Master of Engineering Program in Information and Communication Technology for Embedded Systems (International Program)

Curriculum Title

Master of Engineering in Information and Communication Technology for Embedded Systems
(International Program)

Degree Title

Master of Engineering (Information and Communication Technology for Embedded Systems)

Applicant's Qualifications

1. The applicant must hold a bachelor's degree in engineering or science that is related to electrical, electronics, computer, information technology, and applied mathematics, or a related field that is accepted by the SIIT Academic Committee.
2. The applicant must have a top 20% class rank for a bachelor's degree, or a cumulative GPA of at least 2.75, or 2.50 with sufficient relevant research or work experience as specified by SIIT Academic Committee.
3. The applicant must submit an official score of one of the following English language tests:
   - TOEFL score of not less than 400 (paper-based) or 97 (computer-based), or 32 (internet-based)
   - IELTS score of not less than 4.5
   - TU-GET score of not less than 400

   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.

   In the case of no English score or a score less than the above requirements, the applicant may be admitted with conditions that he/she must take SIIT English remedial courses and/or SIIT English proficiency tests, and meet the requirement set by the institute.

Admission Requirements

1. Two letters of recommendation
2. The applicant must pass a selection process which may include an interview conducted by an SIIT Committee consisting of at least 3 faculty members.
3. Admission to the program requires approval by the SIIT Academic 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 15 weeks. Courses may be offered for a summer semester of at least 8 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 1 regular semester or has gained 12 credits with a minimum cumulative GPA of 3.00.

2.2.2 Thesis Committee

The Thesis Committee consists of at least 3 members:

One principal advisor, faculty members of SIIT or Thammasat University, and at least one member who is not affiliated with Thammasat University and serves as an external committee member.

- The principal advisor must be an SIIT faculty member with a doctoral degree or equivalent or an academic rank of at least associate professor in the program or a related program.
- The external committee member must be an expert outside Thammasat University with a doctoral degree and holding an academic rank of at least assistant professor or equivalent, or without a doctoral degree but holding an academic rank of at least associate professor or equivalent. The specialization of the external committee member must be in a field related to the thesis.
- A co-advisor (if any) must be a faculty member of SIIT or Thammasat University, or an expert outside Thammasat University with a doctoral degree or equivalent, or with an academic rank of at least associate professor in the program or a related program.
- The number of the committee members who are not the thesis advisor or co-advisor must not be less than the number of committee members who are the thesis advisor and co-advisor. The number of Thesis Committee members who are faculty members of SIIT or Thammasat University should not be less 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.

Period of Study

The minimum period of study to complete the program is 2 academic years and the maximum is 5 academic years.

Registration

The student must enroll in courses and/or register for a thesis totalling at least 6 credits but not more than 15 credits per semester for a regular semester and not more than 6 credits for a summer 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 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 and independent study assessment are graded as follows:

- S (Satisfactory)
- U (Unsatisfactory)

Students must receive grade "S" for their theses/independent studies.

1.4 Additional course assessment and English proficiency requirements are graded as follows:

- P (Pass)
- N (Not Pass)

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 a cumulative 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 Thesis Committee

2.4 At least one paper on thesis findings has been accepted for publication in an international journal, or a national journal approved by the Academic Review and Rank Assessment 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)
- An IELTS score of at least 6.0
- A TU-GET score of at least 550

Transferred Credits

A maximum of 9 credits of courses with all grades B or better can be transferred.

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	15	Credits
2.1.2 Compulsory Elective Course	3	Credits
2.1.3 Technical Elective Courses	6	Credits
2.2 Master's Thesis	**15**	**Credits**
Total	**39**	**Credits**

3. Course Coding System

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

3.1 Subject code consists of letters and numbers.

3.2 ES indicates basic subjects.
ET indicates subjects in Engineering Technology.
ICT indicates subjects in Information and Communication Technology for Embedded Systems.
SE indicates subjects in Logistics and Supply Chain Systems Engineering.

3.3 Numbers are composed of 3 digits.

- The first unit-place-digit indicates the order of subject.
- The tenth-place-digit indicates the subject group.
- The hundredth-place-digit indicates the graduate program.

4. List of Courses in the Curriculum

Credits (lecture-practice-self study hours)

4.1 Core Courses, 24 Credits

4.1.1 Compulsory Courses, 15 credits

ES605	Research Methodology	2(2-0-6)
ES606	Research Seminar	1(1-0-3)
ICT700	Software Concepts for Embedded Systems	3(3-0-9)
ICT710	Software Design for Embedded Systems	3(2-3-7)
ICT720	Hardware Concepts for Embedded Systems	3(3-0-9)
ICT730	Hardware Design for Embedded Systems	3(2-3-7)

4.1.2 Compulsory Elective Course, 3 credits

Select one of the following courses:

ES601	Advanced Engineering Mathematics	3(3-0-9)
ES611	Theory of Computation	3(3-0-9)
ES612	Advanced Business Statistics	3(3-0-9)
ET600	Numerical Methods for Engineers	3(3-0-9)
ET601	Computer Applications for Engineers	3(3-0-9)
ICT600	Computational Mathematics	3(3-0-9)
SE600	Decision Making and Optimization	3(3-0-9)

4.1.3 Technical Elective Courses, 6 credits

Select two courses from the following courses:

ICT740	Communication Theory	3(3-0-9)
ICT750	Digital Signal Processing	3(3-0-9)
ICT760	Intelligence Processing	3(3-0-9)
ICT770	Control Systems	3(3-0-9)

		Credits (lecture-practice-self study hours)
ICT780	Current Topics in Embedded Systems	3(3-0-9)
ICT781	Advanced Topics in Embedded Systems	3(3-0-9)
ICT782	Selected Topics in Embedded Systems	3(3-0-9)
ICT790	Current Topics in Information and Communication Technology	3(3-0-9)
ICT791	Advanced Topics in Information and Communication Technology	3(3-0-9)
ICT792	Selected Topics in Information and Communication Technology	3(3-0-9)

4.2 Master's Thesis, 15 credits

ICT800	Thesis	15

Course Descriptions

Compulsory Courses

ES605 Research Methodology 2(2-0-6)

Concepts of scientific and technological research; Statistics for research planning and research study; Data collection and data analysis; Interpretations, conclusions and recommendations of research results.

ES606 Research Seminar 1(1-0-3)

Student-faculty interaction on advanced research topics.

ICT700 Software Concepts for Embedded Systems 3(3-0-9)

Software programming, embedded operating systems and middlewares, verification and testing for embedded systems, software concepts on microcontroller architectures and peripherals, compilers and debuggers, timer and interrupt systems, interfacing of devices, software issues in design of embedded systems, communications and networking, real-time system design for embedded systems, Data Structures, Sequential and Binary searches, Merging and Sorting

ICT710 Software Designs for Embedded Systems 3(2-3-7)

Hardware and software development tools, software project management techniques and tools, embedded operating systems, software development project: requirement analysis, software detailed and test case design, software coding and testing, software documentation. FPGA prototype board using sample application; FPGA logics; VHDL/Verilog programming. Project planning, system specification design, software coding, software implementation and verification on a prototype board.

ICT720 Hardware Concepts for Embedded Systems 3(3-0-9)

Basic digital system design, processor architecture design, VLSI design methodologies, hardware concepts on microcontroller architectures and peripherals, device interface, hardware for communications and networking.

ICT730 Hardware Designs for Embedded Systems 3(2-3-7)

Hardware development tools, hardware description language, VHDL/Verilog programming; FPGA design flow: input and output pin assignment, synchronous and asynchronous logic design, logic simulation and optimization, verification of design constraints, hardware development project, software and hardware implementation and verification on FPGA prototype board, practical issues on microcontroller and FPGA.

Compulsory Elective Courses

ES601 Advanced Engineering Mathematics 3(3-0-9)

Use of computers. High level programming languages and tools. Equation solving and optimization tools. Statistical applications. Tools for visualizing and analyzing graphs and images. Computer applications for engineering problems.

ES611 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.

ES612 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 Applications for Engineers 3(3-0-9)

Use of computers. High level programming languages and tools. Equation solving and optimization tools. Statistical applications. Tools for visualizing and analyzing graphs and images. Computer applications for 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.

Technical Elective Courses

ICT740 Communication Theory 3(3-0-9)

Information theory, signal processing, communication systems, data and digital communication concepts, theory and techniques in data communications: transmission, encoding, decoding, error detection, error correction, link control, networking and standards, communication software and hardware, synchronization subsystems, time division multiple access systems, code division multiple access systems, wireless communications. Cryptography and security in Mobile communication.

ICT750 Digital Signal Processing 3(3-0-9)

Digital signal processing theory, video and audio processing, discrete-time signals and systems, linear time-invariant systems, sampling of continuous-time signals and convolution, finite and infinite impulse response filter designs, discrete Fourier transform, fast Fourier transform algorithms, relations between Fourier transform: discrete-frequency Fourier transform, Fourier series, discrete-time Fourier transform, and discrete Fourier transform. Image and speech coding and decoding, transmultiplexers, filter banks, channel estimation and equalization, synchronization, array processing, power spectral estimation, adaptive filtering, analog digital converter and digital analog converter algorithms.

ICT760 Intelligence Processing 3(3-0-9)

Human interface, computer graphic, artificial intelligence, concept and design of human-machine interface, trends of human interface design, graphic user interface, interactive software design, hardware technology for human interface, basic descriptive geometry, methods of creating, storing, manipulating, presenting and animating two and three dimensional objects, applications of artificial intelligence, artificial intelligence languages, search techniques, knowledge representation, reasoning and inference, machine learning, expert systems. Human sensory information processing.

ICT770 Control Systems 3(3-0-9)

Control system theory, Laplace transforms, control system description and block diagrams, dynamics of typical controlled systems, development and simplification of transfer functions, analytic tools for predicting system response and performance, root locus design techniques, applications for embedded systems: control systems and environment, environment control systems, and power management systems methods, control in power electronics.

ICT780 Current Topics in Embedded Systems 3(3-0-9)

Current topics in embedded systems at the master's degree level. Topics are subject to change each semester.

ICT781 Advanced Topics in Embedded Systems 3(3-0-9)

Advanced topics in embedded systems at the master's degree level. Topics are subject to change each semester.

ICT782 Selected Topics in Embedded Systems 3(3-0-9)

Selected topics in embedded systems at the master's degree level. Topics are subject to change each semester.

ICT790 Current Topics in Information and Communication Technology 3(3-0-9)

Current topics in Information and Communication Technology at the master's degree level. Topics are subject to change each semester.

ICT791 Advanced Topics in Information and Communication Technology 3(3-0-9)

Advanced topics in Information and Communication Technology at the master's degree level. Topics are subject to change each semester.

ICT792 Selected Topics in Information and Communication Technology 3(3-0-9)

Selected topics in Information and Communication Technology at the master's degree level. Topics are subject to change each semester.

Master's Thesis

ICT800 Thesis 15 credits

This course guides students how to develop and carry out master research in the field of information and communication technology for embedded system: Thesis writing, thesis presentation, publication, and research ethics.