

# CISE Computer Engineering Program

Summary for the CISE Industrial Advisory Board Meeting

April 22-23, 1999

## 1 Overview

The Computer Engineering program for CISE students consists of 126 credits in the following areas:

- **Computer engineering core:** (49 credits). Topics include intro to computer science, discrete mathematics, data structures and algorithms, computer architecture and digital logic, software engineering, operating systems, electrical circuits, signals & systems, microprocessors, numerical analysis, networks, ethics, and a senior design project.
- **Technical electives:** (18 credits). Topics listed below, primarily computer science and engineering, and electrical engineering courses.
- **College of Engineering core:** (5 or 6 credits). Thermodynamics, statics, and materials.
- **Math and statistics:** (21 credits). Calculus, differential equations, statistics, and linear algebra.
- **Sciences:** (15 credits). Physics, chemistry, and/or biology.
- **General education:** (18 credits). Social sciences, humanities, and technical writing.

Each of the above areas are described in more detail below.

## 2 Computer Engineering core (49 credits)

- **CIS 3020 Introduction to CIS.** Credits: 3; Prereq: Calculus 1. Introduction to computers and algorithms. Programming in a high level language. Topics include procedural abstraction, data abstraction and structured programming techniques. The student will learn the fundamentals of developing coherent, expressive programs.
- **COT 3100 Applications of Discrete Structures.** Credits: 3; Prereq: Calculus 1. Sets, relations, functions and concept of cardinality. Propositional logic and applications. Predicate logic. Induction and recursion. Finite state machine, grammar and languages. Graphs and trees. Elements of groups, semigroups, lattices and boolean algebra.
- **COP 3530 Data Structures and Algorithms.** Credits: 4; Prereq: CIS 3020, with a grade of C or better, COT 3100; and Calculus 2. Algorithm development using pseudo languages, basic program structures, program design techniques, storage and manipulation of basic data structures like arrays, stacks, queues, sorting and searching and string processing. Linked linear lists. Trees and multilinked structures.

- **CDA 3101 Introduction to Computer Organization.** Credits: 3; Prereq: CIS 3020; and Calculus 1. Organization of computing systems. Logical basis of computer structure. Machine representation of instructions and data, flow of control, and basic machine instructions. Assembly language programming.
- **CEN 3031 Introduction to Software Engineering.** Credits: 3; Prereq: COP 3530. Topics include software planning, specifications, coding, testing and maintenance. Students gain experience in the team approach to large system development.
- **COP 4600 Operating Systems.** Credits: 3; Prereq: COP 3530. The design and implementation of various components of a modern operating system including I/O programming, interrupt handling, process and resource management, computer networks and distributed systems.
- **EEL 3111 Circuits 1.** Credits: 3; Coreq: Physics 1, Calculus 3. Basic analysis of DC and AC electric circuits.
- **EEL 3303L Electrical Circuits Laboratory.** Credits: 1; Coreq: EEL 3111. Introductory electrical engineering laboratory in electrical instrumentation, devices and systems.
- **EEL 3135 Discrete-Time Signals and Systems.** Credits: 3; Prereq: Calculus 3, CIS 3020; Coreq: differential eqn's. Difference equations, discrete convolution, the Z transform, discrete and fast Fourier transforms. State-space theory of discrete-time systems.
- **EEL 3701C Digital Logic and Computer Systems.** Credits: 4; Coreq: CIS 3020. An overview of logic design, algorithms, computer organization and assembly language programming and computer engineering technology. Laboratory.
- **EEL 4712C Digital Design.** Credits: 4; Prereq: EEL 3701C. Advanced modular logic design, design languages, "finite" state machines and binary logic. Laboratory.
- **EEL 4744C Microprocessor Applications.** Credits: 4; Prereq: EEL 3701C. Elements of microprocessor-based systems; hardware interfacing and software design for their application. Laboratory.
- **COT 4501 Numerical Analysis-A Computational Approach.** Credits: 3; Prereq: CIS 3020 and MAS 3114. Numerical integration, nonlinear equations, linear and nonlinear systems of equations, differential equations and interpolation.
- **CEN 4500C Computer Network Fundamentals.** Credits: 4; Prereq: COP 3530 and CDA 3101. This course covers problems in design and analysis of computer networks. While some effort focuses on low level protocols, most of the course is devoted to higher level protocols at the medium access, network and transport layers. Students should be familiar with graph theory and basic probability.
- **CIS 4914 Computer System Design.** Credits: 3; Prereq: Senior CISE standing, approved project proposal. Involves completing a significant CISE related project. Student must coordinate with the instructor and a project adviser, prepare a detailed technical report and deliver an oral presentation.
- **CGS 3090 Ethics on the Electronic Frontier** Credits 1.

### 3 Technical electives (18 credits)

Eighteen credits of topics such as AI, graphics, vision, simulation, real-time systems, databases, translators, programming language concepts, object-oriented programming, theory of computing, computer architecture, engineering economics, co-operative education, 4000-level math & statistics, electrical engineering courses, physics, and programming (max 3 credits). Grad courses can be taken. Twelve credits must be in courses offered by the CISE department.

### 4 College of Engineering core (5 or 6 credits)

Take two of the following three courses:

- **EML 3100 Thermodynamics 1.** Credits: 3; Prereq: Calculus 3, Physics 1, Chemistry 1. Application of the first and second laws of thermodynamics to closed and open systems and to cyclic heat engines. This includes the development of procedures for calculating the properties of multiphase and singlephase pure substances.
- **EGM 2500 Elements of Statics.** Credits: 2; Prereq: Physics 1, Coreq Calculus 3. Reduction of force systems. Equilibrium of particles and rigid bodies. Vector methods. Application to structures and mechanisms.
- **EMA 3010 Materials.** Credits: 3; Prereq: CHM 2045. Conceptual perspective for origin of materials behavior - structure/property/performance interrelationships. Materials selection and use of familiar material - metals, ceramics, polymers, electronic materials and composites in electronics, structural and other engineering applications.

### 5 Mathematics and Statistics (21 credits)

- **MAC 2311 Analytic Geometry and Calculus 1.** Credits: 4; Prereq: algebra and trigonometry. Introduction to analytic geometry; limits; continuity; differentiation of algebraic and trigonometric functions, differentials; introduction to integration and the fundamental theorem of calculus.
- **MAC 2312 Analytic Geometry and Calculus 2.** Credits: 4; Prereq: Calculus 1. Techniques of integration; applications of integration; differentiation and integration of inverse trigonometric, exponential and logarithmic functions; sequences and series.
- **MAC 2313 Analytic Geometry and Calculus 3.** Credits: 4; Prereq: Calculus 2. Solid analytic geometry; vectors; partial derivatives; multiple integrals.
- **MAP 2302 Elementary Differential Equations.** Credits: 3; Prereq: Calculus 2. First order differential equations, theory of linear differential equations, solution of linear equations with constant coefficients, the Laplace transform, solution of equation by the Laplace transform.
- **STA 4321 Mathematical Statistics 1.** Credits: 3; Prereq: Calculus 3. Introduction to the theory of probability, counting rules, conditional probability, independence, additive and multiplicative laws, Bayes Rule. Discrete and continuous random variables, their distributions, moments, moment generating functions. Multivariate probability distributions, independence, covariance. Distributions of functions of random variables.

- **MAS 3114 Computational Linear Algebra.** Credits: 3; Prereq: Calculus 2 and a scientific programming language. Linear equations, matrices and determinants. Vector spaces and linear transformations. Inner products and eigenvalues. This course emphasizes computational aspects of linear algebra.

## 6 Physics, Chemistry, and Biology (15 credits)

- **PHY 2048 Physics with Calculus 1.** Credits: 3; Prereq: High-school physics, Calculus 1. Coreq: Calculus 2. The first of a two-semester sequence of physics for scientists and engineers. The course covers Newtonian mechanics and includes motion, vectors, Newton's laws, work and conservation of energy, systems of particles, collisions, equilibrium, oscillations and waves. One hour per week is devoted to problem solving and discussion.
- **PHY 2055L Laboratory for PHY 2048.** Credits: 1; Coreq: PHY 2048. Physics and measurement principles are taught by having the student conduct basic experiments in mechanics.
- **PHY 2049 Physics with Calculus 2.** Credits: 3; Prereq: Physics 1, Calculus 2. Coreq: Calculus 3. The second of a two-semester sequence of physics for scientists and engineers. Content includes Coulomb's law, electric fields and potentials, capacitance, currents and circuits, Ampere's law, Faraday's law, inductance, Maxwell's equations, electromagnetic waves, ray optics, interference and diffraction. One hour per week is devoted to problem solving and discussion.
- **PHY 2056L Laboratory for PHY 2049.** Credits: 1; Coreq: Physics 2. Physics and measurement principles are taught by having the students perform basic experiments in optics and electricity and magnetism.
- **CHM 2045 General Chemistry (Chem 1)** Credits: 3; Prereq: algebra and trig. Coreq: Chem 1 lab Stoichiometry, atomic and molecular structure, the states of matter, reaction rates and equilibria, acids and bases.
- **CHM 2045L General Chemistry Laboratory.** Credits: 1; Coreq: Chemistry 1.
- **Chemistry 2, or physical or biological science course** Credits: 3.

## 7 General Education (18 credits)

- **Social and Behavioral sciences:** 6 or 9 credits
- **Humanities:** 9 or 6 credits
- **ENC 2210 Technical Writing.** Credits: 3; Prereq: English 1 or test score equivalency. A survey of the forms and methods of communication used in business, industry and government, including nonformal and formal reports, letters, resumes and proposals.