

Master of Engineering in Engineering Technology (International Program)

Curriculum Title

Master of Engineering in Engineering Technology (International Program)

Degree Title

Master of Engineering (Engineering Technology)

Applicants' Qualifications

1. The applicant must hold a bachelor's degree in engineering, science or a related field that is accepted by the SIIT Executive Committee.
2. The applicant must have a cumulative GPA of at least 2.75 or sufficient relevant research or work experience as specified by the SIIT Executive Committee.
3. The applicant must submit an official score of one of the following English language tests:
 - TU-GET,
 - TOEFL (official or institutional),
 - IELTS, or
 - an English test conducted by SIIT.

The score must not be older than two years from the date on which it was issued to the date of the application for admission to the program.

Admission Requirements

1. The applicant must pass a selection interview conducted by an SIIT Committee consisting of at least 3 faculty members.
2. Admission to the program requires approval by the SIIT Executive Committee.

Remark: Students who have inadequate knowledge in some areas, may be required to take additional courses in those areas.

Academic System

1. All courses are conducted in English. An academic year is divided into 2 semesters. Each semester consists of 16 weeks. Courses may be offered for a summer semester of at least 6 weeks duration. The total number of lecture hours required for the summer semester is the same as that for the regular semester. Enrollment for summer courses is optional.

2. Curriculum

2.1 Study Plan

The syllabus consists of prescribed coursework (24 credits) and thesis (15 credits). A total of 39 credits is required for completion of the program.

2.2 Thesis

2.2.1 A student can register for a thesis after he or she has studied for at least 2 regular semesters or has gained 12 credits with a minimum cumulative GPA of 3.00.

2.2.2 Thesis Committee

The Thesis Committee consists of a) a faculty member of SIIT who is the student's advisor, b) two or more members, at least one of whom is a faculty member of SIIT, and c) a co-advisor if necessary. There must be at least one member who is not affiliated with Thammasat University. The advisor and co-advisor (if there is) must not be the chairperson of Thesis Committee. The total number of the committee members who are not the thesis advisor or co-advisor must not be

less than the total number of the thesis advisor and co-advisor. The number of Thesis Committee members who are faculty members of SIIT should not be smaller than that of the Thesis Committee members from outside.

2.2.3 Thesis Final Defense Committee

The Thesis Final Defense Committee consists of the same members as the Thesis Committee. However, the defense must be chaired by a thesis committee member who is not the advisor or co-advisor.

2.2.4 External Examiner

The external examiner must be appointed by the SIIT Executive Committee.

Period of Study

The maximum period of study to complete the program is 4 academic years.

Registration

The student must enroll in courses and/or register for a thesis totaling at least 6 credits but not more than 15 credits per semester.

Academic Performance Evaluation and Graduation

1. Evaluation of Academic Performance

1.1 A credit will be earned only if the grade is "S" or not lower than grade "C". Grade "D" or "F" will be included in the calculation of the grade point average of each semester and for the cumulative grade point average.

1.2 Any student, who gets grade "U", "D" or "F" in a compulsory taught course, can re-enroll in that course only one more time. His or her student status will be terminated if he or she still fails to obtain grade "S" or at least "C" for the course in the second enrollment.

1.3 Thesis assessment is classified into 2 grades:

- S (Satisfactory)
- U (Unsatisfactory).

Students must get grade "S" for their theses.

2. Graduation Requirements

To graduate, students must meet the following minimum requirements:

2.1 Twenty-four credits of taught courses required by the curriculum with an accumulative GPA of at least 3.00. In addition, the grade of each of these courses must be at least "C".

2.2 Fifteen credits of thesis work and passing a thesis defense.

2.3 Approval of the thesis by the external examiner and the thesis committee.

2.4 At least one paper on thesis findings has been accepted for publication in a national journal approved by the Academic Review Committee of SIIT, or at least one paper has been accepted for publication in international conference proceedings.

2.5 Having satisfied one of the following English proficiency requirements:

- A TOEFL (official or institutional) score of at least 550 (paper-based), or 213 (computer-based), or 79 (internet-based), or
- An IELTS score of at least 6.0, or
- A TU-GET score of at least 550.

Curriculum

1. Total credits requirement

A total of 39 credits is required for completion of the program.

2. Structure and Components

2.1	Core Courses	24 Credits
2.1.1	Compulsory Courses	9 Credits
2.1.2	Specialized Courses	12 Credits
	from one of the following six majors of study, i.e.,	
	1. Chemical Engineering	
	2. Civil Engineering	
	3. Electrical Engineering	
	4. Industrial Engineering and Manufacturing Systems	
	5. Mechanical Engineering	
	6. Sustainable Energy and Environment	
2.1.3	Elective Courses	3 Credits
2.2	Master's Thesis	15 Credits
	Total	39 Credits

3. Course Coding System

Sirindhorn International Institute of Technology sets up the course as follows:

3.1 Subject code consists of letters and numbers.

3.2 ES indicates basic subjects.

ET indicates subjects in Engineering Technology Program.

ICT indicates subjects in Information and Communication Technology for Embedded Systems.

SE indicates subjects in Supply Chain System Engineering and Logistics Program.

3.3 Numbers are composed of 3 digits.

- The first unit-place-digit indicates the subject order.
- The tenth-place-digit indicates the subject group.
 - 0 General
 - 1 Chemical Engineering
 - 2 Civil Engineering
 - 3 Electrical Engineering
 - 4 Industrial Engineering and Manufacturing Systems
 - 5 Mechanical Engineering
 - 6-7 Sustainable Energy and Environment
- The hundredth-place-digit indicates the graduate program.

4. List of courses in the curriculum

4.1 Core Courses, 24 credits

4.1.1 Compulsory Courses, 9 credits

Code	Course Title	Credits (lecture-practice-self study hrs)
ES805	Research Methodology	2(2-0-6)
ES806	Research Seminar	1(0-3-1)
ET601	Computer-Aided Engineering	3(3-0-9)
ES801	Advanced Engineering Mathematics	3(3-0-9)
	or ES811 Theory of Computation	3(3-0-9)
	or ES812 Advanced Business Statistics	3(3-0-9)
	or ET600 Numerical Methods for Engineers	3(3-0-9)
	or ICT600 Computational Mathematics	3(3-0-9)
	or SE600 Decision Making and Optimization	3(3-0-9)

4.1.2 Specialized Courses, 12 credits from one of the following majors

4.1.2.1 Major: Chemical Engineering

Code	Course Title	Credits (lecture-practice-self study hrs)
ET610	Special Topic in Chemical Engineering	3(3-0-9)
ET611	Current Topics in Chemical Engineering	3(3-0-9)
ET61x	Technical Elective	3(3-0-9)
ET61x	Technical Elective	3(3-0-9)

4.1.2.2 Major: Civil Engineering

Code	Course Title	Credits (lecture-practice-self study hrs)
ET620	Special Topic in Civil Engineering	3(3-0-9)
ET621	Current Topics in Civil Engineering	3(3-0-9)
ET62x	Technical Elective	3(3-0-9)
ET62x	Technical Elective	3(3-0-9)

4.1.2.3 Major: Electrical Engineering

Code	Course Title	Credits (lecture-practice-self study hrs)
ET630	Special Topic in Electrical Engineering	3(3-0-9)
ET631	Current Topics in Electrical Engineering	3(3-0-9)
ET63x	Technical Elective	3(3-0-9)
ET63x	Technical Elective	3(3-0-9)

4.1.2.4 Major: Industrial Engineering and Manufacturing Systems

Code	Course Title	Credits (lecture-practice-self study hrs)
ET640	Special Topic in Industrial Engineering and Manufacturing Systems	3(3-0-9)
ET641	Current Topics in Industrial Engineering and Manufacturing Systems	3(3-0-9)
ET64x	Technical Elective <i>or</i> SE611-7	3(3-0-9)
ET64x	Technical Elective <i>or</i> SE611-7	3(3-0-9)

4.1.2.5 Major: Mechanical Engineering

Code	Course Title	Credits (lecture-practice-self study hrs)
ET650	Special Topic in Mechanical Engineering	3(3-0-9)
ET651	Current Topics in Mechanical Engineering	3(3-0-9)
ET65x	Technical Elective	3(3-0-9)
ET65x	Technical Elective	3(3-0-9)

4.1.2.6 Major: Sustainable Energy and Environment

Code	Course Title	Credits (lecture-practice-self study hrs)
ET660	Special Topic in Sustainable Energy and Environment	3(3-0-9)
ET661	Current Topics in Sustainable Energy and Environment	3(3-0-9)
ET66x	Technical Elective <i>or</i> ET67x	3(3-0-9)
ET66x	Technical Elective <i>or</i> ET67x	3(3-0-9)

4.1.3 Elective Course, 3 Credits

Code	Course Title	Credits (lecture-practice-self study hrs)
ET6xx	Technical Elective <i>or</i> SE611-7	3(3-0-9)

4.2 Master's Thesis

Code	Course Title	Credits
ES800	Master's Thesis	15

Course Descriptions

Compulsory Courses

- ES800 Master's Thesis** 15 credits
- ES801 Advanced Engineering Mathematics** 3(3-0-9)
Mathematics for solving engineering problems; ordinary differential equations of higher order; partial differential equations; integral equations; numerical analysis; optimization techniques.
- ES805 Research Methodology** 2(2-0-6)
Concept of scientific and technological research; Statistics for research planning and research study; Data collection and data analysis; Interpretations, conclusions and recommendations of research results.
- ES806 Research Seminar** 1(0-3-1)
Student-faculty interaction on advanced research topics.
- ES811 Theory of Computation** 3(3-0-9)
Set theory; relations; formal proof methods; finite automata; regular expressions; context-free grammar; pushdown automata; Turing machines; uncomputability; computational complexity; first-order logic.
- ES812 Advanced Business Statistics** 3(3-0-9)
This course exposes students to the application of statistical techniques used to address business and economic problems. Topics include linear regression and correlation, multiple regression, model building, analysis of variance, multivariate statistics, time series analysis, and chi-square test of significance.
- ET600 Numerical Methods for Engineers** 3(3-0-9)
Programming concepts and techniques; Modern programming languages and computational tools for engineering problems; Numerical methods as applied to practical engineering problems; Introduction to finite element methods.
- ET601 Computer-Aided Engineering** 3(3-0-9)
Computational methods for engineering modeling and simulation; Geometric modeling; Grid generation; Finite element methods; Finite volume methods; Applications of numerical methods to advanced engineering problems.
- ICT600 Computational Mathematics** 3(3-0-9)
Set theory; Relations; Formal proof methods; Finite automata; Regular expressions; Context-free grammar; Pushdown automata; First order logic; Theories related to counting, graphs and networks; Interplay between continuous models and their solution via discrete processes; Vector spaces, basis, dimension, eigenvalue problems, diagonalization, inner products, unitary matrices; Introduction to applied statistics and its application to intelligent systems; Introduction to supervised statistical learning including discrimination methods.
- SE600 Decision Making and Optimization** 3(3-0-9)
Fundamental optimization tools for quantitative analysis to develop modeling and decision-making skill in management sciences; Linear programming; Integer programming; Nonlinear programming; Goal programming; Game theory; Markov chains; Queuing theory and decision analysis techniques; Advanced topics in optimization.

Specialized Courses/Elective Courses

- ET610 Special Topic in Chemical Engineering** 3(3-0-9)
An in-depth study on a topic of interest in the field of Chemical Engineering such as advanced reactor design, advanced process analysis, biochemical process design, principles of coal-fired power plant, advanced transport phenomena, advanced thermodynamics, and automatic control process.
- ET611 Current Topics in Chemical Engineering** 3(3-0-9)
A study on current interests in the field of Chemical Engineering such as nanotechnology, genetic engineering, biochemical engineering, polymer science and engineering, fuel cell and solar cell design, and alternative chemical energy resources.
- ET612 Advanced Thermodynamics for Chemical Engineering** 3(3-0-9)
Review of basic concepts and definitions, the first-law and energy, the second law and entropy; Availability equation for control mass/energy applications; Energy analysis of engineering cycles and Thermoconomics; Thermodynamics of multi component and multiphase chemical system, chemical reaction equilibrium, non-ideal solution system.

- ET613 Advanced Transport Phenomena 3(3-0-9)**
Review on the constitutive equations of momentum, energy and mass transfer; Development of microscopic and macroscopic of momentum, energy and mass transfer equations for chemical engineering applications including non-Newtonian fluid flow and unsteady state system for momentum, energy and mass transfer.
- ET614 Advanced Chemical Kinetics and Reactor Design 3(3-0-9)**
Modeling and design of batch and continuous reactors via the concept of chemical kinetics and mass and energy balances including multiphase reactor design; Concept of catalysis including homogeneous and heterogeneous catalysis, support material synthesis and enzyme catalysis.
- ET615 Genetic Engineering 3(3-0-9)**
Basic mechanisms of genetic information and regulation of DNA replication, transcription, and translation; Methods and applications of genetic engineering, including gene manipulation and transfer techniques in prokaryotes; Emphasis on applications of recombinant DNA technology in the elucidation of gene functions and enhancing the activity of enzymes.
- ET616 Advances in Polymer Science and Technology 3(3-0-9)**
Thermodynamics of polymer solution and blends; Specific interactions in polymer multi-component, especially hydrogen bonding and its characterization employing Fourier Transform Infrared (FTIR) spectroscopy; Biocompatible polymers; Degradable polymers.
- ET617 Petrochemical Technology 3(3-0-9)**
Primary raw materials for petrochemistry; Fundamental chemistry, reactions and separations involved in the value-added processing of refinery products such as ethylene, butylenes, sulfur, medium heating value gas, etc; Use of petrochemical properties in the engineering design and operation of petroleum value-added processes; Chemistry and concerns of petrochemical pollutants.
- ET618 Biochemical Engineering Fundamentals 3(3-0-9)**
Overview of biological basics; Major metabolic pathways; Metabolic stoichiometry and energetics; Kinetics of substrate utilization, product formation, and biomass production in cell cultures; Transport phenomena in bioprocess systems; Selection, scale-up, operation, and control of bioreactors; Recovery and purification of products.
- ET620 Special Topic in Civil Engineering 3(3-0-9)**
An in-depth study on a topic of interest in the field of Civil Engineering such as computational methods in civil engineering, advanced structural analysis and design, advanced foundation engineering, maintenance of structures, and construction materials.
- ET621 Current Topics in Civil Engineering 3(3-0-9)**
A study on current interests in the field of Civil Engineering.
- ET622 Finite Element Methods 3(3-0-9)**
Review of variational principles; The Ritz method; Weighted residual methods; Interpolation and shape functions; Natural coordinate systems; Generic finite element formulation for linear elasticity; Numerical integrations; Standard element shape functions; Applications of finite element methods; Programming of finite element methods.
- ET623 Advanced Structural Analysis 3(3-0-9)**
Structural modeling concepts; Static and kinematic requirements for structural systems; Discrete modeling of structural systems; Matrix force and matrix displacement methods; Direct stiffness method; Numerical methods and solution techniques appropriate to discrete structural systems; Numerical techniques for large-scale structural systems.
- ET624 Advanced Structural Design 3(3-0-9)**
Structural design concepts; Advanced topics on ultimate limit state design and serviceability design of structures; Fatigue design of structures; Design of high-rise buildings; Design of long-span bridges.
- ET625 Foundation Design and Analysis 3(3-0-9)**
Site Investigation; Immediate settlements; Bearing capacity of footings; Eccentric foundations; Settlement analysis; Piled foundations; Foundations on difficult soils; Earth pressure problems including retaining walls and sheet pile structures.
- ET626 Inspection, Maintenance and Retrofit of Concrete Structures 3(3-0-9)**
Damage of concrete structures; Types of damage—mechanisms of deterioration; Inspection—inspection methods, visual inspection; Tests—nondestructive tests, partially destructive tests, chemical tests, corrosion tests, cores, load tests; Protection and repair—materials and methods for protection and repair, special techniques; Strengthening.

- ET627 Engineering Cost and Financial Management** **3(3-0-9)**
Economic decisions; Capital Rationing for investment in projects; Cost estimation—design cost estimation, construction cost estimation, total cost of engineering projects; Cash flow forecasting and budgetary control; Business financing and financial performance; Advanced financial management; Project Financing.
- ET628 Construction Management Information Systems** **3(3-0-9)**
Information systems; Information technology; Information generation and utilization for the management of construction projects; Integration of construction management software; Conceptual modeling and knowledge-based models.
- ET630 Special Topic in Electrical Engineering** **3(3-0-9)**
An in-depth study on a topic of interest in the field of Electrical Engineering such as digital communication systems, telecommunication networks, network planning and design.
- ET631 Current Topics in Electrical Engineering** **3(3-0-9)**
A study on current interests in the field of Electrical Engineering.
- ET632 Data Communication Networks** **3(3-0-9)**
Fundamentals of data communications and networking; Layered network architectures and protocols; Data transmission and coding; Error detection and correction; Local and wide area networks; Internetworking, routing, and switching; Queuing theory; Cryptography and network security.
- ET633 Network Planning and Management** **3(3-0-9)**
Fundamentals of computer and communication network planning, design, and management; Graph theory and queuing theory for network design; Network design problems and optimization; Network planning and design tools; Network management standards and protocols.
- ET634 Optical Communication Systems** **3(3-0-9)**
Fundamentals of optical signals and modern optical devices; Wavelength division multiplexing; Optical communication systems and networks; Optical network architectures; Analysis and design of optical communication systems.
- ET635 Digital Signal Processing in Communication Systems** **3(3-0-9)**
Multirate signal processing; QMF filter bank design; LPC speech coding; Subband image coding; Channel estimation/equalization; Power spectral estimation; Fundamental of adaptive filtering; Basic DSP hardware implementation.
- ET636 Digital Communication System Design** **3(3-0-9)**
Digital transmission principles; Digital modulation techniques—ASK, FSK, PSK; Channel coding design—convolutional code, turbo code; Channel modeling; Synchronization; Transceiver design; Fundamentals of multiple access systems—CDMA, OFDM.
- ET640 Special Topic in Industrial Engineering and Manufacturing Systems** **3(3-0-9)**
An in-depth study on a topic of interest in the field of Industrial Engineering and Manufacturing Systems such as fundamental planning and control concepts for production management and supply chains, organization of the planning, scheduling and control functions, inventory management & control systems and methodologies (MRP, MRPII, ERP, OPT, JIT).
- ET641 Current Topics in Industrial Engineering and Manufacturing Systems** **3(3-0-9)**
A study on current interests in the field of Industrial Engineering and Manufacturing Systems such as design, automation, and integration of supporting systems in the manufacturing environment including flexible manufacturing systems, robotics, automated material handling systems and automated inspection systems.
- ET642 Quality Management** **3(3-0-9)**
Concept of advanced quality management theory; Tools and techniques for quality improvement including SPC, six sigma, measurement system analysis, FMEA, QFD, design of experiment; Quality management system (ISO 9000)—auditing and certification; Quality economic and performance measures.
- ET643 Manufacturing Strategy** **3(3-0-9)**
Role and context of manufacturing strategy; Interaction of manufacturing strategy and other company strategies; Strategic decisions within operations; System approach to strategy formulation and manufacturing system design; Cellular manufacturing concept; Make/buy analysis, sourcing and subcontracting; Manufacturing control and information systems; Company performance evaluation.
- ET644 Simulation Modeling and Analysis** **3(3-0-9)**
Understanding the role of modeling and simulation in the development and improvement of business processes; Methodology and modeling; Conduct of a simulation study; Hands-on exercise of a particular software package and its application in a practical context.

- ET645 Advanced Manufacturing Processes 3(3-0-9)**
Fundamental knowledge, principles, applications, and economics of advanced manufacturing processes including electrical-discharge machining, electrochemical machining, high speed machining, laser beam machining, and water-jet machining; Adhesive and elastic bonding technologies; Principles and applications of rapid prototyping.
- ET646 Design of Operations Facilities and Systems 3(3-0-9)**
Strategic issues in the location of business in a global environment; Modern methods applied to facility layout and location design; Material handling and integrated production systems; Warehousing and logistics; Quantitative approaches to location and layout modeling; Computer-aided layout design; Personnel issues in layout design; Design for next generation manufacturing and services.
- ET647 Advanced Materials and Processes 3(3-0-9)**
Metallic materials with enhanced performance characteristics; Metal alloys; Near net shape forming processes for metals; Advanced ceramic materials—their applications and processing; New engineering polymers; Polymer composite matrix and fiber reinforcement; Polymer composite fabrication techniques; Design techniques for anisotropic composites.
- ET650 Special Topic in Mechanical Engineering 3(3-0-9)**
An in-depth study on a topic of interest in the field of Mechanical Engineering such as advanced refrigeration and cryogenics, solar design methods and applications, energy resources and technologies, principles of gas-fired power plant, air-conditioning system design, steam boiler and furnace technology, fuzzy & neural control, mechatronics, and automatic control.
- ET651 Current Topics in Mechanical Engineering 3(3-0-9)**
A study on current interests in the field of Mechanical Engineering such as advanced technologies for energy management in buildings, energy-economic modeling and policy analysis, bio-energy conversion, and applied soft computing in mechanics.
- ET652 Power Plant Engineering and Emissions 3(3-0-9)**
Fossil fuels—properties, classification, world reserves; Fossil fuel-fired power plants; Fuels and combustion; Combustion methods and boiler classifications; Boiler and power plant efficiencies and fuel consumption; Formation of major pollutants (CO₂, NO_x, SO_x and PM) in boiler furnaces—effects of fuel properties, boiler design and operating conditions; Trace elements and PAHs from firing fossil fuels; Emission control in power plants; Assessment of major emissions from boilers and power plants.
- ET653 Optimization Methods in Mechanical Engineering 3(3-0-9)**
Principles and algorithms in development of optimization problems in mechanical engineering; Methods of solving optimization problems—conventional multi-variable techniques, genetic algorithm, simulated annealing method, linear programming, etc.; Computer-aided optimization and applications.
- ET654 Advanced Heat Transfer 3(3-0-9)**
Laminar forced convection in circular, non-circular, annular cross-sectioned conduits; Turbulent forced convection over ducts and flat plates; Boiling and condensation; Analytical techniques and numerical methods for solving heat conduction problems; Conduction problems including heat sources and geometric factors; Radiation heat transfer—radiation from clouds and gases.
- ET655 Biomass for Heat and Power 3(3-0-9)**
Biomass characteristics and availability; Potential for biomass utilization in heat and power generation; Biomass combustion analysis; Boilers and gasifiers; Power generating equipment and processes; Cogeneration; Performance analysis; Financial evaluation of biomass projects; Emissions calculation and control methods.
- ET656 Computational Fluid Dynamics 3(3-0-9)**
The basic concept of fluid flow; Introduction to numerical analysis—finite difference methods, finite volume methods, techniques for solving linear equation systems, etc.; Application of CFD methods to solving the wave equation, the heat equation, Laplace's equation, Burgers' equation and simple forms of the Navier-Stokes equations; Commercial CFD software.
- ET657 Energy Modeling 3(3-0-9)**
Energy consumption and supply balance; Energy matrix; Thailand sectorial energy consumption; Energy supply and intermediate energy forms; Principles of model building; Model types; Construction of projection functions; Data requirements; Sensitivity and model verification; Policy analysis and choice of models; Linkage with other national models—macro-economic, population planning and agricultural models.
- ET660 Special Topic in Sustainable Energy and Environment 3(3-0-9)**
An in-depth study on a topic of interest in the field of Energy and Environment such as biomass energy, fossil fuels, geothermal energy, nuclear power, wind power, solar energy, hydrogen fuel, fusion energy, biodegradation and bioremediation, waste treatment technologies, and waste disposal technologies.

- ET661 Current Topics in Sustainable Energy and Environment 3(3-0-9)**
A study on current interests in the field of Energy and Environment such as bio-energy conversions, clean energy resources, low carbon economy and technology, energy-environmental-sustainable-economic development, greenhouse gas mitigation technologies.
- ET662 Energy and Environmental Impact Assessment 3(3-0-9)**
EIA objectives and principles; EIA process; Types of EIA; Impact assessment methods; Impacts on various sectors of environment; Energy system and its environmental impacts; Baseline data collection; Modeling of facility combined with existing baseline conditions; Analysis of potential effects and mitigation measures; Issues in social and health impact assessment.
- ET663 Climate Change 3(3-0-9)**
Sources of greenhouse gases (GHG); Global carbon cycle; Greenhouse gases effects on climate; Energy system related to GHG emissions; Sectoral energy demand and GHG emissions; Primary energy consumption and GHG emissions; Energy technologies for climate change mitigation; GHG mitigation assessment in energy system; Impact of climate change on natural resources and ecosystem; Production system and public health; Mitigation measures including sequestration; Clean development mechanisms (CDM).
- ET664 Sustainable Energy 3(3-0-9)**
Current and potential future energy systems, covers resources, extraction, conversion, and end-use, and emphasizes meeting regional and global energy needs in the 21st century in a sustainable manner; Different renewable and conventional energy technologies will be presented including biomass energy, fossil fuels, geothermal energy, nuclear power, wind power, solar energy, hydrogen fuel, and fusion energy and their attributes described within a framework that aids in evaluation and analysis of energy technology systems in the context of political, social, economic, and environmental goals.
- ET665 Energy Planning and Policy 3(3-0-9)**
Energy flows in the economy; Energy accounting framework; Basic econometric Methods; Methodology for energy demand analysis; End-use method of energy; Demand analysis; Energy demand forecasting methodologies; Planning in electricity; Demand side management; Energy policy and institutions; Environmental regulations of energy.
- ET666 Nuclear Power Generation and Management 3(3-0-9)**
Principle of nuclear reaction and power generation; Types of current nuclear reactors and future development; Nuclear fuel cycle and waste disposal management; Nuclear safety; Nuclear power plant siting and public participation; Nuclear reactor decommissioning procedures; Economics of nuclear power plants; Legal and regulatory issues associated with nuclear power generation and proliferation risks.
- ET667 Cleaner Production 3(3-0-9)**
Sustainable waste treatment; Industrial ecology; Green chemistry; Life cycle assessment; Waste and cleaner production audits; Cleaner production technologies, applications, implementation, and success case studies; Roles of international standards; ISO14000.
- ET668 Pollution Control and Management 3(3-0-9)**
Physical, chemical and biological processes influencing the extent of air, water and soil pollution; Methods of treatment and control of air and water pollution; Treatment, reuse, recycle, and management of solid and hazardous wastes; Monitoring; Standards.
- ET669 Nuclear Reactions and Radiation 3(3-0-9)**
Kinetics of nuclear reactions and radioactive decay, fission reactions, fusion reactions, and reactions of energetic neutrons, properties of the fission products and the actinides; nuclear models and transition probabilities; interaction of radiation with matter.
- ET672 Resource Economics 3(3-0-9)**
Economic analysis of the natural and energy resources, relationship between environment and economy, the causes and impacts of environmental deterioration, the economics of environmental quality, The application of economic theories to various kinds of resources, economic theories and instruments in resource management, energy and environmental policy, social and legal issues.
- SE611 Procurement Logistics 3(3-0-9)**
Overview of the procurement and purchasing activities in a supply chain; Supplier evaluation and selection; Pricing, negotiation, contracts; Outsourcing; Multiple sourcing; Just-in-time procurement; Inventory management; Buying decisions and plans; Cost analysis; Purchase agreements; E-procurement; Real-time internet-based e-supply chains; Reverse logistics and customer services; Supply chains for financing; Purchasing analysis of capital equipment; Institutional and government purchases.

SE612 Laws and Regulations in Logistics 3(3-0-9)

Logistics systems and legal framework for the domestic and international movement of goods; Operational characteristics of providers for exporting and importing services; Effects of government trade policies on global logistics.

SE613 Transportation Systems Design and Analysis 3(3-0-9)

Characteristics of various modes of domestic and international transportations; Vehicle types; Urban, air, ocean, highway, pick-up and delivery systems; Scheduling; Factors that influence transport demand; Costs; Market structures; Carrier pricing; Carrier operating and service characteristics and their influence on other supply chain costs and supply chain performance such as routes; labor; competition.

SE614 Warehouse Design and Operations 3(3-0-9)

Fundamental operations in warehousing including roles of warehousing, layout and facility design, warehouse technology such as bar codes, radio frequency identification (RFID) for inventory control systems, modern warehouse operations, classifying products, materials handling, racking and shelving, automated storage and retrieval systems (AS/RS), aisle width decision; Information technology for warehouse operations; Health and safety issues.

SE615 Operations Scheduling 3(3-0-9)

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 logistics and supply chain systems.

SE616 Design of Experiments in Supply Chain Systems 3(3-0-9)

Fundamental of Design of Experiment; Simple experiment design, factorial, fractional factorial experiments; ANOVA analysis, model adequacy analysis, mixed level designs, response surface methodology and Taguchi design; Review of successful experimentation in Supply Chain Management practices.

SE617 Accounting and Financial Management for Logistics and Supply Chain Systems 3(3-0-9)

Profitability, liquidity; Analysis and interpretation of published financial statements; Cost behavior analysis; Profit, volume analyses; Budget preparation and control; Standard costing; Divisional, segmental performance measurement; Capital investment; Risk and uncertainty analysis; Effects of inflation and taxation; Introduction to computer based financial modeling; Good corporate governance.