CORE COURSES & Discipline Specific Courses

CORE COURSES

The core courses meet the dual challenge of broadening and extending training in the individual areas as well as providing experience in applying these individual disciplines to the design and development of products and processes within business and industry. The core courses introduce elements that will pervade the entire program and unify, or connect, the components of the program of study. A unique aspect of the ISAT degree program is the seamless integration of the social context of science and technology throughout the program's curriculum. Students in this program will study all aspects of real systems regardless of their nature, including scientific, technical, social, informational and political characteristics.

***ISAT 600**. Applied Science Seminar, I. Credit 3 hours. Students in the program will be expected to take the two three-credit hour applied science seminars during their first two semesters in the program. The purpose of these seminars is to develop the student's research skills in an applied setting and to show students how interdisciplinary study will benefit their career aspirations. Students will be expected to examine the effects and applications of emerging technology in industry. Problem solving models and techniques will be illustrated and applied. Sharing of professional knowledge and expertise is expected in the flow of classroom interaction. Guest speakers from regional businesses and industries will be an integral part of these seminars.

***ISAT 601**. Applied Science Seminar, II. Credit 3 hours. Prerequisite: ISAT 600. Continuation of ISAT 600. The course is intended to further develop the students' research skills through projects involving current technology. The course will continue to present students with a broad range of current industrial practices. It will also assist students in selecting their team-based project.

***ISAT 615**. Technology in Industry and Society. Credit 3 hours. Prerequisite: ISAT 600 or concurrent enrollment. This course investigates the historical evolution of technology for use in developing models appropriate for predicting future technological trends. The course provides technical understanding and communication skills needed across the disciplines of mathematics, chemistry and physics, industrial technology and computer science. The course provides an understanding of the impact of technology on individuals, the environment and the global community.

***ISAT 625**. Applications of Computing in Science and Technology. Credit 3 hours. Prerequisite: ISAT 600 or concurrent enrollment. Principles for and applications of computing in applied research labs and business and industry settings. Topics include inter- and intra-networking; information acquisition, storage and retrieval; process control systems; and algorithms for scientific visualization.

***ISAT 635**. Industrial Chemistry. Credit 3 hours. Prerequisite: ISAT 600 or concurrent enrollment. This course will be of a survey nature. It will introduce the student to the importance of the chemical industry to our economy as a whole and inform the student about the role of the chemist in typical plant operations such as quality control and assurance, safety compliance, and research and development. In addition, the student

will become acquainted with some important industrial processes in the chemical industry.

***ISAT 645**. Modeling for Science and Technology. Credit 3 hours. Prerequisite: ISAT 600 or concurrent enrollment. A study of typical operation research problems representative of various business and industrial organizations. These problems include production planning, distribution, and scheduling, inventory control, project planning, and control, simulation and forecast of sales.

***ISAT 655**. Error and Risk Analysis Credit 3 hours. Prerequisite: ISAT 600 or concurrent enrollment. This course will present the basic tools of error and risk analysis, with extensive use of case studies (some from the literature or the popular press, others proposed by the instructors – a concerted effort will be made to have students provide topical examples from their areas of expertise). The ultimate goal of this course is to provide students with the mathematical and physical problem solving skills to attack similar data driven problems after leaving the program, and to appreciate the methods by which information is converted into knowledge.

Discipline Specific Courses

CHEMISTRY

***CHEM 610**. Chemical Processes. Credit 3 hours. Prerequisite: CHEM 266. A course designed to study important chemical processes in industry. Examples from the commodity chemical, polymer, pharmaceutical, and agricultural industries will be studied. The content will include basics in the legal and economic issues associated with the industry such as patent filing and costs associated with raw materials, scale-up marketing, energy, and process waste.

***CHEM 650**. Environmental Chemistry. Credit 3 hours. Prerequisites: CHEM 101. Chemical phenomena in the environment will be studied. Topics include redox equilibria in natural waters, complexation in natural waters, environmental chemistry of soil, atmospheric pollutants, and techniques for monitoring these phenomena. There will be a field component to this course, possibly in coordination with Turtle Cove Environmental Research Station.

***CHEM 660**. Polymer Properties and Analysis. Credit 3 hours. Prerequisite: CHEM 266. An applied course designed to increase the student's understanding of the behavior of industrially important polymers in the solid state, melt state, and in solution. Techniques for observing and measuring these properties are also presented.

COMPUTER SCIENCE

***CMPS 611**. Software Engineering Process Concepts. Credit 3 hours. Prerequisite: CMPS 511. Topics include software development processes and models; quality assurance and control; software evolution; current advances in software engineering practice.

***CMPS 612**. Object-Oriented Software Development. Credit 3 hours. Prerequisite: CMPS 390 or CMPS 500. Topics include techniques for identifying and specifying objects; object classes; attributes and methods; applications of polymorphism, parameterization, and inheritance.

***CMPS 639**. Database Theory and Design. Credit 3 hours. Prerequisite: CMPS 539. Topics include theory of relational and object-oriented database systems; design techniques; concurrency control and recovery; application to distributed database systems; and recent advances in database systems.

***CMPS 651**. Applications of Artificial Intelligence and Expert Systems to Problems in Science and Technology. Credit 3 hours. Prerequisite: CMPS 441 or CMPS 500. An analysis of the application of artificial intelligence and expert systems to problems in science and technology including but not limited to the following: encryption systems; security systems for telecommunications; identification of elements in chemistry; number theory; process control; scheduling; planetary motion; properties of materials; and problems in design.

INDUSTRIAL TECHNOLOGY

Communications

***IT 625**. Communication Technology. Credit 3 hours. Prerequisite: IT 614 and IT 442. Discussion topics will include three-dimensional model construction in CAD using Boolean operators and surface modeling, and finite element analysis of models, which are developed for subsequent Computer-Aided Manufacturing (CAM).

Electronics

***IT 633**. Industrial Power Systems. Credit 3 hours. Prerequisites: IT 236. A study of the production, distribution, and control of industrial electrical power systems. Topics include single phase and three phase systems, transformers, motor operation and control, lighting systems, and relay control systems.

Manufacturing

***ISAT 592**. Research and Development in Industrial Technology: Credit 3 hours. Prerequisites: An overall "B" average or recommendation by the faculty and approval of the Department Head. A course devoted to research and development through laboratory experimentation of selected problems of specific interest. Course may be repeated for a total of six hours with no more that three hours in any one semester.

***IT 644**. Automation Technology. Credit 3 hours. Prerequisites: IT 444 and IT 233/236. Sensors, and artificial intelligence for automation in industry. Topics include automated manufacturing environments; stability and feedback concepts and computers in real-time control of processes; programmable controllers and microcomputers in industrial processes; sensors and transducers; data acquisition; control devices; and the nature of digital control and computerization in manufacturing/production from an integrated systems perspective.

Safety

***IT 655**. Safety. Credit 3 hours. This course addresses the application and performance of methods used to sample and monitor the workplace for health hazards that might be encountered; i.e., chemical, physical, biological and ergonomic hazards. Emphasis will be placed on the standards to be met, the instruments that are used, methodologies employed in using the instruments, results to be expected, and interpretation of the results.

MATHEMATICS

***MATH 605**. Applied Statistics. Credit 3 hours. Topics include exploratory analysis of data, sample design and experimental design, normal distributions, sampling distributions, confidence intervals and tests of hypothesis for one and two samples, inference for contingency tables, regression and correlation, and one-way analysis of variance. Statistical packages such as Minitab, SAS, SPSS and NCSS may be used.

***MATH 615**. Coding Theory and Cryptogtaphy. Credit 3hrs. Prerequisite: Math 200. An introduction to fundamentals of coding theory, linear codes and error-correcting codes. Elements of cryptography including simple cryptosystems such as RSA, DES, and AES cryptosystems, and identification schemes.

***MATH 617**. Applications of Combinatorics and Graph Theory. Credit 3 hours. Prerequisite: Math 201 and Math 223 or permission of the department head. An introduction to the fundamentals of combinatorics including algebra of enumeration and its interrelations with finite structures, graph theory and its applications, interrelations with data structures and methods of optimization, and groups and finite fields and their applications.

***MATH 641**. Numerical Analysis. Credit 3 hours. Prerequisite: Proficiency in Calculus. This course is concerned with the development, analysis, and evaluation of numerical algorithms, which can be carried out on a computer for obtaining numerical solutions to mathematical problems arising from various areas of sciences. Topics include methods for solving ordinary and partial differential equations such as Runge-Kutta methods, general one-step methods, multi-step methods, finite difference methods, and finite element methods. A review of interpolation, approximation, numerical integration and differentiation will be included.

***MATH 661**. Scientific Computing. Credit 3 hours. Prerequisite: Proficiency in Calculus. This course supports experimentation with the mathematics that stands behind computational methods. Topics include polynomial interpolation; numerical integration; matrix computations and eigenvalue problems; linear systems; the QR and Cholesky factorizations; nonlinear equations and optimization; and initial value problems.

PHYSICS

***PHYS 612**. Laser Physics. Credit 3 hours. Prerequisite: PHYS 301. PHYS 312 recommended. An introduction to the generation, control and detection of laser radiation. Topics include theory of electromagnetic waves, resonator theory, oscillation and amplification of particular laser systems, and various detection methods and their limitations.

***PHYS 615**. Photonics. Credit 3 hours. Prerequisite: PHYS 301. PHYS 312 and PHYS 421 recommended. An introduction to the field of linear and nonlinear optics, and the linear and nonlinear interaction of light with matter. Emphasis is placed on applications related to the commercial use of optical systems, examples being optical information processing and fiber optic systems.

***PHYS 641**. Numerical Methods for Scientists. Credit 3 hours. Prerequisites: MATH 201, PHYS 222, and CMPS 162 or CMPS 261. Foundations of many fundamental numerical techniques commonly used by scientists such as Fast Fourier Transforms, convolutions, numerical differentiation and integration, extrapolation, root finding, solution to differential equations, inversion of matrices and some elementary statistics. Other advanced topics such as Monte Carlo techniques may be explored. The course will require extensive computer programming.

***PHYS 650**. Semiconductor Physics. Credit 3 hours. Prerequisite: PHYS 421. An introduction to the physics of solid-state materials, with particular attention to semiconductor materials and the physics of semiconductor devices.