

Systems and Computer Engineering (SYSC)

Department of Systems and Computer Engineering
Faculty of Engineering

Note: the Departments of Systems and Computer Engineering and Electronics offer courses in: Communications Engineering, Computer Systems Engineering, Electrical Engineering, Software Engineering and Engineering Physics.

SYSC 1100 [0.5 credit] (formerly 94.110*)

Introduction to OO Computing

A first course in problem solving in the context of object-oriented programming. Programming with Java: control structures, data abstraction, classes, class relationships, inheritance, polymorphism. Tracing and visualizing program execution. Testing and debugging. Program style, documentation, reliability.

Precludes additional credit for ECOR 1606.

Lectures three hours a week, laboratory one hour a week.

SYSC 1101 [0.5 credit] (formerly 94.111*)

OO Software Development

Principles and practice of three paradigms for developing object-oriented software: developing classes from scratch, reuse of existing classes, and incremental extension of frameworks. Design: identifying classes, responsibilities and collaborations. Introduction to UML for describing program designs.

Precludes additional credit for SYSC 2004.

Prerequisite: SYSC 1100.

Lectures three hours a week, laboratory one hour a week.

SYSC 1102 [0.5 credit] (formerly 94.112*)

C++ Programming

Problem solving and program design, emphasizing the computing abstractions underlying real-time system and operating system development. Procedural and data abstraction in C++. Recursion, pointers, linked lists.

Precludes additional credit for ECOR 1606.

Prerequisite: SYSC 1100.

Lectures three hours a week, laboratory one hour a week.

SYSC 2001 [0.5 credit]

Computer Systems Foundation

Computer architecture and organization: CPU, cache, memory, input/output, bus structures, interrupts; computer arithmetic: integer and floating point; CPU: instruction sets, addressing modes, instruction encoding. Input/output: programmed, interrupt-driven, block-oriented. Examples from several modern processor families.

SYSC 2002 [0.5 credit] (formerly 94.202*)

Data Structures and Algorithm

In-depth experience in the design and construction of computer programs involving data structures and different programming paradigms. Data structures, formal specification, abstract data types, graphs, recursion, finite state machines and object-oriented programming.

Precludes additional credit for SYSC 2100 and SYSC 3002.

Prerequisite: ECOR 1606.

Lectures three hours a week, laboratory two hours a week.

SYSC 2003 [0.5 credit] (formerly 94.203*)

Introductory Real-Time System

Principles of event-driven systems. Review of computer organization. Assemblers and linkers. Development of embedded applications. Programming external interfaces, programmable timer. Input/output methods: polling, interrupts. Real-time issues: concurrency, mutual exclusion, buffering. Introduction to concurrent processes.

Precludes additional credit for SYSC 3003 and SYSC 3006.

Prerequisite: SYSC 2001.

Lectures three hours a week, laboratory two hours a week.

SYSC 2004 [0.5 credit] (formerly 94.204*)

OO Software Development

Principles and practice of three software development paradigms with an object-oriented programming language: developing classes from scratch, reuse of existing classes, incremental extension of frameworks. Development of expertise in designing, implementing, and testing industrial-quality, reusable code.

Precludes additional credit for SYSC 1101.

Prerequisite: SYSC 2002.

Lectures three hours a week, laboratory two hours a week.

SYSC 2100 [0.5 credit] (formerly 94.210*)

Algorithms and Data Structures

Specification and design of abstract data types and their implementation as Java classes: stacks, queues, trees, tables, graphs. ADTs as elements of program designs. Common and useful examples: simulation, parsing, and state machines. Introduction to the analysis of algorithms.

Precludes additional credit for SYSC 2002.

Prerequisites: SYSC 1101 and SYSC 1102.

Lectures three hours a week, laboratory two hours a week.

SYSC 2101 [0.5 credit] (formerly 94.211*)

Software Development Project

Development of expertise in designing, implementing, and testing industrial-quality, reusable code through individual and team projects. Applying and extending previously acquired knowledge of patterns, frameworks, UML, iterative and incremental development, Java and C++ to medium- and large-scale systems.

Prerequisite: SYSC 2100 or SYSC 2004.

Lectures two hours a week, laboratory three hours a week.

SYSC 2500 [0.5 credit] (formerly 94.250*)

Signals and Systems

Signals: energy and power signals, discrete-time and continuous. Linear systems and convolution. Fourier Transform; complex Fourier series; signal spectral properties and bandwidth. Laplace transform and transient analysis. Transfer functions, block diagrams. Baseband and passband signals, with applications to communications systems.

Precludes additional credit for SYSC 3600.

Prerequisite: MATH 2004.

Lectures three hours a week, problem analysis three hours alternate weeks.

SYSC 3001 [0.5 credit] (formerly 94.301*)

Operating Systems & Databases

Operating systems and databases treated from a common perspective. Management of CPU, processes, memory, files, and data. Implications of concurrency. Concurrent programming, including interprocess communication in distributed systems. Data models and query languages.

Precludes additional credit for SYSC 4001.

Prerequisites: SYSC 2002 or SYSC 2100, and SYSC 2003.

Lectures three hours a week.

SYSC 3006 [0.5 credit] (formerly 94.306*)

Computer Organization

Computer organization: processor, memory, input/output, instruction encoding and execution. Representation of data, assembly language programming. Devices: display, parallel and serial interfaces, programmable timer. Input/output methods: polling and interrupts.

Precludes additional credit for SYSC 2001, SYSC 2003, and SYSC 3003. May not be taken for credit by students in Computer Systems Engineering.

Prerequisites: ECOR 1606 and ELEC 2607.

Lectures three hours a week, laboratory two hours a week.

SYSC 3100 [0.5 credit] (formerly 94.310*)

Systems Analysis and Design

Creating requirements specifications prior to designing and implementing complex software systems. Software development lifecycles, role of requirements analysis; functional decomposition, data flow modeling; database modeling, entity-relationship diagrams; finite state machines;

object-oriented analysis; use cases, use case maps; project management; introduction to software design.

Prerequisite: SYSC 2004 or SYSC 2101.

Lectures three hours a week, laboratory problem/analysis two hours a week.

SYSC 3101 [0.5 credit] (formerly 94.311*)

Programming Languages

Principles underlying different kinds of programming languages (procedural, functional, logic programming) and their semantics. Overview of machinery needed for language support (compilers, interpreters and run-time systems).

Prerequisite: SYSC 2101.

Lectures three hours a week, laboratory three hours alternate weeks.

SYSC 3200 [0.5 credit] (formerly 94.320*)

Industrial Engineering

Techniques of operations research for decision-making in complex engineering systems. Linear programming, network models, PERT, integer programming, dynamic programming, queuing systems and inventory models. Problem solving is emphasized.

Precludes additional credit for BUSI 2300, ECON 4004, or MATH 3801.

Prerequisites: MATH 1004 and MATH 1104, and ECOR 1606 or SYSC 1100.

Lectures three hours a week, laboratory problem/analysis three hours alternate weeks.

SYSC 3303 [0.5 credit] (formerly 94.333*)

Real-Time Concurrent Systems

Principles and practice of a systems engineering approach to the development of software for real-time, concurrent, distributed systems. Designing to achieve concurrency, performance, and robustness, using visual notations. Converting designs into programs. Introduction to hard real-time systems. Team project.

Prerequisites: Engineering SYSC 2004 or SYSC 2101, and SYSC 2003

Lectures three hours a week, laboratory two hours a week.

SYSC 3501 [0.5 credit] (formerly 94.351*)

Communication Theory

Review of signals, linear systems and Fourier theory; signal bandwidth and spectra; digital waveform coding; introduction to analog and digital modulation systems; synchronization; characterization and effects of noise; link budgets; communications media and circuits; applications to current communications systems.

Precludes additional credit for SYSC 3503.

Prerequisites: MATH 3705 and SYSC 3600, and STAT 3502 (to be taken concurrently).

Lectures three hours a week, laboratory three hours alternate weeks.

SYSC 3502 [0.5 credit] (formerly 94.352*)

Communications Software

Finite state machines and related models. Layered communication models and protocols. Modern programming tools such as C++ and JAVA in programming examples from LAN Logical Link Layer and Medium Access Control Layer Protocols, and the ISO/OSI Physical and Data Link Layer Protocols.

Lectures three hours a week, problem analysis three hours alternate weeks.

SYSC 3503 [0.5 credit] (formerly 94.353*)

Communication Theory II

Amplitude Modulation. Frequency Modulation. Performance of AM and FM in noise. Digital modulation: ASK, FSK, PSK. Optimal reception, probability of error on the AWGN channel.

Precludes additional credit for SYSC 3501 or SYSC 4600.

Prerequisite: SYSC 2500 and STAT 2605.

Lectures three hours a week, laboratory, three hours alternate weeks.

SYSC 3600 [0.5 credit] (formerly 94.360*)

Systems and Simulation

Properties of linear systems. Linear dynamic models of engineering systems. Applications of the Laplace transform. Transfer functions. Block diagrams. Frequency and time response. System simulation with digital computers.

Precludes additional credit for SYSC 2500.

Prerequisites: MATH 1005 and ECOR 1101.

Lectures three hours a week, laboratory three hours a week.

SYSC 3601 [0.5 credit] (formerly 94.361*)

Microprocessor Systems

Microprocessor-based system design for different microprocessor families. Microprocessors: internal organization, instruction sets, address generation, pin-outs, bus cycles, signalling waveforms. Interfacing memory and I/O devices. Interrupt structures, direct memory access. Floating point coprocessors. System bus standards. Introduction to DSPs.

Precludes additional credit for ELEC 4601.

Prerequisites: ELEC 2607, and SYSC 2003, SYSC 3003, or SYSC 3006.

Lectures three hours a week, laboratory three hours alternate weeks.

SYSC 3905 [0.5 credit] (formerly 94.395*)

Professional Practice

Presentations by faculty and external lecturers on the Professional Engineers Act, professional ethics and responsibilities, practice within the discipline and its relationship with other disciplines and to society, health and safety, environmental stewardship, principles and practice of sustainable development. Communication skills are emphasized. (Also listed as ELEC 3905.)

Precludes additional credit for CIVE 4905 and MAAE 4905.

Prerequisites: ECOR 1010, ALSS 1000, and third-year registration.

Lectures three hours a week.

SYSC 4001 [0.5 credit] (formerly 94.401*)

Operating Systems

Introduction to operating system principles. Structure of an operating system; management of CPU, processes, and memory; dead-lock problems, file systems. Concurrent programming.

Precludes additional credit for SYSC 3001.

Prerequisites: SYSC 2002 or SYSC 2100, and SYSC 2003, SYSC 3003, or SYSC 3006.

Lectures three hours a week.

SYSC 4005 [0.5 credit] (formerly 94.405*)

Discrete Simulation/Modeling

Simulation as a problem solving tool. Random variate generation, general discrete simulation procedure: event table and statistical gathering. Analyses of simulation data: point and interval estimation. Confidence intervals. Overview of modeling, simulation, and problem solving using SIMSCRIPT, MODSIM, and other languages.

Prerequisite: STAT 2605 or STAT 3502, and Fourth-year registration, or Third-year registration in Software Engineering or permission of the Department.

Lectures three hours a week, laboratory one hour a week.

SYSC 4101 [0.5 credit] (formerly 94.411*)

Software Validation

Techniques for the systematic testing of software systems. Software validation and verification, software debugging, quality assurance, measurement and prediction of software reliability. Emphasis on the treatment of these topics in the context of real-time and distributed systems.

Prerequisites: SYSC 3100 and SYSC 4800 (SYSC 4800 can be taken concurrently).

Lectures three hours a week, laboratory/problem analysis three hours alternate weeks.

SYSC 4102 [0.5 credit] (formerly 94.412*)

Performance Engineering

Techniques based on measurements and models, for

predicting and evaluating the performance of computer systems. Instrumentation. Simple queueing models and approximations. Techniques for modifying software designs to improve performance.
Prerequisites: STAT 3502, SYSC 3001 or SYSC 4001, and SYSC 4005.

Lectures three hours a week, laboratory/problem analysis three hours alternate weeks.

SYSC 4105 [0.5 credit] (formerly 94.415*)

Engineering Management

Introduction to engineering management: management of new products, management of manufacturing processes, management of the linkages between new products and manufacturing processes. Current theories, concepts and techniques are stressed, using a combination of readings, cases and guest speakers.

Prerequisite: fourth-year registration.

Lectures three hours a week.

SYSC 4106 [0.5 credit] (formerly 94.416*)

Software Product Management

Stages of the life cycle of software products and their implications for architecture definition, requirements specification, variety, target market segmentation, adoption, roll-out plans, documentation, maintenance, skills, building prototypes, testing, feature prioritization, quality and tools infrastructures.

Prerequisite: SYSC 3100 or equivalent.

Lectures three hours a week, laboratory/problem analysis two hours a week.

SYSC 4107 [0.5 credit] (formerly 94.417*)

Software Business

Establishing and growing businesses anchored on software design and development. Models for software business; partnerships with suppliers and customers; distribution; raising money; intellectual property protection; evolving core products and sources of competitive advantage; alignment among the business model, infrastructures, and software development.

Prerequisite: fourth-year registration in Engineering or Computer Science.

Lectures three hours a week.

SYSC 4405 [0.5 credit] (formerly 94.445*)

Digital Signal Processing

Discrete time signal and system representation: time domain, z-transform, frequency domain. Sampling theorem. Digital filters: design, response, implementation, computer-aided design. Spectral analysis: the discrete Fourier transform and the FFT. Applications of digital signal processing.

Prerequisite: SYSC 2500 or SYSC 3600.

Lectures three hours a week, laboratory three hours alternate weeks.

SYSC 4504 [0.5 credit] (formerly 94.454*)

Distributed Network Processing

Software aspects of distributed networks. Client-server systems. Internet and the WWW. LAN's and WAN's, routing protocols. Transportable software, JAVA applets. Use of modern software tools in communication network monitoring and analysis. Network management.

Prerequisite: SYSC 3502.

Lectures three hours a week, laboratory three hours alternate weeks.

SYSC 4505 [0.5 credit] (formerly 94.455*)

Automatic Control Systems I

Review of Laplace transform techniques. Effects of feedback: frequency response, pole-zero positions. Compensation: root locus, Bode plots. State variables: formulation, solution of linear systems, examples of simple second-order non-linear systems. Discrete time systems: z-transforms. Signal reconstruction.

Prerequisites: MATH 2004, and SYSC 2500 or SYSC 3600.

Lectures three hours a week, laboratory three hours alternate weeks.

SYSC 4507 [0.5 credit] (formerly 94.457*)

Computer Systems Architecture

History of computers: evolution of concepts, in uence of technology, techniques to increase performance. Detailed analysis and design of ALUs, control units, memory systems. Multiprocessor systems, pipeline and array processing. Scalable, superscalar, RISC, CISC, fault tolerant, and digital signal processing architectures.

Prerequisite: ELEC 2607 or ELEC 3607.

Lectures three hours a week, laboratory/problem analysis one hour a week.

SYSC 4600 [0.5 credit] (formerly 94.460*)

Digital Communications

Review of probability, random variables, signal representation. Baseband data transmission: Nyquist criterion, equalization, optimal receiver, error probability. Digital modulation, performance. Synchronization. Introduction to information theory. Error detection and correction. Spread spectrum. Applications to current digital wired and wireless communications systems.

Precludes additional credit for SYSC 3503 and SYSC 4604.

Prerequisites: SYSC 3501 and STAT 3502.

Lectures three hours a week, laboratory three hours alternate weeks.

SYSC 4602 [0.5 credit] (formerly 94.462*)

Computer Communications

Layered protocol architectures, OSI. Physical media, physical layer interfaces, data transmission. Data-link protocols, multiplexing, polling. LANs, IEEE 8002 standards, performance. Switched Ethernet, FDDI, bridges. Wide area networks, packet-switching networks, X.25. Frame relay, internetworking, DoD protocols, TCP, UDP. ATM LANs, adaptation layers, traffic issues.

Prerequisite: STAT 2605 or STAT 3502 and fourth-year registration in Electrical, Computer Systems, Software, or Communications Engineering.

Lectures three hours a week, laboratory three hours alternate weeks.

SYSC 4604 [0.5 credit] (formerly 94.464*)

Digital Communication Theory

Advanced topics in digital communications. Error control coding. Bandwidth-efficient modulation. Trellis coding. Synchronization, phase locked loops. Selected topics of current interest: spread spectrum; digital wireless communications.

Precludes additional credit for SYSC 4600.

Prerequisite: SYSC 3503.

Lectures three hours a week, laboratory three hours alternate weeks.

SYSC 4607 [0.5 credit]

Wireless Communications

Wireless radio channel characterization, diversity, equalization; cellular architecture, multiple access principles, spread spectrum systems, radio resource management; examples from modern wireless systems, networks, and standards, including cellular networks, WLANs, ad hoc networks, and satellite systems.

Prerequisite: SYSC 4600 or SYSC 4604.

Lectures three hours a week, laboratory three hours alternate weeks.

SYSC 4700 [0.5 credit] (formerly 94.470*)

Telecommunications Engineering

Telecommunications as a national and international infrastructure. Systems view of network architecture: transmission, switching, signalling, and teletraffic; ISDN; network planning, management and control; global telecommunications. International Telecommunication Union; telecommunications industry as business enterprise (R & D, manufacturing, operations, human factors); standards: role of government, regulation and competition.

Prerequisites: SYSC 3501 or SYSC 3503.

Lectures three hours a week, laboratory three hours alternate weeks.

SYSC 4701 [0.5 credit] (formerly 94.471*)

Communications Systems Lab

Project-oriented level experience in the design of communication systems to meet user requirements. Lectures on queuing theory and teletraffic analysis; system specification and design: requirements analysis, solution alternatives, evaluation of alternative technologies, design, costing, implementation, test.

Prerequisite: registration in fourth-year Communications Engineering.

Lectures two hours a week, laboratory four hours a week.

SYSC 4800 [0.5 credit] (formerly 94.480*)

Computer Systems Design Lab

Review of software lifecycles and requirements analysis. Software design, with emphasis on methods for real-time systems. Testing, verification and validation, quality assurance and control. Project planning and management. Maintenance and configuration management. Software reuse during design and maintenance.

Prerequisites: SYSC 3303 (can be taken concurrently) and SYSC 3100.

Lectures three hours a week, laboratory three hours alternate weeks.

SYSC 4805 [0.5 credit] (formerly 94.485*)

Computer Systems Design Laboratory

Developing professional-level expertise in selected, important areas of the field by applying, honing, integrating, and extending previously acquired knowledge in team projects in the laboratory. Lecture periods are devoted to new knowledge required for the selected areas, to project-related issues, and to student presentations.

Prerequisites: SYSC 3303, SYSC 3601 or ELEC 4601, and SYSC 4800 and registration in fourth-year Computer Systems Engineering (students are encouraged to enrol in both SYSC 4800 AND 4805 in the same academic year). Lectures two hours a week, laboratory four hours a week.

SYSC 4806 [0.5 credit] (formerly 94.486*)

Software Engineering Lab

Applying the full spectrum of engineering and programming knowledge acquired in the program through team projects in the laboratory. Practice in doing presentations and reviews. Lectures will discuss software engineering issues as they relate to the projects, from a mature point of view.

Prerequisite: SYSC 3303 and SYSC 4800.

Lectures two hours a week, laboratory four hours a week.

SYSC 4905 [1.0 credit] (formerly 94.495)

SYSC 4907 [1.0 credit] (formerly 94.497)

SYSC 4908 [1.0 credit] (formerly 94.498)

SYSC 4909 [1.0 credit] (formerly 94.499)

Engineering Project

Student teams develop professional-level experience by applying, honing, integrating and extending previously acquired knowledge in a major design project. Lectures are devoted to discussing project-related issues and student presentations. A project proposal, interim report, oral presentations, and a comprehensive final report are required.

Prerequisites: fourth-year registration and SYSC 3905 (may be taken concurrently). Certain projects may have additional prerequisites or corequisites.

Lecture one hour a week, laboratory seven hours a week

SYSC 4906 [0.5 credit] (formerly 94.496*)

Special Topics

At the discretion of the Department, a course dealing with selected advanced topics of interest to students in Communications, Computer Systems, Electrical and Software Engineering and Engineering Physics may be offered. (Also listed as ELEC 4906.)

Prerequisite: permission of the Department.

Technology, Society, Environment Studies (TSES)

Technology, Society, Environment Studies Committee

Faculties of Arts and Social Sciences, Engineering and Design, Public Affairs and Management, Science

TSES 2006 [0.5 credit]

Ecology and Culture

Cultural adaptations to the environment are set within globalization processes. New ecologies – symbolic, historical and political – arise out of the hubris of classical models. The advocacy role of applied ecological anthropology and the consequences of Western cultures' adaptive capacities will be examined. (Also listed as ANTH 2006.)

Prerequisite: one of SOCI 1000, ANTH 1000, SOAN 1000 or equivalent.

Lectures three hours a week.

TSES 2305 [1.0 credit] (formerly 59.235)

Ancient Science and Technology

Development of science and technology in the ancient world and their practical application. The craftsman and artisan in society; the attitude of intellectuals to science and manual labour. Effects of the institution of slavery. Suitable for students with no previous knowledge of Greece or Rome. (Also listed as CLCV 2305.)

Prerequisite: second-year standing or equivalent.

Lectures two hours a week.

TSES 3001 [0.5 credit] (formerly 59.301*)

Technology-Society Interactions

Ethical issues in introducing technology; historical review of technology and human development; effects on society of medical and communications technologies; automation and its effects on society, especially work; impact of technology on international affairs, especially through multinational enterprises. Guest lectures.

Precludes additional credit for TSES 3000 and TSES 3500.

Prerequisite: at least second-year standing.

Lectures and workshops three hours per week.

TSES 3002 [0.5 credit] (formerly 59.302*)

Energy and Sustainability

History of energy use by humans; utilization of renewable energy sources; energy and agriculture; energy and mineral resources; options for electricity generation; nuclear energy; risks of accidents in large systems, e.g. nuclear plants, hydroelectric dams. Guest lectures.

Precludes additional credit for TSES 3000 and TSES 3500.

Prerequisites: at least second-year standing.

Lectures and workshops three hours per week.

TSES 3500 [0.5 credit] (formerly 59.350*)

Interactions in Industrial Society

Ethical issues involving technology; effects on society of automation, medical and communications technologies; technology and international affairs; energy use by humans; renewable energy sources; energy in agriculture and mineral extraction; electricity generation; nuclear energy; accidents in large systems, e.g. nuclear plants and hydroelectric dams. Guest lecturers. Lectures in common with TSES 3001 and TSES 3002.

Precludes additional credit for TSES 3001, TSES 3002 and TSES 3000.

Prerequisites: at least second-year standing.

Lectures three hours per week for both terms.

TSES 4001 [0.5 credit] (formerly 59.401*)

Technology and Society: Risk

Examines the complex practice of evaluating technology's impact on society and the environment; risk analysis; cost-benefit analysis; technology regulation; retrospective project assessment; necessary aspects of assessment and