BAS357	Economic Decision Analysis	3(3-0-6)

Option I: Business Analytics (BA)

BAS362	Marketing Analytics	3(2-2-5)
BAS363	Data Mining and Web Analytics	3(2-2-5)
BAS364	Enterprise Resource Planning Software	3(2-2-5)
BASxxx	Technical Elective(s)	6(x-x-x)
	Sub-Total	**21(x-x-x)**

Option II: Supply Chain Analytics (SA)

BAS353	Inventory Management and Analytics	3(3-0-6)
BAS354	Transportation, Warehouse and Logistics Management	3(3-0-6)
BAS356	Strategic Sourcing and Supply Management	3(3-0-6)
BASxxx	Technical Elective(s)	6(x-x-x)
	Sub-Total	**21(x-x-x)**

Option III: Engineering Management (EM)

BAS321	Production and Inventory Management	3(3-0-6)
BAS330	Basic Engineering	3(3-0-6)
BAS358	Lean, Internet of Things and Quality Management	3(3-0-6)
BAS359	Facility Location and Layout Planning	3(3-0-6)
BASxxx	Technical Elective	3(x-x-x)
	Sub-Total	**21(x-x-x)**

Option IV: Management Analytics (MA)

BASxxx	Technical Elective(s)	15(x-x-x)
	Sub-Total	**21(x-x-x)**

Summer

Select Senior Project Track, Overseas Exchange Track, Extended Training Track and Startup Track.

BAS300	Business and Supply Chain Analytics Training	1(0-40-0)
	Sub-Total	**1(0-40-0)**

Fourth Year

Semester I

BAS411	International Trade and Business	3(3-0-6)
BAS423	Project Management	3(3-0-6)
BAS441	Business Intelligence and Analytics	3(3-0-6)
XXXxxx	Free Elective(s)	6(x-x-x)

1) Senior Project Track

BAS400	Business and Supply Chain Analytics Seminar	2(0-6-0)
	Sub-Total	**17(x-x-x)**

2) Overseas Exchange Track

XXXxxx	Free Elective(s)	6(x-x-x)
	Sub-Total	**21(x-x-x)**

3) Extended Training Track

XXXxxx	Free Elective(s)	6(x-x-x)
	Sub-Total	**21(x-x-x)**

4) Startup Track

BAS403	Startup Project in Business and Supply Chain Analytics I	2(0-6-6)
	Sub-Total	**17(x-x-x)**

Semester II

1) Senior Project Track

BAS401	Business and Supply Chain Analytics Project	4(0-12-0)
XXXxxx	Free Elective(s)	6(x-x-x)
	Sub-Total	**10(x-x-x)**

2) Overseas Exchange Track

BAS491	Special Study in Business and Supply Chain Analytics I	3(3-0-6)
BAS492	Special Study in Business and Supply Chain Analytics II	3(3-0-6)
	Sub-Total	**6(x-x-x)**

3) Extended Training Track

BAS402	Extended Business and Supply Chain Analytics Training	6(0-40-0)
	Sub-Total	**6(x-x-x)**

4) Startup Track

BAS404	Startup Project in Business and Supply Chain Analytics II	4(0-12-12)
XXXxxx	Free Elective(s)	6(x-x-x)
	Sub-Total	**10(x-x-x)**

Chemical Engineering (ChE)

Curriculum Outline

Chemical engineering (ChE) is a branch of engineering that deals with the chemical and physical processes used to develop and make products such as pharmaceuticals, artificial organs, semiconductors, oil refineries, solar panels, clean water, and biocompatible polymers. Chemical engineers have made major contributions to modern society. With the additional knowledge of biology, chemical engineers are devising new ways for living organisms to perform molecular transformation, and discovering new schemes for delivery of medicines to specific sites in the body.

The Chemical Engineering Program intends to prepare chemical engineers for life-long achievement through education in the principles of chemical engineering: to encourage development of communication, teamwork, and leadership skills.

The basic foundation in mathematics, chemistry, physics, and engineering is established in the first two years of the curriculum. A core of required chemical engineering courses is followed by a selection of electives. One group of electives will prepare students to be biochemical engineers, and another group to be chemical process and material engineers.

In addition, ChE students can choose one among three special study (Senior Project Track, Overseas Exchange Track, and Extended Training Track).

- **Senior Project Track** is for students who would like to conduct their projects under the supervision of ChE faculty members.
- **Overseas Exchange Track** is designed for students who would like to participate in a student exchange program with foreign partner universities.
- **Extended Training Track** is designed for students who would like to participate in a longer training period (for the entire semester) under a co-operative training program with companies or organizations.

Structure and Components

1)	**General Basic Courses**	**30**	**Credits**
1.1	Global Awareness and Social Literacy	6	Credits
1.2	Aesthetics and Communication Skills	6	Credits
1.3	Mathematics, Science, and Technology	9	Credits
1.4	Holistic Well-Being and Skills for the Future	6	Credits
1.5	Social Services and Experiential Learning	3	Credits
2)	**Major Courses**	**97**	**Credits**
2.1	Basic Courses	28	Credits
	2.1.1 Basic Mathematics and Science Courses	14	Credits
	2.1.2 Basic Engineering Courses	14	Credits
2.2	Specialized Courses	69	Credits
	2.2.1 Compulsory Engineering Courses	60	Credits
	2.2.2 Elective Engineering Courses	9	Credits
3)	**Free Elective Courses**	**9**	**Credits**
	Total	**136**	**Credits**

Details of the Curriculum

1.	**General Basic Courses**	**30**	**Credits**
1.1	Global Awareness and Social Literacy (2 courses)	6	Credits
	GTS231 TU109		
1.2	Aesthetics and Communication Skills (2 courses)	6	Credits
	LAS101 TU106		
1.3	Mathematics, Science, and Technology (3 courses)	9	Credits
	GTS123 GTS124 GTS131		
1.4	Holistic Well-Being and Skills for the Future (2 courses)	6	Credits
	GTS101 TU108 or TU201 or TU202 or TU301		
1.5	Social Services and Experiential Learning (1 course)	3	Credits
	TU100		
2.	**Major Courses**	**97**	**Credits**
2.1	Basic Courses	28	Credits
	2.1.1 Basic Mathematics and Science Courses	14	Credits
	MAS116 MAS117 SCS126 SCS136		
	SCS176 SCS186		
	2.1.2 Basic Engineering Courses	14	Credits
	EES203 EES204 GTS302 MES231		
	MES300 SCS241		
2.2	Specialized Courses	69	Credits
	2.2.1 Compulsory Engineering Courses	60	Credits
	2.2.1.1 Principles of Chemical Engineering	18	Credits
	CHS211 CHS212 CHS213 CHS241		
	CHS242 CHS343		
	2.2.1.2 Applied Chemical Engineering	30	Credits
	CHS251 CHS261 CHS264 CHS275		
	CHS331 CHS352 CHS353 CHS355		
	CHS359 CHS362 CHS363 CHS416		
	2.2.1.3 Plant Design and Management	12	Credits
	CHS314 CHS315 CHS417 CHS457		
	2.2.2 Elective Engineering Courses	9	Credits
	2.2.2.1 Special Study	6	Credits

Students can choose one among three special studies:
- **Senior Project Track** — 6 Credits
  CHS301   CHS302   CHS484   CHS485
- **Overseas Exchange Track** — 6 Credits
  CHS301   CHS302   CHS486 or CHS487   CHS488
- **Extended Training Track** — 6 Credits
  CHS302   CHS489

	2.2.2.2 Technical Elective Course (1 course)	3	Credits

Students must select to study one out of eight subjects (3 credits) from
CHS327   CHS328   CHS371   CHS374
CHS425   CHS481   CHS482   CHS483

3.	**Free Elective Courses**	**9**	**Credits**

Students may choose any free elective courses (not less than 9 credits in total) offered by SIIT or TU except:
1. General basic TU courses with course code 1xx.
2. Courses with contents similar to those of other courses in the curriculum that the students use for graduation.

Total Credit Requirement	**136**	**Credits**

ChE Curriculum : 136 Credits

First Year
Semester I
GTS101	Extended English in Practice	3(3-0-6)
GTS124	Artificial Intelligence and Applications	3(3-0-6)
GTS131	Circularity for Sustainable Development	3(3-0-6)
MAS116	Mathematics I	3(3-0-6)
SCS136	Physics	3(3-0-6)
SCS186	Physics Laboratory	1(0-3-0)
TU108	Self Development and Management	3(3-0-6)
or		
TU201	Financial Literacy for Individuals	3(3-0-6)
or		
TU202	Complete Investment	3(3-0-6)
or		
TU301	Investment in the Stock Market	3(3-0-6)
	Sub-Total	19(18-3-36)

Semester II
GTS123	Introduction to Computers and Programming	3(2-3-4)
LAS101	Critical Thinking, Reading, and Writing	3(3-0-6)
MAS117	Mathematics II	3(3-0-6)
SCS126	Chemistry for Engineers	3(3-0-6)
SCS176	Chemistry Laboratory	1(0-3-0)
TU100	Civic Engagement	3(3-0-6)
TU106	Creativity and Communication	3(3-0-6)
	Sub-Total	19(17-6-34)

Second Year
Semester I
CHS211	Organic Chemistry	3(3-0-6)
CHS213	Statistics and Experimental Design for ChE	3(3-0-6)
CHS241	Material and Energy Balance	3(3-0-6)
EES203	Basic Electrical Engineering	3(3-0-6)
EES204	Basic Electrical Engineering Laboratory	1(0-3-0)
MES231	Engineering Mechanics	3(3-0-6)
MES300	Engineering Drawing	3(2-3-4)
	Sub-Total	19(17-6-34)

Semester II
CHS212	Physical Chemistry	3(3-0-6)
CHS242	Thermodynamics I	3(3-0-6)
CHS251	Fluid Dynamics and Transport Phenomena	3(3-0-6)
CHS261	Chemical Engineering Laboratory I	1(0-3-0)
CHS264	Process Dynamics and Control	3(3-0-6)
CHS275	Analytical and Instrumental Chemistry	3(3-0-6)
SCS241	Material Science for Engineers	3(3-0-6)
	Sub-Total	19(18-3-36)

Third Year
Semester I
CHS315	Safety and Environmental Processes for ChE	3(3-0-6)
CHS343	Thermodynamics II	3(3-0-6)
CHS352	Heat Transfer	3(3-0-6)
CHS362	Chemical Engineering Laboratory II	1(0-3-0)
GTS231	Law and Technology	3(3-0-6)
GTS302	Technical Writing	1(0-3-0)
TU109	Innovation and Entrepreneurial mindset	3(3-0-6)
	Sub-Total	17(15-6-30)

Semester II
Select either 1) Senior Project Track, 2) Overseas Exchange Track, or 3) Extended Training Track.
CHS302	Seminar	1(0-2-1)
CHS314	Engineering Economy and Business Management	3(3-0-6)
CHS331	Chemical Reaction Kinetics and Reactor Design	3(3-0-6)
CHS353	Mass Transfer	3(3-0-6)
CHS355	ChE Equipment and Process Design	3(3-0-6)
CHS359	Computer Applications for Chemical Engineering	3(3-0-6)
CHS363	Chemical Engineering Laboratory III	1(0-3-0)

1) Senior Project Track and 2) Overseas Exchange Track
	Sub-Total	17(15-5-31)

3) Extended Training Track
XXXxxx	Free Elective Course	3(x-x-x)
	Sub-Total	20(x-x-x)

Summer
1) Senior Project Track and 2) Overseas Exchange Track
CHS301	Chemical Engineering Training	1(0-40-0)
	Sub-Total	1(0-40-0)

Fourth Year
Semester I
CHS416	Big Data Analytics in Chemical Engineering	3(3-0-6)
CHS417	Green Technology for Chemical Engineering	3(3-0-6)
CHS457	ChE Plant Design and Project Management	3(3-0-6)
CHSxxx	Technical Elective Course	3(3-0-6)
XXXxxx	Free Elective Course	3(x-x-x)

1) Senior Project Track
CHS484	Chemical Engineering Project I	1(0-3-0)
	Sub-Total	16(x-x-x)

2) Overseas Exchange Track
	Sub-Total	15(x-x-x)

3) Extended Training Track
XXXxxx	Free Elective Course	3(x-x-x)
	Sub-Total	18(x-x-x)

Semester II
1) Senior Project Track
CHS485	Chemical Engineering Project II	3(0-9-0)
XXXxxx	Free Elective Course	3(x-x-x)
XXXxxx	Free Elective Course	3(x-x-x)
	Sub-Total	9(x-x-x)

2) Overseas Exchange Track
CHS486	Special Studies in ChE I	3(3-0-6)
or		
CHS487	Special Studies in ChE II	3(3-0-6)
CHS488	Special Studies in ChE III	1(1-0-2)
XXXxxx	Free Elective Course	3(x-x-x)
XXXxxx	Free Elective Course	3(x-x-x)
	Sub-Total	10(x-x-x)

3) Extended Training Track
CHS489	Extended Chemical Engineering Training	5(0-40-0)
	Sub-Total	5(0-40-0)

Civil Engineering (CE)

Curriculum Outline

The Civil Engineering Program aims to produce graduates with sufficient breath of fundamental knowledge, while possessing an in-depth understanding of specific areas. This will enable the graduates to effectively serve in a wide range of key industrial sectors in Thailand, where the need for civil engineers and specialists is ever increasing.

The curriculum gives emphasis to various major fields of civil engineering, which include 1) structural engineering, 2) concrete engineering, 3) soil and foundation engineering, 4) water resources engineering, 5) transportation engineering and 6) construction management.

The total credits for major engineering subjects are equally distributed to all six major fields, except for the field of structural engineering, which has a slightly larger number of credits.

Further specialization can be achieved through the elective courses and senior project. A practical training course is also provided to allow the students an opportunity to practice civil engineering during their studies. In the practical training course, students will be placed in organizations where they would gain relevant practical experiences in specific fields of specialization. In this curriculum, it is possible for students to study their elective courses at other universities, including foreign universities, as exchange students during the final semester. With special arrangements, it will also be possible for students to have thorough practical training during the final semester.

Structure and Components

1)	General Basic Courses		30	Credits
	1.1	Global Awareness and Social Literacy	6	Credits
	1.2	Aesthetics and Communication Skills	6	Credits
	1.3	Mathematics, Science, and Technology	9	Credits
	1.4	Holistic Well-Being and Skills for the Future	6	Credits
	1.5	Social Services and Experiential Learning	3	Credits
2.	Major Courses		99	Credits
	2.1	Basic Courses	36	Credits
		2.1.1 Basic Mathematics and Science Courses	14	Credits
		2.1.2 Basic Engineering Courses	22	Credits
	2.2	Specialized Courses	63	Credits
		2.2.1 Compulsory Engineering Courses	51	Credits
		2.2.2 Elective Engineering Courses	12	Credits
3.	Free Elective Courses		**9**	**Credits**
	Total		**138**	**Credits**

Details of the Curriculum

1.	General Basic Courses		30	Credits
	1.1 Global Awareness and Social Literacy (2 courses)		6	Credits
	GTS231 TU109			
	1.2 Aesthetics and Communication Skills (2 courses)		6	Credits
	LAS101 TU106			
	1.3 Mathematics, Science, and Technology (3 courses)		9	Credits
	GTS123 GTS124 GTS131			
	1.4 Holistic Well-Being and Skills for the Future (2 courses)		6	Credits
	GTS101 TU108 or TU201 or TU202 or TU301			
	1.5 Social Services and Experiential Learning (1 courses)		3	Credits
	TU100			
2.	Major Courses		99	Credits
	2.1 Basic Courses		36	Credits
	2.1.1 Basic Mathematics and Science Courses		14	Credits
	MAS116 MAS117 SCS126			
	SCS136 SCS176 SCS186			
	2.1.2 Basic Engineering Courses		22	Credits
	CES204 CES215 CES261 CES271			
	GTS302 MES300 MES350 SCS241			
	2.2 Specialized Courses		63	Credits
	2.2.1 Compulsory Engineering Courses		51	Credits
	2.2.1.1 Structural Engineering & Materials			
	CES312 CES321 CES322 CES351			
	CES352 CES354 CES414			
	2.2.1.2 Soil & Hydraulics Engineering			
	CES202 CES281 CES282 CES331			
	CES332 CES333 CES334 CES444			
	2.2.1.3 Transportation & Engineering Management			
	CES341 CES343 CES353 CES355			
	2.2.2 Elective Engineering Courses		12	Credits
	2.2.2.1 Special Study (select 1 track)			
	1) Senior Project Track		6	Credits
	CES303 CES403 CES407			
	or			
	2) Overseas Exchange Track		6	Credits
	CES303 CES403 CES409 CES410			
	or			
	3) Extended Training Track		6	Credits
	CES403 CES408			
	and			
	2.2.2.2 Technical Elective Courses		6	Credits
	Select 6 credits from the list of courses offered by the Civil Engineering Program, except basic courses.			
	CESxxx			

3. **Free Elective Courses**   **9**   **Credits**

Students may choose any free elective courses (not less than 9 credits in total) offered by SIIT or TU except:
1. General basic TU courses with course code 1xx.
2. Courses with contents similar to those of other courses in the curriculum that the students use for graduation.

Total Credit Requirement   **138**   **Credits**

CE Curriculum : 138 Credits

First Year
Semester I
GTS101	Extended English in Practice	3(3-0-6)
GTS124	Artificial Intelligence and Applications	3(3-0-6)
GTS131	Circularity for Sustainable Development	3(3-0-6)
MAS116	Mathematics I	3(3-0-6)
SCS136	Physics	3(3-0-6)
SCS186	Physics Laboratory	1(0-3-0)
TU108	Self Development and Management	3(3-0-6)
or		
TU201	Financial Literacy for Individuals	3(3-0-6)
or		
TU202	Complete Investment	3(3-0-6)
or		
TU301	Investment in the Stock Market	3(3-0-6)
	Sub-Total	**19(18-3-36)**

Semester II
GTS123	Introduction to Computers and Programming	3(2-3-4)
MAS117	Mathematics II	3(3-0-6)
SCS126	Chemistry for Engineers	3(3-0-6)
SCS176	Chemistry Laboratory	1(0-3-0)
TU100	Civic Engagement	3(3-0-6)
TU106	Creativity and Communication	3(3-0-6)
LAS101	Critical Thinking, Reading, and Writing	3(3-0-6)
	Sub-Total	**19(17-6-34)**

Second Year
Semester I
CES215	Applied Mathematics in Civil Engineering	3(3-0-6)
CES261	Surveying	3(2-3-4)
MES300	Engineering Drawing	3(2-3-4)
MES350	Engineering Statics	3(3-0-6)
SCS241	Material Science for Engineers	3(3-0-6)
TU109	Innovation and Entrepreneurial mindset	3(3-0-6)
	Sub-Total	**18(16-6-32)**

Semester II
CES202	Engineering Hydrology	3(3-0-6)
CES204	Building Facilities	3(3-0-6)
CES271	Mechanics of Solids I	3(3-0-6)
CES281	Hydraulics	3(3-0-6)
CES282	Hydraulics Laboratory	1(0-3-0)
GTS231	Law and Technology	3(3-0-6)
	Sub-Total	**16(15-3-30)**

Third Year
Semester I
CES312	Structural Analysis	3(3-0-6)
CES331	Soil Mechanics	3(3-0-6)
CES333	Soil Mechanics Laboratory	1(0-3-0)
CES341	Transportation Engineering and Planning	3(3-0-6)
CES351	Concrete Technology	3(2-3-4)
CES353	Construction Engineering and Management	3(3-0-6)
CES444	Hydraulic Engineering	3(3-0-6)
GTS302	Technical Writing	1(0-3-0)
	Sub-Total	**20(17-9-34)**

Semester II
Select either 1) Senior Project Track, 2) Overseas Exchange Track, or 3) Extended Training Track.

CES321	Steel and Timber Design	3(3-0-6)
CES322	Reinforced Concrete Design	3(3-0-6)
CES332	Foundation Engineering	3(3-0-6)
CES334	Geotechnical Earthquake Engineering	3(3-0-6)
CES343	Highway Engineering	3(3-0-6)
CES352	Material Testing	1(0-3-0)
CES355	Integrated Construction Technology	3(3-0-6)

1) Senior Project Track and 2) Overseas Exchange Track
	Sub-Total	**19(18-3-36)**

3) Extended Training Track
XXXxxx	Free Elective(s)	3(x-x-x)
	Sub-Total	**22(x-x-x)**

Summer
1) Senior Project Track and 2) Overseas Exchange Track
CES303	Civil Engineering Training	1(0-40-0)
	Sub-Total	**1(0-40-0)**

Fourth Year
Semester I
CES354	Maintenance of Structures	3(3-0-6)
CES403	Seminar	1(0-3-0)
CES414	Finite Element Methods in Engineering	3(3-0-6)
CESxxx	Technical Elective(s)	6(x-x-x)
XXXxxx	Free Elective(s)	3(3-0-6)

1) Senior Project Track and 2) Overseas Exchange Track
	Sub-Total	**16(x-x-x)**

3) Extended Training Track
XXXxxx	Free Elective(s)	3(x-x-x)
	Sub-Total	**19(x-x-x)**

Semester II
1) Senior Project Track
CES407	Civil Engineering Project	4(0-12-0)
XXXxxx	Free Elective(s)	6(x-x-x)
	Sub-Total	**10(x-x-x)**

2) Overseas Exchange Track
CES409	Special Study in Civil Engineering III	2(2-0-4)
CES410	Special Study in Civil Engineering IV	2(2-0-4)
XXXxxx	Free Elective(s)	6(x-x-x)
	Sub-Total	**10(x-x-x)**

3) Extended Training Track
CES408	Extended Civil Engineering Training	5(0-40-0)
	Sub-Total	**5(0-40-0)**

Computer Engineering (CPE)

Curriculum Outline

The computer engineering curriculum is designed to prepare students for new trends in hardware and software development, as well as frontiers in computing technology. Students are exposed to a wide range of subjects covering all aspects of computer engineering and their applications.

The compulsory core courses help students to:
(1) Gain fundamental concepts related to computers and information technology that lead to high performance digital processing,
(2) Know the essence of hardware and software systems that leads to the effective and efficient development of computer systems, and
(3) Understand applications of fundamental knowledge in frontier multi-disciplinary fields.

After gaining enough background through the compulsory core courses, the students are allowed to tailor their courses according to their personal interest. Twelve credits of elective courses, which are required for graduation, can be selected from one of these:
(1) Artificial Intelligence,
(2) Cloud Computing and Cyber Security, or
(3) General Computer Engineering

Structure and Components

1.	General Basic Courses		30	Credits
	1.1	Global Awareness and Social Literacy	6	Credits
	1.2	Aesthetics and Communication Skills	6	Credits
	1.3	Mathematics, Science, and Technology	9	Credits
	1.4	Holistic Well-Being and Skills for the Future	6	Credits
	1.5	Social Services and Experiential Learning	3	Credits
2.	Major Courses		97	Credits
	2.1	Core Courses	41	Credits
	2.2	Specialized Courses	38	Credits
	2.3	Elective Courses	12	Credits
	2.4	Field-Experience Courses	6	Credits
3.	Free Elective Courses		9	Credits
	Total		**136**	**Credits**

Details of the Curriculum

1. General Basic Courses — 30 Credits

1.1. Global Awareness and Social Literacy (2 courses) — 6 Credits
GTS231   TU109

1.2 Aesthetics and Communication Skills (2 courses) — 6 Credits
LAS101   TU106

1.3 Mathematics, Science, and Technology (3 courses) — 9 Credits
GTS123   GTS124   GTS131

1.4 Holistic Well-Being and Skills for the Future (2 courses) — 6 Credits
GTS101   TU108 or TU201 or TU202 or TU301

1.5 Social Services and Experiential Learning (1 course) — 3 Credits
TU100

2. Major Courses — 97 Credits

2.1 Core Courses — 41 Credits
BAS357   CSS322   CSS331   CSS400
DES102   DES103   DES201   DES221
DES229   DES231   EES216   EES270
GTS210   GTS302   MAS116   MAS117
SCS141

2.2 Specialized Courses — 38 Credits

2.2.1 Technologies for Applications — 4 Credits
CSS325   CSS326

2.2.2 Technologies and Software Processes — 9 Credits
CSS323   DES227   DES329

2.2.3 System Infrastructure — 13 Credits
CSS221   CSS225   CSS321   CSS324
DES352

2.2.4 Hardware and Computer Architecture — 12 Credits
CSS224   CSS332   CSS334   EES271

2.3 Elective Courses — 12 Credits
Select one of the following options

2.3.1 **Option I: Artificial Intelligence**
CSS431   CSS432   CSS433   CSS434

2.3.2 **Option II: Cloud Computing and Cyber Security**
CSS451   CSS452   CSS453   CSS454

2.3.3 **Option III: General Computer Engineering**
Select 4 courses from the following courses:
CSS431   CSS432   CSS433   CSS434
CSS451   CSS452   CSS453   CSS454
CSS481   CSS482   CSS483   CSS484
CSS485   CSS486

2.4 Field-Experience Courses — 6 Credits
Select one of the following tracks

2.4.1 **Senior Project Track**
CSS300   CSS403

2.4.2 **Overseas Exchange Track**
CSS300   CSS495   CSS497

2.4.3 **Extended Training Track**
CSS499

3. Free Elective Courses — 9 Credits
Students may choose any free elective courses (not less than 9 credits in total) offered by SIIT or TU except:
1. General basic TU courses with course code 1xx.
2. Courses with contents similar to those of other courses in the curriculum that the students use for graduation.

Total Credit Requirement — 136 Credits

CPE Curriculum : 136 Credits

First Year
Semester I

GTS101	Extended English in Practice	3(3-0-6)
GTS123	Introduction to Computers and Programming	3(2-3-4)
MAS116	Mathematics I	3(3-0-6)
SCS141	General Science	3(3-0-6)
TU100	Civic Engagement	3(3-0-6)
TU106	Creativity and Communication	3(3-0-6)
	Sub-Total	**18(17-3-34)**

Semester II

CSS224	Computer Architectures	3(3-0-6)
DES102	Object-oriented Programming	3(3-0-6)
DES103	Object-oriented Programming Laboratory	1(0-3-0)
GTS124	Artificial Intelligence and Applications	3(3-0-6)
GTS131	Circularity for Sustainable Development	3(3-0-6)
MAS117	Mathematics II	3(3-0-6)
TU108	Self Development and Management	3(3-0-6)
or		
TU201	Financial Literacy for Individuals	3(3-0-6)
or		
TU202	Complete Investment	3(3-0-6)
or		
TU301	Investment in the Stock Market	3(3-0-6)
	Sub-Total	**19(18-3-36)**

Second Year
Semester I

DES201	Discrete Mathematics	3(3-0-6)
DES221	Data Structures and Algorithms	3(3-0-6)
DES231	Data Structures and Algorithms Laboratory	1(0-3-0)
EES270	Digital Circuits Laboratory	1(0-3-0)
EES271	Digital Circuits	3(3-0-6)
GTS210	Mathematics for Technologists III	3(3-0-6)
GTS231	Law and Technology	3(3-0-6)
	Sub-Total	**17(15-6-30)**

Semester II

CSS221	Computer Graphics and Applications	3(2-3-4)
CSS225	Operating System	3(3-0-6)
CSS332	Microcontrollers and Applications	3(2-3-4)
DES227	Algorithms Design	3(3-0-6)
DES229	Human Computer Interface Design	3(3-0-6)
EES216	Circuit Analysis	3(3-0-6)
	Sub-Total	**18(16-6-32)**

Third Year
Semester I

CSS321	Theory of Computation	3(3-0-6)
CSS322	Scientific Computing	3(3-0-6)
CSS324	Artificial Intelligence	3(3-0-6)
CSS325	Database Systems	3(3-0-6)
CSS326	Database Programming Laboratory	1(0-3-0)
CSS331	Fundamentals of Data Communications	3(3-0-6)
GTS302	Technical Writing	1(0-3-0)
LAS101	Critical Thinking, Reading, and Writing	3(3-0-6)
	Sub-Total	**20(18-6-36)**

Semester II

BAS357	Economic Decision Analysis	3(3-0-6)
CSS323	Software Engineering	3(3-0-6)
CSS334	Computer Networks and Internetworking	3(3-0-6)
DES329	System Analysis and Design	3(3-0-6)
DES352	Networking Laboratory	1(0-3-0)

	Option I: Artificial Intelligence	
CSS431	Machine Learning and Pattern Recognition	3(3-0-6)
CSS432	Natural Language Processing and Information Retrieval	3(3-0-6)
	Sub-Total	**19(18-3-36)**
	Option II: Cloud Computing and Cyber Security	
CSS451	Cloud Computing	3(3-0-6)
CSS454	Computer and Communication Security	3(3-0-6)
	Sub-Total	**19(18-3-36)**
	Option III: General Computer Engineering	
CSSxxx	Compulsory Elective	3(x-x-x)
CSSxxx	Compulsory Elective	3(x-x-x)
	Sub-Total	**19(x-x-x)**

Summer
1) Senior Project Track and Overseas Exchange Track

CSS300	Computer Engineering Training	1(0-40-0)
	Sub-Total	**1(0-40-0)**

Fourth Year
Semester I

CSS400	Project Development	1(0-3-0)
TU109	Innovation and Entrepreneurial mindset	3(3-0-6)
	Option I: Artificial Intelligence	
CSS433	Computer Vision	3(3-0-6)
CSS434	Knowledge Representation and Reasoning	3(3-0-6)
	Option II: Cloud Computing and Cyber Security	
CSS452	Internet of Things	3(3-0-6)
CSS453	Cyber Crimes and Digital Forensics	3(3-0-6)
	Option III: General Computer Engineering	
CSSxxx	Compulsory Elective	3(x-x-x)
CSSxxx	Compulsory Elective	3(x-x-x)

1) Senior Project Track and Overseas Exchange Track

XXXxxx	Free Elective(s)	3(x-x-x)
	Sub-Total	**13(x-x-x)**

2) Extended Training Track

XXXxxx	Free Elective(s)	9(x-x-x)
	Sub-Total	**19(x-x-x)**

Semester II
1) Senior Project Track

CSS403	Computer Engineering Project	5(0-15-0)
XXXxxx	Free Elective(s)	6(x-x-x)
	Sub-Total	**11(x-x-x)**

2) Overseas Exchange Track

CSS495	Special Studies in Computer Engineering I	3(3-0-6)
CSS497	Special Studies in Computer Engineering III	2(2-0-4)
XXXxxx	Free Elective(s)	6(x-x-x)
	Sub-Total	**11(x-x-x)**

3) Extended Training Track

CSS499	Extended Computer Engineering Training	6(0-40-0)
	Sub-Total	**6(0-40-0)**

Digital Engineering (DE)

Curriculum Outline

The digital engineering curriculum is designed to prepare students for rapidly changing digital technology and its applications. Emphasis is put on the area of application software development based on new trends such as artificial intelligence, machine learning, and cloud computing, as well as that of data science, including big data analytic and data modeling.

The compulsory core courses are designed to help students to:
(1) understand fundamental concepts related to computers and digital technology that lead to high performance digital and information processing,
(2) gain fundamental concepts related to management and analysis of large-scale structured and unstructured data, and
(3) know the essence of techniques that are needed for application of digital technology to industry and business.

After gaining enough background through the compulsory core courses, the students are allowed to tailor their courses according to their personal interest. Twelve credits of elective courses, which are required for graduation, can be selected from one of these:
(1) Application Software Development, or
(2) Data Science, or
(3) General Digital Engineering

Structure and Components

1.	General Basic Courses		30	Credits
	1.1	Global Awareness and Social Literacy	6	Credits
	1.2	Aesthetics and Communication Skills	6	Credits
	1.3	Mathematics, Science, and Technology	9	Credits
	1.4	Holistic Well-Being and Skills for the Future	6	Credits
	1.5	Social Services and Experiential Learning	3	Credits
2.	Major Courses		97	Credits
	2.1	Core Courses	40	Credits
	2.2	Specialized Courses	39	Credits
	2.3	Elective Courses	12	Credits
	2.4	Field-Experience Courses	6	Credits
3.	Free Elective Courses		9	Credits
	Total		136	Credits

Details of the Curriculum

1. **General Basic Courses** — **30** Credit
   - 1.1 Global Awareness and Social Literacy (2 courses) — 6 Credits
     GTS231   TU109
   - 1.2 Aesthetics and Communication Skills (2 courses) — 6 Credits
     LAS101   TU106
   - 1.3 Mathematics, Science, and Technology (3 courses) — 9 Credits
     GTS123   GTS124   GTS131
   - 1.4 Holistic Well-Being and Skills for the Future (2 courses) — 6 Credits
     GTS101   TU108 or TU201 or TU202 or TU301
   - 1.5 Social Services and Experiential Learning (1 course) — 3 Credits
     TU100

2. **Major Courses** — **97** Credits
   - 2.1 Core Courses — 40 Credits
     - 2.1.1 Core Engineering Courses
       BAS357   CSS322   DES102   DES103   DES201   DES221
       DES231   DES232   DES322   DES324   DES400   GTS210
       GTS302   MAS116   MAS117   SCS141
   - 2.2 Specialized Courses — 39 Credits
     - 2.2.1 Technologies for Applications — 4 Credits
       CSS325   CSS326
     - 2.2.2 Technologies and Software Processes — 9 Credits
       DES227   DES229   DES329
     - 2.2.3 System Infrastructure — 13 Credits
       CSS221   CSS225   CSS324   DES331   DES352
     - 2.2.4 Hardware and Computer Architecture — 13 Credits
       CSS224   CSS332   DES332   EES270   EES271
   - 2.3 Elective Courses — 12 Credits
     - 2.3.1 Specialized Elective Courses
       Select one of the following options;
       - **2.3.1.1 Option I: Application Software Development** — 12 Credits
         DES421   DES422   DES423   DES424
       - **2.3.1.2 Option II: Data Science** — 12 Credits
         DES431   DES432   DES433   DES435
       - **2.3.1.3 Option III: General Digital Engineering** — 12 Credits
         Select 4 compulsory elective courses from the following courses:
         DES421   DES422   DES423   DES424
         DES431   DES432   DES433   DES435
         DES481   DES482   DES483   DES484
         DES485   DES486   DES487   DES488
         DES489
   - 2.4 Field-Experience Courses — 6 Credits
     Select one of the following tracks
     - 2.4.1 **Senior Project Track**
       DES300   DES403
     - 2.4.2 **Overseas Exchange Track**
       DES300   DES495   DES497
     - 2.4.3 **Extended Training Track**
       DES499

3. **Free Elective Courses** — **9** Credits
   Students may choose any free elective courses (not less than 9 credits in total) offered by SIIT or TU except:
   1. General basic TU courses with course code 1xx.
   2. Courses with contents similar to those of other courses in the curriculum that the students use for graduation.

   Total Credit Requirement — **136** Credits

DE Curriculum : 136 Credits

First Year

Semester I

GTS101	Extended English in Practice	3(3-0-6)
GTS123	Introduction to Computers and Programming	3(2-3-4)
MAS116	Mathematics I	3(3-0-6)
SCS141	General Science	3(3-0-6)
TU100	Civic Engagement	3(3-0-6)
TU106	Creativity and Communication	3(3-0-6)
	Sub-Total	**18(17-3-34)**

Semester II

CSS224	Computer Architectures	3(3-0-6)
DES102	Object-Oriented Programming	3(3-0-6)
DES103	Object-Oriented Programming Laboratory	1(0-3-0)
GTS124	Artificial Intelligence and Applications	3(3-0-6)
GTS131	Circularity for Sustainable Development	3(3-0-6)
MAS117	Mathematics II	3(3-0-6)
TU108	Self-Development and Management	3(3-0-6)
or		
TU201	Financial Literacy for Individuals	3(3-0-6)
or		
TU202	Complete Investment	3(3-0-6)
or		
TU301	Investment in the Stock Market	3(3-0-6)
	Sub-Total	**19(18-3-36)**

Second Year

Semester I

DES201	Discrete Mathematics	3(3-0-6)
DES221	Data Structures and Algorithms	3(3-0-6)
DES231	Data Structures and Algorithms Laboratory	1(0-3-0)
EES270	Digital Circuits Laboratory	1(0-3-0)
EES271	Digital Circuits	3(3-0-6)
GTS231	Law and Technology	3(3-0-6)
LAS101	Critical Thinking, Reading, and Writing	3(3-0-6)
	Sub-Total	**17(15-6-30)**

Semester II

CSS221	Computer Graphics and Applications	3(2-3-4)
CSS225	Operating System	3(3-0-6)
CSS332	Microcontrollers and Applications	3(2-3-4)
DES227	Algorithm Design	3(3-0-6)
DES229	Human Computer Interface Design	3(3-0-6)
GTS210	Mathematics for Technologist III	3(3-0-6)
	Sub-Total	**18(16-6-32)**

Third Year

Semester I

CSS322	Scientific Computing	3(3-0-6)
CSS324	Artificial Intelligence	3(3-0-6)
CSS325	Database Systems	3(3-0-6)
CSS326	Database Programming Laboratory	1(0-3-0)
DES232	Introduction to Data Communications	3(3-0-6)
DES322	Digital Business Experience	3(3-0-6)
DES331	Computer Networks Architectures and Protocols	3(3-0-6)
	Sub-Total	**19(18-3-36)**

Semester II

Select either 1) Senior Project Track, 2) Overseas Exchange Track, or 3) Extended Training Track.

BAS357	Economic Decision Analysis	3(3-0-6)
DES329	System Analysis and Design	3(3-0-6)
DES332	Computer and Network Security	3(3-0-6)
DES352	Networking Laboratory	1(0-3-0)
GTS302	Technical Writing	1(0-3-0)

Option I: Application Software Development

DES421	Location-based Services and Digital Mapping	3(3-0-6)
DES422	Business Application Development	3(3-0-6)

Option II: Data Science

DES431	Big Data Analytic and Machine learning	3(3-0-6)
DES432	Statistics and Data Modeling	3(3-0-6)

Option III: General Digital Engineering

DESxxx	Compulsory Elective(s)	6(x-x-x)

1) Senior Project Track and 2) Overseas Exchange Track

	Sub-Total	**17(x-x-x)**

3) Extended Training Track

XXXxxx	Free Elective(s)	3(x-x-x)
	Sub-Total	**20(x-x-x)**

Summer

1) Senior Project Track and 2) Overseas Exchange Track

DES300	Digital Engineering Training	1(0-40-0)
	Sub-Total	**1(0-40-0)**

Fourth Year

Semester I

DES324	Entrepreneurship for Digital Business	3(3-0-6)
DES400	Project Development	1(0-3-0)
XXXxxx	Free Elective(s)	3(x-x-x)
TU109	Innovation and Entrepreneurial mindset	3(3-0-6)

Option I: Application Software Development

DES423	Applied Machine Learning and AI	3(3-0-6)
DES424	Cloud-based Application Development	3(3-0-6)

Option II: Data Science

DES433	Data Visualization	3(3-0-6)
DES435	Virtual Reality and Augmented Reality for Data Analytic	3(3-0-6)

Option III: General Digital Engineering

DESxxx	Specialized Elective Courses	6(x-x-x)

1) Senior Project Track and 2) Overseas Exchange Track

	Sub-Total	**16(x-x-x)**

3) Extended Training Track

XXXxxx	Free Elective(s)	3(x-x-x)
	Sub-Total	**19(x-x-x)**

Semester II

1) Senior Project Track

DES403	Digital Engineering Project	5(0-15-0)
XXXxxx	Free Elective(s)	6(x-x-x)
	Sub-Total	**11(x-x-x)**

2) Overseas Exchange Track

DES495	Special Studies in Digital Engineering I	3(3-0-6)
DES497	Special Studies in Digital Engineering III	2(2-0-4)
XXXxxx	Free Elective(s)	6(x-x-x)
	Sub-Total	**11(x-x-x)**

3) Extended Training Track

DES499	Extended Digital Engineering Training	6(0-40-0)
	Sub-Total	**6(0-40-0)**

Electrical Engineering (EE)

Curriculum Outline

The areas of study in electrical engineering are quite diverse. The curriculum is therefore developed to provide fundamental knowledge in several major study areas so that students will be well-prepared for work in the highly competitive and fast-moving electrical engineering professions.

The compulsory courses are designed to provide students a broad understanding of the principles, illustrated by current applications, in electrical engineering. The compulsory courses include several laboratory courses, providing hands-on learning of electric circuits, digital circuits, electronics, control system, and microprocessor. They also include a project design course emphasizing the applications of the principles under the framework of CDIO (conceiving, designing, implementing and operating) process.

By the end of the first semester of their third year, students will complete the study of most compulsory courses. The students will then choose to study in one of the two options: communication engineering or power engineering. Each option includes one laboratory course and three lecture courses covering several important areas in the corresponding options. Furthermore, through elective courses, students can further extend their knowledge with courses from another option and/or explore topics in other areas.

In the their final year, students can choose from three main options: academic exchange programs abroad, extended training programs with leading local companies, or senior projects with SIIT advisors. The last two options provide a project-based learning opportunity, in which students must integrate and apply the knowledge they have acquired throughout their study in the program.

Structure and Components

1. General Basic Courses	**30**	**Credits**
1.1 Global Awareness and Social Literacy	6	Credits
1.2 Aesthetics and Communication Skills	6	Credits
1.3 Mathematics, Science, and Technology	9	Credits
1.4 Holistic Well-Being and Skills for the Future	6	Credits
1.5 Social Services and Experiential Learning	3	Credits
2. Major Courses	**99**	**Credits**
2.1 Basic Courses	24	Credits
2.1.1 Basic Mathematics and Science Courses	14	Credits
2.1.2 Basic Engineering Courses	10	Credits
2.2 Specialized Courses	75	Credits
2.2.1 Compulsory Engineering Courses	69	Credits
2.2.2 Elective Engineering Courses	6	Credits
3. Free Elective Courses	**9**	**Credits**
Total	**138**	**Credits**

Details of the Curriculum

1. General Basic Courses — **30 Credits**

1.1 Global Awareness and Social Literacy (2 courses) — 6 Credits
GTS231   TU109

1.2 Aesthetics and Communication Skills (2 courses) — 6 Credits
LAS101   TU106

1.3 Mathematics, Science, and Technology (3 courses) — 9 Credits
GTS123   GTS124   GTS131

1.4 Holistic Well-Being and Skills for the Future (2 courses) — 6 Credits
GTS101   TU108 or TU201 or TU202 or TU301

1.5 Social Services and Experiential Learning (1 course) — 3 Credits
TU100

2. Major Courses — **99 Credits**

2.1 Basic Courses — 24 Credits

2.1.1 Basic Mathematics and Science Courses — 14 Credits
MAS116   MAS117   SCS126   SCS136
SCS176   SCS186

2.1.2 Basic Engineering Courses — 10 Credits
GTS302   IES303   MES211   SCS241

2.2 Specialized Courses — 75 Credits

2.2.1 Compulsory Engineering Courses — 69 Credits
Select one of the following two options

1) Option I: Communication Engineering

1.1 Basic Electrical Engineering
EES210   EES212   EES216   EES222
EES227   EES270   EES271   EES281
EES299   EES315   EES341

1.2 Electronics, Measurement, Instrument and Control System
EES330   EES331   EES332   EES380
EES381   EES382   EES383

1.3 Communication Theory
EES351   EES452

1.4 Signal Processing
EES477   EES478

1.5 Communication Devices and Transmission Lines
EES450   EES456   EES463

1.6 Communication Systems and Networks
EES451   EES455   EES486

2) Option II: Power Engineering

2.1 Basic Electrical Engineering
EES210   EES212   EES216   EES222
EES227   EES270   EES271   EES281
EES299   EES315   EES351

2.2 Electronics, Measurement, Instrument and Control System
EES330   EES331   EES332   EES380
EES381   EES382   EES383

2.3 Robotics and Automation
EES478

2.4 Electromechanical Energy Conversion
EES340   EES341   EES445

2.5 Electrical System and Installation Standard
EES342   EES441   EES442   EES443
EES447   EES449

2.2.2 Elective Engineering Courses — 6 Credits

2.2.2.1 Special Study — 6 Credits
Select one of the following tracks

- **Senior Project Track**
  EES300   EES498   EES499

- **Overseas Exchange Track**
  EES300   EES496   EES497

- **Extended Training Track**
  EES400

3. Free Elective Courses — **9 Credits**

Students may choose any free elective courses (not less than 9 credits in total) offered by SIIT or TU except:

1. General basic TU courses with course code 1xx.
2. Courses with contents similar to those of other courses in the curriculum that the students use for graduation.

Total Credit Requirement — **138 Credits**

EE Curriculum : 138 Credits

First Year

Semester I

GTS101	Extended English in Practice	3(3-0-6)
GTS124	Artificial Intelligence and Applications	3(3-0-6)
GTS131	Circularity for Sustainable Development	3(3-0-6)
MAS116	Mathematics I	3(3-0-6)
SCS136	Physics	3(3-0-6)
SCS186	Physics Laboratory	1(0-3-0)
TU108	Self Development and Management	3(3-0-6)
or		
TU201	Financial Literacy for Individuals	3(3-0-6)
or		
TU202	Complete Investment	3(3-0-6)
or		
TU301	Investment in the Stock Market	3(3-0-6)
	Sub-Total	**19(18-3-36)**

Semester II

GTS123	Introduction to Computers and Programming	3(2-3-4)
LAS101	Critical Thinking, Reading, and Writing	3(3-0-6)
MAS117	Mathematics II	3(3-0-6)
SCS126	Chemistry for Engineers	3(3-0-6)
SCS176	Chemistry Laboratory	1(0-3-0)
TU100	Civic Engagement	3(3-0-6)
TU106	Creativity and Communication	3(3-0-6)
	Sub-Total	**19(17-6-34)**

Second Year

Semester I

EES210	Basic Electrical Engineering Laboratory	1(0-3-0)
EES216	Circuit Analysis	3(3-0-6)
EES222	Electrical Engineering Crafting Skill	2(1-3-2)
EES227	Linear Algebra and Optimization Method	3(3-0-6)
GTS231	Law and Technology	3(3-0-6)
SCS241	Material Science for Engineers	3(3-0-6)
TU109	Innovation and Entrepreneurial mindset	3(3-0-6)
	Sub-Total	**18(16-6-32)**

Semester II

EES212	Electromagnetics	3(3-0-6)
EES270	Digital Circuits Laboratory	1(0-3-0)
EES271	Digital Circuits	3(3-0-6)
EES281	Signals and Systems	3(3-0-6)
EES299	Electrical Project Design	1(0-3-0)
EES315	Probability and Random Processes	3(3-0-6)
EES331	Electronics	3(3-0-6)
	Sub-Total	**17(15-6-30)**

Third Year

Semester I

EES332	Microelectronics and Fabrication	3(3-0-6)
EES341	Electrical Machines	3(3-0-6)
EES351	Principles of Communications	3(3-0-6)
EES381	Control Systems	3(3-0-6)
EES382	Microprocessors and IoT	3(3-0-6)
EES383	Microprocessor and IoT Laboratory	1(0-3-0)
GTS302	Technical Writing	1(0-3-0)
	Sub-Total	**17(15-6-30)**

Semester II

Select either 1) Senior Project Track, 2) Overseas Exchange Track, or 3) Extended Training Track.

EES330	Electronics and Microelectronics Laboratories	1(0-3-0)
EES380	Control Systems Laboratory	1(0-3-0)
EES478	Computer Vision	3(3-0-6)
MES211	Thermofluids	3(3-0-6)

Option I: Communication Engineering

EES450	Communications Laboratory	1(0-3-0)
EES451	Data Communications and Networks	3(3-0-6)
EES452	Digital Communication Systems	3(3-0-6)
EES477	Signal Processing for Communication Systems	3(3-0-6)

Option II: Power Engineering

EES340	Electrical Machines Laboratory	1(0-3-0)
EES342	Electrical Power System	3(3-0-6)
EES442	Power Electronics	3(3-0-6)
EES447	Power Plants and Substations	3(3-0-6)

1) Senior Project Track and 2) Overseas Exchange Track

	Sub-Total	**18(x-x-x)**

3) Extended Training Track

XXXxxx	Free Elective(s)	3(x-x-x)
	Sub-Total	**21(x-x-x)**

Summer

1) Senior Project Track and 2) Overseas Exchange Track

EES300	Electrical Engineering Training	1(0-40-0)
	Sub-Total	**1(0-40-0)**

Fourth Year

Semester I

IES303	Engineering Management and Cost Analysis	3(3-0-6)

Option I: Communication Engineering

EES455	Wireless Communications	3(3-0-6)
EES456	Optical Communications	3(3-0-6)
EES463	Electromagnetic Waves and Applications	3(3-0-6)
EES486	Embedded Systems and IoT	3(3-0-6)

Option II: Power Engineering

EES441	Electrical System Design and Safety	3(3-0-6)
EES443	High Voltage Engineering	3(3-0-6)
EES445	Renewable Energy and Energy Management	3(3-0-6)
EES449	Smart Grid Technology	3(3-0-6)

1) Senior Project Track

EES498	Electrical Engineering Project I	2(0-6-0)
XXXxxx	Free Elective(s)	3(x-x-x)
	Sub-Total	**20(x-x-x)**

2) Overseas Exchange Track

XXXxxx	Free Elective(s)	3(x-x-x)
	Sub-Total	**18(x-x-x)**

3) Extended Training Track

XXXxxx	Free Elective(s)	6(x-x-x)
	Sub-Total	**21(x-x-x)**

Semester II

1) Senior Project Track

EES499	Electrical Engineering Project II	3(0-9-0)
XXXxxx	Free Elective(s)	6(x-x-x)
	Sub-Total	**9(x-x-x)**

2) Overseas Exchange Track

EES496	Special Studies in EE I	3(3-0-6)
EES497	Special Studies in EE III	2(2-0-4)
XXXxxx	Free Elective(s)	6(x-x-x)
	Sub-Total	**11(x-x-x)**

3) Extended Training Track

EES400	Extended Electrical Engineering Training	6(0-40-0)
	Sub-Total	**6(0-40-0)**

Industrial Engineering and Smart Logistics (IE)

Curriculum Outline

Industrial Engineering and Smart Logistics (IE) program integrates and applies industrial engineering principles, digital, and smart technologies to effectively design and operate the logistics and supply chain systems. The curriculum has outstanding characteristics in addition to IE principles and techniques. First, it focuses on logistics and supply chain systems with a network of suppliers, own company, and customers. Productivity, efficiency, profitability, and cost effectiveness of own company may be limited by constraints at suppliers and customers. Thus, enlargement of the application scope can improve the performances of the system. Second, digital and smart technologies, e.g., artificial intelligence, machine learning, business intelligence, data analytics, internet of things (IoT), smart sensors, virtual and augmented realities, and flexible automations, allow Industrial Engineers to visualize, predict, and optimize system performances easily and accurately. Third, the curriculum allows students to earn credits from various ways of learning outside classrooms, e.g., learning from participation in national and international competitions, learning from development of intellectual properties, learning from full-time on-the-job training in companies, and learning from startup business building. Finally, the curriculum encourages active learning using active learning rooms where lectures, workshops, experiments, group discussions, group works, and presentations can be done seamlessly in the same room.

Industrial Engineering and Smart Logistics is a combination of basic engineering knowledge, quantitative analysis techniques, and smart technologies to support managerial decision making. It is concerned with the efficiency in which work is performed by machines and people. Industrial engineers (IEs) use the information and techniques from physical, mathematical, behavioral, engineering sciences, and digital and smart technologies to plan, control, design, and manage complex manufacturing and business systems in a supply chain.

The study of Industrial Engineering and Smart Logistics places emphasis upon developing a student's abilities to analyze and design systems that integrate technical, economic, and social behavioral factors in manufacturing, service, social, and government organizations. The IE study leads to a variety of professional opportunities in the manufacturing and logistics industry, health care services, research and development, financial centers, public service enterprises, and business corporations.

In addition, IE students can choose among four optional tracks, namely, Senior Project Track, Overseas Exchange Track, Extended Training Track, and Startup Business Building Track.

- **Senior Project Track** is for students who would like to conduct their projects under the supervision of IE faculty members.
- **Overseas Exchange Track** is designed for students who wish to participate in a student exchange program with foreign partner universities.
- **Extended Training Track** is for students who would like to perform full-time on-the-job training for the entire semester under co-supervision between IE faculties and collaborative companies.
- **Startup Business Building Track** is for students who wish to develop a startup business based on their innovative ideas under supervision of IE faculties and external experts.

Structure and Components

1.	**General Basic Courses**	**30**	**Credits**
	1.1 Global Awareness and Social Literacy	6	Credits
	1.2 Aesthetics and Communication Skills	6	Credits
	1.3 Mathematics, Science, and Technology	9	Credits
	1.4 Holistic Well-Being and Skills for the Future	6	Credits
	1.5 Social Services and Experiential Learning	3	Credits
2.	**Major Courses**	**99**	**Credits**
	2.1 Basic Courses	42	Credits
	2.1.1 Basic Mathematics and Sciences Courses	17	Credits
	2.1.2 Basic Engineering Courses	25	Credits
	2.2 Specialized Courses	57	Credits
	2.2.1 Compulsory Engineering Courses	45	Credits
	2.2.2 Elective Engineering Courses	12	Credits
3.	**Free Elective Courses**	**9**	**Credits**
	Total	<u>138</u>	Credits

Details of the Curriculum

1.	**General Basic Courses**	**30**	**Credits**
	1.1 Global Awareness and Social Literacy (2 courses)	6	credits
	GTS231 TU109		
	1.2 Aesthetics and Communication Skills (2 courses)	6	credits
	LAS101 TU106		
	1.3 Mathematics, Science, and Technology (3 course)	9	credits
	GTS123 GTS124 GTS131		
	1.4 Holistic Well-Being and Skills for the Future (2 courses)	6	credits
	GTS101 TU108 or TU201 or TU202 or TU301		
	1.5 Social Services and Experiential Learning (1 course)	3	credits
	TU100		
2.	**Major Courses**	**99**	**Credits**
	2.1 Basic Courses	42	Credits
	2.1.1 Basic Mathematics and Science Courses	17	Credits
	IES201 MAS116 MAS117 SCS126 SCS136		
	SCS176 SCS186		
	2.1.2 Basic Engineering Courses	25	Credits
	EES203 EES204 GTS302 IES301 IES302 IES308		
	MES211 MES231 MES300 MES390 SCS241		
	2.2 Specialized Courses	57	Credits
	2.2.1 Compulsory Engineering Courses	45	Credits
	1) Materials and Modern Manufacturing Process	8	Credits
	IES332 IES337 IES361 IES362		
	2) Work Systems and Safety	7	Credits
	IES312 IES315 IES343		
	3) Quality Systems	6	Credits
	IES331 IES391		
	4) Economic and Finance	6	Credits
	IES341 IES342		
	5) Production and Operations Management	9	Credits
	IES321 IES323 IES351		
	6) Integration of Industrial Engineering Techniques	9	Credits
	IES313 IES333 IES376		
	2.2.2 Elective Engineering Courses	12	Credits
	Students can choose among four optional tracks:	6	Credits
	1. For students who wish to join the Senior Project Track	**12**	**Credits**
	IES304 IES305 IES401		
	(and Select 6 credits from the list of IE Technical Elective Course: 2.2.2.1)		
	2. For students who wish to join the Overseas Exchange Track	**12**	**Credits**
	IES304 IES402 IES405		
	(and Select 6 credits from the list of IE Technical Elective Course: 2.2.2.1)		
	3. For students who wish to join the Extended Training Track	**12**	**Credits**
	IES404		
	4. For students who wish to join the Startup Business Building Track	**9**	**Credits**
	IES406		
	(and Select 3 credits from the list of IE Technical Elective Course: 2.2.2.1)		
	2.2.2.1 IE Technical Elective in Industrial Engineering		
	Select IE Technical Elective course from the following courses:		
	IES324 IES334 IES335 IES336 IES345		
	IES353 IES363 IES364 IES365 IES372		
	IES374 IES377 IES378 IES392 IES394		
	IES395 IES396 IES403		
3.	**Free Elective Courses**	**9**	**Credits**

Students may choose any free elective courses (not less than 9 credits in total) offered by SIIT or TU except:

1. General basic TU courses with course code 1xx.
2. Courses with contents similar to those of other courses in the curriculum that the students use for graduation.

Total Credit Requirement	**<u>138</u>**	**Credits**

IE Curriculum : 138 Credits

First Year

Semester I

GTS101	Extended English in Practice	3(3-0-6)
GTS124	Artificial Intelligence and Applications	3(3-0-6)
GTS131	Circularity for Sustainable Development	3(3-0-6)
MAS116	Mathematics I	3(3-0-6)
SCS136	Physics	3(3-0-6)
SCS186	Physics Laboratory	1(0-3-0)
TU108	Self Development and Management	3(3-0-6)
or		
TU201	Financial Literacy for Individuals	3(3-0-6)
or		
TU202	Complete Investment	3(3-0-6)
or		
TU301	Investment in the Stock Market	3(3-0-6)
	Sub-Total	**19(18-3-36)**

Semester II

GTS123	Introduction to Computers and Programming	3(2-3-4)
LAS101	Critical Thinking, Reading, and Writing	3(3-0-6)
MAS117	Mathematics II	3(3-0-6)
SCS126	Chemistry for Engineers	3(3-0-6)
SCS176	Chemistry Laboratory	1(0-3-0)
TU100	Civic Engagement	3(3-0-6)
TU106	Creativity and Communication	3(3-0-6)
	Sub-Total	**19(17-6-34)**

Second Year

Semester I

EES203	Basic Electrical Engineering	3(3-0-6)
IES201	Industrial Engineering Mathematics	3(3-0-6)
IES301	Manufacturing Processes	3(2-3-4)
IES308	Manufacturing Process Laboratory	1(0-3-0)
MES231	Engineering Mechanics	3(3-0-6)
MES300	Engineering Drawing	3(2-3-4)
SCS241	Material Science for Engineers	3(3-0-6)
	Sub-Total	**19(16-9-32)**

Semester II

EES204	Basic Electrical Engineering Laboratory	1(0-3-0)
IES302	Engineering Statistics	3(3-0-6)
IES312	Methods Analysis and Work Measurement	3(3-0-6)
IES341	Engineering Economy	3(3-0-6)
IES361	Manufacturing Process Design	3(3-0-6)
MES211	Thermofluids	3(3-0-6)
TU109	Innovation and Entrepreneurial mindset	3(3-0-6)
	Sub-Total	**19(18-3-36)**

Third Year

Semester I

GTS231	Law and Technology	3(3-0-6)
IES315	Methods Analysis and Work Measurement Laboratory	1(0-3-0)
IES321	Operations Research I	3(3-0-6)
IES331	Quality Control	3(3-0-6)
IES343	Safety Engineering	3(3-0-6)
IES391	Applied Statistical Methods	3(3-0-6)
XXXxxx	Free Elective(s)	3(x-x-x)
	Sub-Total	**19(x-x-x)**

Semester II

GTS302	Technical Writing	1(0-3-0)
IES313	Industrial Plant Design	3(3-0-6)
IES323	Production Planning and Control	3(3-0-6)
IES342	Industrial Cost Analysis and Control	3(3-0-6)
IES362	Manufacturing Engineering Lab. I	1(0-3-0)
IES376	Logistics and Supply Chain Management	3(3-0-6)
MES390	Basic Mechanical Engineering Laboratory	1(0-3-0)
XXXxxx	Free Elective(s)	3(x-x-x)
	Sub-Total	**18(x-x-x)**

Summer

Select either 1) Senior Project Track or 2) Overseas Exchange Track or 3) Extended Training Track or 4) Startup Business Building Track.

1) Senior Project Track and

2) Overseas Exchange Track:

IES304	Industrial Engineering Training	1(0-40-0)
	Sub-Total	**1(0-40-0)**

Fourth Year

Semester I

1) Senior Project Track:

IES305	Industrial Engineering Project I	1(0-3-0)
IES332	Factory Automation and Intelligent Control	3(3-0-6)
IES333	Product Design and Development	3(3-0-6)
IES337	Smart Industrial Engineering and Logistics Laboratory	1(0-3-0)
IES351	Maintenance Engineering and Intelligent Technologies	3(3-0-6)
XXXxxx	Free Elective(s)	3(x-x-x)
	Sub-Total	**14(x-x-x)**

2) Overseas Exchange Track and

3) Extended Training Track and

4) Startup Business Building Track:

IES332	Factory Automation and Intelligent Control	3(3-0-6)
IES333	Product Design and Development	3(3-0-6)
IES337	Smart Industrial Engineering and Logistics Laboratory	1(0-3-0)
IES351	Maintenance Engineering and Intelligent Technologies	3(3-0-6)
XXXxxx	Free Elective(s)	3(x-x-x)
	Sub-Total	**13(x-x-x)**

Semester II

1) Senior Project Track:

IES401	Industrial Engineering Project II	4(0-12-0)
IESxxx	IE Technical Elective(s)	6(x-x-x)
	Sub-Total	**10(x-x-x)**

2) Overseas Exchange Track:

IES402	Special Studies in IE I	3(3-0-6)
IES405	Special Studies in IE III	2(2-0-4)
IESxxx	IE Technical Elective(s)	6(x-x-x)
	Sub-Total	**11(x-x-x)**

3) Extended Training Track:

IES404	Full-time on the Job Training in Industries	12(0-36-36)
	Sub-Total	**12(x-x-x)**

4) Startup Business Building Track:

IES406	Startup Business Building	9(0-27-27)
IESxxx	IE Technical Elective(s)	3(x-x-x)
	Sub-Total	**12(x-x-x)**

Mechanical Engineering (ME)

Curriculum Outline

Mechanical engineering is concerned with the mechanisms of energy conversion and their utilization in all fields of industry, as well as in improving the quality of life for everyone. The mechanical engineering discipline has always been central to engineering. Mechanical engineers are involved in a wide range of technological activities which include: production, building-facilities, chemical processing, power generation, material science, mining and mineral extraction, transportation, aerospace engineering, and so on. For these reasons, all industries require the services of mechanical engineers. The aim of the Mechanical Engineering Program at SIIT is to provide an effective education to prospective engineers, giving them the ability to plan, administer, and manage the latest technologies.

Engineering science is taught mainly in the first and second years. Specialized mechanical engineering courses are offered to the third and fourth year students. Additionally, fundamentals of electrical engineering and industrial practice are included in the undergraduate program in mechanical engineering.

In order to serve industry competently, students have to be exposed to real equipment and processes. Two laboratory courses are required. An extended laboratory course is offered as an elective subject to senior projects, and guided by members of the teaching staff. As engineering students should obtain some experience of industry in order to learn the ways of industrial life and work, an industrial training course is offered for mechanical engineering students.

In addition, ME students can choose among three optional tracks (Senior Project Track, Overseas Exchange Track, and Extended Training Track).

- Senior Project Track is designed for ME students who wish to conduct a project under the supervision of ME faculty members.
- Overseas Exchange Track is designed for students who wish to participate in a student exchange program with foreign partner universities.
- Extended Training Track is designed for students who wish to conduct a co-operative training program in industry.

Structure and Components

1)	**General Basic Courses**	**30**	**Credits**
1.1	Global Awareness and Social Literacy	6	Credits
1.2	Aesthetics and Communication Skills	6	Credits
1.3	Mathematics, Science, and Technology	9	Credits
1.4	Holistic Well-Being and Skills for the Future	6	Credits
1.5	Social Services and Experiential Learning	3	Credits
2.	**Major Courses**	**100**	**Credits**
2.1	Basic Courses	53	Credits
	2.1.1 Basic Mathematics and Sciences Courses	17	Credits
	2.1.2 Basic Engineering Courses	36	Credits
2.2	Specialized Courses	47	Credits
	2.2.1 Compulsory Engineering Courses	40	Credits
	2.2.2 Elective Engineering Courses	7	Credits
3.	**Free Elective Courses**	**9**	**Credits**
	Total	**139**	**Credits**

Details of the Curriculum

1.	**General Basic Courses**	**30**	**Credits**
1.1	Global Awareness and Social Literacy (2 courses)	6	Credits
	GTS231 TU109		
1.2	Aesthetics and Communication Skills (2 courses)	6	Credits
	LAS101 TU106		
1.3	Mathematics, Science, and Technology (3 courses)	9	Credits
	GTS123 GTS124 GTS131		
1.4	Holistic Well-Being and Skills for the Future (2 courses)	6	Credits
	GTS101 TU108 or TU201 or TU202 or TU301		
1.5	Social Services and Experiential Learning (1 course)	3	Credits
	TU100		
2.	**Major Courses**	**100**	**Credits**
2.1	Basic Courses	53	Credits
	2.1.1 Basic Mathematics and Sciences Courses	17	Credits
	MAS116 MAS117 SCS126 SCS136		
	SCS176 SCS186 MES210		
	2.1.2 Basic Engineering Courses	36	Credits
	EES203 EES204 GTS302 IES301 IES308		
	IES361 MES300 MES301 MES311 MES331		
	MES341 MES350 MES351 MES391 SCS241		
2.2	Specialized Courses	47	Credits
	2.2.1 Compulsory Engineering Courses	40	Credits

1. Machinery — 9 Credits
MES333   MES352   MES462

2. Heat, Cooling and Applied Fluids — 9 Credits
MES321   MES342   MES482

3. Dynamic Systems and Automatic Control — 15 Credits
IES394   MES382   MES383   MES384   MES486

4. Mechanical Systems — 7 Credits
IES341   MES392   MES484

2.2.2 Elective Engineering Courses — 7 Credits
Students choose one of three optional tracks:

1. For Students who wish to join the Senior Project Track
MES303   MES401   MES403   MES404

2. For Students who wish to join the Overseas Exchange Track
MES303   MES401   MES403   MES405   MES406

3. For Students who wish to join the Extended Training Track
MES401   MES408

3. Free Elective Courses — **9 Credits**
Students may choose any free elective courses (not less than 9 credits in total) offered by SIIT or TU except:
1. General basic TU courses with course code 1xx.
2. Courses with contents similar to those of other courses in the curriculum that the students use for graduation.

Total Credit Requirement — **139 Credits**

ME Curriculum : 139 Credits

First Year
Semester I
GTS101	Extended English in Practice	3(3-0-6)
GTS124	Artificial Intelligence and Applications	3(3-0-6)
GTS131	Circularity for Sustainable Development	3(3-0-6)
MAS116	Mathematics I	3(3-0-6)
SCS136	Physics	3(3-0-6)
SCS186	Physics Laboratory	1(0-3-0)
TU108	Self Development and Management	3(3-0-6)
or		
TU201	Financial Literacy for Individuals	3(3-0-6)
or		
TU202	Complete Investment	3(3-0-6)
or		
TU301	Investment in the Stock Market	3(3-0-6)
	Sub-Total	**19(18-3-36)**

Semester II
GTS123	Introduction to Computers and Programming	3(2-3-4)
LAS101	Critical Thinking, Reading, and Writing	3(3-0-6)
MAS117	Mathematics II	3(3-0-6)
SCS126	Chemistry for Engineers	3(3-0-6)
SCS176	Chemistry Laboratory	1(0-3-0)
TU100	Civic Engagement	3(3-0-6)
TU106	Creativity and Communication	3(3-0-6)
	Sub-Total	**19(17-6-34)**

Second Year
Semester I
EES203	Basic Electrical Engineering	3(3-0-6)
IES301	Manufacturing Processes	3(3-0-6)
IES308	Manufacturing Processes Laboratory	1(0-3-0)
MES300	Engineering Drawing	3(2-3-4)
MES311	Thermodynamics	3(3-0-6)
MES350	Engineering Statics	3(3-0-6)
TU109	Innovation and Entrepreneurial mindset	3(3-0-6)
	Sub-Total	**19(17-6-34)**

Semester II
EES204	Basic Electrical Engineering Laboratory	1(0-3-0)
MES210	Applied Mathematics for Mechanical Engineers	3(3-0-6)
MES301	Computer Aided Mechanical Engineering Design	2(1-3-2)
MES331	Solid Mechanics	3(3-0-6)
MES341	Fluid Mechanics	3(3-0-6)
MES351	Engineering Dynamics	3(3-0-6)
SCS241	Material Science for Engineers	3(3-0-6)
	Sub-Total	**18(16-6-32)**

Third Year
Semester I
GTS302	Technical Writing	1(0-3-0)
IES341	Engineering Economy	3(3-0-6)
IES361	Manufacturing Process Design	3(3-0-6)
MES321	Heat Transfer	3(3-0-6)
MES352	Mechanics of Machinery	3(3-0-6)
MES382	Mechanical Vibration	3(3-0-6)
MES391	Mechanical Engineering Laboratory I	1(0-3-0)
	Sub-Total	**17(15-6-30)**

Semester II
GTS231	Law and Technology	3(3-0-6)
MES333	Design of Machine Elements	3(3-0-6)
MES342	Refrigeration and Air Conditioning	3(3-0-6)
MES383	Hydraulic and Pneumatic Control	3(3-0-6)
MES384	Measurement and Instrumentation	3(3-0-6)
MES392	Mechanical Engineering Laboratory II	1(0-3-0)
MES401	Seminar in Mechanical Engineering	1(0-2-1)
	Sub-Total	**17(15-5-31)**

Summer
Select either Senior Project Track, Overseas Exchange Track, or Extended Training Track.

1. Senior Project Track and 2. Overseas Exchange Track
MES303	Mechanical Engineering Training	1(0-40-0)
	Sub-Total	**1(0-40-0)**

3. Extended Training Track
XXXxxx	Free Elective(s)	6(x-x-x)
	Sub-Total	**6(x-x-x)**

Fourth Year
Semester I
1. Senior Project Track and 2. Overseas Exchange Track
IES394	Artificial Intelligence and Industrial Applications	3(3-0-6)
MES403	Mechanical Engineering Project I	1(0-2-1)
MES462	Turbomachinery	3(3-0-6)
MES482	Power Generation Systems and Environmental Impacts	3(3-0-6)
MES484	Automatic Control	3(3-0-6)
MES486	Robotics	3(3-0-6)
XXXxxx	Free Elective(s)	3(x-x-x)
	Sub-Total	**19(x-x-x)**

3. Extended Training Track
IES394	Artificial Intelligence and Industrial Applications	3(3-0-6)
MES462	Turbomachinery	3(3-0-6)
MES482	Power Generation Systems and Environmental Impacts	3(3-0-6)
MES484	Automatic Control	3(3-0-6)
MES486	Robotics	3(3-0-6)
XXXxxx	Free Elective(s)	3(x-x-x)
	Sub-Total	**18(x-x-x)**

Semester II
1. Senior Project Track
MES404	Mechanical Engineering Project II	4(0-12-0)
XXXxxx	Free Elective(s)	6(x-x-x)
	Sub-Total	**10(x-x-x)**

2. Overseas Exchange Track
MES405	Special Study in Mechanical Engineering I	2(2-0-4)
MES406	Special Study in Mechanical Engineering II	2(2-0-4)
XXXxxx	Free Elective(s)	6(x-x-x)
	Sub-Total	**10(x-x-x)**

3. Extended Training Track
MES408	Extended Mechanical Engineering Training	6(0-40-0)
	Sub-Total	**6(0-40-0)**

Course Descriptions

Numerical Code

For the engineering and technology courses, the following numerical codes are used.

- The first digit indicates the level of difficulty.
- The second digit indicates the course groups.

For common courses, the above codes do not apply.

The numbers after each course (e.g., 3(3-0-6)) represent the credits, lecture hours, laboratory/practice hours, and self study hours, respectively.

Prerequisite / Corequisite Requirements

It is the responsibility of the student to meet all prerequisite and corequisite requirements. Students may not be allowed to take a course if its prerequisites have not been satisfactorily passed. A corequisite course must be taken concurrently or must have been previously passed.

BAS111 Principles of Business and Management   3(3-0-6)
Prerequisite: None
An overview of the world of business preparing students for various business-related subjects. A comprehensive introduction of in any aspects of business and the environment in which business operates. The fundamentals of business, covering functional areas of management: accounting, marketing, operations, information systems, finance, and legal studies. A study of organization and management. Evolution of thought and theory of management. Management functions: planning, organizing, directing, and controlling. Human factors in organizations. Management ethics.

BAS130 Calculus for Technologists   3(3-0-6)
Prerequisite: None
Real numbers, functions and their graphs: polynomial, rational, exponential, logarithmic, and trigonometric functions. Analytic trigonometry. Limits and continuity of functions. Derivatives. Rules of differentiation. Product and quotient rules. Higher order derivatives. Chain rule. Derivative of implicit functions. Indefinite integration and techniques of integration. Integration by substitution. Integration by parts. Applications in management, and social sciences.

BAS131 Statistical Methods for Managers   3(3-0-6)
Prerequisite: None
Fundamentals of statistics. Sampling distribution. Central Limit Theorem. Point estimation. The basic notions of statistical inference. Confidence interval estimation and tests of hypothesis. One and two sample t-tests. One-way analysis of variance. Analysis of variance. A simple regression analysis. Examples and applications in class, selected for managers.

BAS210 Principles of Marketing   3(3-0-6)
Prerequisite: None
Definition and roles of marketing, modern marketing concepts; marketing system, consumer behavior, marketing mix, tools for marketing management and responsibility, ethics of marketers.

**BAS211 Fundamentals of Financial and   3(3-0-6)
          Managerial Accounting**
Prerequisite: None
An introduction to both financial and managerial accounting. Analysis and evaluation of accounting information as part of the managerial processes of planning, decision-making, and control. A basic overview of financial accounting: basic accounting concepts and principles, and structure of financial statements. A basic overview of managerial accounting: development and use of accounting information for internal decisions, cost behavior and analysis, product and service costing, and relevant costs for internal decision-making.

BAS212 Business Finance   3(3-0-6)
Prerequisite: None
Basic principles in financial management: roles, functions, and objectives of financial management, various types of business organizations, financial statement analysis, time value of money, management of cash flow, risk and return, and sources of financing.

BAS213 Business Information Systems   3(3-0-6)
Prerequisite: None
Relationships between information systems and organization: information systems in global business, strategic uses of information systems; information systems in business functions, IT infrastructure, telecommunications and networks, Information systems security, electronic commerce, data and knowledge management, decision support systems, and systems development.

BAS214 Operations Management and Analytics   3(3-0-6)
Prerequisite: None
Functions in modern manufacturing and service organizations: operation strategy, decision analysis, operating system design, facility design, project management, supply-chain management, forecasting, capacity and aggregate planning, inventory management, scheduling, and quality management. Applications of predictive and prescriptive analytics by using a spreadsheet optimization and simulation.

BAS215 Economics for Technologists   3(3-0-6)
Prerequisite: None
The principles of micro and macro economics with applications in basic economic problems and applications for technologists. Factors that influence supply and demand of products. Consumer behavior. Individual and market demand. Production. Cost of production. Profit maximization and competitive supply. Analysis of competitive markets. Market structures and competitive strategy. Pricing with market power. Markets with asymmetric information. Analysis of Gross National Product. Determination of National Income. Fiscal and monetary policies. Importance of international trade and finance on balance of payments and national income.

BAS230 Introduction to Management Science   3(3-0-6)
Prerequisite: None
Applications of quantitative methods: linear programming modeling, graphical method for linear programming and sensitivity analysis, assignments problems, network models, integer linear programming, goal programming, analytic hierarchy process, decision analysis, project management, simulation, and forecasting models.

BAS240 Data Analytics Programming   3(2-2-5)
Prerequisite: None
Data: variable, variable types, types conversion, pivot, unpivot, aggregation and granularity. Data preprocessing: data exploratory, preprocessing, missing value, outlier. Multiple data sources: relation, join, merge. Data analytics: descriptive analytics, diagnostic analytics, predictive analytics, prescriptive analytics, Machine learning: unsupervised learning, supervised learning, semi-supervised learning. Visualization: distribution, histogram, box plots, scatter plots, correlation, linear regression. Data storytelling process

**BAS241 Applied Business Analytics and   3(2-2-5)
        Optimization for Decision Making**
Prerequisite: None
Basic theories and models used in optimization, decision making, data analytics, machine learning, forecasting, and simulation. Hands-on experience using selected software or spreadsheet tools: Basic to advanced spread-sheet skills, basic formulas in spreadsheets, vlookup, pivot table, simple VBA, Solver, time-series and panel data forecasting tools, decision trees, Monte Carlo simulation, business intelligence software such as Power Query/BI/Pivot and/or other machine learning tools.

BAS300 Business and Supply Chain Analytics Training   1(0-40-0)
Prerequisite: Have credits earned of not less than 85 credits
Students are provided with on-the-job training at selected industrial or service organizations. The purposes of this course are to allow the students opportunities to learn through hands-on experience how various modern technologies can be applied to manage facilities and systems. Moreover, students learn how to collaborate with co-workers, coordinate project activities, and develop self-responsibility. The training period must not less than 240 hours. Students must submit a written report at the end of the training period. Satisfactory (S) or unsatisfactory (U) grade will be given based on the student's performance, the quality of the report, and the supervisor's comments.

BAS321 Production and Inventory Management   3(3-0-6)
Prerequisite: None
Relationship between inventory and production. Qualitative and quantitative approaches for production. Inventory management of both dependent and independent demands: economic order quantity (EOQ), economic lot sizing (EPSO), just in time (JIT), materials requirement planning (MRP), manufacturing resources planning (MRP II), enterprise resources planning (ERP), production planning, and capacity planning.

BAS330 Basic Engineering   3(3-0-6)
Prerequisite: None
Fundamental principles of Thermodynamics and Electrical Engineering: thermodynamic system, properties, phase equilibrium of pure substances, equations of state for gases, tables of thermodynamic properties, work and heat. First and second law of thermodynamics, basic heat transfer and energy conversion, entropy. Electrical signals, basic circuit theory. DC and AC analysis. Kirchoff's law. Thevenin theorem. Three-phase circuits. Basic electronic devices and circuits. Fundamental of operational amplifiers. Fundamental of power systems. Schematic diagram. One-line diagram. DC and AC motor and generator modeling.

BAS331 Statistics for Data Science and Empirical Study 3(2-2-5)
Prerequisite: None
Linear parametric and non-parametric methods of regression and classification. Simple regression. Multiple regression. Binary logistic regression. Multinomial (nominal and ordinal) logistic regression. Discriminant analysis. Non-parametric regression and classification. Principal components analysis and dimension reduction. Time series. Hand-on experience using software such as R or other equivalent software. Examples in class, selected for data scientists.

BAS340 Machine Learning for Business Analytics   3(2-2-5)
Prerequisite: None
Classification theory. Bayesian and linear discriminant analysis. Machine learning. Reinforcement learning. Neural networks. Basic natural language processing. Statistical modeling: dimension reduction, regression analysis, advanced regression analysis, data mining, supervised learning, unsupervised learning, forecasting with time series data. Emphasis on business analytics applications. Hands-on experience using software.

BAS341 Database Systems and Applications   3(2-2-5)
Prerequisite: None
Logical data models, relational database systems, structured query language (SQL), conceptual modeling; database design, Web-connected databases, transaction management, data warehousing, data mining, and database application.

BAS350 Enterprise Planning and Control Systems   3(3-0-6)
Prerequisite: None
The design, analysis, and implementation of enterprise-wide resource planning and control systems; demand forecasting, aggregate planning, decision support models for production planning, master scheduling, shop floor control; application of information technologies, such as ERP and MRP II, to operations planning and control.

**BAS351 Management Optimization and   3(3-0-6)
        Prescriptive Analytics**
Prerequisite: None
Basic operations research models and their applications. Linear programming. Simplex method. Duality and sensitivity analysis. Transportation model. Nonlinear programming. Non-linear optimization. Game theory, and Queuing models. Application of Prescriptive Analytics in Business.

BAS352 Supply Chain Management and Analytics   3(3-0-6)
Prerequisite: None
Principles of domestic and international supply chain systems: introduction to logistics, transportation, production planning, inventory control, purchasing and procurement, packaging, supply chain integration, and information technology for supply chain management. Applications of Metrics and Analytics to monitor and improve a supply chain. Service level segmentation and return on availability. Cryptocurrency and related technologies. Applications of Cryptocurrency in Supply Chain.

BAS353 Inventory Management and Analytics   3(3-0-6)
Prerequisite: None
Introduction to inventory management. Types of inventories. Inventory problem classifications. Inventory cost. Independent demand systems. Deterministic and probabilistic models. Just-in-time (JIT). Example of Inventory data for classification. Usage of Metrics in Inventory. Usage of Predictive and Prescriptive Analytics to make decision using a spreadsheet optimization and simulation.

**BAS354 Transportation, Warehouse and   3(3-0-6)
        Logistics Management**
Prerequisite: None
Theories, tools, techniques, and technologies to manage transportation, warehouse, and logistics systems. Introduction to logistics management. Supply chain drivers. Roles of logistics in supply chain. Transportation modes: motor, railroad, air, water, and intermodal modes. Inventory models with transportation choices. Global transportation. Designing of distribution networks. Information technology in transportation. Logistic strategies and other advanced topics in logistics and supply chain management. Fundamentals of warehouse managements, such as warehousing, warehouse technology, and best practice of modern warehouse operations.

BAS355 Simulation and Predictive Analytics   3(2-2-5)
Prerequisite: None
A study of the application of computer simulation software to model business decision making problems and statistics problems. Discrete-event simulation approaches. Simulated data analysis. Simulation variance reduction techniques. Application of predictive analytics to forecast business outcomes given business settings.

BAS356 Strategic Sourcing and Supply Management 3(3-0-6)
Prerequisite: None

Cooperative efforts across internal functions and external business partners to eliminate inefficiencies in the supply chain. Purchasing aspects: purchasing process, policy, supply chain integration, and purchasing in organizations. Sourcing topics: concepts and principles of strategic sourcing, internal analysis, strategic approach in procuring different inputs, supplier strategy, fact-based negotiation, required infrastructure of supply management, supplier evaluation, selection and development, contract management, outsourcing issues and global sourcing.

BAS357 Economic Decision Analysis 3(3-0-6)
Prerequisite: None

Economic principles. Analytical tools, and concepts for managerial decision-making: cash flow analysis, capital budgeting, project valuation techniques. Feasibility study appraisal and analysis: financial analysis parameters, investment appraisal analysis, sensitivity analysis and risk analysis for investment alternatives.

BAS358 Lean, Internet of Things and Quality Management 3(3-0-6)
Prerequisite: None

Quality control and management in both manufacturing and service environments. Strategic importance of quality. Quality and productivity relationships. Statistical process statistical control methods. Techniques for design of experiments. Problem solving tools for quality assurance. Concepts of quality systems: six sigma, TQM, ISO9000 standards and lean manufacturing. Kaizen. Toyota production system. Types of waste and waste reduction. Lean philosophy in various areas. Basic Internet of Things (IoT). Application of IoT in lean manufacturing. Application of quality management in services.

BAS359 Facility Location and Layout Planning 3(3-0-6)
Prerequisite: None

A study of production facilities: location, planning, design and maintenance, production systems, machine selection, automation, material handling, storage and warehousing, quality, retrofitting, and preventative maintenance.

BAS360 Applied Data Analytics and Visualization Programming 3(2-2-5)
Prerequisite: None

Emphasis on hand-on practice using R/Python programming or other Machine learning (e.g., Weka, RapidMiner) and Visualization software (e.g., Tableau, Power BI). Case studies in Business and Supply Chain Analytics. Classification: k-nearest neighbor, Naïve bayes. Affinity-based marketing. Association Rule Mining. Recommender system. Clustering. Text mining. Principles and techniques for data visualization. Graphical depictions of data that can improve comprehension, communication, and decision-making. Understanding data and suitable data visualization. Representing data. Exploring data visuality.

BAS361 Digital Transformation and Robotic Process Automation 3(2-2-5)
Prerequisite: None

Digital Transformation Strategies. Process and production innovation. Business model innovation. Leadership and people management. Platform Strategies. Digital Supply Chain. Implementing digital technologies. Business process perspectives: process management, process modeling, analysis, and design. Business process management framework. BPM implementation strategies. Business process architecture. Basics of Robotic Process Automation (RPA): RPA implementation plan, automated business processes, challenges, and risks of RPA implementation.

BAS362 Marketing Analytics 3(2-2-5)
Prerequisite: None

Introduction to marketing analytics. Data management. Exploratory data analytics using cognitive analytics. Data visualization. Applications of regression analysis and Neural networks in marketing. Automated machine learning. Applications of cluster analysis in marketing. Market basket analysis. Basic natural language processing in marketing. Social network analysis. Digital marketing analytics.

BAS363 Data Mining and Web Analytics 3(2-2-5)
Prerequisite: None

Overview of data mining and web data mining. Mining frequent patterns: market basket analysis, association rule mining. Predictive modeling concept. Classification and prediction: decision tree, Bayesian, distance-based, k-nearest neighbors. Basic clustering concepts and algorithms. Clustering application in web mining. Data preparation for web usage analytics, web scraping. Web usage mining for e-business analytics. e-business analytics case studies. Hands-on experience using software.

BAS364 Enterprise Resource Planning Software 3(2-2-5)
Prerequisite: None

Introduction to the integrated business planning and execution systems currently in use by most large and medium-sized organizations. The focus of this course is on fundamentals of enterprise resource planning (ERP) systems, and the importance of integrated information systems in an organization. The implementation process of ERP is discussed. An illustration of a small business firm with the functions of procurement, production, and sales, using commercial ERP software.

BAS365 Business Information Systems Analysis 3(3-0-6)
Prerequisite: None

Systems development life cycle, project planning, investigation, requirements definition, system specifications, alternative selection. Tools and techniques of object-oriented development and structured development.

BAS366 Digital Marketing 3(3-0-6)
Prerequisite: None

Usage of a customer database to analyze customer information, to help create strategies for marketing. Application of marketing schemes aimed at consumers, using digital channels from general advertising to closing a sale. Introduction of direct, database, and digital marketing. Using direct and database marketing to analyze market situation. Setting objectives and strategies within direct and database marketing. Creating segmentation using database, direct, and database marketing. Implementation and control. Introduction to digital marketing technology: Internet, Social media, Customer databases. Information systems such as CRM and Demand Generation Systems.

BAS367 Financial Analytics 3(3-0-6)
Prerequisite: None

Applications of financial data analytics, investment science, risk, uncertainty and machine learning to data in financial areas. Visualizing stock data. Linear Regression Models for Financial Analysis. Algorithmic trading. Case studies and Real world examples.

BAS368 Image Analytics 3(2-2-5)
Prerequisite: None

Pattern analysis and statistical learning. Unsupervised learning for visual pattern analysis: cluster analysis, cluster algorithms, perceptual grouping. Learning representational models for visual patterns. Component analysis: generative models, discriminative models, standard extensions of linear model. Manifold learning. Supervised learning for visual pattern classification: support vector machine, boosting algorithm. Statistical motion analysis.

BAS369 Text Mining and Web Scraping 3(2-2-5)
Prerequisite: None
A primer on Web and data technologies: HTML, XML and JSON, XPath, HTTP, AJAX. Scraping the web: retrieval scenarios, extraction strategies. Statistical text processing: processing textual data, supervised learning techniques, unsupervised learning techniques. Managing data projects. Hand-on experience using case studies.

BAS371 Time Series Analysis and Forecasting 3(3-0-6)
Prerequisites: None
Principles of applied time series analysis and other forecasting techniques. Choosing right types of forecasting models, tools for practical business forecasting. General linear regression models. Tests for autocorrelation, heteroscedasticity, and multicollinearity. Basic time-series methods: Linear and nonlinear trends. Methods of smoothing, exponential moving average, Holt-Winters method, methods for seasonal adjustment, Box-Jenkins approach, ARMA model, ARIMA model, combining structural and non-structural methods, short-term sales forecasting model, long-term forecasting, simultaneous-equation model.

BAS372 Financial Technologies 3(3-0-6)
Prerequisites: None
Overview of financial technologies. Changes in how to borrow, save, invest, and other financial operations. Analysis of competition under the changes and new strategies adopted. Digital platform economics. Network effects. Economies of scale. Areas of payments. Alternative credit. Virtual currencies. Related technologies used in the implementation of financial technology, such as Bitcoin and Blockchain.

BAS374 Innovative Startup Strategy 3(3-0-6)
Prerequisite: None
Nature, types, personality of entrepreneur. Entrepreneurial process. Business opportunity. Resources in entrepreneurial venture. Entrepreneurial venture and organization. Choosing a direction: vision, mission, strategy for the venture, business plan, gaining financial support. Initiating and developing the new venture: identifying and analyzing the gap for the new business, scanning for opportunity, positioning the new venture, gaining commitment, sustaining the competitiveness, dimension of the business growth, consolidating the venture.

BAS377 Customer Relationship Management Analytics 3(2-2-5)
Prerequisite: None
Data mining applications in marketing and customer relationship management. Data mining process. Customer profiling and predictive modeling. RFM model. Classic statistical techniques for data mining. Tools used in: survival analysis to understand customers, market basket analysis and association rules, social network analysis, lifetime value using predictive analysis, segmentation.

BAS380 Application Programming for Technologists 3(3-0-6)
Prerequisite: None
Introduction to business programming, programming processes, programming environments, object-oriented and event-oriented models, and database programming.

BAS381 Business Data Communications and Networking 3(3-0-6)
Prerequisite: None
Introduction to data communications. Network layers: application, transport, network, data link, and physical. Network technologies: Local Area Networks, Wireless Local Area Networks, Backbone Networks. Introduction to network security.

BAS382 Distributed and Collaborative Computing 3(3-0-6)
Prerequisite: None
Distributed computing concepts. Social networks and their applications. Tools for collaborative computing, such as Google Documents, Google Site, and Blogger. Introduction to Web application development. Introduction to Web Services and Service-Oriented Architecture. Introduction to Cloud Computing.

BAS383 Information System and Data Security 3(3-0-6)
Prerequisite: None
Basic concepts in information security and privacy. Implications of security and privacy breaches. Security and privacy policies, threats and protection mechanisms. Security and privacy laws, regulations and ethics. Analysis of computer security and sources of threats. Concepts and techniques applicable to the design of hardware and software for Trusted Systems

BAS384 Information Systems Implementation 3(3-0-6)
Prerequisite: None
Logical and physical design of computer-based information systems; tools and techniques that underline the design processes. Design of an enterprise information system with CASE tools. Alternative approaches to systems design with emphasis on object-orientation.

BAS391 Current topics for Business and Supply Chain Analytics I 3(3-0-6)
Prerequisite: None
Current topics related to Business and Supply Chain Analytics, but not presently offered in other courses available. Topics covered different from other current topic courses with code BAS39x.

BAS392 Current topics for Business and Supply Chain Analytics II 3(3-0-6)
Prerequisite: None
Current topics related to Business and Supply Chain Analytics, but not presently offered in other courses available. Topics covered different from other current topic courses with code BAS39x.

BAS393 Current topics for Business and Supply Chain Analytics III 3(3-0-6)
Prerequisite: None
Current topics related to Business and Supply Chain Analytics, but not presently offered in other courses available. Topics covered different from other current topic courses with code BAS39x.

BAS394 Current topics for Business and Supply Chain Analytics IV 3(3-0-6)
Prerequisite: None
Current topics related to Business and Supply Chain Analytics, but not presently offered in other courses available. Topics covered different from other current topic courses with code BAS39x.

BAS395 Current topics for Business and Supply Chain Analytics V 3(3-0-6)
Prerequisite: None
Current topics related to Business and Supply Chain Analytics, but not presently offered in other courses available. Topics covered different from other current topic courses with code BAS39x.

BAS396 Current topics for Business and Supply Chain Analytics VI 3(3-0-6)
Prerequisite: None
Current topics related to Business and Supply Chain Analytics, but not presently offered in other courses available. Topics covered different from other current topic courses with code BAS39x.

BAS397   Current topics for Business and   **3(3-0-6)**
Supply Chain Analytics VII
Prerequisite: None
Current topics related to Business and Supply Chain Analytics, but not presently offered in other courses available. Topics covered different from other current topic courses with code BAS39x.

BAS398   Current topics for Business and   **3(3-0-6)**
Supply Chain Analytics VIII
Prerequisite: None
Current topics related to Business and Supply Chain Analytics, but not presently offered in other courses available. Topics covered different from other current topic courses with code BAS39x.

BAS400   Business and Supply Chain Analytics Seminar   2(0-6-0)
Prerequisite: Have credits earned of not less than 95 credits
Each student group is assigned a real-world or research-like problem as its seminar topic. Under supervision and guidance of a faculty member, the group must conduct a thorough literature review and collect published articles relevant to the assigned topic. They must develop a project proposal which consists of the project scope, objectives, feasible approach, project activities, Gantt chart, and expected results and their contributions. The group must submit the proposal to the project advisor and give a public seminar on the assigned topic at the end of the semester.

BAS401   Business and Supply Chain Analytics Project   4(0-12-0)
Prerequisite: Have earned credits of BAS400
A continuation of BAS400. An individual student or a team of students work on the senior project. The projects can be intensively conducted in industry or within the institute. After a project is completed, students are responsible for submitting their final report and giving a presentation.

BAS402   Extended Business and   **6(0-40-0)**
Supply Chain Analytics Training
Prerequisite: None
This extended Business and Supply Chain Analytics Training provides students with intensive on-the-job training at selected industrial or service organizations. The training period must not be less than 16 weeks (640 hours). This intensive training enables students to work with company personnel to solve real problems, not simulated ones. Students gain hands-on experience on how various modern technologies are applied to manage facilities and systems. Moreover, they will learn how to collaborate with colleagues, coordinate project activities, and develop self-responsibility. In addition to a designated supervisor at the company, a faculty member is assigned to co-supervise a student's training program. An approved industrial project is expected to be carried out by the student. At the end of the training period, the student must give an oral presentation of his/her work and submit a written report of the assigned project to the company and the Business and Supply Chain Analytics Program.

BAS403   Startup Project in Business and   **2(0-6-6)**
Supply Chain Analytics I
Prerequisite: Have credits earned of not less than 95 credits
A group of students builds a startup business with innovations under supervision of assigned advisors. A proposal should be prepared including innovative business ideas, business plan, expected venture capital, expected business advisors, marketing plan, and expand customer base plan. Advisors are appointed by Head of school. The grades are determined based on the criteria set up by the school committee depending on the progress of the project.

BAS404   Startup Project in Business and   **4(0-12-12)**
Supply Chain Analytics II
Prerequisite: Have earned credits of BAS403
Continuation of BAS403. A group of students builds a startup business with innovations under supervision of assigned advisors. A proposal should be prepared including innovative business ideas, business plan, marketing plan, and expand customer base plan. Rounds of business pitching should be organized to present the business ideas. The grade for this course is considered by a school committee. Advisors are appointed by Head of school. The grades are determined based on the criteria set up by the school committee depending on the progress of the project.

BAS410   E-Business   **3(3-0-6)**
Prerequisite: None
This course offers the learning that is needed to develop electronic business. Topics include: developing a strategy; business-to-consumer (B2C) and business-to-business (B2B) marketing; pricing; customer relationship management (CRM); supply chain management; bar codes and radio frequency identification (RFID) for inventory management system; planning, developing, and maintaining websites and supporting information systems; business processes; online payments and international, legal, privacy, and security issues. A unique feature is an ongoing project within the course that provides an opportunity to develop electronic commerce implementation plans.

BAS411   International Trade and Business   **3(3-0-6)**
Prerequisite: Have earned credits of BAS111
An introduction to international and globalization of business; global trade; global trade theories; global business environment (cultural, political, social, etc.), international competitiveness, international operations, international marketing, international financial management, global strategic planning, strategy adaptations (marketing, human resources, etc.).

BAS412   Innovation and Entrepreneurship   **3(3-0-6)**
Prerequisite: None
Study of problem solving in organizations by using innovation. Creativity and innovation skills. Thinking tools. Creative organizations, teams, individuals, and communities. An introduction to the big picture of entrepreneurship. Techniques of analysis of starting up a business and managing the risk. Decision analysis and economic analysis of failure consequences. How to create, design, find, assess, and shape opportunities to define and manage the risk.

BAS413   Ergonomics and Work Design   **3(3-0-6)**
Prerequisite: None
Essential concepts in operation analysis: simplification of work procedures, work measurement, integrated systems of humans, and machines (Equipment), and work environment (H-M-E) systems, factors influencing workers' physical well-being, issues in workplace ergonomics and safety.

BAS414   Human Resources Management   **3(3-0-6)**
Prerequisite: None
A study of concepts and practices of human resource management: roles and responsibilities of human resource manager, staff acquisition; recruitment, selection, orientation, training and development. Staff management; performance management, rewards and compensation, benefits, counseling, employment legislation, safety and health issues, labor retentions, release of staff, and multinational human resources.

BAS415 Strategic Management 3(3-0-6)
Prerequisite: None
The role of top management in integrating an organization's internal functional activities and external environmental forces. Economic, technological, ethical, political, and social factors that affect an organization and the consideration in setting goals and strategies. The relationships of organizations to their environments. The hierarchy of organizational objectives. Structured and informal approaches to strategic planning. The integration of business functions. Organizational structure. Policy implementation and evaluation. Assessing the competitive dynamics of firms.

BAS416 Business Law 3(3-0-6)
Prerequisite: None
A basic understanding of legal issues that corporations face during their existence. Legal systems and basic legal principles affecting various forms of business. Review of contracts: sales, hiring, purchasing, agency, mortgages, leasing, creditors' rights, and bankruptcy, etc. The applications of law to financial instruments. Laws on management of business organizations. A broad array of law-sensitive issues: intellectual property, patent, labor, duties of directors and officers, business disputes, and bankruptcy and reorganization.

BAS417 Operations Strategy 3(3-0-6)
Prerequisites: None
Management of operations at manufacturing and service firms. The structure of their global supply chains, internal processes, and sourcing strategy in response to the uncertainties and risks they face in these turbulent times. Evolving patterns of operation strategies adopted by firms for producing products, sourcing, manufacturing, distributing products, delivering services, and managing products. Programs for enhancing quality, productivity and flexibility. Formulation and execution of such strategies for a collection of firms in the context of the current dynamics of global competition.

BAS419 Warehouse Operations Management 3(3-0-6)
Prerequisite: None
Fundamental operations in warehouse management, including roles of warehousing and warehouse technology, such as bar codes, radio frequency identification (RFID) for inventory control system, modern warehouse operations, classifying products, materials handling equipment and systems, racking and shelving, aisle width decision, information technology for warehouse operations, health and safety issues

BAS420 Analysis Techniques for Complex 3(3-0-6)
Supply Chain Management Problems
Prerequisite: None
This course deals with real-world complex supply chain management (SCM) problems from both the individual and integrated viewpoints of the SCM components. Well-known heuristic and meta-heuristic techniques, such as greedy heuristics, genetic algorithms (GA), simulated annealing (SA), ant colony optimization (ACO), etc. are introduced. Selected SCM problems are illustrated and their solution approaches are explained.

BAS421 Introduction to Research Methodology in 3(3-0-6)
Business and Supply Chain Analytics
Prerequisite: None
An introduction to research methodology: basic terminology, ethical considerations in research, problem definition, literature review, research proposal, collecting primary data, sampling and fieldwork, tools and techniques for analyzing research data, communicating research findings.

BAS422 Operations Scheduling 3(3-0-6)
Prerequisite: None
This course emphasizes models for sequencing and scheduling activities including: static and dynamic problems, deterministic and stochastic models, single machine processing, parallel machine processing, flow-shop and job-shop scheduling, project scheduling, workforce scheduling, exact and heuristic solution methods, and applications in manufacturing environments.

BAS423 Project Management 3(3-0-6)
Prerequisite: Have earned credits of BAS111
This course introduces concepts of project management and techniques for planning, utilizing, and controlling of resources to accomplish specific goals. While the focus is on technically-oriented projects, the principles discussed are applicable to the management of any project. Topics include estimation of project duration, time-cost consideration, workforce allocation, cash flow forecasting, financial and performance control, and documentation.

BAS424 Organizational Behavior 3(3-0-6)
Prerequisite: None
A study of the human behavior in a variety of organizations: organizational culture, socialization, individual differences, motivation, leadership, performance improvement, groups and teams, decision making, conflict and negotiation, communications, power and politics, managing change.

BAS430 Decision Analysis 3(3-0-6)
Prerequisites: None
Foundations of decision modeling. Decision processes. Decision trees. Payoff matrix. Utilities and rewards. Subjective probability. Bayesian inference for decision analysis. Multi-dimensional decision modeling. Multi-attribute utility theory. Bayesian networks. Multi-dimensional learning. Decision under competitions using a game theoretic approach.

BAS431 Fundamentals of Thermofluids 3(3-0-6)
Prerequisite: None
Basic principles of Thermofluid Science: mass-energy equation, conservation of mass and energy, energy transfer by heat, work and mass, thermodynamic properties, properties of pure substances. First and Second Law for closed and open systems. Flow in pressure conduit. Entropy. Fluid properties. Fluid statics. Momentum equation. Mechanism of heat transfer.

BAS432 Fundamentals of Electrical and 3(3-0-6)
Electronics Engineering
Prerequisite: None
An overview of Electrical and Electronics Engineering: electrical signals, basic circuit theory, DC and AC analysis, Kirchoff's law, Thevenin theorem, three-phase circuits, basic electronic devices and circuits, fundamentals of operational amplifiers, fundamentals of power systems. Schematic diagram: one-line diagram DC and AC motor and generator modeling. Transformer modeling. Loss and efficiency of DC/AC machinery. Household/industry wiring.

BAS440 Big Data Analytics 3(3-0-6)
Prerequisites: None
Key IT technologies that you can use to manipulate, store, and analyze big data. Basic tools for statistical analysis, R, Python or equivalent language, and a few key methods used in Machine Learning. The review of techniques for parallel processing and technologies that allow analysis of data near real time. Big data systems that can accept, store, and analyze large volumes of unstructured data in batch mode and/or real time.

BAS441 Business Intelligence and Analytics   3(3-0-6)
Prerequisite: Have earned credits of BAS213
An overview of business intelligence, analytics, and decision support. Technologies for decision making. Data warehousing. Business reporting. Visual analytics. Data mining. Techniques for predictive modeling. Text analytics. Text mining. Sentiment analysis. Web analytics. Web mining. Social analytics. Model-based decision making using optimization and multi-criteria systems. Modeling and analytics using heuristic search methods and simulation. Automated decision systems and expert systems. Knowledge management systems. Big data analytics. Emerging trends and future impact of business analytics.

BAS490 Special Topics in Business and   3(3-0-6)
Supply Chain Analytics
Prerequisite: None
Topics related to Business and Supply Chain Analytics, but not presently offered as either a required or technical elective.

BAS491 Special Study in Business and   3(3-0-6)
Supply Chain Analytics I
Prerequisite: None
This course is intended for students who wish to participate in the exchange program. It covers new topics or areas of study related to Business and Supply Chain Analytics, but not presently offered in general basic courses, basic courses in science and mathematics, compulsory courses, or compulsory elective courses of the Business and Supply Chain Analytics curriculum. Topics covered are different from other BAS49x.

BAS492 Special Study in Business and   3(3-0-6)
Supply Chain Analytics II
Prerequisite: None
This course is intended for students who wish to participate in the exchange program. It covers new topics or areas of study related to Business and Supply Chain Analytics, but not presently offered in general basic courses, basic courses in science and mathematics, compulsory courses, or compulsory elective courses of the Business and Supply Chain Analytics curriculum. Topics covered are different from other BAS49x.

BAS493 Special Study in Business and   2(2-0-4)
Supply Chain Analytics III
Prerequisite: None
This course is intended for students who wish to participate in the exchange program. It covers new topics or areas of study related to Business and Supply Chain Analytics, but not presently offered in general basic courses, basic courses in science and mathematics, compulsory courses, or compulsory elective courses of the Business and Supply Chain Analytics curriculum. Topics covered are different from other BAS49x.

CES202 Engineering Hydrology   3(3-0-6)
Prerequisite: None
Hydrologic cycle. Atmospheric water. Subsurface water. Groundwater. Surface water. Unit hydrograph. Flood routing. Hydrologic statistics. Frequency analysis.

CES204 Building Facilities   3(3-0-6)
Prerequisite: None
Thermofluid science for buildings, building system, components and environment in buildings. Energy conversion, conservation and management. Piping and plumbing systems, HVAC system, and lighting system for buildings. Concepts of electrical system. Electrical devices and their specifications. Symbols and circuit diagrams. Standard electrical codes. Load characteristics and calculations. Power distribution and wiring. Electrical systems for buildings. Safety systems and others.

CES215 Applied Mathematics in Civil Engineering   3(3-0-6)
Prerequisite: Have earned credits of MAS117
Linear algebra. Solutions of algebraic and transcendental equations. Solutions of linear systems. First and second-order differential equations. Fourier transforms and Laplace transforms. Vector calculus. Introduction to numerical methods as applied to civil engineering problems. Introduction to probability and statistics.

CES261 Surveying   3(2-3-4)
Prerequisite: None
Introduction to surveying work. Basic field works: leveling. Principles and applications of theodolite. Angle measurement. Distance measurement. Errors in surveying: acceptable error, data correction, and triangulation. Precise determination of azimuth. Precise traverse plane coordinate system. Precise leveling. Route survey. Topographic survey. Map plotting. Introduction to photogrammetry and remote sensing.

CES271 Mechanics of Solids I   3(3-0-6)
Prerequisite: Have earned credits of MES350
Forces and stresses. Stress and strain relationships. Stresses in beams. Shear and bending moment diagrams. Deflection of beams. Torsion. Buckling of columns. Mohr's circle and combined stresses. Failure criteria.

CES281 Hydraulics   3(3-0-6)
Prerequisite: None
Properties of fluids. Fluid statics. Kinematics of fluid flow, conservation of mass, momentum, and energy. Similitude and dimensional analysis. Flow in pipes, Open-channel flow. Flow measurements. Unsteady flow problems.

CES282 Hydraulics Laboratory   1(0-3-0)
Prerequisite: Have earned credits of CES281 or taking CES281 in the same semester
Experimental measurement of viscosity. Fluid pressure. Principles of fluid flow through orifices and weirs. Flow in pipes. Flow in open channels. Pump test.

CES303 Civil Engineering Training   1(0-40-0)
Prerequisite: Have credits earned of not less than 85 credits
Students are provided with on-the-job training at selected governmental organizations, state enterprises or private companies. The purposes of the course are to provide the students opportunities to experience civil engineering works other than what learned in the class. The training period must not be less than 240 hours. Student must submit a report at the end of the training period. Satisfactory (S) or unsatisfactory (U) grade will be given based on student's performance, quality of the report, and supervisor's comments.

CES312 Structural Analysis   3(3-0-6)
Prerequisite: Have earned credits of CES271
Types of structure. Types of force. Equilibrium equations. Determinate and indeterminate structures. Compatibility conditions. Superposition principle. Virtual work principle. Direct stiffness method. Influence lines. Approximate analysis. Introduction to finite element methods. Interpretation of analysis results. Introduction to plastic analysis.

CES315 Computational Methods in Civil Engineering   3(3-0-6)
Prerequisite: Have earned credits of CES215
Use of computers. Programming concepts and techniques. Modern programming languages and tools for engineering problems. Numerical methods as applied to civil engineering problems. Introduction to finite element methods.

CES321   Steel and Timber Design   3(3-0-6)
Prerequisite: Have earned credits of CES312
Design of steel and timber structures. Tension and compression members. Beams. Beam-columns. Built-up members. Plate girders. Connection. Allowable Strength Design (ASD) and Load and Resistance Factor Design (LRFD) methods. Design practice.

CES322   Reinforced Concrete Design   3(3-0-6)
Prerequisite: Have earned credits of CES351
Concrete and reinforcement. Fundamental behavior in axial load, flexure, torsion, shear, bond and combined actions. Design of reinforced concrete (RC) structural components by working stress and strength design methods. Design of RC structural components under various loading actions, e.g. gravity, wind and earthquake loadings. Design practice.

CES323   Advanced Structural Concrete Design   3(3-0-6)
Prerequisite: Have earned credits of CES322
Analysis and design of T-beams, continuous beams, deep beams, long columns, combined footings, mat footings, pile caps. Shear friction design. Strut-and-tie design method. Design of reinforced concrete buildings.

CES331   Soil Mechanics   3(3-0-6)
Prerequisite: Have earned credits of CES271
Fundamentals of soil mechanics. Description of soil and clay mineralogy. Earth geology that covers origin and formation of soils. Properties of sedimentary, igneous and metamorphic rock types. Weight-volume relationships. Sieve and hydrometer analysis. Soil classification and consistency. Compaction and relative density. Flow of water through soil and hydraulic conductivity. Stresses in a soil mass, principle of effective stress and induced stresses due to different types of loading. Compressibility and consolidation settlement (one-dimensional). Mohr circles. Shear strength of soils and Mohr–Coulomb failure criteria.

CES332   Foundation Engineering   3(3-0-6)
Prerequisite: Have earned credit of CES331
Foundation description, classification and types. Site exploration program by soil boring and sampling of disturbed and undisturbed specimen. Identification and analysis of common soil failure modes, and remediation using soil improvement methods. Calculation of bearing capacity of shallow foundations using Terzaghi's and General bearing capacity equations. Settlement of shallow foundations on sand and clay, immediate settlement and consolidation (one-dimensional) settlement. Design of rectangular footing. Pile foundation types, end bearing and friction piles. Estimation of bearing capacity of axially and laterally loaded single piles and pile groups. Design of pile caps.

CES333   Soil Mechanics Laboratory   1(0-3-0)
Prerequisite: Have earned credits of CES331 or taking CES331 in the same semester
Soil exploration. Particle size analysis; sieve and hydrometer test. Atterberg limits. Permeability. Compaction. California Bearing Ratio (CBR). Stress-strain behavior of soils. Shear strength parameters; direct shear and triaxial test. Compressibility and one-dimensional consolidation.

CES334   Geotechnical Earthquake Engineering   3(3-0-6)
Prerequisite: Have earned credits of CES331
Plate tectonics and processes that lead to earthquakes. Identifying different seismic hazards. Tsunami and ways to mitigate its effects. Design techniques for earthquake resistant structures. Determination of dynamic properties of soil. Wave propagation in soils. Assessment of the ground liquefaction potential. Slope stability analysis and seismic design of retaining walls.

CES341   Transportation Engineering and Planning   3(3-0-6)
Prerequisite: None
Characteristics and equilibrium of transportation demand and supply. Planning, design and evaluation of transportation systems, transportation models; water transportation; pipeline transportation; road transportation; railway transportation; air transportation. Economic and financial assessment of transport projects. Transportation planning. Logistics. Analysis of traffic parameters. Design of signaling systems.

CES343   Highway Engineering   3(3-0-6)
Prequisite: None
Historical development of highways. Highway administration. Principles of highway planning and traffic analysis. Geometric design and operations. Highway finance and economic. Introduction to pavement design. Highway materials. Construction and maintenance of highways.

CES344   Logistics System Engineering   3(3-0-6)
Prerequisite: None
Roles of infrastructure systems and logistics. Basic concepts and case studies in international, regional, and urban logistics. Theory of commodity flows. Inventory management. Transportation costs. Intermodal logistics. Logistics distribution centers. Geographic Information System (GIS) for logistics routing and scheduling. Logistics optimization, decision making, and strategic planning. Information technologies in logistics.

CES351   Concrete Technology   3(2-3-4)
Prerequisite: None
History of cement and concrete. Cement: production, raw materials, types of cement, chemical and physical properties of cement, and hydration of cement. Aggregates: absorption, moisture content, specific gravity, solid volume and void ratio, gradation, and mechanical properties. Admixtures: mineral, chemical and special admixtures. Properties of concrete in fresh state: workability, deformability, and segregation. Properties of concrete in plastic state. Properties of concrete in early age state. Properties of concrete in hardened state: mechanical properties and introduction to durability. Concrete construction practices.

CES352   Material Testing   1(0-3-0)
Prerequisite: Have earned credits of CES351
Tests on cement, aggregates, and concrete properties. Tests on steel bars and steel members: tensile test, torsion test, bending test. Tests on other civil engineering materials such as polymer-based materials, grouting materials, wood, highway materials. Non-destructive tests and instruments: Rebound hammer, ultrasonic pulse velocity, half-cell potential, etc. Simulation of stress-strain relationship of concrete.

CES353   Construction Engineering and Management   3(3-0-6)
Prerequisite: None
Overview of the construction industry. Construction project lifecycle. Project feasibility study: principles of engineering economy, economic evaluation of projects (using Payback Period, Net Present Value, Benefit-Cost Analysis and Internal Rate of Return), multi-criteria project selection and environmental impact assessment. Construction law and contracts. Project delivery systems (e.g. Traditional, Design-Build, Turnkey and Public-Private-Partnership). Types of contract (e.g. Fixed-price/Lump-sum and Cost-reimbursable). Project planning using Critical Path Method. Resource planning and levelling. Project risk management. Project control using Earned Value Analysis. Construction cost estimation.

CES354   Maintenance of Structures   3(3-0-6)
Prerequisite: Have earned credits of CES351
Review on deteriorations of structures. Concept of maintenance planning for civil engineering structures. Inspection: Visual inspection, non-destructive tests, partially destructive tests, load tests. Evaluation. Protection methods against deterioration and corrosion. Repair and strengthening methods, Materials for repair and strengthening. Test methods for performances and properties of repair materials. Life cycle cost evaluation. Design for structural strengthening: continuous fibers, external prestressing, steel jacketing, etc.

CES355   Integrated Construction Technology   3(3-0-6)
Prerequisite: None
Introduction to construction methods, techniques, and equipment. The roles of technology in the construction industry. Digital transformation in the construction industry. Digital Twin, Building Information Modelling (BIM) and other modern technology in construction.

CES372   Mechanics of Solids II   3(3-0-6)
Prerequisite: Have earned credits of CES271
Torsion. Shear stress and shear center. Composite beams and reinforce concrete beams. Buckling of columns. Unsymmetrical bending. Impact and repetitive loading. Failure criteria.

CES391   Special Topics in Civil Engineering I   3(3-0-6)
Prerequisite: None
New topics or areas of study not offered in other civil engineering courses. Topics may vary from semester to semester, but are different from CES392.

CES392   Special Topics in Civil Engineering II   3(3-0-6)
Prerequisite: None
New topics or areas of study not offered in other civil engineering courses. Topics may vary from semester to semester, but are different from CES391.

CES403   Seminar   1(0-3-0)
Prerequisite: Have credits earned of not less than 95 credits
Literature review and online tools for searching scholarly articles. Research design and reporting. A group seminar on topics of interest in the field of civil engineering.

CES405   Special Studies in Civil Engineering I   3(3-0-6)
Prerequisite: None
An in-depth study of a topic in the field of civil engineering that is different from CES406, CES409 and CES410.

CES406   Special Studies in Civil Engineering II   3(3-0-6)
Prerequisite: None
An in-depth study of a topic in the field of civil engineering that is different from CES405, CES409 and CES410.

CES407   Civil Engineering Project   4(0-12-0)
Prerequisite: Have earned credits of CES403
An in-depth study on a topic of interest in the field of civil engineering as approved by the project advisor.

CES408   Extended Civil Engineering Training   5(0-40-0)
Prerequisite: Have credits earned of not less than 95 credits
Extensive on-the-job training of at least 16 weeks (640 hours) at a selected organization that provides civil engineering services-an individual comprehensive research or practical project related to the training must be intensively conducted under close supervision of faculty members and supervisors assigned by the training organization. At the end of the training, the student must submit a report of the project and also gives a presentation.

CES409   Special Studies in Civil Engineering III   2(2-0-4)
Prerequisite: None
An in-depth study of a topic in the field of civil engineering that is different from CES405, CES406 and CES410

CES410   Special Studies in Civil Engineering IV   2(2-0-4)
Prerequisite: None
An in-depth study of a topic in the field of civil engineering that is different from CES405, CES406 and CES409

CES414   Finite Element Methods in Engineering   3(3-0-6)
Prerequisite: None
Fundamentals of finite element methods. Boundary-value problems. Variational principles. Approximate methods. Development of standard elements. Finite element procedures. Solution techniques and computer implementation. Problem-based studies.

CES424   Bridge Engineering   3(3-0-6)
Prerequisite: Have earned credits of CES322
Planning of bridge projects. Design, analysis and construction of various types of bridges including reinforced and prestressed concrete bridges, steel bridges, composite bridges, and cable-supported bridges.

CES426   Durability and Deteriorations of   3(3-0-6)
           Construction Materials
Prerequisite: Have earned credits of CES351
Durability problems and deteriorations of concrete structures: Bleeding, plastic shrinkage, plastic settlement, autogenous shrinkage, thermal cracking, carbonation, drying shrinkage, alkali-aggregate reactions, acid attack, sulfate attack, delayed ettringite formation, freezing and thawing, chloride-induced steel corrosion, abrasion and erosion, biological degradation. Deterioration of steel structures. Deterioration of polymer-based materials. Behaviors under extreme temperature. Damages due to loads and others. Durability and service life design. Case studies of problems in real structures.

CES444   Hydraulic Engineering   3(3-0-6)
Prerequisite: Have earned credits of CES281
Application of hydraulic principles to study and practice of hydraulic engineering. Piping systems, water hammer. Pumps and turbines. Open channel flow. Design of reservoir, dams, spillways. Hydraulic models. Drainage system.

CES446   Port and Airport Engineering   3(3-0-6)
Prerequisite: None
Planning and design of seaports and harbor. Planning of container terminal and cargo handling systems. Airport master planning. Air traffic control. Design of airport facilities.

CES450   Urban Engineering   3(3-0-6)
Prerequisite: None
Urban land use patterns and modeling. Urban land use planning. Population dynamics and cohort analysis. Urban transportation planning. Characteristics and planning of Mass transit systems. Geographic Information System for urban planning. Multi-criteria decision making in urban planning. Optimization and network analysis in urban planning.

CES494   Coastal Engineering   3(3-0-6)
Prerequisite: Have earned credits of CES281
Review of mathematics and hydrodynamics. Linear wave theory. Wave properties. Transformation of regular waves. Analysis of irregular waves. Transformation of irregular waves. Design of breakwaters, seawalls, groins and beach nourishment.

CHS211 Organic Chemistry   3(3-0-6)
Prerequisites: Have earned credits of SCS126
A study of all aspects of fundamental organic chemistry: nomenclature, chemical and physical properties, reactions, and syntheses of the major classes of organic compounds.

CHS212 Physical Chemistry   3(3-0-6)
Prerequisites: Have earned credits of SCS126
The nature of physical chemistry. Gases. Solutions of non-electrolytes and electrolytes. Electrochemistry. Introduction to quantum chemistry: simple quantum systems such as particle in a box, harmonic oscillator, hydrogen atom. Molecular Symmetry.

**CHS213 Statistics and Experimental Design   3(3-0-6)
         for Chemical Engineering**
Prerequisites: Have earned credits of MAS117
Scientific and technological concepts. Ethics and good practice in research. Applications of statistical analyses. Research design principles: factorial design, non-regular design, interpretation of analyses.

CHS241 Material and Energy Balance   3(3-0-6)
Prerequisites: Have earned credits of SCS126
Introduction to chemical engineering calculation: Stoichiometry and material balance calculation, recycling, bypassing, and purging, use of chemical and phase equilibrium data, energy balance. Introduction of chemical engineering units and processes.

CHS242 Thermodynamics I   3(3-0-6)
Prerequisites: None
First law of thermodynamics. Second law of thermodynamics and Carnot cycle. Energy. Entropy. Basic heat transfer and energy conversion. Concept of Entropy. Power and refrigeration cycles and equipment: gas turbine, internal combustion engines.

CHS251 Fluid Dynamics and Transport Phenomena   3(3-0-6)
Prerequisites: Have earned credits of CHS241
Physical properties of fluids. Fluid static and application. Characteristics of fluid flow and momentum transfer: Applications and design of unit operations for solid-fluid separations. Constitutive equations for momentum, energy, and mass transfer. Development of microscopic and macroscopic momentum, energy, and mass transfer equations.

CHS261 Chemical Engineering Laboratory I   1(0-3-0)
Prerequisites: None
Laboratory practice and experimental studies on topics covered in Chemistry, Analytical Chemistry, and general Chemical Engineering.

CHS264 Process Dynamics and Control   3(3-0-6)
Prerequisites: Have earned credits of MAS117
Basic Linear algebra. Ordinary differential equations of the first order and higher order. Partial differential equations. Laplace transformation. Fourier analysis-Fourier series. Mathematical modeling of chemical engineering systems: solution techniques and dynamics of these systems, introduction to automatic control, feedback control concept, stability analysis, frequency response and control system designs. Introduction to measurement and control instrument characteristics. Application of process control in chemical/biological systems.

CHS275 Analytical and Instrumental Chemistry   3(3-0-6)
Prerequisites: Have earned credits of SCS126
Theory and practice of chemical quantitative analyses. Conventional and modern instrumental chemical and physical analyses. Statistical treatment of data. Gravimetric and volumetric analyses. Chemical equilibria. Acid-base chemistry. Electrochemistry. Complex formation reaction. Chromatographic analyses. Theory and applications of analytical instruments used in chemical engineering and technology.

CHS301 Chemical Engineering Training   1(0-40-0)
Prerequisites: Have credits earned of not less than 85 credits
Students are provided with on-the-job training at selected modern industrial or service facilities. The purpose of the course is to allow the students opportunities to observe how industrial engineers function, to learn how to collaborate with co-workers, and to develop self-responsibility. The training period must not be less than 240 hours. Students must submit a report at the end of the training period. Satisfactory (S) or unsatisfactory (U) grade will be given based on student's performance, quality of the report, and supervisor's comments.

CHS302 Seminar   1(0-2-1)
Prerequisites: None
Literature reviews, reports and presentations on current developments of chemical engineering technology to classmates and faculty members.

**CHS314 Engineering Economy and   3(3-0-6)
         Business Management**
Prerequisites: None
Introduction to the principles of engineering economics for utilization and evaluation of capital investments: Time value of money, net present value, rate of return, depreciation, and selection of the best economic investment alternative. Risk analysis and uncertainty of the related chemical industries. Uncertainty of investment and estimation of income tax.

**CHS315 Safety and Environmental Processes   3(3-0-6)
         for Chemical Engineering**
Prerequisites: Have earned credits of CHS241
Impacts of environmental pollution. Environmental quality standards. Sources and characteristics of industrial wastes and treatment methods. Hazardous wastes and disposal methods. Principles of safety and loss prevention control. Hazard identification and handling: risk assessment, principles of safety management, legislation, safety laws.

CHS327 Bio-Chemical Technology   3(3-0-6)
Prerequisites: Have earned credits of SCS126
Principles of biotechnology: microbiology, microbial biotechnology, enzyme catalysis, bio-chemical processes and applications.

CHS328 Pharmaceutical Industry and Technology   3(3-0-6)
Prerequisites: Have earned credits of SCS126
Basic principles of biochemistry and molecular biology. Introduction of the pharmaceutical production system including separation and purification processes.

**CHS331 Chemical Reaction Kinetics   33-0-6)
         and Reactor Design**
Prerequisites: Have earned credits of CHS241
Application of thermodynamic and kinetic fundamentals to the analysis and design of chemical reactors. Type of reactors: single reactor and multiple reactor systems. Isothermal and non-isothermal operation: homogeneous reactors and introduction to heterogeneous reactors.

CHS343 Thermodynamics II   3(3-0-6)
Prerequisites: Have earned credits of CHS242
Thermodynamics of multi-component systems and applications for phase equilibrium and chemical reaction equilibrium.

CHS352 Heat Transfer   3(3-0-6)
Prerequisites: Have earned credits of CHS251
Basic principles and mechanisms for heat transfer. Conceptual design for heat transfer equipments.

CHS353 Mass Transfer   3(3-0-6)
Prerequisites: Have earned credits of CHS352
Basic principles and mechanisms for mass transfer. Conceptual design of mass transfer and simultaneous heat-mass transfer equipments.

CHS355 Chemical Engineering Equipment   3(3-0-6)
and Process Design
Prerequisites: Have earned credits of CHS241
Applications of chemical engineering fundamentals to the design of an equipment: pressure vessel, heat exchanger, mixing and agitation unit. A multi-unit process: solid and fluid transport and the related economic assessments.

CHS359 Computer Applications for Chemical Engineering 3(3-0-6)
Prerequisites: Have earned credits of CHS241
The use of computer software to deal with chemical engineering problems: the development of flowsheet simulation, unit operations design, process analysis, and process dynamic control simulation with controller design using software packages.

CHS362 Chemical Engineering Laboratory II   1(0-3-0)
Prerequisites: Taking CHS352 in the same semester
Laboratory practice and experimental studies on topics covered in fluid dynamics and heat transfer.

CHS363 Chemical Engineering Laboratory III   1(0-3-0)
Prerequisites: Taking CHS353 in the same semester
Laboratory practice and experimental studies on topics covered in simultaneous heat and mass transfer.

CHS371 Petroleum and Petrochemical Technology   3(3-0-6)
Prerequisites: Have earned credits of CHS211
Introduction to petroleum, petrochemical products, natural gas and their uses. Chemical and physical properties of some important petrochemical products. Applications of chemical engineering fundamentals to the design of processes in petrochemical industry, refinery and production plants.

CHS374 Polymer Science and Engineering   3(3-0-6)
Prerequisites: Have earned credits of CHS211
Principles of polymer synthesis. Characterizations and structural property of polymer. Polymer processing. Mechanical properties: fluid mechanics, viscoelasticity, stress, deformation and fracture.

CHS416 Big Data Analytics in Chemical Engineering 3(3-0-6)
Prerequisites: None
The manipulation strategies of "Big Data" from variety of chemicals and biological processes. The usage of big data in main essential industries: petroleum, energy, semiconductors, pharmaceuticals, and food. Introduction of software, and platforms for big data collection and analysis. The application of big data analysis for improvement of process efficiency: expanding production volume, boosting innovation through connection with other industries.

CHS417 Green Technology for Chemical Engineering   3(3-0-6)
Prerequisites: None
The Green Technology for Chemical Engineering for the sustainability in energy and environment: energy storage and energy conversion technologies, catalyst for the production of green chemical species, renewable and alternative energy, ion transport technologies for the chemical species treatment in the chemical industrial. Development of novel technologies for the sustainability in production and consumption sector.

CHS425 General Food Science   3(3-0-6)
Prerequisites: None
A study of the physical, chemical, and microbiological aspects of food. The function and changes in components during preparation and processing of food.

CHS457 Chemical Engineering Plant Design   3(3-0-6)
and Project Management
Prerequisites: Have earned credits of CHS355
Problem-based course: Conceptual design of a chemical plant, general design considerations and selection, process design project of a chemical plant as well as project management.

CHS481 Special Topics in Chemical Engineering I   3(3-0-6)
Prerequisites: None
New topics or areas of study not offered in other chemical engineering courses. Topics may vary from semester to semester. Topic covered is different from CHS482 and CHS483.

CHS482 Special Topics in Chemical Engineering II   3(3-0-6)
Prerequisites: None
New topics or areas of study not offered in other chemical engineering courses. Topics may vary from semester to semester. Topic covered is different from CHS481 and CHS483.

CHS483 Special Topics in Chemical Engineering III 3(3-0-6)
Prerequisites: None
New topics or areas of study not offered in other chemical engineering courses. Topics may vary from semester to semester. Topic covered is different from CHS481 and CHS482.

CHS484 Chemical Engineering Project I   1(0-3-0)
Prerequisites: Have credits earned of not less than 95 credits
The first course in the senior project course series. A student team will be given a problem, for which they must determine appropriate approaches and actions to obtain feasible solutions. This involves establishment of initial contacts, project proposal development, preliminary data collection, data analysis, verification of the results, and practical implementation. A presentation of the progress and a submission of the status report are due at the end of the semester.

CHS485 Chemical Engineering Project II   3(0-9-0)
Prerequisites: Have earned credits of CHS484
A continuation of CHS484. A team of students will work on group projects assigned to them. The projects can be intensively conducted in industry or within the institute. After a project is completed, students are responsible for submitting their final report and giving a presentation.

CHS486 Special Studies in Chemical Engineering I   3(3-0-6)
Prerequisites: None
An in-depth study of a topic in the field of chemical engineering.

CHS487 Special Studies in Chemical Engineering II 3(3-0-6)
Prerequisites: None
An in-depth study of a topic in the field of chemical engineering. Topic covered is different from CHS486.

CHS488 Special Studies in Chemical Engineering III 1(1-0-2)
Prerequisites: None
An in-depth study of a topic in the field of chemical engineering. Topic covered is different from CHS486 and CHS487.

CHS489 Extended Chemical Engineering Training   5(0-40-0)
Prerequisites: Have credits earned of not less than 95 credits
Students are provided with on-the-job training at selected modern industrial or service facilities for an extended period of at least 16 weeks (640 hours). The purpose of the course is to allow the students opportunities to observe how industrial engineers function, to learn how to collaborate with co-workers, and to develop self-responsibility. Students must submit a report at the end of the training period.

CSS221 Computer Graphics and Applications 3(2-3-4)
Prerequisite: None
Ray tracing. The graphics pipeline. Transformations. Texture mapping. Shadows. Sampling. Global illumination. Splines. Animation. Color.

CSS224 Computer Architectures 3(3-0-6)
Prerequisite : None
Combinational logic. Computer evolution. Conventional computer architectures. CPU and ALU structures and design. Instruction sets. Hardwired and microprogrammed control. Pipelining. Array and vector processors. Multiprocessor systems. Memory organizations. Cache memory. I/O organizations.

CSS225 Operating System 3(3-0-6)
Prerequisite: None
Basic concepts of operating systems. Processes. Interprocess communication and synchronization. Input-output. File systems. Memory management.

CSS300 Computer Engineering Training 1(0-40-0)
Prerequisite: Have credits earned of not less than 85 credits
Practical training in private sectors or governmental departments in the field of Computer Engineering, not less than 240 hours during summer vacation of the third year. Students must submit a report to his/her supervisor who will decide for the final grade of either satisfactory (S) or unsatisfactory (U).

CSS321 Theory of Computation 3(3-0-6)
Prerequisite: Have earned credits of DES227
Automata. Computability. Complexity: computability, computational complexity theory. Regular and context-free languages. Decidable and undecidable problems. Reducibility. Completeness theory. Recursive function theory. Finite automata and regular languages. Push-down automata and context-free languages. Turing machines and decidable (recursive) languages.

CSS322 Scientific Computing 3(3-0-6)
Prerequisite: Have earned credits of GTS210
Conditioning. Stability. Interpolation. Quadrature. Linear and nonlinear equation solving. Least-squares fitting. Eigenvalue and eigenvector computation. Optimization. Ordinary differential equations. Singular value decomposition.

CSS323 Software Engineering 3(3-0-6)
Prerequisite: None
Methodologies and strategies for developing medium and large scale software. Software management. Problem analysis. Cost estimation. System design techniques. System testing and performance evaluation. System maintenance.

CSS324 Artificial Intelligence 3(3-0-6)
Prerequisite: Have earned credits of DES221
Overview of current research and application of artificial intelligence. Introduction to the languages of artificial intelligence such as Prolog or LISP. Search techniques. Knowledge representation: reasoning, inference. Machine learning. Expert systems.

CSS325 Database Systems 3(3-0-6)
Prerequisite: Have earned credits of DES221
Database systems architectures. Relational data models. Query languages. Database security, integrity, and concurrency.

CSS326 Database Programming Laboratory 1(0-3-0)
Prerequisite: Have earned credits of or taking CSS325 in the same semester
Hands-on practice and experiments of topics in database programming.

Practical Usage of database design tools. Designing user interface for database applications. Programming database applications. Security and access in database programming. Efficient use of SQL for complicated tasks and teach a 3GL database language. Usage of triggers, stored procedures and functions for efficient and more secure implementations of database applications.

CSS331 Fundamentals of Data Communications 3(3-0-6)
Prerequisite: Have earned credits of CSS225
An overview of techniques used in data communications and switched communication networks. Protocol architectures. Data transmission and transmission media. Signal encoding techniques. Data link control protocols. Multiplexing. Multiple access and spread spectrum. Switching networks.

CSS332 Microcontrollers and Applications 3(2-3-4)
Prerequisite: Have earned credits of EES271
Microcontroller and microprocessor architectures. Assembly language programming. Microcontroller interfacing. Descriptions of the microcontroller-based system components: electronics, functions, and interfaces. System bus. Interrupts. DMA and I/O. Laboratory practice and experimental studies on topics related to microcontrollers.

CSS334 Computer Networks and Internetworking 3(3-0-6)
Prerequisite: Have earned credits of CSS331
An overview of networking and internetworking technologies. Open Systems Interconnect (OSI) reference model. Internet Protocol suite. Standards. Design concepts of protocols. Routing algorithms. Applications of networks.

CSS400 Project Development 1(0-3-0)
Prerequisite: Have credits earned of not less than 95 credits
Practical projects or problems in Computer Engineering for individual students or groups of students under supervision of faculty members. Students are required to submit and present a project proposal to their project committee, appointed by the school.

CSS403 Computer Engineering Project 5(0-15-0)
Prerequisite: Have earned credits of CSS400
Practical projects or problems in Computer Engineering for individual students or group of students under supervision of faculty members. Students are required to submit and present a project report to their project committee, appointed by the school.

CSS431 Machine Learning and Pattern Recognition 3(3-0-6)
Prerequisite: Have earned credits of CSS324
Machine learning and statistical decision theory. Adaptive classifiers. Supervised and unsupervised learning. Deep learning. Transducers. Feature extraction. Decision units. Optical character recognition. Speech processing. Remote sensing.

CSS432 Natural Language Processing and Information Retrieval 3(3-0-6)
Prerequisite: Have earned credits of CSS324
Techniques for filtering junk email. Techniques for discovering the different meanings of a word. Efficiently encoding of spelling rules. Tagging words according to their part of speech. Parsing English sentences. Language translation. Modeling language semantics. Organization, representation, and access to information. Categorization, indexing, and content analysis. Data structures for information retrieval. Design and maintenance of databases, indexes, classification schemes, and thesauri. Use of codes, formats, and standards. Analysis and evaluation of search and navigation techniques.

CSS433 Computer Vision 3(3-0-6)
Prerequisite: None

Optics and image acquisition. Image sequence processing. Stereo vision. Texture segmentation. Multivariate data analysis. Discriminant functions. Unsupervised learning and clustering. Self-organizing map (SOM). 3-D medical imaging (computed tomography), Range data and surface analysis. 3-D structure analysis.

CSS434 Knowledge Representation and Reasoning 3(3-0-6)
Prerequisite: Have earned credits of CSS324

Logic-based knowledge representation. First-order logic. Description logic. Inference mechanisms. Applications in ontologies and the Semantic Web.

CSS451 Cloud Computing 3(3-0-6)
Prerequisite: Have earned credits of CSS331

Definition and evolution of cloud computing. Enabling technologies, service and deployment models. Popular cloud stacks and use cases. Benefits, risks, and challenges of cloud computing. Economic models and SLAs. Cloud security. Cloud infrastructure. Virtualization. Cloud storage. Programming models for the Cloud.

CSS452 Internet of Things 3(3-0-6)
Prerequisite: Have earned credits of CSS331

Internet of Things (IoT) and Web of Things (WoT). Layering and REST. Making things smart. IoT business aspects. IoT business issues and models. IoT communication protocols. Persuasive technologies. Big IoT data. Semantics and semantic technologies. Implications for society.

CSS453 Cyber Crimes and Digital Forensics 3(3-0-6)
Prerequisite: Have earned credits of CSS454

Principles and practices of Cyber Crimes and digital forensics. Legal and ethical implications of computer forensics. Forensic duplication. Data recovery. Steganography. Digital evidence controls. Network forensics. Software reverse engineer. Tools and techniques for investigating computer intrusions.

CSS454 Computer and Communication Security 3(3-0-6)
Prerequisite: Have earned credits of CSS331

Theory and practice of network security, focusing in particular on the security aspects of the web and Internet. Security services. Communication privacy. Threats against networked applications. Cryptographic algorithms. Key management. Digital signatures. Certificates and authentication protocols. Access controls. Controls against network attacks. Internet security protocols. Firewalls. Intrusion detection systems. Private e-mails. Trust management.

CSS481 Special Topics in Computer Engineering Fundamentals I 3(3-0-6)
Prerequisite: None

Topics of current interest in Computer Engineering Fundamentals.

CSS482 Special Topics in Computer Engineering Fundamentals II 3(3-0-6)
Prerequisite: None

Topics of current interest in Computer Engineering Fundamentals.

CSS483 Special Topics in Computer Engineering Fundamentals III 3(3-0-6)
Prerequisite: None

Topics of current interest in Computer Engineering Fundamentals.

CSS484 Special Topics in Computer Engineering Applications I 3(3-0-6)
Prerequisite: None

Topics of current interest in Computer Engineering Applications.

CSS485 Special Topics in Computer Engineering Applications II 3(3-0-6)
Prerequisite: None

Topics of current interest in Computer Engineering Applications.

CSS486 Special Topics in Computer Engineering Applications III 3(3-0-6)
Prerequisite: None

Topics of current interest in Computer Engineering Applications.

CSS495 Special Studies in Computer Engineering I 3(3-0-6)
Prerequisite: None

Special study on current topics related to Computer Engineering.

CSS496 Special Studies in Computer Engineering II 3(3-0-6)
Prerequisite: None

Special study on current topics related to Computer Engineering.

CSS497 Special Studies in Computer Engineering III 2(2-0-4)
Prerequisite: None

Special study on current topics related to Computer Engineering.

CSS499 Extended Computer Engineering Training 6(0-40-0)
Prerequisite: Have earned credits of CSS400

Extensive on-the-job training of at least 16 weeks (640 hours) at a selected organization that provides Computer Engineering services. An individual comprehensive research or practical project must be intensively conducted under close supervision of faculty members and supervisors assigned by the training organization. At the end of the training, the student must submit a report of the project and also give a presentation.

DES102 Object-oriented Programming 3(3-0-6)
Prerequisite: None

Concepts of object-oriented programming. constructors and destructors. methods. Members: static, non-static. encapsulation. Abstraction. Inheritance. Polymorphism. Overloading. Modeling and application with classes. Generics.

DES103 Object-oriented Programming Laboratory 1(0-3-0)
Prerequisite: Have earned credits of or taking DES102 in the same semester

Hands-on practice and experiments of topics on object-oriented programming.

DES201 Discrete Mathematics 3(3-0-6)
Prerequisite: None

Sets and Projections. Boolean algebras. Relations. Automation. Formal grammars. Graphs and algorithms.

DES221 Data Structures and Algorithms 3(3-0-6)
Prerequisite: None

Concepts of data structures. Data structures and programming. Big-O. Recursion. Sorting and searching algorithms. Basic data structures: array, hash table, linked lists, stacks, queues, trees, binary trees, binary search trees, heaps, and graphs.

DES227 Algorithms Design 3(3-0-6)
Prerequisite: Have earned credits of DES221

Greedy algorithms. Divide-and-conquer. Dynamic programming. Network flow. Polynomial-time reduction. NP-completeness. Extending the limit of tractability. Approximation algorithms.

DES229 Human Computer Interface Design 3(3-0-6)
Prerequisite: None
Design concepts of hardware and software interface. Overview of the trends in human interfaces design. Graphical user interface. Interactive software design. Hardware technology for human interfaces.

DES231 Data Structures and Algorithms Laboratory 1(0-3-0)
Prerequisite: Have earned credits of or taking DES221
Hands-on practice and experiments of topics on data structures and algorithms

DES232 Introduction to Data Communications 3(3-0-6)
Prerequisite: None
The process of data exchange between computers. Analog data transmission systems. Digital data transmission systems. Various network topologies. Client-server models. Structure/mechanism of the 5-layer simplified OSI model: Application, Transport, Network, Data-link and Physical layers.

DES300 Digital Engineering Training 1(0-40-0)
Prerequisite: Have credits earned of not less than 85 credits
Practical training in the private sector or governmental departments in the field of Digital Engineering. Not less than 240 hours during the summer vacation of the third year. Students must submits a report to his/her supervisor who will decide for the final grade of either satisfactory (S) or unsatisfactory (U)

DES321 Management Information Systems 3(3-0-6)
Prerequisite: None
Structure and design of computer-based information systems. Topics included are computer hardware and software, database models, database management systems, system analysis, design and implementation.

DES322 Digital Business Experience 3(3-0-6)
Prerequisite: None
Design and development of business-oriented applications. case studies in businesses. the use of digital technology to create new value in business models and customer experiences.

DES323 Multi-platform Software Development 3(3-0-6)
Prerequisite: None
The process of data exchange between computers. Analog data transmission systems. Digital data transmission systems. Various network topologies. Client-server models. Structure/mechanism of the 5-layer simplified OSI model: Application, Transport, Network, Data-link and Physical layers.

DES324 Entrepreneurship for Digital Business 3(3-0-6)
Prerequisite: None
The emergence of digital economy: opportunities for entrepreneurs, creation of new business models, innovations, data driven. The nature of business developments: the context of new business startups, the concepts of innovation, creativity, the roles play in entrepreneurship. The essential attributes of an entrepreneur. Develop a business plan for their startup firm. Presentation in business pitch. Explore different kinds of IT startup. Traditional IT business through case studies. Digital marketing strategy. Implementation.

DES329 System Analysis and Design 3(3-0-6)
Prerequisite: None
Software models. Software modeling methodologies. Basic abstraction mechanisms in software modeling. Modeling techniques. Modeling process and languages. Software development process. Object-oriented system analysis and design. Hands-on practice: software development process, system analysis, design.

DES331 Computer Network Architectures and Protocols 3(3-0-6)
Prerequisite: None
Principles of networking. OSI and TCP/IP models. Transmission media. Applications of networks. Network programming. Design concepts of protocols. Local area networks. Network routing. Wireless networks. Network security

DES332 Computer and Network Security 3(3-0-6)
Prerequisite: None
Principles of building secure computer and network systems. Topic includes: security and privacy, threats, attacks, authentication, access control and authorization, formal security models, OS security, database security, symmetric and asymmetric cryptography, digital signature, security management. Network security: firewalls, Denial-of Service attacks, security protocols, Web and mobile security, SSL/TLS.

DES342 Computer Animation 3(2-3-4)
Prerequisite: None
Introduction to techniques for computer animation such as keyframing, procedural methods, motion capture, and simulation. Overview of story-boarding, scene composition, lighting and sound track generation. 2D & 3D images and animations application software.

DES352 Networking Laboratory 1(0-3-0)
Prerequisite: Have earned credits of DES232 or CSS331
Hands-on practice with the administration of computer networks and the development of computer network applications. Topics include: configuring network interfaces; designing and building switched and routed networks; monitoring network activities; and programming client/server applications.

DES400 Project Development 1(0-3-0)
Prerequisite: Have credits earned of not less than 95 credits
Practical projects or problems in Digital Engineering for individual students or groups of students under supervision of faculty members. Students are required to submit and present the project proposal to their project committee appointed by the school.

DES403 Digital Engineering Project 5(0-15-0)
Prerequisite: Have earned credits of DES400
Practical projects or problems in Digital Engineering for individual student or group of students under supervision of faculty members. Students are required to submits and present the project report to their project committee appointed by the school.

DES412 Tele-services and Services Architecture 3(3-0-6)
Prerequisite: None
In modern telecommunications, service providers experience market expansion and changes in service provisioning technologies. This course aims at presenting students with an architectural foundation: based on the convergence of computer, telecommunication, an digital content technologies. Topics includes: Intelligent Networks, Common Object Request Broker Architecture (CORBA), and common service architectures available in several telecommunication standards.

DES413 Internet Technologies and Applications 3(3-0-6)
Prerequisite: None
An overview of Internet technologies and applications. Topics includes: TCP/IP first generation (IPv4), TCP/IP new generation (IPv6), integration with ATM. New infrastructures: Internet 2, gigapops, IP over SONET, and IP over WDM. IP telephony. Video over IP. Multimedia applications over IP.

DES421   Location-based Services and Digital Mapping   3(3-0-6)
Prerequisite: None
This course describes: a comprehensive picture of the Location-based Services (LBS) world, cover key technologies, key markets, vertical industries, applications, solutions, value chain and key stakeholders. This course provides: an introduction to digital mapping, location technologies overview, Satellite based location methods (GNSS), Mapping, Navigation

DES422   Business Application Development   3(3-0-6)
Prerequisite: None
Business domains analysis (healthcare, financial, etc.). Business application architecture. Business requirement analysis. Business process modeling and visualization. Application design for business domain. User experience analysis and design. Design thinking for business solution improvement.

DES423   Applied Machine Learning and AI   3(3-0-6)
Prerequisite: None
Introduction to Machine Learning. Artificial Intelligence. Data and Models. Basic Concepts: Generalization, Error Functions, Error Minimization. Classification: Memory based methods, Decision Trees, Naive Bayes, Artificial Neural Networks, Support Vector Machines. Regression: Linear Regression, Logistic Regression, Dimensionality Reduction. Clustering: K-means, Simple Gaussian Mixture Models, Hierarchical Clustering. Association: Correlation, Association Rule Mining. Model Ensemble Techniques: Bagging, Boosting, Stacking, Co-training. Performance Evaluation. Artificial Intelligence, Human-Computer Interaction (HCI), Intelligent Information Systems Technologies. Natural Language Processing, Simulation and Modelling. Theoretical Computing. Artificial Intelligence Component: Knowledge Representation, Problem Solving, Reasoning, Planning, Basic and Advanced Search Algorithms, Pattern Recognition, Fuzzy Logic. AI Applications: Natural language understanding, computer vision, Automatic Programming, Intelligent Signal Processing.

DES424   Cloud-based Application Development   3(3-0-6)
Prerequisite: None
A cloud application, or cloud app, is a software program where cloud-based and local components work together. Cloud-based Application Development is a project based learning where students will learn the latest cloud computing technologies and integrate the technologies for a software or an app. , Introduction to cloud based technology, latest cloud technology, cloud storage, cloud server, cloud API, cloud API consumption, cloud-based authentication, data transfer security.

DES425   Electronic Commerce   3(3-0-6)
Prerequisite: None
The course introduces: the underlying economic aspects of the electronic marketplace providing with an understanding of its foundations for the development of new business models. Topics includes: electronic commerce, the Internet, characteristics of digital products and processes, product information, market efficiency, copyright protection, and electronic payment systems.

DES426   Business Innovation   3(3-0-6)
Prerequisite: None
This course provides: an overview and discussion of Design Thinking Principles, Service Science concepts for developing better products, services, processes, strategies, spaces, architecture, and experiences for customers-centric organization. Design Thinking helps organization to develop practical and innovative solutions for their problems. Design Thinking and Service Science are essential knowledge for transforming traditional business to human-focused. Prototype-driven. Service-oriented business. This course provides: develop a solid understanding of the fundamental concepts of Design Thinking, Service Science, Service Dominant Logic (SDL), how to apply multi-disciplinary knowledge for service-oriented business innovation.

DES427   Mobile Application Programming   3(3-0-6)
Prerequisite: None
Problem-based learning: principles of mobile application development, programming languages for mobile devices, JAVA, .NET, C/C++, Object-C, syntax and library usage. Hand-on practice on a suitable software development kit (SDK). Current and future trends of mobile applications.

DES428   Web Services and Service Architecture   3(3-0-6)
Prerequisite: None
This course aims: presenting students with an architectural foundation of software as Web services, basing on the convergence of computer, communication and digital content. Topics includes: notations, models, specifications for designing service-based distributed software systems. A clear understanding of the main types of established service design elements. Technologies: REST services, SOAP services.

DES429   Accounting Information Systems   3(3-0-6)
Prerequisite: None
An introduction to information systems for accounting and finance. The course includes: role, identifying, recording, Classifying financial transactions: characteristics of various types of accounts, accounting principles, concepts for measuring financial transactions, preparation of financial statements. Financial analysis. The basic principles of financial management in the allocation and acquisition of funds.

DES431   Big Data Analytic and Machine Learning   3(3-0-6)
Prerequisite: None
Introduction to data mining and machine learning: principles, algorithms, implementations, applications of data mining and machine learning. Data mining tasks: characterization, association mining, classification, and clustering. Statistical decision theory: adaptive classifiers, supervised, unsupervised learning, feature extraction, and decision units. Techniques for image and speech processing: text mining, and remote sensing. A process of examining and collecting large data sets to uncover hidden patterns. Unknown correlations. Market trends. Customer preferences. Other useful business information. This course brings several key information technologies: AI, machine learning, deep Learning technologies for manipulating, storing, and analyzing big data.

DES432   Statistics and Data Modeling   3(3-0-6)
Prerequisite: None
Statistical methods and probability for data analytics. Data collection. Analysis of data. Interpretation of data. Data model and visualization. Data classification. Probability distributions. Statistical significance. Hypothesis testing. Regression analysis. Data simulation. Analysis using statistical software

DES433   Data Visualization   3(3-0-6)
Prerequisite: None
Value of Visualization. Data and Image Models. Exploratory Data Analysis. Multidimensional Data. Graphical Perception. Visualization Software. Visualization of categorical data. Time series data. Multiple variables. Geospatial data. Interactive visualizations. Interaction. Animation. Effective Space Design: color, dashboard design, web-based visualizations. Design Critiques. Exploratory Visualization. Narrative with Data. Text Visualization. Visualization Evaluation.

DES435   Virtual Reality and Augmented Reality   3(3-0-6)
**   for Data Analytic**
Prerequisite: None
Introduction to Augmented Reality (AR) and Virtual Reality (VR) concepts and interfaces used in data analysis and for the communication of information. The use of traditional media types such as images, videos, text, audio and interaction scenarios for a range of real-world applications in data science, engineering, IT, education, marketing, medicine, and entertainment.

DES442   Entrepreneurship for IT Business Development   3(3-0-6)
Prerequisite: None
Technology viability assessment. Legal issues associated with forming a new company. Competitive positioning. Market analysis and market opportunity assessment. Product life-cycle planning. Marketing strategy. Organization management. Intellectual property management. Patenting. Technopreneurship. Business plan. Venture capital. Entrepreneurial ethics.

DES443   Business Process Model and Management   3(3-0-6)
Prerequisite: None
This course provides: an overview and discussion of the principles, concepts and techniques required to transform business from a traditional, functional organization to a process-centric organization. The course introduces: a systematic approach, methodology for planning, monitoring, measuring and managing organizational business process performance, redesigning, improving specific processes. The students will understand: the value and benefits of business process management, the principles of business process management, how to apply them. Business Process Model and Notation (BPMN) will be used as a standard language for process analysis and design. Process reengineering. Process improvement and process automation. Examples and exercises of process model and process management. This course includes: financial, accounting, human resource management, CRM processes, etc.

DES481   Topics in Hardware and Communications I   3(3-0-6)
Prerequisite: None
Topics of current interest in Hardware and Communications.

DES482   Topics in Hardware and Communications II   3(3-0-6)
Prerequisite: None
Topics of current interest in Hardware and Communications.

DES483   Topics in Hardware and Communications III   3(3-0-6)
Prerequisite: None
Topics of current interest in Hardware and Communications.

DES484   Topics in Software Technology I   3(3-0-6)
Prerequisite: None
Topics of current interest in Software Technology.

DES485   Topics in Software Technology II   3(3-0-6)
Prerequisite: None
Topics of current interest in Software Technology.

DES486   Topics in Software Technology III   3(3-0-6)
Prerequisite: None
Topics of current interest in Software Technology.

DES487   Topics in Computer Information Systems I   3(3-0-6)
Prerequisite: None
Topics of current interest in Computer Information Systems.

DES488   Topics in Computer Information Systems II   3(3-0-6)
Prerequisite: None
Topics of current interest in Computer Information Systems.

DES489   Topics in Computer Information Systems III   3(3-0-6)
Prerequisite: None
Topics of current interest in Computer Information Systems.

DES495   Special Studies in Digital Engineering I   3(3-0-6)
Prerequisite: None
Special study on current topics related to Digital Engineering.

DES496   Special Studies in Digital Engineering II   3(3-0-6)
Prerequisite: None
Special study on current topics related to Digital Engineering.

DES497   Special Studies in Digital Engineering III   2(2-0-4)
Prerequisite: None
Special study on current topics related to Digital Engineering.

DES499   Extended Digital Engineering Training   6(0-40-0)
Prerequisite: Have credits earned of DES400
Extensive on-the-job training of at least 16 weeks (640 hours) at a selected organization that provides digital engineering services-an individual comprehensive research or practical project related to the training must be intensively conducted under close supervision of faculty members and supervisors assigned by the training organization. At the end of the training, the student must submit a report of the project and also give a presentation.

EES203   Basic Electrical Engineering   3(3-0-6)
(For non-major students)
Prerequisite: None
Current, voltage, and power. Basic DC and AC circuit analysis. Introduction to electrical machinery: transformers, generators, and motors. Concepts of three phase systems. Methods of power transmission. Introduction to some basic electrical instruments.

EES204   Basic Electrical Engineering Laboratory   1(0-3-0)
(For non-major students)
Prerequisite: Have earned credits of or taking EES203 in the same semester
Laboratory practice and experimental studies on topics covered in EES203.

EES210   Basic Electrical Engineering Laboratory   1(0-3-0)
Prerequisite: Have earned credits of or taking EES216 in the same semester
Laboratory practice and experimental studies on topics covered in EES216.

EES212   Electromagnetics   3(3-0-6)
Prerequisite: Have earned credits of SCS136
Electrostatic fields. Conductors and dielectrics. Capacitance. Currents. Resistance. Magnetostatic fields. Magnetic materials. Inductance. Time-varying electromagnetic fields. Maxwell's equations. Transmission lines. Plane waves. Radio and RF transmission systems.

EES216   Circuit Analysis   3(3-0-6)
Prerequisite: None
Circuit elements. Node and mesh analysis. Circuit theorems. Resistance. Inductance and capacitance. First and second order circuits. Phasor diagram. AC power circuits. Three-phase systems.

EES222   Electrical Engineering Crafting Skill   2(1-3-2)
Prerequisite: None
Electrical schematic: interpretation, and drawing using computer aided design software. Crafting: circuit simulation software, printed circuit board, and circuit populating. Technical communication skill: report writing, and infographic design.

EES227   Linear Algebra and Optimization Method   3(3-0-6)
Prerequisite: None
Matrix: determinant, inverse, rank. Vector space. Linear system solution by direct and iterative methods. Linear transformation. Block matrix. Tensor product. Eigen problem. Function of matrices. Linear programing. Unconstrained and constrained multivariable optimization methods.

EES270 Digital Circuits Laboratory   1(0-3-0)
Prerequisite: Have earned credits of or taking EES271 in the same
   semester
Laboratory practice and experimental studies on topics covered in
EES271.

EES271 Digital Circuits   3(3-0-6)
Prerequisite: None
Number systems. Boolean algebra and logic gates. Combinational logic
circuits. Arithmetic circuits. Medium-scale integration logic circuits.
Sequential logic circuits (Finite state machines). Programmable logic
devices. Logic gate characteristics. Introduction to digital integrated
circuits.

EES281 Signals and Systems   3(3-0-6)
Prerequisite: None
Continuous-time and discrete-time signals and systems. Linear systems
and their properties. Fourier analysis of continuous-time and discrete-
time signals and systems. Convolution. Laplace transform and its
applications to continuous-time system analysis. Z-transform and its
applications to discrete-time system analysis. Sampling and
reconstruction.

EES299 Electrical Project Design   1(0-3-0)
Prerequisite: None
Project design concept: conceive, design, implementation and operation
(CDIO). Problem-based learning focusing on Conceive and Design
processes. Multi-disciplinary, and self-driven initiatives. Idea generation:
creative solution, and efficiency concern. Effective communication skill.
Technical presentation skill. Teamwork skill.

EES300 Electrical Engineering Training   1(0-40-0)
Prerequisite: Have credits earned of not less than 85 credits
Practical training in a private sector or governmental departments in
related fields of electrical engineering for not less than 240 hours during
summer vacation of the third year. Students must submit a report at
the end of the training period. A satisfactory (S) grade or an
unsatisfactory (U) grade will be given based on the student's
performance, quality of the report, and supervisor's comments.

EES306 Basic Electrical Machines and Power Systems 3(3-0-6)
Prerequisite: Have earned credits of EES203 or EES216
Basic concepts in power system analysis: phasors, complex power,
power factor improvement, three-phase circuits. Voltage, current, and
power calculations in single-phase and three-phase systems.
Introduction to magnetic circuits. Transformers. Basic concept of DC
and AC rotating machines. Principles, characteristic, operations, and
applications of induction motor and synchronous generator.

EES307 Basic Electromechanical Energy   1(0-3-0)
        Conversion Laboratory
Prerequisite: Have earned credits of EES306 or EES308
Laboratory practice and experimental studies on topics covered in
EES306 or EES308

EES308 Basic Electromechanical Energy Conversion 3(3-0-6)
Prerequisite: Have earned credits of EES203 or EES216
Introduction to magnetic circuits. Basic principles, efficiency, and
connections of transformers. Basic concepts of DC and AC rotating
machines. Characteristics, control, and applications of DC generators
and motors. Principles, characteristics, operations, and applications of
synchronous and induction machines. Three-phase and single-phase
induction motors. Methods of starting single-phase induction motors.

EES315 Probability and Random Processes   3(3-0-6)
Prerequisite: Have earned credits of MAS116

Random experiments. Classical probability. Counting techniques. Axioms
of probability. Conditional probability. Independent Events. Random
variables. Probability Distributions. Probability density function. Joint
probability. Functions of random variables. Expectation. Variance.
Covariance. Central limit theorem. Law of large numbers. Introduction
to random processes.

EES330 Electronics and Microelectronics Laboratories 1(0-3-0)
Prerequisite: Have earned credits of EES332
Laboratory practice and experimental studies on topics covered in
EES331 and EES332.

EES331 Electronics   3(3-0-6)
Prerequisite: Have earned credits of EES216
Analog electronic devices, e.g., operational amplifiers. Analog electronic
circuits, e.g., amplifiers, filters, and oscillators. For example, inverting
and non-inverting amplifiers, a voltage buffer, summing and difference
amplifiers, sensors and instrumentation amplifiers, integrators,
differentiators, low-pass and high-pass filters, and sinusoidal oscillators.
Instrumentation and measurement, e.g., meters based on
analog-to-digital converters, and digital-to-analog converters.

EES332 Microelectronics and Fabrication   3(3-0-6)
Prerequisite: Have earned credits of EES216
Semiconductors, a pn junction, diodes, diode circuits. Bipolar junction
transistors (BJTs) and BJT-based amplifiers, e.g., common-emitter,
common-base, and common-collector amplifiers. MOS field-effect
transistors (MOSFETs) and MOSFET-based amplifiers, e.g.,
common-source, common-gate, and common-drain amplifiers. Basic
digital integrated circuits, layout design, solid-state technology, and
fabrication processes.

EES340 Electrical Machines Laboratory   1(0-3-0)
Prerequisite: Have earned credits of EES341
Laboratory practice and experimental studies on topics covered in
EES341

EES341 Electrical Machines   3(3-0-6)
Prerequisite: Have earned credits of EES203 or EES216
Magnetic circuits. Principles of electromechanical energy conversion.
Energy and co- energy in magnetic circuits. Single-phase and three-
phase transformers. Principles of rotating machines. Direct current
machines. Synchronous machines. Induction machines.

EES342 Electrical Power System   3(3-0-6)
Prerequisite: Have earned credits of EES203 or EES216
Electrical power system structure: generation, transmission, and
distribution systems. Per-unit system. Electric generators. Power
transformers. Transmission lines and electrical cables. Fundamentals of
load flow. Fundamentals of fault calculation. Smart grid.

EES351 Principles of Communications   3(3-0-6)
Prerequisite: Have earned credits of EES281
Communications technology. Wired and wireless communication systems.
Communication models. Analog modulation. Technical standards and
organizations. Sampling theory. Digital communications systems.
Introduction to source coding and channel coding. Digital modulation.
Noise. Introduction to signal detection and performance analysis.

EES363 Mechatronic Instrumentation   3(3-0-6)
Prerequisite: None
Analysis, characteristics, and applications of instruments used in
engineering mechatronics: transducers, sensors, actuators, etc.

Measurement principles. Integrated sensors and actuators. Programmable logic control (PLC). Data acquisition system.

EES380   Control Systems Laboratory   1(0-3-0)
Prerequisite: Have earned credits of EES381
Laboratory practice and experimental studies on topics covered in EES381.

EES381   Control Systems   3(3-0-6)
Prerequisite: Have earned credits of EES281
System models on time domain and frequency domain. Transfer function. State-Space Representation. Dynamic models and dynamic responses of systems: Electrical Systems, Mechanical Systems. Force Analysis. Translational Motion. Conditions of system stability. Methods of stability testing. Time-Response Analysis. Steady State error. Frequency Response Analysis. Control Systems Design. PID controller.

EES382   Microprocessors and IoT   3(3-0-6)
Prerequisite: Have earned credits of EES271
C programming language. Microprocessor architecture. Instruction sets and assembly language. Concepts of timing and clocks. Memory and I/O interfacing.

EES383   Microprocessor and IoT Laboratory   1(0-3-0)
Prerequisite: Have earned credits of or taking EES382 in the same semester
Laboratory practice and experimental studies on topics covered in EES382.

EES400   Extended Electrical Engineering Training   6(0-40-0)
Prerequisite: Have credits earned of not less than 95 credits
Full-time research or practical training under close supervision of faculty members and assigned supervisors from the Electrical Engineering -related company for at least 16 weeks (640 hours). Evaluation based on the project achievement, project report and final oral presentation.

EES431   Analog Integrated Circuits   3(3-0-6)
Prerequisite: Have earned credits of EES332
Current mirrors and differential amplifiers based on BJTs and MOSFETs. Output stage and power amplifiers. Analog integrated circuits of operational amplifiers, filters, and oscillators. Analog multipliers. Digital-to-analog converters. Analog-to-digital converters. Phase-locked loops.

EES432   Digital Integrated Circuits   3(3-0-6)
Prerequisite: Have earned credits of EES332
Design principles of digital integrated circuits. NMOS inverters, pseudo NMOS, pass transistors, CMOS inverters, transmission gates. Logic families and their characteristics. Sources of propagation delay. Noise margins. Dynamic loads. Crosstalk. Transmission line effects. Advanced design concepts, Programmable gate arrays (PLAs).

EES433   Introduction to VLSI Design   3(3-0-6)
Prerequisite: Have earned credits of EES332
Introduction to design and fabrication of very large scale integrated systems using NMOS and CMOS technologies. CAD tools and computer-aided design. Use of state-of-the art design methodologies and tools. Testing and design for testability. Modularity, parallelism, local communications, fault tolerance.

EES435   Physical Electronics   3(3-0-6)
Prerequisite: Have earned credits of EES331
Quantum mechanical principles. Atomic structure. Crystal structure. Energy band theory. Energy bands and charge carriers in semiconductors and metals. Equilibrium and transport properties of semiconductors.

p-n Junction and diode equation. Diodes, bipolar and field-effect transistors. Physical principles of other semiconductor devices of current interest.

EES436   Chaotic Circuits and Systems   3(3-0-6)
Prerequisite: Have earned credits of EES332
Emergence of chaos theory, classical and modern history of chaos theory. Chua's circuit. Chaotic circuits and systems. Chaotic jerk circuits and systems. Hyperchaotic circuits and systems. Hyperchaotic hyperjerk circuits and systems. Applications of chaotic circuits and systems to secure communications and others. Bifurcations, spectrum of Lyapunov exponents, homoclinic orbits, Poincare sections. Self-excited attractors and hidden attractors.

EES441   Electrical System Design and Safety   3(3-0-6)
Prerequisite: Have earned credits of EES203 or EES216
Basic design concepts. Codes and standards. Power distribution schemes. Electrical wires and cables. Raceways. Electrical equipment and apparatus. Load calculation. Power factor improvement and capacitor bank circuit design. Lighting and appliances circuit design. Motor circuit design. Load, feeder, and main schedule. Emergency power systems. Short circuit calculation. Grounding systems for electrical installation. Electrical hazards and safety measures. Electric shock. Step and touch potentials. Electrostatic discharge (EDS). Electrical arc flash and protection. Electrical isolation. Circuit protection devices.

EES442   Power Electronics   3(3-0-6)
Prerequisite: Have earned credits of EES331
Characteristics of power electronics devices. Principles of power converters: AC to DC converter, DC to DC converter, AC to AC converter, DC to AC converter.

EES443   High Voltage Engineering   3(3-0-6)
Prerequisite: Have earned credits of EES203 or EES216
Uses of high voltage and overvoltage in power systems. Generation of high voltage for testing. High voltage measurement techniques. Electric field stress and insulation techniques. Breakdown of gas. Liquid and solid dielectric materials. High voltage testing techniques. Lightning protection. Insulation coordination.

EES444   Power System Protection   3(3-0-6)
Prerequisite: Have earned credits of EES341
Fundamental of protection practices. Instrument transformer and transducers. Protection devices and protection systems. Overcurrent and earth fault protection. Differential protection. Transmission line protection by distance relaying. Transmission line protection by pilot relaying. Motor protection. Transformer protection. Generator protection. Bus zone protection. Introduction to digital protection devices.

EES445   Renewable Energy and Energy Management   3(3-0-6)
Prerequisite: None
Introduction to energy systems and renewable energy resources. Fundamentals of energy efficiency. Energy management and analysis. Energy storages. Co-generation. Energy conservations. Potential of renewable resources. Difference of conventional and renewable energy technologies. Renewable technologies: solar, wind, biomass, geothermal, biogas, municipal solid waste, wave energy, fuel cell, laws, regulations, and policies of renewable energy and energy conservation. Economic aspects.

EES447   Power Plants and Substations   3(3-0-6)
Prerequisite: Have earned credits of EES341
Load curve. Diesel power plants. Steam power plants. Gas turbine power plant. Combined cycle power plants. Hydro power plants. Nuclear

power plant. Renewable energy sources. Type of substation. Substation equipment. Substation layout. Substation automation system. Lightning protection for substations. Grounding systems.

EES449   Smart Grid Technology   3(3-0-6)
Prerequisite: None
Introduction to smart grids. Distributed generation. Microgrid. Active network management. Wide area monitoring and protection systems. Grid connection codes. Automatic meter reading. Smart meters and advanced metering infrastructure. Communication technology in power systems and smart grids.

EES450   Communications Laboratory   1(0-3-0)
Prerequisite: Have earned credits of or taking EES451 in the same semester
Laboratory practice and experimental studies on topics in signal processing, communications, and networks.

EES451   Data Communications and Networks   3(3-0-6)
Prerequisite: None
Introduction to data communications and networks. Layered network architecture. Point-to-point protocols and links. Delay models in data networks. Medium-access control protocols. Flow control. Error control. Local area networks. Switching networks. Routing in data networks. Network security. Cloud networks. Architecture and systems. Standards.

EES452   Digital Communication Systems   3(3-0-6)
Prerequisite: Have earned credits of EES315 or IES302
Digital communication systems. Entropy. Conditional entropy. Mutual information. Channel capacity. Block codes. Cyclic codes. Convolutional codes. Viterbi decoding. Signal detections and performance analysis.

EES453   Satellite Communication Systems   3(3-0-6)
Prerequisite: Have earned credits of EES351
Introduction to space communications and frequency used. Satellite orbits and their effect on communication systems design. Communication satellites and their principal subsystems. Multiple access. Earth stations. Satellite networks. Techniques in satellite communications. Satellite internet.

EES454   Communication Networks and Transmission Lines   3(3-0-6)
Prerequisite: Have earned credits of EES351
Wire and wireless communication. Wire communication network. Y, Z, F, G, H matrix and relation. Connection and basic circuits. Network transformation. Transmission quantities. Signal transmission circuit techniques. Wave filters. Attenuator. Impedance matching. Transmission line theory. Equation, solution for low, medium, high frequencies, primary and secondary constant. Incident and reflected waves. Standing wave ratio. Line characteristics for open, short, terminated load, lossless, and lossy lines. Reflections in time domain, bounce diagrams, near-end and far-end crosstalk. Differential signaling, composite line, types of cable, and unshielded twisted pair. Coaxial cable. Current cable standards.

EES455   Wireless Communications   3(3-0-6)
Prerequisite: Have earned credits of EES351
Standards of current wireless communication systems. Mobile communication systems: 4G, 5G, and beyond. Characteristic and impact of radio propagation. Multipath fading channels. Orthogonal frequency division multiplexing. Multiple access and interference management. Spread spectrum techniques. MIMO systems.

EES456   Optical Communications   3(3-0-6)
Prerequisite: Have earned credits of EES212
Cylindrical dielectric waveguides and propagating conditions. Structure and types of optical fiber. Optical fiber parameters. Optical cable types.

Optical transmitters. Optical receivers. Attenuation and dispersion in fiber link. Optical repeaters and amplifiers. Link budget calculation design. Multiplexing in optical link system. Access network as FTTX. Industrial standards of optical fiber cables and optical communication systems. Measurement in optical fiber link.

EES458   Communication Electronics   3(3-0-6)
Prerequisite: Have earned credits of EES332
RF and power amplifiers, oscillators, phase-locked loops, filters, carrier modulators and demodulators, analog-to-digital and digital-to-analog converters, examples of commercially available integrated circuits for communication systems.

EES461   Microwave Principles   3(3-0-6)
Prerequisite: Have earned credits of EES212
Review of Maxwell's equations. Plane waves. Microwave transmission lines and waveguides. Microwave network analysis. Impedance, equivalent voltage and current. The s- matrix. Signal flow graphs. Impedance matching and tuning. Microwave resonators. Power dividers and directional couplers. Microwave filters. Point-to-point microwave link. Radar system. Microwave propagation. Basics of microwave measurement. Applications.

EES462   Antennas   3(3-0-6)
Prerequisite: Have earned credits of EES212
Basic definitions and theory. Isotropic point source. Power and field patterns. Directivity and gain. Efficiency. Polarization. Input impedance and bandwidth. Friis transmission equation. Radiation from current elements. Ground effects. Radiation properties of wire antenna. Array antenna. Yagi-Uda antennas and log-periodic antenna. Aperture antenna. Microstrip antennas. Modern antennas for current applications. Antenna characteristics measurement.

EES463   Electromagnetic Waves and Applications   3(3-0-6)
Prerequisite: Have earned credits of EES212
Electromagnetic waves in vacuum, media and waveguides. Transmission lines. Smith chart and impedance matching. Radiation. Concepts and design of antennas and electromagnetic wave transmitters and receivers. Satellite communication. Link budget calculation. Other applications such as Global Positioning System (GPS) and remote sensing.

EES465   Biomedical Instrumentation   3(3-0-6)
Prerequisite: Have earned credits of EES331
Overviews of human body. Electrodes and biotransducers. Bioelectric amplifiers. Instrumentation for heart and brain parameters. Magnetic resonance imaging. Medical laboratory instrumentation. Medical ultrasound. Bioelectric and biomagnetic measurement. Biochemical measurement. Chemical transducers: electrochemical, optical, and biosensor based chemical transducers, etc. Continuous measurement of chemical qualities. Computers in biomedical equipment. Optical based chemical equipment for environment monitoring.

EES472   Digital Signal Processing   3(3-0-6)
Prerequisite: Have earned credits of EES281
Continuous-time and discrete-time signals. Spectral analysis. Decimation and interpolation. Sampling rate conversion. DFT. Design of FIR, IIR digital filters, Multirate systems and Filter Banks. Discrete Wavelet Transform. Introduction to some DSP applications: image processing, speech and audio processing.

EES477   Signal Processing for Communication Systems   3(3-0-6)
Prerequisite: None
Digital signals and systems. Multirate processing. Digital filters. Filter banks. Channel estimation. Channel equalization. Power spectral estimation. Adaptive filtering.

EES478   Computer Vision   3(3-0-6)
Prerequisite: None
Image acquisition. Digital image fundamentals. Image enhancement. Image filtering in the spatial and frequency domains. Morphological operations. Color models. Feature detection and extraction. Shape analysis. Motion detection. Stereo vision. Image classification and pattern recognition.

EES481   Introduction to Robotics   3(3-0-6)
Prerequisite: Have earned credits of EES381
Operation principles, analysis, and design of robots. Kinematics, dynamics, trajectory planning, and control of mechanical manipulators. Robotic vision and visual feedback. Robot programming languages. Control algorithm design. Current topics of interest from the literature.

EES482   Introduction to Mechatronics   3(3-0-6)
Prerequisite: None
Introduction to integration of mechanical, electrical, and computer systems for information processing and control of machines and devices. Basic electronics. Signal processing. Micro-controller and microprocessor. Sensors and actuators. Control architecture in mechatronic systems. Overview of electro-mechanical design and embedded systems. Topics of current interest in mechatronics.

EES483   Linear System Theory   3(3-0-6)
Prerequisite: Have earned credits of EES381
Mathematical description of systems. State-space description of linear dynamical systems. Controllability and observability. Stability analysis. Stabilizability and dectectability. State feedback and observers. Introduction to optimal control.

EES486   Embedded Systems and IoT   3(3-0-6)
Prerequisite: Have earned credits of EES382
Architecture and design of embedded systems and Internet of Things (IoT). Programming for embedded systems. Microcontroller and interfaces. Real-time operating systems and applications, timers, interrupts, DMA and I/O. Serial communication protocols. TCP/IP, wired and wireless network communication protocols, and security for IoT.

EES491   Electrical Engineering Seminar I   1(0-3-0)
Prerequisite: Have credits earned of not less than 95 credits
Presentation and discussion of recent advances and research in electrical engineering by guest lecturers, faculty, and students. Topics may vary from semester to semester. S/U grading.

EES492   Electrical Engineering Seminar II   1(0-3-0)
Prerequisite: Have credits earned of not less than 95 credits
Presentation and discussion of recent advances and research in electrical engineering by guest lecturers, faculty, and students. Topics may vary from semester to semester. S/U grading.

EES493   Special Topics in Electrical Engineering I   3(3-0-6)
Prerequisite: None
New topics or areas of study not offered in other electrical engineering courses. Topics may vary from semester to semester.

EES494   Special Topics in Electrical Engineering II   3(3-0-6)
Prerequisite: None
New topics or areas of study not offered in other electrical engineering courses. Topics may vary from semester to semester. Topic covered is different from EES493.

EES495   Special Studies in Electrical Engineering II   3(3-0-6)
Prerequisite: None
Current development and/or fundamental knowledge in electrical engineering technologies.

EES496   Special Studies in Electrical Engineering I   3(3-0-6)
Prerequisite: None
Current development and/or fundamental knowledge in electrical engineering technologies.

EES497   Special Studies in Electrical Engineering III   2(2-0-4)
Prerequisite: None
Current development and/or fundamental knowledge in electrical engineering technologies.

EES498   Electrical Engineering Project I   2(0-6-0)
Prerequisite: Have credits earned of not less than 95 credits
Practical projects or problems in electrical engineering for individual students or groups of students under supervision of faculty members. Students are required to submit complete project reports and present the project results to their project committee appointed by the program.

EES499   Electrical Engineering Project II   3(0-9-0)
Prerequisite: Have earned credits of or taking EES498 in the same semester
Practical projects or problems in electrical engineering for individual students or groups of students under supervision of faculty members. Students are required to submit complete project reports and present the project results to their project committee appointed by the program.

GTS101   Extended English in Practice   3(3-0-6)
Prerequisite: None
This course provides a flexible approach to grammar instruction and integrates the study of new structures (form) with information on how to use them and what they mean (function). Comprehensive grammar coverage ensures a thorough and effective presentation of all basic structures. Extensive practice guides students to accurate production and fluent use of new grammar. Short writing assignments incorporate grammar into step-by-step tasks for a variety of writing purposes, such as narrating and describing. There is also a focus on real-world listening skills.

GTS113   Finite Mathematics for Business Analytics   3(3-0-6)
Prerequisite: None
Elementary matrix algebra. Arithmetic operations. Inverses, and systems of equations. Sets and counting principles: permutations and combinations. Elementary probability. Conditional probability. Intersection and independence. Introduction to statistics. Level of measurements. Data description. Measure of central tendency. Measures of dispersion. Introduction of random variables. Introduction of discrete and continuous random variables., Applications in the business analytics.

GTS123   Introduction to Computers and Programming   3(2-3-4)
Prerequisite: None
Computer system components and organization. Hardware and software interaction. Introduction to data processing and databases. Algorithms and programming languages. Programming in high-level languages. Program design and development. Practical laboratories are essential parts of the course, designed to develop students' programming skills and understanding of computer system. These skills are important foundations for other technical courses.

GTS124   Artificial Intelligence and Applications   3(3-0-6)
Prerequisite: None
Basic terminologies and concepts of artificial intelligence (AI), machine learning, artificial neural networks, and deep learning. Applications of AI in various fields, including transportation management systems, information technology systems, and business models. Various issues and concerns surrounding AI, such as ethics, bias and arguments, and

jobs of future demands. The impact of AI in decision making and organizational behavior.

GTS131 Circularity for Sustainable Development 3(3-0-6)
Prerequisite: None
Introduction to Sustainable Development Goals (SDGs). Circular economy and how to solve challenging issues we are facing due to a growing world population, i.e., waste, climate change, resource scarcity, loss of biodiversity. How businesses can create value by reusing and recycling products. How designers can come up with effective solutions. How we can contribute to make the Circular Economy happen for sustainable development

GTS210 Mathematics for Technologists III 3(3-0-6)
Prerequisite: Have earned credits of MAS117
Vectors in the plane and space, systems of linear equations, vectors, vector spaces, linear transformations, inner products, eigenvalues and eigenvectors. Introduction to matrices and determinants and complex numbers.

GTS231 Law and Technology 3(3-0-6)
Prerequisite: None
A study of the relation between law and technology: an exploration of issues in both private and public laws pertaining to the application of technology, Thai and international law development. Legal issues involving digital content, intellectual property, privacy, civil and commercial transactions, torts, business organizations, electronic commerce, electronic contracts, computer-related crime, and other related topics. General legal principles concerning civil and criminal liability. Understanding of the basic concepts of law: interpretation and application of the legal principles related to technology in discussion and in the real world.

GTS302 Technical Writing 1(0-3-0)
Prerequisite: None
Students learn and practice writing and presentation of technical reports, which include reports of laboratory experiments, in-depth technical reports, overview articles of technical topics for the general public, as well as executive summaries.

GTS303 Communications in Business 2(2-0-4)
Prerequisite: Have earned credits of GTS101
This course prepares students to communicate effectively in various types of business situations. Students learn how to write professional letters and emails with an emphasis on tone, format, and formality. Students also make a resume and cover letter, and give a business style presentation. By expressing ideas in a thoughtful and professional manner, students gain important skills that are necessary for success in the business world.

GTS351 National Competition Participation 3(0-9-9)
Prerequisite: None
A student or a group of students under supervision of an advisor from an academic program that can participate in the last round of the national competition approved by the academic program, and has an evidence or certificate of participation, are eligible to earn 3 credits from this course. This course may be registered after the competition is finished not later than 2 years. The grade of this course is considered by the advisor and a committee member set by the academic program based on the outcome of the competition.

GTS352 International Competition Participation 3(0-9-9)
Prerequisite: None
A student or a group of students under supervision of an advisor from an academic program that can participate in the last round of the international competition approved by the academic program, and has an evidence or certificate of participation, are eligible to earn 3 credits

from this course. This course may be registered after the competition is finished not later than 2 years. The grade of this course is considered by the advisor and a committee member set by the academic program based on the outcome of the competition.

GTS401 Intensive English Proficiency 6(6-0-12)
Prerequisite:
1. Student has completed all the course work according to respective curriculum.
2. Student has already taken, at least 5 times, an acceptable English Proficiency test (TOEFL, TU-GET, IELTS, TOEIC, or Institutional TOEFL).

Students who pass this course will have similar English skills to those students who satisfy the English Proficiency requirement. The course content is based primarily on the Institutional TOEFL (ITP) exam; however, materials may be drawn from other tests (e.g., IELTS or TOEIC). Strategies for answering the different types of exam questions are discussed and practiced in class. Special emphasis is placed on helping students improve their individual weaknesses in the listening, reading, or structure sections of the exam. An S (satisfactory) or U (unsatisfactory) grade is given.

GTS451 Intellectual Property Development 1 6(0-18-18)
Prerequisite: None
A student or a group of students under supervision or collaboration of an advisor or advisors from an academic program that can develop an invention or other forms of output and successfully apply for registration under petty patent, patent, copyright, or intellectual property with the related government agency or international organization. All students are eligible to earn 6 credits from this course. This course may be registered after the successful application for registration of the intellectual property not later than 2 years. The grade of this course is considered by the advisor(s) and a committee member set by the academic program based on the quality of the intellectual property.

GTS452 Intellectual Property Development 2 6(0-18-18)
Prerequisite: None
This course is a continuation of GTS451 Intellectual Property Development 1. All students are eligible to earn 6 credits from this course when the registration application of the intellectual property is approved by the related organization or the intellectual property is used by an organization and generates continuous tangible income. This course may be registered after the approval or the tangible income is generated not later than 1 year. The grade of this course is considered by the advisor(s) and a committee member set by an academic program based on the quality of the intellectual property.

IES201 Industrial Engineering Mathematics 3(3-0-6)
Prerequisite: None
How to use mathematical software packages, e.g., MATLAB, Excel, Excel Solver, and Open Solver to do matrix operations, solve systems of linear equations, differential equations and related transformations. Basic numerical methods using mathematical software packages. Fundamentals of numerical methods. Basic and advanced applications of Excel software for Industrial Engineering and Logistics applications are included.

IES301 Manufacturing Processes 3(3-0-6)
Prerequisite: None
Fundamentals of metrology and measuring tools, and manufacturing processes. Cutting processes and machines: drilling, lathe and turning, and milling. Abrasive and grinding processes and machines. Nontraditional machine tools. Sand casting. Basic gas and electric welding. Pressing operations and machines. Sheet forming: blanking, bending, deep drawing. Rolling and rolling mill. Forging operations and machines. Extrusion and drawing processes and equipment.

Relationships between materials and manufacturing processes. Basic of manufacturing cost.

IES302 Engineering Statistics 3(3-0-6)
Prerequisite: None
Fundamentals of probability: discrete and continuous probability distributions, and conditional probability. Moment generating functions. Discrete and continuous random variables. Sampling distributions. Hypothesis testings of the means, variances, and proportions. Regression analysis.

IES303 Engineering Management and Cost Analysis 3(3-0-6)
(For Non-Industrial Engineering and Smart Logistics Students)
Prerequisite: None
Broad view of management system (in both its classical and modern aspects). Structures and functions of interrelated departments. Inventory management. Quality assurance. Project management. Basic concepts and applications of an economic evaluation of engineering projects. Interest formulas, time value of money, economic decision making involving several alternatives. This course is not intended for industrial engineering students.

IES304 Industrial Engineering Training 1(0-40-0)
Prerequisite: Have credits earned of not less than 85 credits
Students are provided with on-the-job training at selected modern industrial or service facilities. The purposes of the course are to allow the students opportunities to observe how industrial engineers function, to learn how to collaborate with co-workers, and to develop self-responsibility. The training period must not be less than 240 hours. Students must submit a report at the end of the training period. Satisfactory (S) or unsatisfactory (U) grade will be given based on student's performance, quality of the report, and supervisor's comments.

IES305 Industrial Engineering Project I 1(0-3-0)
Prerequisite: Have credits earned of not less than 95 credits
The first course in the senior project course series. A student team will be given a real world problem which they must determine appropriate approaches and actions to obtain feasible solutions. This involves establishment of initial contacts, project proposal development, preliminary data collection, data analysis, verification of the results, and practical implementation. A presentation of the progress and a submission of the status report are due at the end of the semester.

IES308 Manufacturing Processes Laboratory 1(0-3-0)
Prerequisite: None
Students experience practical skills in workshop practices of bench working, turning, milling, electric welding, gas welding, cutting tool shaping and grinding, casting and foundry, and safety regulations, practices, personal protection equipment.

IES312 Methods Analysis and Work Measurement 3(3-0-6)
Prerequisite: None
Measurement and evaluation of work methods. Work improvement methods. Visual and micromotion study techniques. Motion economy. Time study and determination of standard time. Work sampling. Development and use of standard time data and computerized techniques.

IES313 Industrial Plant Design 3(3-0-6)
Prerequisite: None
Modern methods for facility layout and location design. Logistics of motion of people and materials. Flow analysis. Plant layout. Material handling techniques. Mathematical approaches and computer packages applicable for solving facility layout and location problems.

IES315 Methods Analysis and Work Measurement Laboratory 1(0-3-0)
Prerequisite: None
This laboratory course demonstrates a practical use of modern apparatus available for motion and time study applications. Process charts and a time study board will be utilized to not only analyze manufacturing and service operations, but also improve the productivity.

IES321 Operations Research I 3(3-0-6)
Prerequisite: None
Basic operations research models, algorithms, and their applications. Linear programming and its extensions. Transportation model. Game theory. Network flow analysis. Queueing theory. Simulation modeling.

IES323 Production Planning and Control 3(3-0-6)
Prerequisite: None
Components and functions of integrated production, planning, and control systems. Material, equipment, and manpower requirements for optimizing continuous and intermittent manufacturing operations. Demand forecasting. Hierarchical production planning. Capacity planning. Line balancing. Operation sequencing and scheduling.

IES324 Production Sequencing and Scheduling 3(3-0-6)
Prerequisite: Have earned credits of IES323
Techniques of sequencing and scheduling for job shops, flow lines, and other general manufacturing and production systems. Deterministic and stochastic models.

IES331 Quality Control 3(3-0-6)
Prerequisite: Have earned credits of IES302
Methods to improve product quality, to prevent defects, to locate chronic sources of trouble. Process capability. Use of inspection data to regulate manufacturing processes. Preparation of statistical control charts. Selection of suitable sampling plans. Total quality control, quality control circle, and ISO 9000 standard.

IES332 Factory Automation and Intelligent Control 3(3-0-6)
Prerequisite: None
Design of automation production system and integration of supporting subsystems in the overall manufacturing environment. Flexible manufacturing system (FMS). Robotic cells. Automated warehousing (AS/RS). Automated material handling systems (conveyor, AGV, etc). Automated inspection systems. Computerized controls. Linear and proportion-integral-differential (PID) control systems. System reliability analysis. Open and closed loop control systems. System response.

IES333 Product Design and Development 3(3-0-6)
Prerequisite: None
Key components of product design and development (PDD): concept development, system-level design, detail design, testing and refinement, and production ramp-up. Translating and establishing customer needs/feelings/perceptions/experiences to an idea of the product's characteristics, design thinking, product planning, design-for-assembly, design-for-manufacturing, material selection, decision-making strategy, color theory, prototyping, and industrial design. Tools of customer-centric design, storytelling, ethnography, and innovation via some case studies and a group project. The aims of a group project are breaking complex tasks properly into portions and steps, planning what to do in sequences, managing time for performing tasks with an equal distribution of workload, and refining understanding through discussion and explanation.

IES334 Industrial Robotics and Applications 3(3-0-6)
Prerequisite: None
Robotics in manufacturing systems. Role of programmable robots in manufacturing. Students will obtain hands-on experience about hardware and software available for various industrial robot systems.

IES335 Metrology 3(3-0-6)
Prerequisite: None
Principles and applications of precision or fine measuring equipment: optical, laser, and electro-magnetic devices. Standards and accuracy of measurement. Dimensional toleaces. Geometric tolerances. Tolerance design.

IES336 Industrial Instrument and Controlling System 3(3-0-6)
Prerequisite: None
Principles and applications of instrument, particularly measuring and controlling instrument in industies. Eelectrical measurement, distance measurement, color detector, pressure measurement, level measurement, and temperature measurement. Programmable Logic Control (PLC). Driving system. Design of measuring and controlling system to integrate all industrial instrument.

IES337 Smart Industrial Engineering and Logistics laboratory 1(0-3-0)
Prerequisite: None
Laboratory of modern, automation, and intelligent technologies available in industries and developed by collaboration between faculties and industries, e.g., Augment Realities and Virtual Realities, Holo lens, automatic quality inspection by vision systems, Internet of Things (IoT), smart sensors, real-time performance reporting system, and smart warehousing systems.

IES341 Engineering Economy 3(3-0-6)
Prerequisite: None
Principles of engineering economics for utilization and evaluation of capital investments. Time value of money. Net present value. Rate of return. Depreciation. Selection of the best economic investment alternative. Multiple choice replacement analysis. Uncertainty and risk. Estimating income tax consequences.

IES342 Industrial Cost Analysis and Control 3(3-0-6)
Prerequisite: None
Tools and techniques applicable for cost analysis and control. Financial analysis of the accounting system. Standard costs. Variance analysis. Cost-volume-profit relationships. Cost estimation. Utilization of accounting data for control of operations.

IES343 Safety Engineering 3(3-0-6)
Prerequisite: None
Principles and practices of safety engineering in product and facilities design. Loss prevention principles. Safe practices and hazard control. Safety standards and codes. Inspection procedures. Governmental regulations. Safety statistics. Occupational Safety and Health Act (OSHAct) and Thai legislation. Engineering ethics, moral principles and social responsibility.

IES345 Project Feasibility Study 3(3-0-6)
Prerequisite: None
Problem-based course on project feasibility study. Fundamental concepts of a project feasibility study. Essential qualitative and quantitative aspects of the feasibility study: marketing evaluation, proposal development (preparation and presentation), economic analysis, project planning and scheduling.

IES351 Maintenance Engineering and Intelligent Technologies 3(3-0-6)
Prerequisite: None
Key components of maintenance engineering: objective of maintenance management, responsibility of maintenance, management and structure of maintenance. Total Productive Maintenance (TPM). Types of maintenance activities: preventive, corrective, predictive, and scheduled maintenance. Mathematical models of maintenance management. Maintenance software in industrial organization and service industries. Definition of key terminologies. Design for maintainability. Human error in maintenance. Application of Fault Tree Analysis (FTA). Applications of smart sensors and Internet of Things (IoT) to analyze conditions of machines for maintenance. Human error in maintenance; Application of Fault Tree Analysis (FTA): Applications of smart sensors and Internet of Things (IoT) to analyze conditions of machines for maintenance.

IES353 Pollution Control and Waste Treatment 3(3-0-6)
Prerequisite: None
Physical, chemical, and biological processes which influence the extent of air, water, and land pollution. Methods for monitoring, controlling, and preventing pollution. Methods of waste treatment. Chemical wastes and hazardous wastes.

IES361 Manufacturing Process Design 3(3-0-6)
Prerequisite: Have earned credits of IES301
Process and material selection and design of cost-effective manufacturing processes which are suitable for the characteristics of workpieces. Material properties and product attributes. Engineering materials: metals, ceramics, polymers, and composites. Solidification processes: metal casting, glass working, plastics and rubber processing. Shaping of composites. Powder metallurgy. Reverse engineering and rapid prototyping. Material removal processes: cutting, machining, and grinding. Nontraditional machining processes: chemical, electro-chemical, thermal energy, and laser processes. Manufacturing and support systems: numerical controls, programmable logic controllers, and flexible manufacturing systems.

IES362 Manufacturing Engineering Laboratory I 1(0-3-0)
Prerequisite: Have earned credits of IES301
This course provides hands-on exercises on CAD/CAM, CNC machine programming and control (lathe and milling), and robot programming and control.

IES363 Manufacturing Engineering Laboratory II 2(1-3-2)
Prerequisite: None
The laboratory course provides practical integration between measuring and controlling instrument used in manufacturing environment. Measuring instrument is focused on the physical property measuring such as pressure, temperature and level. Controlling instrument is emphasized in both mechanical and electrical control devices such as Programmable Logic Control (PLC).

IES364 Manufacturing Processes and Technologies 3(3-0-6)
Prerequisite: Have earned credits of IES361
Non-traditional manufacturing processes and technologies for metal parts, plastic, and composite-material parts. Manufacturing processes for electronic devices, and printed circuit boards.

IES365 Jig, Fixture and Mold Design 3(3-0-6)
Prerequisite: Have earned credits of IES301
Fundamentals of jig, fixture, and mold design. Types, classifications, functions, and applications of jig, fixture, and mold. Design economics. Computer aided design (CAD) concept to develop jig, fixture, and mold. Hands-on exercises of CAD.

IES372 Materials Management and Inventory Control 3(3-0-6)
Prerequisite: Have earned credits of IES323
Philosophy of materials management and quantitative techniques used in controlling level of inventories in an organization. Classifications of inventory from different perspectives. Deterministic and probabilistic inventory models. Modern materials management systems: MRP-II and JIT.

IES374   Management Information Systems   3(3-0-6)
Prerequisite: Have earned credits of GTS123
Structure and design of computer-based information systems. Computer hardware and software. Database models. Database management systems. System analysis, design, and implementation.

IES376   Logistics and Supply Chain Management   3(3-0-6)
Prerequisite: None
Principles of logistics and supply chain management. Logistic planning. Cooperation and management in the supply chain. Transportation. Material purchasing and inventory control. Packaging. Integration between production planning and distribution among partners in the chain. Information system. The present and future roles of logistics in the supply chain management.

IES377   Distribution Network Models: Warehouse,   3(3-0-6)
**   Inventory and Transportation**
Prerequisite: None
Guidelines for design and management of distribution networks. Roles of warehouse, distribution center, inventory, and transportation in multi-echelon supply chain. Optimization models for warehouse location, size, and market allocation. Warehouse design and layout. Types of distribution networks. Inventory management models. Simulation models for studying and evaluating of inventory models. Analysis of transportation systems. Transportation modes. Vehicle routing problems. Case studies of model implementation.

IES378   Business Intelligence and Data Analytics   3(3-0-6)
Prerequisite: None
Concepts, tools and techniques of business intelligence; data visualization; data exploration; business analytics in descriptive, predictive, and prescriptive; data cleansing, verification, validation, and integration; data mining; data-driven business decisions; best practices and case studies.

IES391   Applied Statistical Methods   3(3-0-6)
Prerequisite: Have earned credits of IES302
Statistical analysis techniques and their applications. Hypothesis testing. Goodness-of-fit tests. Regression analysis. Analysis of variance. Applications in engineering fields.

IES392   Systems Simulation   3(3-0-6)
Prerequisite: None
Problem-based course on systems simulation. Application of discrete time simulation modeling for the analysis of complex manufacturing and service systems, using case examples in warehousing, material handling, banking, etc. Applications of continuous time and combined discrete-continuous simulation modeling. Students will gain first-hand practice on how to use state-of-the-art simulation software through a series of laboratory exercises or a realistic semester project.

IES394   Artificial Intelligence and Industrial Applications   3(3-0-6)
Prerequisite: None
Concepts and techniques of intelligent systems. Search methodologies. Knowledge-based system: knowledge representation, components of knowledge-based systems, design of knowledge bases, and inferencing. Applications of knowledge-based systems in design of products, processes, and systems, machine diagnostics, and production planning and scheduling. Modern industrial applications.

IES395   Special Topics in Industrial Engineering I   3(3-0-6)
Prerequisite: None
This course is designed for topics related to industrial engineering, but not presently offered as either a required or technical elective.

IES396   Special Topics in Industrial Engineering II   3(3-0-6)
Prerequisite: None
This course is designed for topics related to industrial engineering, but not presently offered as either a required or technical elective. Topics covered are different from IES395.

IES397   Introduction to Business Intelligence   3(3-0-6)
          (For Non-Industrial Engineering and Smart Logistics Students)
Prerequisite: None
Basic concepts, tools and techniques of business intelligence; data visualization; data exploration; business analytics; data pre-processing; data-driven business decisions; design of analytics dashboard prototype; best practices.

IES401   Industrial Engineering Project II   4(0-12-0)
Prerequisite: Have earned credits of IES305
A continuation of IES305. An individual student or a team of students will work on the individual or group projects assigned to them. The projects can be intensively conducted in industrials or within the institute. After a project is completed, students are responsible for submitting their final report and giving a presentation.

IES402   Special Studies in Industrial Engineering I   3(3-0-6)
Prerequisite: None
This course is intended for students who wish to participate in the exchange program. It covers new topics or areas of study related to industrial engineering, but not presently offered as either a required or technical elective. Topics covered are different from IES403.

IES403   Special Studies in Industrial Engineering II   3(3-0-6)
Prerequisite: None
This course is intended for students who wish to participate in the exchange program. It covers new topics or areas of study related to industrial engineering but not presently offered as either a required or technical elective. Topics covered are different from IES402.

IES404   Full-time on the Job Training in Industries   12(0-36-36)
          (For Extended Industrial Training Track)
Prerequisite: Have credits earned of not less than 95 credits
The student is full-time trained in an organization approved by the IE program with a duration of at least 540 hours under supervision from a committee set by the IE program. The committee comprises an advisor, a committee member from the IE program, and a co-advisor from the organization. The advisor and co-advisor should prepare the training plan with objectives, scope, activity plan, and deliverables. The advisor and co-advisor should monitor the progress of the student regularly either through online meetings or onsite visits. The grade of this course is considered by the committee, and the reasons for the grade should be written.

IES405   Special Studies in Industrial Engineering III   2(2-0-4)
Prerequisite: None
This course is intended for students who wish to participate in the exchange program. It covers new topics or areas of study related to industrial engineering, but not presently offered as either a required or technical elective. Topics covered are different from IES402 and IES403.

IES406   Startup Business Building   9(0-27-27)
          (For Start up Business Building Track)
Prerequisite: None
A group of students build a startup business with innovations under supervision of an advisor from IE program and external advisors. A proposal should be prepared including innovative business ideas, business plan, expected venture capital, expected business advisors, marketing plan, and expand customer base plan. Rounds of business

pitching should be organized to present the business ideas and plans to venture capitals. The duration for building the startup business is one semester. The grade for this course is considered by IE advisor, external advisors, and venture capitals.

LAS101 Critical Thinking, Reading, and Writing   3(3-0-6)
Development of critical thinking through questioning, analytical, synthetic and evaluation skills. Students learn how to read without necessarily accepting all the information presented in the text, but rather consider the content in depth, taking into account the objectives, perspectives, assumptions, bias and supporting evidence, as well as logic or strategies leading to the author's conclusion. The purpose is to apply these methods to students' own persuasive writing based on information researched from various sources, using effective presentation techniques.

MAS116 Mathematics I   3(3-0-6)
Prerequisite: None
Mathematical induction; functions; limits; continuity; differential calculus: derivatives of functions, higher order derivatives, extrema, applications of derivatives, indeterminate forms; integral calculus: integrals of functions, techniques of integration, numerical integration, improper integrals; introduction to differential equations and their applications; sequence and series: Taylor's expansion, infinite sums.

MAS117 Mathematics II   3(3-0-6)
Prerequisite: Have earned credits of MAS116
Analytic geometry in calculus: polar and curvilinear coordinates; three-dimensional space: vectors, lines, planes, and surfaces in three-dimensional space; function of several variables; calculus of real-valued functions of several variables and its applications: partial derivatives, extremes of functions, functions of higher derivatives, Lagrange multipliers; topics in vector calculus: line and surface integrals, Green's theorem.

MES210 Applied Mathematics for Mechanical Engineers   3(3-0-6)
Prerequisite: None
Basic linear algebra. Matrix determinants. Vector spaces. Inner product spaces. Eigenvalues and eigenvectors. Orthogonality. Symmetric matrices. First order and second order system. Fourier series. Emphasis on mechanical engineering applications.

MES211 Thermofluids   3(3-0-6)
Prerequisite: None
Fundamental concepts in thermodynamics. The first and second law of thermodynamics. Basic concepts and basic properties of fluids. Fundamentals of fluid statics. Fundamentals of fluid dynamics. Characteristics of fluids such as laminar and turbulent flows.

MES231 Engineering Mechanics   3(3-0-6)
(For non-mechanical engineering students)
Prerequisite: None
Force systems; resultants; equilibrium; trusses; frames and machines; internal force diagrams; mass and geometric properties of objects; fluid statics; kinematics and kinetics of particles and rigid bodies; Newton's second law of motion; work and energy, impulse and momentum.

MES300 Engineering Drawing   3(2-3-4)
Prerequisite: None
Manual sketching. Applied geometry. Line conventions. Orthographic drawing. Dimensioning and tolerance. Sectional views and conventions. Detail drawing. Assembly drawing. Basic development views. Drawing interpretation and How to use Computer software to create drawings of model assemblies.

MES301 Computer Aided Mechanical Engineering Design   2(1-3-2)
Prerequisite: None
Use of industrial computer aided design software for design, analysis, modeling and simulation of mechanical engineering problems and related applications. Introduction to three-dimensional wireframe, surfacing and solid modeling using CAD tools.

MES302 Introduction to Computer Aided Design   2(1-3-2)
(For non-mechanical engineering students)
Prerequisite: None
Use of industrial Computer Aided Design Software for detail design and drafting in various engineering fields such as in mechanical, civil, and electrical engineering. Introduction to three-dimensional wireframe, surfacing and solid modeling using CAD tools.

MES303 Mechanical Engineering Training   1(0-40-0)
Prerequisite: Have credits earned of not less than 85 credits
Students are required to obtain practical training in the field of mechanical engineering at selected private sectors or governmental departments for not less than 240 hours during summer vacation of the third year. The objective is to allow the students to have opportunities to experience actual working conditions other than what learned in the classrooms and laboratories. Students must submit a report at the end of the training period, Satisfactory (S) or unsatisfactory (U) grade will be given based on student's performance, quality of the report and supervisor's comments.

MES311 Thermodynamics   3(3-0-6)
Prerequisite: None
Basic Concepts of Thermodynamics, Energy Transfer, First Law of Thermodynamics, Properties of Pure Substances, Closed-System Analysis, Control Volume Analysis of Steady and Unsteady Flows, Second Law of Thermodynamics, Entropy, Exergy. Engineering Equation Solver for Thermodynamics Problems.

MES312 Combustion and Emission Control   3(3-0-6)
Prerequisite: None
Properties of fossil fuels. Production of synthetic fuels from biomass, coal, oil shales and tar sands. Stoichiometry, Combustion processes and emission control in boilers and furnaces, internal combustion engines and gas turbines, turbulent flame, laminar flame.

MES313 Internal Combustion Engines   3(3-0-6)
Prerequisite: None
Internal combustion engine fundamentals, spark-ignition and compression-ignition engines, fuels and combustion, ignition systems, ideal fuel air cycle, supercharging and scavenging performance and testing, lubrication.

MES321 Heat Transfer   3(3-0-6)
Prerequisite: Have earned credits of MES311 or MES341
Steady-state conduction. Natural convection. Forced convection. Thermal radiation. Unsteady-state conduction. Combined heat transfer problems. Condensation and boiling heat transfer. Heat exchangers. Introduction to Heat Transfer Simulation.

MES331 Solid Mechanics   3(3-0-6)
Prerequisite: None
Concepts of internal force and stress and deformation and strain. Analysis of stress and strain, Mohr's circles for stress and strain, stress-strain relationship. Stress and strain in thin-walled pressure vessels. Thermal stresses. Energy method. Torsion of circular shaft, thin-walled tubes, and close-coiled helical spring. Shear force, bending moment and bending stress in beams. Deflection of beams. Failure criterion.

MES333 Design of Machine Elements　　　3(3-0-6)
Prerequisite: Have earned credits of MES331
Review of Stress analysis. Theories of failure for static and dynamic loading. Design and selection of mechanical components: rotating shafts, bearings, power screws, fastener, gear, belt, springs and motors. Introduction to Computer Aided Design Software for design and analysis.

MES341　Fluid Mechanics　　　3(3-0-6)
Prerequisite: None
Fluid Statics, Fluid Kinematics, Reynolds Transport Theorem, Control Volume Analysis, Energy and Momentum Equations, Conservation of Mass, Dimensional Analysis, Differential Analysis, Continuity Equation, Navier-Stokes Equation, Boundary Layer Approximation, Internal Flow, Losses in Pipes, Design of Piping Systems, Pumps, External Flow, Drag Coefficient, Life Coefficient.

MES342　Refrigeration and Air Conditioning　　　3(3-0-6)
Prerequisite: Have earned credits of MES311
Refrigeration cycles and properties of refrigerants. Evaporative cooling and cooling towers. Refrigeration load estimation. Design of refrigeration systems. Equipment selection and design. Psychromatric properties and processes of air. Criteria for thermal comfort. Cooling load estimation. Design of air-conditioning systems. Equipment selection and design.

MES350　Engineering Statics　　　3(3-0-6)
Prerequisites: None
Method of solving engineering problem using fundamental principles of mechanics, resultant and resolution of forces and couples, equilibrium of particles, rigid bodies and various structures, concept of friction, centroid, mass center and center of gravity, moment of inertia of area and mass, virtual work and stability, introduction to dynamics.

MES351　Engineering Dynamics　　　3(3-0-6)
Prerequisite: None
Dynamics of particles: velocity, acceleration, force, momentum, laws of motion, work, power, energy, impulse, impact of elastic bodies, projectiles, circular motion. Dynamics of rigid bodies: moment of inertia and radius of gyration of various rigid bodies, rigid-body motion, force and acceleration, work and energy, impulse and momentum.

MES352 Mechanics of Machinery　　　3(3-0-6)
Prerequisite: Have earned credits of MES351
Kinematics of machines; displacement, velocity, acceleration, and force analysis of linkage, cams and gear systems. Graphical and Analytical linkage synthesis. Balancing of rotating and reciprocation machine parts; gyroscopic effects, critical speeds; energy variation in machinery, Machine Design.

MES382 Mechanical Vibration　　　3(3-0-6)
Prerequisite: Have earned credits of MES210 or MES351
Theory of vibration of mechanical systems. Free and forced vibration problems in single and multi-degree of freedom. Damped and undamped linear systems. Mode shapes. Vibration measuring instruments. Vibration isolation and absorbers.

MES383 Hydraulic and Pneumatic Control　　　3(3-0-6)
Prerequisite: None
Static and dynamic modeling of hydraulic and pneumatic components and systems. Energy and power transfer and impedance matching concepts. Dynamic performance and stability of open and closed-loop servodrives. Introduction to hydraulic and pneumatic control system design.

MES384 Measurements and Instrumentation　　　3(3-0-6)
Prerequisite: None
Measurements and instrumentation of motion, stress and strain, force, torque, pressure, temperature, and fluid flow. Measurement circuits. Data processing and acquisition systems. Statistical data analysis. Uncertainty analysis.

MES390 Basic Mechanical Engineering Laboratory　　　1(0-3-0)
(For Non-Mechanical Engineering Students)
Prerequisite: None
A service course for students with major outside mechanical engineering. Experimental practices cover fluid mechanics, heat transfer, thermodynamics, combustion and emission, mechanism, physical and mechanical properties of materials. Technical notes on the experimental tests have to be submitted for grading.

MES391　Mechanical Engineering Laboratory I　　　1(0-3-0)
Prerequisite: None
Students are required to conduct tests and experiments on physical and mechanical properties of materials, mechanisms, fluid mechanics, thermodynamics and heat transfer, combustion and internal combustion engines. Reports or technical notes on the tests and experiments have to be submitted for grading.

MES392　Mechanical Engineering Laboratory II　　　1(0-3-0)
Prerequisite: None
Students are required to conduct tests and experiments on physical and mechanical properties of materials, mechanisms, fluid mechanics, thermodynamics and heat transfer, combustion and internal combustion engines. Reports or technical notes on the tests and experiments have to be submitted for grading.

MES401　Seminar in Mechanical Engineering　　　1(0-2-1)
Prerequisite: None
Seminar course covering topics relevant to project development and research proposal writing. Students, faculty, and invited outside speakers present and discuss selected topics related to research interests of mechanical engineering.

MES403　Mechanical Engineering Project I　　　1(0-2-1)
Prerequisite: Have credits earned of not less than 95 credits
Students are required to present seminars on current development of mechanical engineering to their class mates and faculties. The seminars may lead to senior projects later on. The reports of the seminars have to be submitted for grading.

MES404　Mechanical Engineering Project II　　　4(0-12-0)
Prerequisite: Have earned credits of MES403
A final course involving individual or group projects including design, analysis and implementation of mechanical systems selected from various interested areas within mechanical engineering. Students are required to propose their projects during the first semester of their senior year. After a project is completed, students are responsible for submitting their final report and giving a presentation.

MES405 Special Studies in Mechanical Engineering I　　　2(2-0-4)
Prerequisite: None
This course is intended for students wish to participate in the exchange program. It is designed for topics related to mechanical engineering, but not presently offered as either a required or technical elective. Topic covered is different from MES406.

MES406 Special Studies in Mechanical Engineering II　　　2(2-0-4)
Prerequisite: None
This course is intended for students wish to participate in the exchange

track. It is designed for topics related to mechanical engineering, but not presently offered as either a required or technical elective. Topic covered is different from MES405.

MES407 Special Studies in Mechanical Engineering III   2(2-0-4)
Prerequisite: None
This course is intended for students wish to participate in the exchange track. It is designed for topics related to mechanical engineering, but not presently offered as either a required or technical elective. Topic covered is different from MES405 and 406.

MES408 Extended Mechanical Engineering Training   6(0-40-0)
Prerequisite: Have credits earned of not less than 95 credits
Students are provided with extensive on-the-job training at selected modern mechanical engineering facilities. The purposes of the course are to allow the students opportunities to work and intensively conduct an individual research or practical project for at least 16 weeks (640 hours) under the close supervision of faculty members and main supervisors assigned by the training company. After the project is completed, students are responsible for submitting their final report and giving a presentation.

MES413   Advanced Thermodynamics   3(3-0-6)
Prerequisite: Have earned credits of MES311 or MES211
Review on basic concepts and definitions, the first-law and energy, the second law and entropy. Thermomechanical availability and irreversibility. Availability equation for a control mass and applications. Energy and mass equations for a control volume and applications. Second law efficiencies for control mass and control volume applications. Chemical availability. Energy analysis of engineering cycles. Thermoeconomics.

MES422 Thermal System Design   3(3-0-6)
Prerequisite: None
This course is a problem-based course on the design of thermal system. Student will learn the design procedure. Comparison between a workable system and optimum system. Equation fitting for equipment and processes characterization. Modeling of equipment and processes based on physical laws. Simulation of thermal systems. Selected optimization techniques such as Lagrange multiplier, search methods, linear programming, etc.

MES434 Mechanical System Design   3(3-0-6)
Prerequisite: Have earned credits of MES333
A problem-based course on the design of mechanical engineering systems involving practical problems in industries. Students, working in groups, will expose the design methodology and process from concept through final design including a detailed analysis of all mechanical components of the system by which knowledge of all engineering disciplines. Projects are proposed from various areas of study within mechanical engineering. Students submit a final report and present their projects at the end of the semester.

MES444 Alternative and Renewable Energy Resources   3(3-0-6)
Prerequisite: None
Global and regional resources, conversion technologies and economics of renewable energy such as hydropower, biomass energy, solar energy, wind energy and geothermal energy.

MES462   Turbomachinery   3(3-0-6)
Prerequisite: Have earned credits of MES341
Review of thermodynamics of compressible flow. Principles, designs and applications of centrifugal and axial flow machines, i.e. centrifugal turbine and compressor, axial flow turbine and compressor, impulse and reaction steam turbine and laval nozzle. Steam and gas turbine

plants: theories, applications, performance characteristics of practical cycles. Erosion problems in steam and gas turbine components.

MES471   Electrical Energy Management   3(3-0-6)
Prerequisite: None
Basic concepts. Management of electrical energy. Distribution circuits and equipment. Electrical tariff. Load and demand management. Power factor and loss management. Applications of thermodynamics to the analysis of electromagnetic circuits, transformer, motor and generator.

MES473   Energy Economics   3(3-0-6)
Prerequisite: None
Depletion of energy resources. Energy pricing. Fiscal instruments of energy policy. Uncertainty and energy policy. Energy analysis and energy policy. Environmental policy and energy development. Energy analysis and energy policies of selected countries. Energy project appraisal.

MES474 Thermal Energy Management   3(3-0-6)
Prerequisite: None
Efficient uses of thermal equipment and systems such as boilers and steam equipment, evaporator and condenser, pre-heater and economiser, dryers and drying systems, etc.

MES481 Power Plant Engineering   3(3-0-6)
Prerequisite: None
Energy conversion principles and availability concept, fuels and combustion analysis and component study of study, gas turbine and internal combustion engine power plants, combined cycle and cogeneration, hydro power plant, nuclear power plant, control and instrumentation, power plant economics and environmental

MES482 Power Generation Systems and   3(3-0-6)
Environmental Impacts
Prerequisite: None
Fundamentals of Energy Conversion. Gas Power Cycles: Otto Cycle, Diesel Cycle, Stirling and Ericsson Cycle, Brayton Cycle. Vapor and Combined Power Cycles: Rankine Cycle, Combined Gas-Vapor Power Cycle. Power Generation from Energy Resources and Related Environmental Impacts and Climate Change Issues.

MES483 Dynamic Systems and Control   3(3-0-6)
Prerequisite: None
Physical understanding of dynamics and feedback. Linear feedback control of dynamic systems. Mathematical tools for analysis and design. Stability. Modeling systems with differential equations. Linearization. Solution to linear, time-invariant differential equations.

MES484   Automatic Control   3(3-0-6)
Prerequisite: None
Automatic control principles, analysis and modeling of linear control elements, stability of feedback systems, design and compensation of control systems.

MES485 Mechatronics Design   3(3-0-6)
Prerequisite: None
Introduction to mechatronic systems. Modeling of mixed mechatronic systems. Microcontroller programming and interfacing. Theory, selection and implementation of sensors and actuators commonly used in mechatronic systems. Design of electric, hydraulic, and pneumatic actuators. Kinematics and dynamics of robotics devices.

MES486 Robotics   3(3-0-6)
Prerequisite: None
Operation principles, analysis, and design of robots. Mechanical manipulators: kinematics, inverse kinematics, dynamics, trajectory planning, and control algorithm design.

MES491 Trends in Mechanical Engineering　　　3(3-0-6)
Prerequisite: None
Topics of recent advances in mechanical engineering technologies.

MES494 Special Topic in Mechanical Engineering I　　　3(3-0-6)
Prerequisite: None
New topics or areas of study not offered in other mechanical engineering courses. Topics may vary from semester to semester and will not be the same as the one offered in Special Topic II MES495.

MES495 Special Topic in Mechanical Engineering II　　　3(3-0-6)
Prerequisite: None
New topics or areas of study not offered in other mechanical engineering courses. Topics may vary from semester to semester and will not be the same as the one offered in Special Topic I MES494.

SCS126 Chemistry for Engineers　　　3(3-0-6)
Prerequisite: None
Principles of chemistry with a focus on engineering applications. Stoichiometric calculations. Atomic structure and chemical bonding. Types of chemical reactions. Redox reactions. Properties of gases, liquids, and solutions. Thermochemistry. Reaction kinetics. Chemical equilibrium. Ionic equilibrium in aqueous solution. Electrochemistry. Introduction to some of the engineering aspects of environmental and organic chemistry, polymers, and nanomaterials.

SCS136 Physics　　　3(3-0-6)
Prerequisite: None
Mechanics of particles and rigid bodies: statics of particles and rigid bodies, analysis of simple structure, work, energy, momentum, rotation, vibration; Mechanics of fluids: statics and flow, Elements of electromagnetism: electric fields, potential and current, simple circuits, induction, electromagnetic oscillations and waves, fundamental electronics.

SCS140 Pre-Mathematics and Sciences　　　3(3-0-6)
Prerequisite: None
This course is designed for students who have insufficient background in mathematics, physics, or chemistry. Its objective is to improve basic knowledge of students to be able to study mathematics, physics, and chemistry, effectively. Differential and Integral calculus, Trigonometric functions, Logarithmic functions, Limits, chain rule, L'Hospital rule; Motion in three dimensions, Rotational motion, Angular momentum, Equilibrium of rigid bodies, Fluid mechanics, Harmonic oscillation; Thermodynamics, Chemical equilibrium, Atomic structure.

SCS141 General Science　　　3(3-0-6)
Prerequisite: None
An introduction to chemistry, chemical bonding, chemical reactions, materials and their applications. Introduction to biology, interplay between structures and functions at the molecular, cellular, and organismal levels of organization, study of major systems in human body.

SCS176 Chemistry Laboratory　　　1(0-3-0)
Prerequisite: None
This laboratory course is designed to augment the learning experience for students taking SCS126 by providing hands-on experience with some of the topics covered in SCS126. Through a series of laboratory exercises and computer simulations, students will learn how to safely conduct chemistry experiments, critically analyze experimental results, and report their findings in a professional manner.

SCS186 Physics Laboratory　　　1(0-3-0)
Prerequisite: None
A series of experiments that will help students to develop hands-on experience and practical skills in conducting experiments relating to measurements of physical phenomena, including experimental design, data collection, visualization, analysis, presentation, and communication.

SCS241 Material Science for Engineers　　　3(3-0-6)
Prerequisite: None
Relationships between structures, properties, production processes and applications of main groups of engineering materials: metal alloys, polymers, ceramics, and composites. Mechanical properties and materials deterioration and degradation. Macroscopic and microscopic mechanical behavior with emphasis on specific materials used in engineering fields: steels, concrete, and woods.

TU100　Civic Engagement　　　3(3-0-6)
Instillation of social conscience and awareness of one's role and duties as a good global citizen. This is done through a variety of methods such as lectures, discussion of various case studies and field study outings. Students are required to organise a campaign to raise awareness or bring about change in an area of their interest.

TU106　Creativity and Communication　　　3(3-0-6)
Creative thought processes, with critical thinking as an important part, as well as communication of these thoughts that lead to suitable results in social, cultural and environmental contexts, at personal, organisational and social levels.

TU108　Self Development and Management　　　3(3-0-6)
Coping with and adaptation to university life. Development of social skill and emotional intelligence. Self-understanding and planning for the future. Personality and social etiquette. Lifelong learning. Learning to live harmoniously and respectfully with others and the society. Holistic healthcare.

TU109　Innovation and Entrepreneurial mindset　　　3(3-0-6)
Risk assessment and creating new opportunities. Thinking and planning as an entrepreneur. Decision making and entrepreneurial venture development. Business communication for delivering concept or initiative in an efficient, effective and compelling manner. Social shared value creation.

TU201　Financial Literacy for Individuals　　　3(3-0-6)
To learn the foundations, principles, importance and guidelines of financial planning for life goals, the uses of financial instruments, together with self-discovery techniques, financial planning techniques including how to earn, collect, use and invest money, savings allocation and DCA investment techniques, debt management techniques, savings increase techniques, personal income tax saving planning techniques as well as the principles and importance of the Sufficiency Economy Philosophy in Thai society in order to be applied in living.

TU202　Complete Investment　　　3(3-0-6)
To learn the alternatives and process of investment in financial market, stock investment foundations started from return, risk, tax on investment as well as stock analysis, trade stocks method and the rights of shareholders in order to prepare before making investment decisions. To learn investment foundation in mutual fund, mutual fund selection techniques and DCA (Dollar Cost Averaging) regular investment in stocks and funds, suitable portfolio management process and learn the important factors that will make investors not successful in investing and mindset guidelines in order to create long-term investment success.

TU301　Investment in the Stock Market　　　3(3-0-6)
To learn the preparation guideline before trading stocks online, the uses of stock and derivatives trading program like Settrade Streaming to be investment helper. To learn the analytical principles of fundamental factors of the economy, industries and companies, reading and

interpreting key information in financial statements techniques along with including sustainable investment (ESG) ideas and alternatives. To learn the investment foundation in different types of derivatives both futures and options together with trading mechanism of the derivatives market, collateral, investment strategies and cautions of investment in derivatives. To learn the basics of investment in bonds including return, risk, tax on investment as well as price analysis and bonds trading process in order to prepare before making investment decisions and learn investment foundations in DW (Derivative Warrant), price action mechanism and investment selection method and investment strategy in DW

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Assistant Professor

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Education:

Ph.D.	Applied Chemistry, Tohoku University, Japan
M.Eng.	Applied Chemistry, Tohoku University, Japan
B.Eng.	Chemical Engineering, (1st Class Honors), Kasetsart University, Thailand

Academic Awards:
- TU outstanding Young Researcher 2017.
- Best poster award at the 3rd Symposium on Graphene Oxide, Tokyo (Japan), 2014.
- BCSJ Award Article from Bulletin of the Chemical Society of Japan, 2014.
- Recipient of Sato Yo International Scholarship, 2011-2013.
- Best poster award at the Annual World Conference on Carbon, Shanghai (China), 2011.
- Best poster award at the 37th Japanese Carbon Conference, Himeji (Japan), 2010.
- Recipient of Japanese Government (Monbukagakusho) Scholarship, 2008-2010.

Research Areas:
- Carbon-based materials and their surface functionalization.
- Electrochemical capacitors and related hybrid systems for energy storage

Dr. Luckhana Lawtrakul   Nationality: Thai

Academic Rank:
Associate Professor

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Education:

Dr.rer.nat.	Theoretical Biochemistry, University of Vienna, Austria
M.Sc.	Physical Chemistry, Kasetsart University, Thailand
B.Sc.	Chemistry, Kasetsart University, Thailand

Academic Awards:
- 2013 Gold Medal, 41st International Exhibition of Inventions of Geneva
- 2007 Best Teaching Award, Sirindhorn International Institute of Technology
- 2001 Research Award, National Research Council of Thailand (NRCT)
- 1997 Outstanding Thesis Award, Kasetsart University
- 1987-2000 Development and Promotion of Science and Technology Talents Project (DPST) Scholarship

Research Areas:
- Computer-aided molecular modeling and molecular design

Dr. Paiboon Sreearunothai

Nationality: Thai

Academic Rank:
Associate Professor

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paiboon_sree@siit.tu.ac.th

Education:

Ph.D.	Physics, University of Cambridge, UK
M.Sc.	Physics, University of Cambridge, UK
B.A.	Physics, University of Cambridge, UK

Academic Awards:
- Development and Promotion of Science and Technology Talents Project (DPST) Scholarship, 1996-2006

Research Areas:
- Nanomaterials
- Photo-Active Materials
- Sensors
- Environmental Technology
- Optical and Time-Resolved Instrumentation

Dr. Pakorn Opaprakasit

Nationality: Thai

Academic Rank:
Associate Professor

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Education:

Ph.D.	Materials Science and Engineering, The Pennsylvania State University Pennsylvania, USA
M.S.	Materials Science and Engineering: Polymer Option, The Pennsylvania State University, Pennsylvania, USA
B.Sc.	Chemistry, (1st Class Honors), Chiang Mai University, Thailand

Academic Awards:
- NRCT research awards, National Research Council of Thailand, 2022.
- World-Class Professors fellowships, Ministry of Education and Culture of Republic Indonesia, 2020 and 2021.
- Seven Innovation award, National Innovation Agency (NIA), 2016.
- NRCT research awards, National Research Council of Thailand, 2015.
- TU IP Innovation awards, Thammasat University, 2015.
- Thailand Toray Science Foundation research grant award, 2009.
- Young Researcher Award, Thammasat University, 2008.
- Gold Medal Prize, 1997, Chiang Mai University, Thailand.
- Gold Medal Prize, 1997, The Thab Foundation, Chulalongkorn University, Thailand.
- Development and Promotion of Science and Technology Talents Project (DPST) Scholarship, 1990-2003.

Research Areas:
- Materials in Bio-Circular-Green (BCG) economy for sustainability
- Nanomaterials/Functional materials
- Materials Characterization
- Infrared spectroscopy
- Rapid prototyping/Electrospinning/3D printing

Present Academic and Professional Activities:
- Head, School of Integrated Science and Innovation (ISI), SIIT.
- Vice President, The Materials Research Society of Thailand (MRS-Thailand).
- Executive Board of the Polymer Society of Thailand (PST).
- Vice President, The Science, Mathematics, and Technology Teachers Association of Thailand (SMTAT).
- Head, Functional Advanced Materials Engineering (FAME) research center.
- Fellows, Thai Academy of Science and Technology Foundation (TAST)
- Associate editor of the Science and Innovation of Advanced Materials (SIAM) journal, an official journal of the MRS-Thailand

Dr. Pisanu Toochinda   Nationality: Thai

Academic Rank:
Associate Professor

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Education:
Ph.D.   Chemical Engineering, The University of Akron, Ohio, USA
M.S.   Chemical Engineering, The University of Akron, Ohio, USA
B.Sc.   Chemistry, Mahidol University, Thailand

Academic Awards:
- 2014 Outstanding teacher Award, Thammasat University
- 2013 Best teaching Award, Sirindhorn International Institute of Technology
- 2013 Distinguished teacher Award, Sirindhorn International Institute of Technology
- 2013 Gold Medal, 41st International Exhibition of Inventions of Geneva
- 2008 Best Teaching Award, Sirindhorn International Institute of Technology
- 2004 Best Teaching Award, Sirindhorn International Institute of Technology

Dr. Pawin Iamprasertkun   Nationality: Thai

Academic Rank:
Lecturer

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pawin@siit.tu.ac.th

Education:
Ph.D.   Materials Chemistry, The University of Manchester, United Kingdom
M.Eng.   Chemical Engineering, Kasetsart University, Thailand
B.Eng.   Chemical Engineering, Kasetsart University, Thailand

Research Areas:
- Electrochemistry
- 2D materials, Graphene, TMDs, Carbon based materials
- Energy storage: Supercapacitors, and Batteries
- Surface Wettability
- Ions transport and membrane technologies

Academic Awards:
- Academic Excellent (Pure sciences), Anglo-Thai Society, United Kingdom, 2019
- Sheelagh Campbell Award, Royal Society of Chemistry, United Kingdom, 2019
- National Innovation Award, Research Council of Thailand, Thailand, 2017
- Recipient of The Royal Thai Government Scholarship, 2015

Dr. Sandhya Babel   Nationality: Indian

Academic Rank:
Professor

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Education:
D.Tech.Sc.   Environmental Technology and Management, Asian Institute of Technology (AIT), Thailand
M.Sc.   Environmental Technology and Management, Asian Institute of Technology (AIT), Thailand
M.Sc.   Biochemistry, University of Indore, India
B.Sc.   Biology/Chemistry, (1st Class), University of Indore, India

Academic Awards:
- First position in order of merit award in Master of Science (Biochemistry) Program, University of Indore, India

Research Areas:
- Adsorption
- Bio-hydrogen production
- Phytoremediation
- Solid and hazardous waste management
- Wastewater treatment

Dr. Shu-Han Hsu   Nationality: Taiwanese

Academic Rank:
Assistant Professor

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Education:
Ph.D.	Molecular Nanofabrication, MESA+ Institute Supramolecular Chemistry & Technology, University of Twente, Netherlands.
M.Sc.	Materials Physics and Nanotechnology, Linkoping University, Sweden.
B.Sc.	Materials Science and Engineering, National Tsing Hua University, Taiwan

Academic Awards:
- 2nd place award for talent researcher presentation, National Applied Research laboratory, Taiwan, 2013
- Awarded exchange program between Linköping University and Tsing-Hua University, 2004-2005

Research Areas:
- Nanofabrication
- Surface modification
- Sensing Device

Dr. Chariya Kaewsaneha   Nationality: Thai

Academic Rank:
Assistant Professor

E-mail:
chariya@siit.tu.ac.th

Education:
Ph.D.	Polymer Science and Technology, Mahidol University, Thailand
M.Sc.	Polymer Science and Technology, Mahidol University, Thailand
B.Sc.	Chemistry, Mahidol University, Thailand

Academic Awards:
- Outstanding New Researcher Award (department level), Thammasat University, Thailand
- Silver Publication Achievement Awards, Sirindhorn International Institute of Technology, Thailand
- National Research Council of Thailand - Development and Property Enhancement of Magnetic Nanoparticles and Graphene Oxide for Environmental and Medical Applications

Research Areas:
- Colloidal polymer science
- Fabrication/functionalization of (hybrid) polymer particles
- Bionanotechnology
- Natural rubber latex

Dr. Tanyakarn Treeratanaphitak   Nationality: Thai

Academic Rank:
Lecturer

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Education:
Ph.D.	Chemical Engineering, University of Waterloo, Waterloo, Ontario, Canada
M.A.Sc.	Chemical Engineering, University of Waterloo, Waterloo, Ontario, Canada
B.A.Sc.	Honours Chemical Engineering, Co-operative Program (With Distinction, Dean's Honours List), University of Waterloo, Waterloo, Ontario, Canada

Research Areas:
- Computational fluid dynamics
- Modeling of transport processes and fluid flow
- Numerical methods
- Transport phenomena
- Simulation-assisted design and optimization of chemical processes

SCHOOL OF CIVIL ENGINEERING AND TECHNOLOGY

Dr. Amin Eisazadeh Otaghsaraei   Nationality: Iranian

Academic Rank:
Assistant Professor

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Education:

Ph.D.	Geotechnic, University of Technology, Malaysia
M.Sc.	Geotechnic, Tehran Polytechnic, Iran
B.Sc.	Civil Engineering, Tehran University, Iran

Academic Awards:
- 2018 High Quality Publication Award, Sirindhorn International Institute of Technology
- 2017 Silver Publication Achievement Award, Sirindhorn International Institute of Technology
- 2012 UTM ICON Award (Best Researcher with IF Publication)
- 2005 Masters Degree (Hons) (GPA of 3.38)
- 2003 Ranked 119 in Iran's Civil Eng. Masters Degree Qualification Test
- 1999 Secondary School Diploma (Hons) (GPA of 3.85)

Research Areas:
- Tropical Soil Engineering
- Soil Stabilization
- Geochemistry
- Water Treatment

Present Academic and Professional Activities:
- Member of Civil Engineering Society of Iran

Dr. Kriengsak Panuwatwanich   Nationality: Thai

Academic Rank:
Associate Professor

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Education:

Ph.D.   Construction Engineering and Management, Griffith University, Australia

M.Eng.   Engineering Construction and Management, University of New South Wales, Australia

B.Eng.   Civil Engineering, Sirindhorn International Institute of Technology, Thammasat University, Thailand

Academic Awards:

- Excellent Research Publication Award by Sirindhorn International Institute of Technology, June 2021
- Platinum Research Publication Achievement Award by Sirindhorn International Institute of Technology, June 2019
- Best Teaching Award by Sirindhorn International Institute of Technology, June 2018
- Award for Innovation in Learning and Teaching by Griffith School of Engineering, Griffith University, 2014
- Dean's Highly Commended Award - Learning and Teaching Citations by Griffith Sciences, Griffith University, 2014
- Pro Vice Chancellor's Learning and Teaching Excellence Award by the Science, Environment, Engineering and Technology Group, Griffith University, 2013
- Grand Award for Research Excellence (Sustainability Specialist Group Prize) by the International Water Association (IWA), 2010
- Emerald Literati Award for Excellence: Outstanding Paper by Emerald Literati Network, Journal of Construction Innovation, 2010

Research Areas:

- Digital technology in construction engineering and management (Big data, Building Information Modeling, Extended Reality and Metaverse)
- Green building/sustainable construction
- Safety management in construction
- Innovation diffusion and management within project and organizational environments
- Engineering Education

Present Academic and Professional Activities:

- Scientific Chair - The 12th International Conference on Engineering Project and Production Management (EPPM2022), 12-14, October 2022, Ahtens, Greece.
- Scientific Committee - The 38th Annual Conference of the Association of Researchers in Construction Management (ARCOM), 5-7, September 2022, Glasgow, Scotland.
- Editorial Board - The Journal of Engineering, Project, and Production Management
- Editor (Production Engineering) - Engineering Management in Production and Services
- Member (MIEAust), Engineers Australia (Civil College)
- Member, Australasian Association for Engineering Education
- Member, Association of Engineering, Project, and Production Management
- Member, Thai Council of Engineers
- Member, The Engineering Institute of Thailand
- Registered Civil Engineer (Thailand)

Dr. Mongkut Piantanakulchai
Nationality: Thai

Academic Rank:
Associate Professor

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Education:
Ph.D.   Transportation, Tohoku University, Japan
M.Eng.   Transportation, Asian Institute of Technology (AIT), Thailand
B.Eng.   Civil Engineering, Chulalongkorn University, Thailand

Academic Awards:
- Researcher Awards from Thammasat University, 2006 and 2015
- Thomas L. Saaty's Best Paper Award at the Eighth International Symposium on the Analytic Hierarchy Process (ISAHP), 2005
- Japanese Government (Monbukagakusho) Scholarship, 1996-2000
- Barbara and John Hugh Jones Prize (Award for the Most Outstanding Transportation Engineering Student), 1995, Asian Institute of Technology (AIT), Thailand

Research Areas:
- Intelligent Transportation Systems (ITS)
- Multi Criteria Decision Making in Transportation Planning
- Reducing Logistics Cost in Trucking Industry Using Smart Technology
- Application of Artificial Intelligence to Reduce Logistics Cost by Smart Truck Routing
- Reducing Logistics Cost in Container Port's Operations
- Sharing Mobility (Carpooling, Carsharing, E-bikes, E-scooters)
- Smart Traffic Control using Artificial Intelligence
- Computable General Equilibrium Modelling for Transport and Energy Policy Studies
- Traffic and Pedestrain Simulation

Present Academic and Professional Activities:
- Executive Board Member, Thai Society for Transportation and Traffic Studies
- Regular Member, Eastern Asia Society for Transportation Studies

Dr. Pruettha Nanakorn
Nationality: Thai

Academic Rank:
Professor

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nanakorn@siit.tu.ac.th

Education:
D.Eng.   Civil Engineering, The University of Tokyo, Japan
M.Eng.   Structural Engineering, Asian Institute of Technology (AIT), Thailand
B.Eng.   Civil Engineering (1st Class Honors), Chulalongkorn University, Thailand

Academic Awards:
- The High Quality Publication Awards for Publications in Top 1% Journal Percentiles of SJR in years 2020 & 2021, Sirindhorn International Institute of Technology
- The High Quality Publication Award for Publications in Top 10% Journal Percentiles of SJR in 2018, Sirindhorn International Institute of Technology
- 2003 Best Teaching Award, Sirindhorn International Institute of Technology
- Japanese Government (Monbukagakusho) Scholarship, 1991-1994
- The Mahesh Varma Prize (Award for the Most Outstanding Structural Engineering and Construction Student), 1991, Asian Institute of Technology (AIT), Thailand
- Gold Medal Prize, 1989, Chulalongkorn University, Thailand

Research Areas:
- Computational mechanics
- Finite element technology
- Structural optimization
- Design automation
- AI in structural design

Dr. Somnuk Tangtermsirikul   Nationality: Thai

Academic Rank:
Professor

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Education:
D.Eng.   Civil Engineering, The University of Tokyo, Japan
M.Eng.   Civil Engineering, The University of Tokyo, Japan
B.Eng.   Civil Engineering, (Honors), Chulalongkorn University, Thailand

Academic Awards:
- NSTDA Chair Professor 2019
- Excellent Research Award, National Research Council 2016
- National Distinguished Researcher, National Research Council 2013
- Chair Professor of Siam Cement Group, since 2012
- Distinguished Scholar of Science and Technology of Thammasat University, 2008
- Outstanding Technologist Award from the Foundation for the Promotion of Science and Technology under the Patronage of H.M. the King, 2002
- Outstanding Researcher 1999, Thammasat University, Thailand
- Paper Award from JSCE, 1999
- Yoshida Award from JSCE, 1993

Research Areas:
- Modeling of concrete behavior
- Durability evaluation and service life design of concrete structures
- High performance cementitious based materials
- Functional concrete materials and structures
- Use of wastes and recycled materials in cement and concrete
- 3D printed concrete behavior
- Maintenance of concrete structures

Academic and Professional Activities:
- Honorary Member, Japan Concrete Institute
- Advisor, Thailand Concrete Association
- Advisor, Civil Engineering Committee, Engineering Institute of Thailand
- Advisory Board of the Advanced Concrete Technology International Journal
- Editorial Board of Journal of Sustainable Cement-based Materials
- Chairman of Editorial Board of the Journal of Thailand Concrete Association

Dr. Taweep Chaisomphob   Nationality: Thai

Academic Rank:
Associate Professor

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chaisomphobt@gmail.com

Education:
D.Eng.   Civil Engineering, The University of Tokyo, Japan, 1987
M.Eng.   Civil Engineering, The University of Tokyo, Japan, 1984
B.Eng.   Civil Engineering, (1st Class Honors and Gold Medal), Chulalongkorn University, Thailand, 1982

Academic Awards:
• Fellow, School of Engineering, The University of Tokyo, Japan, 2007

Research Areas:
• Steel structures
• Corrosion of Structural Steel
• Advanced Structural Steel Design
• Social Capital Study
• Serial Self-turning Reactor System (STR) Composting Technology

Present Academic and Professional Activities:
• President, Thailand Structural Steel Society (TSSS), 2016 - present
• Advisor, "Super Smart Society" Educational Program Tokyo Institute of Technology, Japan, 2019 - present

Dr. Winyu Rattanapitikon   Nationality: Thai

Academic Rank:
Associate Professor

E-mail:
winyu@siit.tu.ac.th

Education:
D.Eng.   Civil Engineering, Yokohama National University, Japan
M.Eng.   Water Resources Development, Asian Institute of Technology (AIT), Thailand
B.Eng.   Agricultural Engineering, Khon Kaen University, Thailand

Academic Awards:
• 2011 SIIT Distinguished Teacher Award, Sirindhorn International Institute of Technology
• 2011 Best Teaching Award, Sirindhorn International Institute of Technology
• TU Outstanding Teacher in Science and Technology Award 2006, Thammasat University
• 2005 Best Teaching Award, Sirindhorn International Institute of Technology
• 1998 Best Teaching Award, Sirindhorn International Institute of Technology
• Japanese Government (Monbukagakusho) Scholarship, 1992-1995
• The James A. Linen III Memorial Prize (Award for the Most Outstanding Water Resources Development Student), 1991, Asian Institute of Technology (AIT), Thailand

Research Areas:
• Mathematical modeling
• Sediment Transport
• Beach Deformation

CONSTRUCTION AND MAINTENANCE TECHNOLOGY RESEARCH CENTER (CONTEC) RESEARCH FACULTY MEMBERS

Dr. Ganchai Tanapornraweekit   Nationality: Thai

Academic Rank:
Associate Professor

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ganchai@siit.tu.ac.th

Education:

Ph.D.   Civil and Environmental Engineering, University of Melbourne, Australia
M.Sc.   Civil Engineering, Sirindhorn International Institute of Technology, Thammasat University, Thailand
B.Eng.   Civil Engineering, Chulalongkorn University, Thailand

Academic Awards:

• IPRS & MIRS scholarships from Australian Government and University of Melbourne (2006-2010)
• Highly commended presentation in Postgrad-seminar from University of Melbourne (2009)
• SIIT Full Scholarship (2001-2004)

Research Areas:

• Analysis and design of 3D printed concrete structures
• Behavior of precast/prestressed composite concrete structures
• Ultra-high performance concrete composite structures
• Expansive concrete structures
• Fiber reinforced concrete for hybrid structures
• Prevention of cracking in concrete structures
• Finite element analysis (FEA) of concrete structures
• Analysis and design of structures under shock and impact including explosion/blast loads

Present Academic and Professional Activities:

• Committee on Concrete Materials, Thai Concrete Association (TCA)
• Advisor to the Committee on Development of Building Structures of Ministry of Defense

Dr. Krittiya Kaewmanee   Nationality: Thai

Academic Rank:
Faculty Member

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Education:
Ph.D.   Engineering, Sirindhorn International Institute of Technology, Thammasat University, Thailand
M.Eng.   Civil Engineering, Kochi University of Technology, Japan
B.Eng.   Civil Engineering, Sirindhorn International Institute of Technology, Thammasat University, Thailand

Academic Awards:
- An outstanding oral presentation award at the RGJ Seminar Series LX I: Innovation and Sustainable Development in Civil Engineering (September 4, 2008)
- Royal Golden Jubilee Scholarship (PhD Program), The Thailand Research Fund (2007)
- Master's Degree Scholarship, Kochi University of Technology, JAPAN (1999-2001)

Research Areas:
- Design of concrete mix proportions
- Multi-binder concrete
- Use of waste and recycled materials in concrete
- Thermal analysis of mass concrete

Present Academic and Professional Activities:
- Member, Subcommittee on concrete and materials, Engineering Institute of Thailand
- Secretariat, Asian Concrete Federation (ACF)

Dr. Pakawat Sancharoen   Nationality: Thai

Academic Rank:
Assistant Professor

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Education:
Ph.D.   Civil Engineering, The University of Tokyo, Japan
M.Eng.   Civil Engineering, The University of Tokyo, Japan
M.Sc.   Environmental Management, Chulalongkorn University, Thailand
B.Eng.   Civil Engineering, (2nd Class Honors), Chulalongkorn University, Thailand

Academic Awards:
- Outstanding young researcher award, Thammasat University (2012)
- Excellent Presentation Award at Annual Convention of Japan Concrete Institute (2006)
- Excellent Paper Award at Annual Convention of Japan Concrete Institute (2006)
- Excellent Presentation Award at Annual Meeting of Japan Cement Association (2003)
- Ministry of Education, Culture, Sports, Science and Technology of Japan (MEXT) Scholarship (2002-2007)
- Asian Development Bank (ADB) Scholarship (2001-2003)
- 2nd Class Honors, Department of Civil Engineering, Faculty of Engineering, Chulalongkorn University, Bangkok, Thailand (2001)

Research Areas:
- Waste utilization in concrete
- Corrosion of reinforcing steel in concrete
- Durability of concrete and repairing system
- Repairing and maintenance management of reinforced concrete, pre-stressed concrete and steel structures
- Non-Destructive Testings on structures

Present Academic and Professional Activities:
- Subcommittee member (Maintenance), Thailand Concrete Association

Dr. Parnthep Julnipitawong   Nationality: Thai

Academic Rank:
Assistant Professor

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parnthep@siit.tu.ac.th

Education:
Ph.D.   Civil Engineering, Hamburg University of Technology, Germany
M.Sc.   Engineering, Sirindhorn International Institute of Technology, Thammasat University, Thailand
B.Eng.   Building Facilities Engineering, (2nd Class Honors), Sirindhorn International Institute of Technology, Thammasat University, Thailand

Academic Awards:
- 2nd Class Honors for Bachelor's degree

Research Areas:
- Water transport in concrete
- Bleeding of concrete
- Moisture measurement techniques in concrete
- Fresh properties of concrete
- Supplementary Cementing Materials in Concrete

Present Academic and Professional Activities:
- Subcommittee - Thai Concrete Association (TCA)

Dr. Warangkana Saengsoy   Nationality: Thai

Academic Rank:
Associate Professor

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Education:
Ph.D.   Resources and Eco-materials Engineering, Hokkaido University, Japan
M.Sc.   Engineering, Sirindhorn International Institute of Technology, Thammasat University, Thailand
B.Eng.   Civil Engineering, (2nd Class Honors), Sirindhorn International Institute of Technology, Thammasat University, Thailand

Academic Awards:
- High Quality Publication Award In Year 2019, Sirindhorn International Institute of Technology (2020)
- Outstanding Researcher Award for research award recipients from external organizations, Thammasat University (2017-2018)
- NRCT Outstanding Research Project Award 2017
- Outstanding Researcher Award for research award recipients from external organizations in 2014, Thammasat University (2014)
- ACF 2014 Best Paper Award (2014)
- Outstanding Young Researcher Award, Thammasat University (2012)
- Ministry of Education, Culture, Sports, Science and Technology of Japan (MEXT) Scholarship (2005-2008)
- SIIT Research Assistant Scholarship (2001-2003)
- 2nd Class Honors for Bachelor's degree (2001)

Research Areas:
- Cement Chemistry
- Hydration reaction and microstructure of cementitious system
- Chemical and microstructural analysis of hardened concrete
- Utilization of pozzolans and eco-materials in concrete
- Durability of concrete

Present Academic and Professional Activities:
- Committee on Concrete Materials, Thai Concrete Association (TCA)
- Technical committee, Asian Concrete Federation (ACF)

INFORMATION, COMPUTER, AND COMMUNICATION TECHNOLOGY

Dr. Adisak Seesanea   Nationality: Thai

Academic Rank:
Lecturer

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adisak.see@siit.tu.ac.th

Education:
Ph.D.   Mathematics, University of Missouri-Columbia, USA, 2018
M.Sc.   Applied Mathematics, Suranaree University of Technology, Thailand, 2013
B.Sc.   Mathematics (1st Class Honors), Silpakorn University, Thailand, 2010

Work Experience:
- Faculty Member, Sirindhorn International Institute of Technology, Thailand, 2021 - present
- Postdoctoral Scholar (Mentor: Daniel E. Spector), Okinawa Institute of Science and Technology Graduate University, Japan, 2020-2021
- Research Fellow (Mentor: Jun Masamune), Hokkaido University, Japan, 2018-2020
- Graduate Research Assistant
- (Mentor: Igor E. Verbitsky), University of Missouri-Columbia, USA, 2017
- Teaching Assistant, Silpakorn University, Thailand, 2009-2010

Research Areas:
- Partial Differential Equation
- Nonlinear Potential Theory
- Harmonic Analysis
- Homogenization Theory

Awards:
- Research fellowship as part of JSPS KAKENHI grant number JP17H01092 (PI: Hiroaki Aikawa), 2018-2020
- Research assistantship from Department of Mathematics, University of Missouri-Columbia (PI: Igor E. Verbitsky), 2017
- Award recognizing outstanding performance in graduate study from The Professor Dr. Tab Nilanidhi Foundation, 2013
- Full scholarship from Development and Promotion of Science and Technology Talents Project (DPST), 2003-2018

Dr. Apichon Witayangkurn   Nationality: Thai

Academic Rank:
Assistant Professor

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Education:
D.Eng.   GIS & Spatial Information, the University of Tokyo, Japan
M.Eng.   Information Management, Asian Institute of Technology (AIT), Thailand
B.Eng.   Computer Engineering, King Mongkut's Institute of Technology Ladkrabang, Thailand

Research Areas:
- Large-Scale Spatial Data Processing/Mining
- Trajectory data processing (GPS, CDR)
- Human Activity and Behavior Analysis
- Parallel Processing, Cloud Computing Platform
- Sensor Network, Real-time monitoring system
- Sensor-based Unmanned Aerial Vehicle (UAV)
- Deep Learning, AI-enabled Application

Dr. Banlue Srisuchinwong

Nationality: Thai

Academic Rank:
Associate Professor

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Education:

Ph.D.   Electronics Engineering, The University of Manchester, the UK.
M.Sc.   Electronics Engineering, The University of Manchester, the UK.
B.Eng.   Electronics Engineering, (Honors), King Mongkut's Institute of Technology Ladkrabang, Thailand.

Academic Awards:

- The Excellent Research Publication Award 2019, Sirindhorn International Institute of Technology, 28 June, 2019
- The Patent Award 2019, Sirindhorn International Institute of Technology, 28 June, 2019
- The TU Honor Plaque 2017 for a merit, Thammasat University (TU), 21 November 2017.
- The TU Distinguished Research Award 2016 in Science and Technology, 26 December 2016.
- The Best Paper Award 2016, the 3rd Management and Innovation Technology International Conference (MITicon 2016), October 2016. Thailand.
- The Sirindhorn International Institute of Technology Research Award 2011, 28 June 2012.
- The ICT Award 2010, (the 3rd -prize award), the Ministry of Information and Communication Technology (MICT), 9 March 2011.
- The British Council Scholarship, the UK, October 1989-1991.
- The Overseas Research Studentship (ORS) Award, CVCP, the UK, October 1988-1989.
- The Philips Scholarship, Philips International Institute of Technological Studies (PII), and Philips Research Laboratories, Eindhoven, the Netherlands, January 1987-February 1988.

Research Areas:

- Microelectronics.
- Periodic and chaotic circuits and systems.

Present Academic and Professional Activities:

- A plenary-keynote-invited speaker, CHAOS2020, Florence, Italy (turned into a virtual conference due to Covid-19).
- Associate Member, Thai Academy of Science and Technology Foundation.
- Researcher, National Research Council of Thailand (NRCT).
- Member, Academic Committee No. 900, Thai Industrial Standard Institute, Ministry of Industry, 1997-2013.
- Treasurer, Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology (ECTI) Association, 2004-2010.

Dr. Cholwich Nattee   Nationality: Thai

Academic Rank:
Associate Professor

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Education:
D.Eng.   Computer Science, Tokyo Institute of Technology, Japan
M.Eng.   Computer Science, Tokyo Institute of Technology, Japan
B.Eng.   Computer Engineering, Chulalongkorn University, Thailand

Academic Awards:
- Finalist of "Telecom Prototype Award" from the Telecommunications Research and Industrial Development Institute (with K. Zintus-art, S. Saetia, and V. Pongparnich)
- Young Researcher Award 2009, Thammasat University
- Very Good Research Award 2008, Thammasat University
- Japanese Government (Monbukagakusho) Scholarship, 1998-2004

Research Areas:
- Artificial intelligence
- Machine learning
- Knowledge discovery and data mining
- Artificial intelligence applications in distance learning
- Pattern recognition

Dr. Chalie Charoenlarpnopparut   Nationality: Thai

Academic Rank:
Associate Professor

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Education:
Ph.D.   Electrical Engineering, The Pennsylvania State University, University Park, PA, USA
M.S.   Electrical Engineering, The Pennsylvania State University, University Park, PA, USA
B.Eng.   Electrical Engineering, (1st Class Honors), Chulalongkorn University, Bangkok, Thailand

Academic Awards:
- 2011 Sirindhorn International Institute of Technology Research Award 2011
- 2010 Distinguished Teacher Award, Sirindhorn International Institute of Technology
- 2010 Best Teaching Award, Sirindhorn International Institute of Technology
- 2008 Outstanding Teacher in Science and Technology Award, Thammasat University
- 2006 Best Teaching Award, Sirindhorn International Institute of Technology
- 2002 Best Teaching Award, Sirindhorn International Institute of Technology
- Best Presenter-in-the-track Award, Automatic Control Conference, USA, 1998
- Gold Medal Prize, 1993, Chulalongkorn University

Research Areas:
- Multidimensional systems and signal processing
- Image processing/pattern recognition
- Signal processing for communication
- STEM Education & Learning
- Smart grid Technology: renewable energy and energy storage
- Machine Learning

Present Academic and Professional Activities:
- Subcommittee on Energy and public services, Thailand Consumers Council
- Sigma Xi, The Science Research Society, USA, 2000
- Phi Kappa Phi Honor Society, USA, 1995

Dr. Ekawit Nantajeewarawat
Nationality: Thai

Academic Rank:
Associate Professor

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Education:
D.Eng.   Computer Science, Asian Institute of Technology (AIT), Thailand
M.Eng.   Computer Science, Asian Institute of Technology (AIT), Thailand
B.Eng.   Computer Engineering, Chulalongkorn University, Thailand

Academic Awards:
- Very Good Research Award 2008, Thammasat University
- 2001 Best Teaching Award, Sirindhorn International Institute of Technology
- Outstanding Dissertation Award 1999, National Research Council of Thailand (NRCT)
- 1997 Best Teaching Award, Sirindhorn International Institute of Technology

Research Areas:
- Knowledge representation
- Automated reasoning
- Knowledge-based software engineering
- Semantic web
- Information extraction

Dr. Gun Srijuntongsiri
Nationality: Thai

Academic Rank:
Associate Professor

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Education:
Ph.D.   Computer Science, Cornell University, USA
M.S.   Computer Science, Cornell University, USA
B.S.   Computer Science, Cornell University, USA

Academic Awards:
- NRCT Dissertation Award 2012
- Thammasat University Young Researcher Award 2012
- 22nd Place in the 2000 ACM Programming Contest World Finals
- King's Scholarship, 1997

Research Areas:
- Scientific computing and numerical analysis, with focus on intersection problems and optimization

Dr. Itthisek Nilkhamhang   Nationality: Thai

Academic Rank:
Associate Professor

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Education:

Ph.D.	Integrated System Design Engineering, Keio University, Tokyo, Japan
M.Eng.	Integrated System Design Engineering, Keio University, Tokyo, Japan
B.Eng.	Electrical Engineering, (1st Class Honors), Sirindhorn International Institute of Technology, Thammasat University, Thailand

Academic Awards:
- Outstanding Young Researcher Award, Thammasat University, 2014
- Best Teaching Award, Sirindhorn International Institute of Technology, 2014 and 2018
- Japanese Government (Monbukagakusho) Scholarship, 2005-2008
- Keio Graduate Scholarship, 2002-2005

Research Areas:
- Robust and adaptive control
- Iterative control
- System identification
- Nonlinear systems
- Mechatronics
- Robotics

Dr. Nguyen Duy Hung   Nationality: Vietnamese

Academic Rank:
Assistant Professor

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Education:

Ph.D.	Remote Sensing and GIS, Asian Institute of Technology (AIT), Thailand
M.Eng.	Computer Science, Asian Institute of Technology (AIT), Thailand
B.Eng.	Electronics and Telecommunication, Hanoi University of Technology, Vietnam

Academic Awards:
- Exellent Research Award, Sirindhorn International Institute of Technology, 2017
- JICA scholarship, 2003-2006, Asian Institute of Technology (AIT), Thailand
- Hisamatsu prize (Award for the Most Outstanding Computer Science Student), 2002, Asian Institute of Technology (AIT), Thailand
- Bronze medal in International Chemistry Olympiad, 1996, Russia

Research Areas:
- Artificial Intelligence
- Machine Learning
- Multi-agents
- Argumentation
- Proof Procedures
- Dialogues
- Contract Dispute Resolution Systems

Dr. Nirattaya Khamsemanan   Nationality: Thai

Academic Rank:
Associate Professor

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Education:
Ph.D.   Mathematics, University of California, Los Angeles (UCLA), USA
M.A.   Mathematics, University of California, Los Angeles (UCLA), USA
B.A.   Mathematics, (Cum Laude) Cornell University, USA

Academic Awards:
- Distinguished Teacher Award 2022. Sirindhorn International Institute of Technology, Thammasat University, Thailand.
- Best Teaching Award 2022. Sirindhorn International Institute of Technology, Thammasat University, Thailand.
- Best Teaching Award 2015. Sirindhorn International Institute of Technology, Thammasat University, Thailand.
- Great teacher of the year 2014, Thammasat University, Thailand.
- Best Teaching Award 2009. Sirindhorn International Institute of Technology, Thammasat University, Thailand.
- Very High Student Evaluation Recognition 2007. Department of Mathematics, University of Connecticut, USA
- The Robert Sorgenfrey Distinguished Teaching Assistant Award 2005. Department of Mathematics. UCLA, CA.
- The Cranson W. and Edna B. Shelly Award for Excellence in Undergraduate Research in Astronomy 1999-2000, Cornell University, NY.
- Full DPST Scholarship, (Development and Promotion for Science and Technology) from the Royal Thai Government, 1996-2006.

Research Areas:
- Machine Learning
- Gait and Pose Recognition
- Mathematical Modelling
- Algebraic Topology
- Big Data
- Cryptography

Academic Experience:
- Associate Professor Sirindhorn International Institute of Technology, Thammasat University, Thailand.
- Assistant Professor Sirindhorn International Institute of Technology, Thammasat University, Thailand.
- Assistant Professor in Residence September Department of Mathematics, University of Connecticut.
- Lecturer Department of Mathematics, UCLA.
- Teaching Instructor Department of Mathematics, UCLA.
- Teaching Assistant Consultant Department of Mathematics, UCLA.
- Teaching Assistant July Department of Mathematics, UCLA.
- Teaching Assistant Astronomy Department, UCLA.
- Astronomy Research Assistant Astronomy Department, Cornell University

Dr. Pakinee Aimmanee   Nationality: Thai

Academic Rank:
Associate Professor

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Education:

Ph.D.	Applied Mathematics, University of Colorado, USA
M.S.	Applied Mathematics, University of Colorado, USA
B.S.	Mathematics, (Cum Laude) University of Delaware, USA

Academic Awards:

- Best Paper Award, the 19th International Conference on Electrical Engineering Electronics, Computer, Telecommunications, and Information Technology (ECTI-CON) 2022
- Research honorary through outside organization awards from Thammasart University in 2017 and 2018.
- Best paper award from the 14th International Conference on Intelligent Information Hiding and Multimedia Signal Processing, Sendai, Japan 2018.
- Best paper and presentation awards from the 13th International Joint Symposium on Artificial Intelligence and Natural Language Processing (iSAI-NLP 2018), Pattaya, Thailand 2018.
- Silver Medal in the 16th International Invention Exhibition at Geneva, Switzerland, 2018.
- Best Journal Paper Award 2016, Institute of Electronics, Information and Communication Engineers (IEICE).
- Large Research Project Award 2014, An award from Thammasat University given to a person who received a large research project (via the institute), Thammasat University researcher day 2014.
- Very Good Research Award from Thammasat University, 2008.
- Stribic fellowship awarded to women who succeed in teaching and researching, University of Colorado at Boulder, 2002-2003.
- William Clark Prize, a prize given to an excellent student in Mathematics, University of Delaware, 1999.
- Development and Promotion for Science and Technology Talents Project (DPST) Scholarship, 1995-2005.
- The Second prize winner in a science competition, Chiang Mai University, 1993.

Research Areas:

- Information retrieval
- Data mining
- Applied mathematics
- Image processing
- Acoustic processing
- Information Hiding
- Information Extraction
- Medical Image Processing
- Audio Watermarking

Dr. Prapun Suksompong   Nationality: Thai

Academic Rank:
Assistant Professor

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Education:

Ph.D.	Electrical and Computer Engineering, Cornell University, Ithaca, New York, USA
M.S.	Electrical and Computer Engineering, Cornell University, Ithaca, New York, USA
B.S.	Electrical and Computer (Summa Cum Laude) Engineering, Cornell University, Ithaca, New York, USA

Academic Awards:
- 2018 Outstanding Teacher in Science and Technology Award, Thammasat University
- 2017 Distinguished Teacher Award, Sirindhorn International Institute of Technology
- 2017 Best Teaching Award, Sirindhorn International Institute of Technology
- 2013 Best Teaching Award, Sirindhorn International Institute of Technology
- 2013 Outstanding Young Researcher Award, Thammasat University
- 2011 SIIT Research Award
- 2009 Best Teaching Award, Sirindhorn International Institute of Technology
- 2006 Teaching Assistant of the Year, Cornell IEEE student branch
- 2002 Fellowship, Cornell University
- King's Scholarship, 1997

Research Areas:
- Wireless communications
- Game Theory in Communication Networks
- Indoor positioning principles and localization techniques
- Computational neuroscience
- Energy-efficient coding
- Poisson process and Poisson convergence

Dr. Sasiporn Usanavasin   Nationality: Thai

Academic Rank:
Assistant Professor

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Education:

Ph.D.	Software Engineering, Keio University, Japan
M.S.	Software Engineering, Keio University, Japan
B.Sc.	Information Technology, (1st Class Honors), Sirindhorn International Institute of Technology, Thammasat University, Thailand

Research Areas:
- Software Engineering
- Semantic Web and Knowledge Engineering
- Artificial Intelligent
- Service Science and Service Innovation

Present Academic and Professional Activities:
- Head of Sirindhorn International Institute of Technology Consulting Center

Dr. Seksan Laitrakun   Nationality: Thai

Academic Rank:
Lecturer

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Education:

Ph.D.	Electrical and Computer Engineering, Georgia Institute of Technology, USA
M.Sc.	Electrical and Computer Engineering, Georgia Institute of Technology, USA
M.Sc.	Electrical Engineering, Sirindhorn International Institute of Technology, Thammasat University, Thailand
B.Eng.	Electrical Engineering, Sirindhorn International Institute of Technology, Thammasat University, Thailand

Academic Awards:
• Royal Thai Government Scholarship (awarded by Commission of Higher Education), 2007-2011

Research Areas:
• Distributed signal processing in wireless sensor networks
• Internet of Things
• Applications of Machine Learning and Deep Learning

Dr. Somchart Fugkeaw   Nationality: Thai

Academic Rank:
Assistant Professor

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Education:

Ph.D.	Electrical Engineering and Information Systems, The University of Tokyo, Japan
M.Sc.	Computer Science, Mahidol University, Thailand
B.B.A.	Management Infomation System, Thammasart University, Thailand

Research Areas:
• Information Security, Privacy, and Trust Management
  • Access Control Model and Authorization Management
  • Security and Privacy in Cloud Computing
  • Organizational Security and Privacy Management
  • Database Security
• AI Security
• Cloud computing
• Blockchain
• Big Data
• Business Intelligence
• Database Systems

Dr. Somrudee Deepaisarn

Nationality: Thai

Academic Rank:
Lecturer

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Education:

Ph.D.	Imaging, The University of Manchester, United Kingdom
MSc.	Medical Imaging, The University of Manchester, United Kingdom
BSc.	Physics, The University of Manchester, United Kingdom

Academic Awards:
- High Quality Publication Award from Sirindhorn International Institute of Technology in 2020.
- Best Papers Award from 2020 International Electronics Symposium (IES).
- Development and Promotion for Science and Technology Talents Project (DPST) Scholarship, 2006-2019.
- Scholarship for maintaining good academic results awarded in 2010, 2011 and 2012 from the School of Physics and Astronomy, the University of Manchester.
- 3rd place in the Physics competition at CU Academic Expo in 2008.
- Best oral presentation, DPST summer camp in 2008.
- The Promotion of Academic Olympiads and Development of Science Education Foundation; Thailand's Physics Olympiad preparation camps in 2006-2007.
- King's scholarship for Ratwinit students, with outstanding academic results in 2004, 2005 and 2006.

Research Areas:
- Medical Image Processing
- Spectral Analysis
- Bioinformatics
- Artificial Intelligence
- Computer Vision
- Smart City

Dr. Stanislav S. Makhanov

Nationality: Russian

Academic Rank:
Professor

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Education:

Ph.D.	Applied Mathematics, Computer Center of the Russian Academy of Science, Moscow, Russia
Diploma	English Language, Moscow State University of Linguistics, Russia
M.Sci.	Applied Mathematics, Moscow State University, Russia

Academic Awards:
- Excellent Research Publication Award, Sirindhorn International Institute of Technology, 2019
- Silver Medal, 2018, 46th International Invention Exhibition, Geneva
- Gold Publication Achievement Award, Sirindhorn International Institute of Technology, 2018
- The Best Research in Science and Technology, Thammasat University, 2017
- Excellent Publication Award 2016, Sirindhorn International Institute of Technology
- Excellent Research Award 2015, Sirindhorn International Institute of Technology
- Very Good Research Award, 2009, Thammasat University
- Very Good Research Award, 2007, Thammasat University
- Outstanding Research Award, 2006, Thammasat University

Research Areas:
- Robotics
- Image Processing
- Pattern Recognition
- Grid generation

Dr. Toshiaki Kondo   Nationality: Japanese

Academic Rank:
Associate Professor

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Education:
Ph.D.   Image Processing, National University of Singapore, Singapore
M.Eng.   Image Processing, The University of Sydney, Australia
M.Eng.   Information Processing, Tokyo Institute of Technology, Japan
B.Eng.   Mechanical Engineering, Tokyo Institute of Technology, Japan

Academic Awards:
- Invited speaker at the 21st International Workshop on Advanced Image Technology (IWaIT 2018), Thailand, 2018.
- Best Paper Award at the 9th Regional Conference on Electrical and Electronics Engineering (RCEEE 2016), Vietnam, 2016.
- Best Teaching Award, Sirindhorn International Institute of Technology, 2016.
- Outstanding Presentation Award at the 30th JSST Annual Conference (JSST 2011), Japan, 2011.
- Outstanding Poster Award at the 12th International Conference on Biomedical Engineering (ICBME 2005), Singapore, 2005.
- NUS (National University of Singapore) Research Scholarship, 1999-2003.
- Scholarship for Postgraduate Study from Canon Inc., 1986-1988.

Research Areas:
- Digital image/video processing (e.g. digital watermarking, object tracking)
- Computer vision (e.g. motion estimation, heart rate measurement)
- Pattern classification and recognition

Dr. Teerayut Horanont   Nationality: Thai

Academic Rank:
Associate Professor

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Education:
Ph.D.   Spatial Information Engineering, The University of Tokyo, Japan
M.Sc.   Remote Sensing and Geographic Information System, Asian Institute of Technology (AIT), Thailand
B.Arch.   Architecture, Chulalongkorn University, Thailand

Academic Awards:
- Best Paper, PURBA Workshop, ACM Ubicomp conference 2013
- Best Paper, 5th International Conference on Health GIS 2013
- Best Paper, The 33rd Asian Conference On Remote Sensing, 2012
- Best Paper, AisaGIS conference 2008
- Young GIS Professional Award, Asia Geographic Information System Association, 2008
- Japanese Government Monbukagakusho Scholarship 2007-2010
- Biography in Asian/American Who's Who, selected by editor, Vol. IV, 2004
- Ed Forrest Internship Program awards, The Geospatial Information & Technology Association (GITA), USA, 2003
- The John A. Hrones Prize for outstanding academic works, School of Advanced Technologies, Asian Institute of Technology (AIT), Thailand, 2002
- Asian Institute of Technology (AIT) Fellowship (Full Scholarship) Award, 2001

Research Areas:
- Geographic Information System (GIS)
- Urban Computing
- Indoor Navigation
- Geospatial Big Data Platform Development and Analysis
- Smart City and Precision Agriculture
- Open Source Software and Open Standards Development

Present Academic and Professional Activities:
- Voting Member, IndoorGML, Open Geospatial Consortium (OGC)

Dr. Thanaruk Theeramunkong

Nationality: Thai

Academic Rank:
Professor

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Education:

D.Eng.	Computer Science, Tokyo Institute of Technology, Japan
M.Eng.	Computer Science, Tokyo Institute of Technology, Japan
B.Eng.	Electrical and Electronics Engineering, Tokyo Institute of Technology, Japan

Academic Awards:
- TRF Research Team Promotion Grant (RTA) (2019)
- 47th Innovation Contest (2019)
- 43rd Innovation contest at Geneva (2015)
- National Distinguished Researcher Award 2014 from National Research Council of Thailand (NRCT)
- Very Good Research Awards 2008-2010, Thammasat University
- Best Paper Award from the Japanese Society for Artificial Intelligence, 1994
- Scholarship from Tokyo Marine, 1992-1995
- Japanese Government (Monbukagakusho) Scholarship, 1985-1991

Research Areas:
- Natural language processing
- Artificial Intelligence
- Knowledge data discovery
- Information retrieval
- Data mining
- Machine Learning (ML)
- Intelligent information systems

Dr. Waree Kongprawechnon

Nationality: Thai

Academic Rank:
Associate Professor

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Education:

Ph.D.	Mathematics Engineering and Information Physics, The University of Tokyo, Japan
M.Eng.	Control Engineering, Osaka University, Japan
B.Eng.	Electrical Engineering, (1st Class Honors), Chulalongkorn University, Thailand

Academic Awards:
- Japanese Government (Monbukagakusho) Scholarship, 1992-1998

Research Areas:
- Theory in H∞ control
- Control theory
- Robust control
- System identification
- Adaptive control
- Learning control
- Neural network
- Machine learning

SCHOOL OF MANAGEMENT TECHNOLOGY

Dr. Aussadavut Dumrongsiri   Nationality: Thai

Academic Rank:
Associate Professor

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Education:

Ph.D.	Business Administration Operations Management, University of Washington, Seattle, WA, USA
M.Sc.	Industrial and Operations Engineering, The University of Michigan, Ann Arbor, MI, USA
M.Sc.	Electrical Engineering, Michigan State University East Lansing, MI, USA
B.Eng.	Electrical Engineering, Chulalongkorn University, Thailand

Academic Awards:
- Bertauche Endowment Fellowship, University of Washington, USA
- Evert McCabe Fellowship, University of Washington, USA

Research Areas:
- Operations management
- Supply chain management
- E-Business
- E-Word of Mouth
- Project management
- Inventory management
- Game theory
- Business competition

Present Academic and Professional Activities:
- Ad hoc reviewer for Operations Research, European Journal of Operational Research, International Journal of Production Economics, and Thammasat International Journal of Science and Technology
- Member of Institute for Operations Research and the Management Sciences (INFORMS)
- Member of Decision Science Institute (DSI)

Dr. Chawalit Jeenanunta   Nationality: Thai

Academic Rank:
Associate Professor

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Education:

Ph.D.	Industrial and Systems Engineering, Virginia Polytechnic Institute and State University, USA
M.S.	Management Science, University of Maryland, USA
B.S.	Mathematics, University of Maryland, USA
B.S.	Computer Science, University of Maryland, USA

Academic Awards:
- Development and Promotion of Science and Technology Talents Project (DPST) Scholarship, 1990-2004

Research Areas:
- Linear programming
- Integer programming
- Network optimization
- Simulation
- Supply chain management

Dr. Narameth Nananukul   Nationality: Thai

Academic Rank:
Associate Professor

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Education:
Ph.D.   Operations Research and Industrial Engineering, University of Texas at Austin, USA
M.S.   Industrial Engineering, Texas A&M University, USA
M.Eng.   Electrical Engineering, Chulalongkorn University, Thailand
B.Eng.   Electrical Engineering, Chulalongkorn University, Thailand

Academic Awards:
- Cullen Trust for Higher Education Endowed Professorship in Engineering Fellowship, University of Texas at Austin, 2006-2007
- Graduate School Continuing Fellowship, University of Texas at Austin, 2007-2008

Research Areas:
- Business Intelligence
- Inference and Data Mining
- Decision Support System
- Optimization in Supply chain
- Energy System and Online Advertising
- Quality Management

Present Academic and Professional Activities:
- Reviewer, Journal of Applied Mathematical Modelling
- Member, The Institute for Operations Research and the Management Sciences (INFORMS)

Dr. Nattharika Rittippant   Nationality: Thai

Academic Rank:
Assistant Professor

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Education:
Ph.D.   Strategic and International Management, The University of Texas at Arlington, USA
M.M.   E-Commerce, University of Dallas, USA
M.B.A.   International Business Management, University of Dallas, USA
B.A.   Economics, University of Dallas, USA
B.S.   Biology, University of Dallas, USA

Research Areas:
- Entrepreneurial intentions
- MNE and international strategies
- Strategic management
- CSR

Dr. Natsuda Kaothanthong   Nationality: Thai

Academic Rank:
Assistant Professor

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Education:
Ph.D.   Information Science, Tohoku University, Japan
M.S.   Information Science, Tohoku University, Japan
B.S.   Information Technology, Sirindhorn International Institute of Technology, Thammasat University, Thailand

Research Areas:
- Pattern Recognition
- Computer Vision
- Information Retrieval
- Data Mining
- Machine Learning

Dr. Pisit Chanvarasuth   Nationality: Thai

Academic Rank:
Associate Professor

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Education:
Ph.D.	Management Information Systems, Rensselaer Polytechnic Institute, USA
M.S.	Management Information Systems, Rensselaer Polytechnic Institute, USA
M.B.A.	Finance, Loyola University Chicago, Chicago, USA
D.V.M.	Doctor of Veterinary Medicine, Chulalongkorn University, Thailand

Research Areas:
- Information technology management
- Electronic business
- Supply chain management
- Outsourcing
- Management of organizational business processes

Dr. Rujira Chaysiri   Nationality: Thai

Academic Rank:
Assistant Professor

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Education:
Ph.D.	Systems Engineering, University of Virginia, USA
M.S.	Operations Research, Columbia University, USA
B.A.	Mathematics, University of Virginia, USA

Academic Awards:
- Development and Promotion of Science and Technology Talents Project (DPST) Scholarship, 2001-2016

Research Areas:
- Systems Integration
- Nonlinear Systems
- Dynamical Systems and Control

Dr. SangGyu Nam   Nationality: Korean

Academic Rank:
Lecturer

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Education:
D.Eng.	Information Science, Japan Advanced Institute of Science and Technology, Japan
M.Eng.	Information Science, Japan Advanced Institute of Science and Technology, Japan
B.Eng.	Computer engineering, Chung-Ang University, Korea

Research Areas:
- Deep machine learning
- Multicar elevator control system
- Procedural Content Generation
- Entertaining, assisting, teaching AI agents
- Human computer interaction design
- Human-like AI agents.

Dr. Suebsak Nanthavanij   Nationality: Thai

Academic Rank:
Associate Professor

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Education:
Ph.D.   Industrial Engineering, The University of Texas at Arlington, USA
M.S.   Industrial Engineering, The University of Texas at Arlington, USA
B.S.   Chemical Engineering, Chulalongkorn University, Thailand

Research Areas:
- Industrial ergonomics
- Product and workstation design
- Industrial noise

Dr. Suthathip Suanmali   Nationality: Thai

Academic Rank:
Associate Professor

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Education:
Ph.D.   Mathematics, North Carolina State University, USA
M.S.   Applied Mathematics, North Carolina State University, USA
B.S.   Mathematics and Financial (Summa Cum Laude) Economics, Methodist University, USA

Academic Awards:
- Distinguished Paper Award, 2014 International Symposium on Business and Management
- Best Paper Award 2012, World Business Research Conference (organized by World Business Institute)
- 2011 Best Teaching Award, Sirindhorn International Institute of Technology
- 2008 Best Teaching Award, Sirindhorn International Institute of Technology
- The Armstrong Maltbie Award for Excellence in Teaching, North Carolina State University, April 2006
- Outstanding Teaching Assistant Award, North Carolina State University, April 2005
- The Balaez-Ambrose Outstanding Mathematics Award, Methodist University, April 2002
- The Walter Clark Maximum Effort Award from the Reeves School of Business, Methodist University, April 2002

Research Areas:
- Applied linear algebra
- Highway assets maintenance and management system
- Regional trade analysis
- Cross border trade facilitation

Dr. Thanwadee Chinda   Nationality: Thai-Australian

Academic Rank:
Associate Professor

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Education:
Ph.D.   Engineering Management, Griffith University, Australia
M.Eng.   Engineering Management, Griffith University, Australia
B.Eng.   Mechanical Engineering King Mongkut's University of Technology Thonburi, Thailand

Academic Awards:
- Thammasat University Researcher Award, 2013
- "Master of Excellence 2002", Griffith University, Australia

Research Areas:
- Construction safety management
- Construction waste
- System dynamics modeling
- Structural equation modeling

SCHOOL OF MANUFACTURING SYSTEMS AND MECHANICAL ENGINEERING

Dr. Bundit Limmeechokchai   Nationality: Thai

Education:
D.Eng.   Energy Economics and Planning, Asian Institute of Technology (AIT), Thailand
M.Eng.   Energy Technology, Asian Institute of Technology (AIT), Thailand
B.Eng.   Mechanical Engineering, (1st Class Honors),
          King Mongkut's Institute of Technology North Bangkok, Thailand

Academic Rank:
Associate Professor

Research Areas:
- Energy efficiency, economics, planning and policy
- GHG mitigation
- Modeling of energy and environment systems
- Low-carbon technologies

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Dr. Bhawat Traipattanakul   Nationality: Thai

Education:
Ph.D.   Mechanical Engineering, Hong Kong University of Science and Technology, Hong Kong
M.Eng.   Energy, Asian Institute of Technology (AIT), Thailand
B.Eng.   Mechanical Engineering (1st Class Honor, Gold Medal), King Mongkut's University of Technology
          North Bangkok, Thailand

Academic Rank:
Lecturer

Research Areas:
- Bio-Inspired Materials for Energy Applications
- Energy Harvesting
- Heat and Mass Transfer
- Nanofluids Heat Transfer
- Thermal Rectification

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Dr. Jirachai Buddhakulsomsiri   Nationality: Thai

Education:
Ph.D.   Industrial Engineering, Oregon State University, USA
M.S.   Statistics, Oregon State University, USA
M.S.   Industrial Engineering, Oregon State University, USA
B.Eng.   Chemical Engineering, Chulalongkorn University, Thailand

Academic Rank:
Associate Professor

Research Areas:
- Logistics and supply chain management in inventory management and optimization, vehicle routing with transshipment, and supply contract
- Applied operations research
- Production planning and control
- Systems simulation
- Data mining
- Engineering economics analysis

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Dr. Maroay Phlernjai   Nationality: Thai

Academic Rank:
Lecturer

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Education:

D.Eng.	Mechano-Micro Engineering, Tokyo Institute of Technology, Japan
M.Eng.	Mechano-Micro Engineering, Tokyo Institute of Technology, Japan
B.Eng.	Mechanical Engineering, Sirindhorn International Institute of Technology, Thammasat University, Thailand

Research Areas:
- Variable transmission system in Robotics
- Machine design
- Differential mechanism
- CAD/CAM

Dr. Navee Chiadamrong   Nationality: Thai

Academic Rank:
Associate Professor

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Education:

Ph.D.	Manufacturing Engineering and Operations Management, The University of Nottingham, UK
M.Sc.	Engineering Business Management, The University of Warwick, UK
B.Eng.	Industrial Engineering, Chulalongkorn University, Thailand

Research Areas:
- Cellular manufacturing systems (CMS)
- Advanced manufacturing systems
- Systems simulation
- Production planning and control
- Supply chain management

Dr. Pham Duc Tai   Nationality: Vietnamese

Academic Rank:
Lecturer

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Education:

Ph.D.	Engineering and Technology, Sirindhorn International Institute of Technology, Thammasat University, Thailand
M.E.	Logistics and Supply Chain Systems Engineering, Sirindhorn International Institute of Technology, Thammasat University, Thailand
B.E.	Industrial Engineering, Ho Chi Minh City University of Technology, Vietnam

Research Areas:
- Bullwhip effect in supply chain
- Information sharing
- Supply chain network design
- Marketing - Operations interfaces
- Retail management
- Inventory optimization
- Supply contract

Dr. Pisal Yenradee   Nationality: Thai

Academic Rank:
Associate Professor

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Education:

D.Eng.	Industrial Engineering and Management, Asian Institute of Technology (AIT), Thailand
M.Eng.	Industrial Engineering and Management, Asian Institute of Technology (AIT), Thailand
B.Eng.	Production Engineering, (1st Class Honors), King Mongkut's Institute of Technology North Bangkok, Thailand

Research Areas:
- Production and Inventory control (P&IC) systems, JIT, MRP, and TOC
- P&IC systems for Thai industries
- P&IC in supply chain
- Applied operations research
- Real time optimal vehicle route planning and control.

Dr. Satha Aphornratana   Nationality: Thai

Academic Rank:
Professor

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Education:

Ph.D.	Mechanical Engineering, The University of Sheffield, England
B.Sc.	Mechanical Engineering, Prince of Songkla University, Thailand

Research Areas:
- Refrigeration systems

Dr. Suchada Rianmora   Nationality: Thai

Academic Rank:
Associate Professor

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Education:

D.Eng.	Design and Manufacturing Engineering, Asian Institute of Technology (AIT), Thailand
M.Eng.	Industrial Production Technology, Kasetsart University, Thailand
B.Eng.	Industrial Engineering, Sirindhorn International Institute of Technology, Thammasat University, Thailand

Research Areas:
- Structured light system-based selective data acquisition
- Reverse engineering
- Application of image processing in manufacturing process
- Adaptive layered manufacturing
- CAD/CAM

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Ph.D.   Industrial Engineering, New Jersey Institute of Technology (NJIT), USA
M.S.   Industrial Engineering, San Jose State University, USA
B.Eng.   Mechanical Engineering, Sirindhorn International Institute of Technology,
              Thammasat University, Thailand

Academic Awards:
- Best Presentation Award at the 5th KKU International Engineering Conference (KKU-IENC), 2014
- Doctoral Scholarship in Nanotechnology awarded by the Office of the Higher Education Commission (OHEC), 2005

Research Areas:
- Applied Operations Research
- Sustainability in production and supply chain management
- Decision-making for sustainable development

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B.Eng.   Mechanical Engineering, Chulalongkorn University, Thailand

Academic Awards:
- Gold Medal Award 2014, Taipei International Invention show & Technomart
- Very Good Research Award 2006, Thammasat University
- Thailand's Young Scientist Award 2002, Foundation for the Promotion of Science and Technology under the Patronage of His Majesty the King, Thailand
- The Award-Winning Book of Thammasat University, Dynamic Systems and Control, 2002

Research Areas:
- Process control and modeling
- Robotics
- Expert control systems
- Neural networks and fuzzy logics
- System identification
- Numerical simulation and optimization

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Education:

Ph.D.   Systems and Control Engineering, Case Western Reserve University, Ohio, USA

B.Eng.   Mechanical Engineering, Sirindhorn International Institute of Technology, Thammasat University, Thailand

Research Areas:

- Systems Biology
- Biomedical Mechanics
- Neurosurgical Systems
- Cardiovascular Systems
- Simulation Modeling
- Signal Analysis
- Computational Fluid Dynamics (CFD)

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Education:

Ph.D.   Knowledge Science, Japan Advanced Institute of Science and Technology, Japan

M.Eng.   Logistics and Supply Chain Systems Engineering, Sirindhorn International Institute of Technology, Thammasat University, Thailand

B.Eng.   Industrial Engineering (1st Class Honors), Sirindhorn International Institute of Technology, Thammasat University, Thailand

Research Areas:

- Time series forecasting
- Data mining
- Logistics and supply chain management
- Discrete-event systems simulation
- Agro-industry management
- Vehicle routing and scheduling

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M.Ed.	Teaching Foreign Languages, University of Southern Queensland, Australia.
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	Certificate I in Copyediting, Chartered Institute of Editing Proofreading, UK.
	TESL/TEFL Certificate (120 hours), TEFLPlus Teaching Training,
	Patong Language School Phuket, Thailand.
	Diploma of Public Safety, Charles Darwin University, Australia
	Advanced Certificate in Policing, Charles Darwin University, Australia.

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B.A.	Psychology, University of Iceland, Reykjavik, Iceland.

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TESOL	Teaching English to Speakers of Other Languages, Payap University, Chiang Mai, Thailand.
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Mr. John Jasper Cortes

Education:

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B.Ed.	Northern Star College, Bohol, Philippines
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