Master of Engineering 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)

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 Have 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	15 Credits
2.1.2	Compulsory Elective Courses	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 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 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

4.1 Core Courses, 24 credits

4.1.1 Compulsory Courses, 15 credits

Code	Course Title	Credits (lecture-practice-self study hrs)
ES805	Research Methodology	2(2-0-6)
ES806	Research Seminar	1(0-3-1)
ICT700	Software for Embedded Systems	3(3-0-9)
ICT710	Software Design Exercise for Embedded Systems	3(2-3-7)
ICT720	Hardware for Embedded Systems	3(3-0-9)
ICT730	Hardware Design Exercise for Embedded Systems	3(2-3-7)

4.1.2 Compulsory Elective Courses, 3 credits

Code	Course Title	Credits (lecture-practice-self study hrs)
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)

4.1.3 Technical Elective Courses, 6 credits

Code	Course Title	Credits (lecture-practice-self study hrs)
ICT740	Communication	3(3-0-9)
ICT750	Signal Processing	3(3-0-9)
ICT760	Intelligence Processing	3(3-0-9)
ICT770	Environment and Control Systems	3(3-0-9)
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

Code	Course Title	Credits
ICT800	Master's Thesis	15

Course Descriptions

Compulsory Courses

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)**
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.

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.

ICT700 Software for Embedded Systems **3(3-0-9)**
Software programming; embedded operating systems and middle-wares such as ITRON or embedded linux; verification and testing for embedded Systems; software issues in the design of embedded systems; microcontroller architectures and peripherals; compilers and debuggers; timer and interrupt systems; interfacing of devices; software issues in communications and networking.

ICT710 Software Design Exercise for Embedded Systems **3(2-3-7)**
Overview of hardware tools (training board, JTAG interface) and software development tools (compiler, linker, debugger); software project management techniques and tools: UML, test plan, test automation, CASE; embedded operating systems: services and APIs; 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 FPGA prototype board.

ICT720 Hardware 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 Design Exercise for Embedded Systems **3(2-3-7)**
Overview of hardware development tools (logic synthesis, simulation, verification); VHDL/Verilog programming language; FPGA design flow: I/O pin assignment, synchronous/asynchronous logic design, logic simulation and optimization, verification of design constraints; custom hardware development project: implementation and verification of IP cores on FPGA; software/hardware implementation and verification on FPGA prototype board; practical issues on microcontroller and FPGA.

ICT800 Master's Thesis **15 credits**
Student-faculty interaction on research and development in embedded system-related fields or information and communication technology-related fields.

Compulsory Elective Courses

ET 600 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.

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 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 hardware and software; synchronization subsystems; time-division multiple-access systems; code-division multiple-access systems.

ICT750 Signal Processing 3(3-0-9)
Digital signal processing theory; audio processing; video processing; discrete-time signals and systems; linear time-invariant systems and their properties; sampling of continuous-time signals and convolution; IIR and FIR filter designs; discrete Fourier transforms; fast Fourier transform algorithms; relations between Fourier transform (FT), discrete-frequency FT (DFFT) or Fourier series discrete-time FT (DTFT), and discrete FT (DFT: discrete both time & frequency); Speech coding and decoding; image coding and decoding; transmultiplexers; filter banks; channel estimation; channel equalization; synchronization; array processing; power spectral estimation; adaptive filtering; ADC and DAC algorithms.

ICT760 Intelligence Processing 3(3-0-9)
Human interface; computer graphics; artificial intelligence (AI); 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: points, lines, planes and their relationships; Methods of creating, storing, manipulating, presenting and animating two and three dimensional objects; overview of current research and application of artificial intelligence; introduction to AI languages such as Prolog or LISP; search techniques; knowledge representation, reasoning and inference; machine learning; expert systems.

ICT770 Environment and Control Systems 3(3-0-9)
Control systems theory; environment control systems; power management systems; 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.

ICT780 Current Topics in Embedded Systems 3(3-0-9)
Topics of current interest in the field of embedded systems.

ICT 781 Advanced Topics in Embedded Systems 3(3-0-9)
Advanced topics which may be continuation of embedded system-related topics offered in other lower-level courses.

ICT782 Selected Topics in Embedded Systems 3(3-0-9)
Topics selected by the instructor to prepare students to continue their research in embedded systems.

ICT790 Current Topics in Information and Communication Technology 3(3-0-9)
Topics of current interest in the field of information and communication technology

ICT791 Advanced Topics in Information and Communication Technology 3(3-0-9)
Advanced topics which may be continuation of a topic offered in other lower-level courses of information and communication technology.

ICT792 Selected Topics in Information and Communication Technology 3(3-0-9)
Topics selected by the instructor to prepare students to continue their research in information and communication technology.