IS 203. Portfolio Development Workshop. 1 credit.
A short orientation course designed to prepare students for transition into higher learning education programs. Specific content includes identifying college-level expectations, documenting experiential learning, determining a credit request and organizing a portfolio for assessment. Prerequisite: Individualized studies majors and individualized studies special students only.

IS 250. Service Learning. 1-6 credits, repeatable to 6 credits.
Leadership, citizenship and professional competencies may be acquired through community service experiences. Documented service learning competencies will be assessed by the Community Service Learning and credit awarded as appropriate. Prerequisite: IS 200.

IS 270. Selected Topics. 1-6 credits, repeatable.
In-depth study of selected topics with current importance and interest to lower division students that are not otherwise covered in the regular course offerings of academic units. Course content will vary. Prerequisite: Approval of the “Course Agreement Form” by the Individualized Study department head.

IS 275. Dollars and Sense. 3 credits.
This practical course will review the affect a personal philosophy on money, and management of personal finances, has on all aspects of life when it comes to securing the American Dream. Students will learn real life skills in the areas of eliminating debt, creating a budget, understanding investments and insurance, saving money, planning for retirement, shopping for a house and other topics dealing with financial issues faced in daily life.

IS 290. Special Studies. 1-6 credits, repeatable.
Designed to give students an opportunity to do lower-division independent study in selected interdisciplinary areas under the supervision of a faculty member in the appropriate academic unit. Prerequisite: Approval of the “Course Agreement Form” by the Individualized Study department head.

IS 300. Sponsored Learning. 1-6 credits, repeatable.
A structured learning activity related to a student’s area of study and sponsored by an employer, volunteer agency or other appropriate organization. Prerequisite: Approval of the “Course Agreement Form” by the Individualized Study department head.

IS 480. Cooperative Studies. 1-6 credits, repeatable.
Two or more upper-level students may elect to study cooperatively in a selected area of current importance and interest under the supervision of a faculty member in the appropriate academic unit. Prerequisite: Approval of the “Course Agreement Form” by the Individualized Study department head.

IS 490. Special Studies. 1-6 credits, repeatable.
Designed to give students an opportunity to do upper-division independent study in selected interdisciplinary areas under the supervision of a faculty member in the appropriate academic unit.

IS 498. Bachelor of Individualized Study Project. 3-6 credits.
An in-depth study of an interdisciplinary topic directly related to the student’s areas of concentration. A final oral report is required. Prerequisite: Approval of the “Course Agreement Form” by the Individualized Study department head.

IS 499. Honors. 6 credits.
Multiple-semester course. Prerequisite: Approval of the “Course Agreement Form” by the Individualized Study department head.

INDU 220. CAD: 3D Modeling. 3 credits.
This course will introduce students to principles used in 3D Cad and BIM modeling. Technologies to draw three dimensionally on the computer will be considered as a discipline within itself, and students will be instructed to use the machine for design exploration. Various software packages will be utilized during the semester.

Independent activity at the intermediate level, such as research or studio practice, under faculty supervision. Projected studies in any area of the school’s offering must be arranged with the instructors who will direct them. Offered only with the consent of the instructor.

INDU 392. Topics in Industrial Design. 3 credits.
Study of selected topics in art, history, graphic design, interior design, or industrial design at the intermediate level. May be repeated when course content changes. See e-campus for current topics.

INDU 490. Independent Studies Industrial Design. 1-3 credits, repeatable.
Offering varies.
Independent activity, such as research or studio practice, under faculty supervision. Projected studies in any area of the school’s offering must be arranged with the instructors who will direct them. Offered only with the consent of the instructor.

INDU 491. Studio Assistant. 1-3 credits, repeatable. Offering varies.
An on-campus program monitored on an individual basis designed to provide practical studio experience in the visual arts. Students will learn safe studio practices and management skills, including material use, inventory control and the proper operation of equipment found within various individual classroom studios. Prerequisites: Permission of the instructor.

INDU 492. Topics in Industrial Design. 3 credits, Offering varies.
Study of selected topics in industrial design at the advanced level. May be repeated when course content changes. See MyMadison for current topics.

INDU 498. Internship in Industrial Design. 1-8 credits.
An off-campus program prepared and monitored on an individual basis. Internships are designed to provide practical experience in the arts. Prerequisites: Permission of the instructor.

Integrated Science and Technology

Department of Integrated Science and Technology

First Year Student – Sophomore Sequence

GISAT 100. Environmental and Energy Sustainability. 3 credits.
This course explores scientific and technical issues important to environmental and energy sustainability. Students study fundamental chemistry and physics and then apply this knowledge to better understand air quality, water quality, and conventional and alternative energy processes. The class also explores the societal impacts of our energy choices and the potential impact we as individuals can have through personal initiative.

ISAT 101. ISAT Freshman Seminar. 1 credit.
This seminar course will introduce the ISAT curriculum and career options to freshmen students and will describe how various elements of the curriculum and available ISAT elective sequences in each technology sector relate to the goals and objectives of the program. Prerequisite: Freshman standing at JMU.

GISAT 112. Environmental Issues in Science and Technology (2, 2). 4 credits.
This course integrates the study of biology, chemistry and statistics within the context of environmental issues that include ozone depletion, acid rain, global warming, waste management and biodiversity.

GISAT 113. Biotechnology Issues in Science and Technology (2, 2). 4 credits.
This course introduces current topics in the life science technologies through lecture and laboratory exercises. Topics include advances in genetic engineering, the hierarchy of life and the rise of infectious diseases.

ISAT 131. Technology, Science and Society (1, 2). 3 credits.
This course introduces the social aspects of technology and science. It covers social science methods and related philosophical and ethical analyses. Students learn how the practice of science relates to the human-built world and why critical evaluations of science and technology policies are important.

GISAT 141. Analytical Methods. 4 credits.
This course introduces the student to science and the scientific method; introductory statistics and graphical data analysis, with emphasis on using the computer for managing data and for empirical modeling; functions for modeling real-world systems; critical thinking skills for analyzing arguments involving data; project management.

ISAT 150. Algebra Essentials. 1 credit.
This course provides review and practice in algebra concepts that are needed to successfully complete GISAT 151. Various mathematical models, including trigonometric, are also reviewed. The course is designed for students who possess a basic understanding of algebra but are not proficient in its application. Prerequisite: Permission of the instructor. Corequisite: GISAT 151 and permission of the instructor.

http://www.jmu.edu/catalog/14
This course introduces the concepts of differential and integral calculus and ordinary differential equations to model real-world applications in science, business, technology, and economics. This course includes a computer laboratory component emphasizing modeling and numerical methods. Course assumes familiarity with algebra and trigonometry.

**ISAT 151L Analytical Methods I: Applied Calculus Laboratory** 1 credit.
This course is the laboratory portion of ISAT 151. Topics in Applied Calculus in ISAT. It is intended for students who already have AP credit or calculus lecture credit. Students will use numerical methods to solve mathematical modeling and calculus problems with Microsoft Excel. Students will study linear, polynomial, exponential, logarithmic, S-curve and trigonometric models in business and the physical and natural sciences. Prerequisites: Permission of the instructor or academic unit head required.

**ISAT 152 Topics in Applied Physics in Integrated Science and Technology** 4 credits.
This course introduces topics in general physics including one- and two-dimensional motion, mechanics, energy, waves, electricity, magnetism, optics, lasers, and early quantum theory. Vectors, algebra, and differential and integral calculus, are used to model physical system behavior. Laboratory experiments and computer exercises enhance understanding of the concepts. Prerequisites: ISAT 151 or permission of the instructor.

**ISAT 160 Problem Solving Applications in Science and Technology** 3 credits.
This course examines issues in modern science and technology as a means to introduce, develop and enhance critical thinking and problem solving skills. Current scientific and technological research and applications will be introduced to reinforce problem solving, instruction in systems thinking and critical inquiry. The course provides opportunities for using both oral and written communication in a variety of learning activities.

**ISAT 165/BIO 203 Viral Discovery** 1 credit.
This course is an exploratory laboratory experience, designed for incoming freshmen. In the course, the students will learn about the life cycle and ecology of viruses infecting bacteria. Soil samples will be collected, and techniques for isolation and purification of the viruses will be performed by the students. Isolated viruses will be visualized using electron microscopy. The genomic material will be isolated and prepared for nucleic acid sequencing.

**ISAT 166/BIO 204 Viral Genome and Bioinformatics** 2 credits.
This is a computer-based laboratory experience, designed for those students completing the Viral Discovery course. Students will learn how to identify genes in a viral genome, compare the predicted proteins with known proteins in databases, describe the contents of the genome, and notate all the relevant information for publication. Students will also research the role of soil and the role played by bacteriophages in ecology and evolution. Prerequisites: ISAT 165 or BIO 203.

**ISAT 180 Topics in Integrated Science and Technology** 1-4 credits.
Special topics in integrated science and technology which are of interest to the entry-level student. May be repeated for credit when course content changes. Students should consult the instructor prior to enrolling for the course. Prerequisite: Permission of the instructor.

**ISAT 181 Student Research Report** 1-6 credits, variable.
Research project on a science and technology topic of interest, as arranged with a faculty research adviser. Projects will include as assessment of the non-technical issues that surround the technical problem.

**ISAT 203 Viral Discovery** 2 credits.
An exploratory laboratory experience, designed for incoming freshmen. Students will learn about the life cycle and ecology of viruses infecting bacteria. Soil samples will be collected, and techniques for isolation and purification of the viruses will be performed by the students. Isolated viruses will be visualized using electron microscopy. The genomic material will be isolated and prepared for nucleic acid sequencing.

**ISAT 204 Viral Genome and Bioinformatics** 2 credits.
A computer-based laboratory experience, designed for students completing the Viral Discovery course. Students will learn to identify genes in a viral genome, compare the predicted proteins with known proteins in databases, describe the contents of the genome and notate all the relevant information for publication. Students will also research the role of bacteriophages in ecology and evolution. Prerequisite: ISAT 203 or BIO 203.

**ISAT 211 Modern Production Issues in Science & Technology** 2 credits.
This course introduces the structure and function of a manufacturing enterprise and product design and process selection with emphasis on computer-based automation and integration technologies. Total Quality Management (TQM), statistical process control, principles of engineering drawings, and engineering economy will also be covered. Prerequisite: ISAT 151 or consent of instructor.

**ISAT 212 Energy Issues in Science and Technology** 2 credits.
Introduction to scientific and economic concepts relevant to energy. Concepts are taught within the context of three or four themes, e.g., residential energy efficiency, renewable energy sources, "make-or-buy" fossil energy application and space power systems. Themes may change from year to year reflecting contemporary issues and opportunities to link with industry and government agencies. Prerequisite: ISAT 152 or consent of instructor.

**ISAT 231 Political Economy of Technology and Science** 3 credits.
Solutions to human problems are mediated by economic and political institutions, which in turn help to shape technology and science. The course covers basic political and economic concepts, institutions and processes as they relate to American and international science and technology.

**ISAT 251 Topics in Applied Statistics** 3 credits.
This course introduces statistical thinking - the discipline and methods for collecting, analyzing and interpreting data for making decisions, doing science and understanding our world. Topics covered include an introduction to data analysis methods, probability and chance, statistical reasoning and inference, and experimental design. The course includes a laboratory component emphasizing hands-on analysis of data taken from a variety of applications in ISAT. Prerequisite: Sophomore standing or permission of the instructor.

**ISAT 252 Programming and Problem Solving** 2 credits.
Introduction to computational thinking and formal logic. Students create software to solve problems in applied science, business, and engineering taking social context into account. Programming paradigms include procedural, object-oriented, event-driven, and declarative. Emphasis is placed on effective analysis, planning, documentation, communication, and teamwork in professional software development settings. Prerequisite: Sophomore standing or permission of the instructor.

**ISAT 252X Programming and Problem Solving: Knowledge Based Systems** 1 credit.
Introduction to computational thinking and formal logic. Students create software to solve problems in applied science, business, and engineering taking social context into account. The declarative programming paradigm is covered. Emphasis is placed on effective analysis, planning, documentation, communication, and teamwork in professional software development settings. Prerequisite: Sophomore standing or permission of the instructor.

**ISAT 253 Instrumentation and Measurement** 2 credits.
Fundamental nature of measurement in the practice of science, how and why measurements are taken and representative instrumentation. Data collection in science (measuring physical properties and biometrics), statistical tools for analyzing data and visualization of data. Prerequisites: ISAT 152 and ISAT 251.

**ISAT 280 Projects in Integrated Science and Technology** 1-4 credits.
Projects or special topics in integrated science and technology, which are of interest to the lower division student. May be repeated for credit when course content changes. Projects or topics selected may dictate prerequisites. Students should consult the instructor prior to enrolling for the course. Prerequisite: Permission of the instructor.

**Junior — Senior Sequence**

**ISAT 301 Instrumentation and Measurement in Energy** 2 credits.
Instrumentation is used to acquire data from representative systems that include mechanical, thermal, solar, chemical and nuclear energy. Students analyze the data to enhance understanding of these forms of energy. Energy transport processes are also characterized. Computer-based data acquisition is emphasized. Prerequisites: ISAT 212 and ISAT 253 or permission of the instructor.

**ISAT 302 Instrumentation and Measurement of the Environment** 2 credits.
Traditional and contemporary analytical laboratory and field techniques used in environmental quality monitoring are surveyed. Emphasis is placed on understanding the physical, chemical and biological basis of these techniques. Hands-on laboratory and field work will be emphasized, in addition to quality control/assurance of environmental data.

**ISAT 303 Instrumentation and Measurement in Engineering and Manufacturing** 2 credits.
Instrumentation is used to acquire data from representative systems that are relevant to modern manufacturing processes. Process control instrumentation is also studied. Topics include shop-floor data collection, electronic sensors and actuators, pneumatics and hydraulics. Computer-based data acquisition is available in this course.

http://www.jmu.edu/catalog/14
Prerequisites: CS 239, CS 159 or ISAT 340.

This course provides a hands-on experience of the techniques and instrumentation used in the modern biotechnology laboratory. Topics include aspec time techniques for establishing microbial cultures, detection and analysis of recombinant DNA molecules, protein purification, SDS gel electrophoresis and the use of PCR technology for genetic analysis.

ISAT 306. Instrumentation and Measurements in Data Communications and Networking. 1 credit.

This course covers the integration of fundamental concepts from physics, chemistry, mathematics and engineering within the context of energy applications. Principles governing energy transformations, transport and conversion, including laws of thermodynamics, chemical and nuclear reactions and thermal science. Prerequisite: ISAT 212 or consent of instructor.

ISAT 310. Energy Fundamentals I. 3 credits.

This course covers the role of energy in the U.S. and world economies. Geology of energy-valued natural resources: size, quality and economics of domestic and world resource base. Models for energy use by different sectors. The role of energy in global climate change; other energy-related environmental concerns; and the implications for national and international security will be studied. Prerequisite: ISAT 212 or consent of instructor.

ISAT 320. Fundamentals of Environmental Science and Technology I. 3 credits.

This course provides the student with a basic understanding of environmental pollution, processes and control technologies. The course begins with a review and extension of the basic sciences supporting environmental science. Water and wastewaster quality, management and treatment, are then addressed, culminating in independent team projects in this area. Prerequisite: GISAT 112 or permission of the instructor.

ISAT 321. Fundamentals of Environmental Science and Technology II. 3 credits.

This course continues to build on the student's basic understanding of environmental pollution, processes and control technologies. The course considers solid and hazardous waste and its management, discusses the principles of environmental risk assessment, and addresses air quality analysis and management, culminating in independent team projects in this area. Prerequisite: GISAT 112 or permission of the instructor.


The course will introduce students to various manufacturing systems within a manufacturing organization. The systems studied will be selected from the following areas: (a) manufacturing/production management, (b) batch and continuous processes, (c) resource utilization, (d) material management, and (e) scheduling and inventory control. Prerequisites: GISAT 151 and ISAT 211 or permission of the instructor.

ISAT 331. Automation in Manufacturing. 3 credits.

This course offers an in-depth treatment of the structure and function of computer integrated manufacturing processes; integration and automation in design and manufacturing; product and process design, computer-aided design and computer-aided manufacturing, process planning, robotics and flexible manufacturing systems; production planning and product data management. Prerequisites: GISAT 161 and ISAT 211 or permission of the instructor.

ISAT 340. Software Development II. 3 credits.

This course is an introduction to the processes, methods and techniques of efficient and effective software application development. Students will create or enhance software systems in a sophisticated development environment. Prerequisite: ISAT 252.

ISAT 341. Modeling and Simulation. 3 credits.

The development and use of models to understand, analyze and improve systems in several areas of science and technology. Students will use computer simulation in a variety of modeling projects. Prerequisites: Junior standing and ISAT 340 or CS 139 or permission of the instructor.

ISAT/CS 344. Intelligent Systems I. 3 credits.

In-depth introduction to current and future intelligent systems, including expert systems, neural networks, hybrid intelligent systems and other intelligent system technologies and their development, uses and limitations. Prerequisites: CS 239, CS 159 or ISAT 340.
ISAT 411. Energy Economics and Policy. 3 credits.
This course is concerned with methods for analyzing the economics, environmental and societal benefits of energy technologies. Topics include optimization techniques, utility planning and finance, benefit-cost techniques, discounting for time and risk, econometric models and input-output analysis. The role of government in determining energy costs supply and markets will be considered. Prerequisite: ISAT 311 or permission of the instructor.

ISAT 412. Dynamic Control of Energy Systems. 3 credits.
This course introduces methods for developing dynamic models of energy processes and technologies to achieve improved process control and increased efficiency with applications of differential equations and discrete math equations. Dynamic models are used to evaluate load management strategies and to develop computer control algorithms for building energy systems. Prerequisite: ISAT 310 or consent of instructor.

ISAT 413. Options for Energy Efficiency. 3 credits.
This course makes detailed examination of new technologies to increase the efficiency of energy conversion, transportation systems and end-use technologies. Examples include MHD, combined-cycle systems, advanced nuclear reactors, intelligent transportation systems, high-efficiency lighting, energy management and utilization of low-temperature heat. Consideration is made of the socioeconomic and governmental barriers to energy efficiency. Prerequisites: ISAT 310 and ISAT 311 or consent of instructor.

ISAT 414. Energy Fundamentals II. 3 credits.
Introduction to the sciences of fluid mechanics and heat transfer and the physical laws governing the mechanical behavior of liquids and gasses. Conservation of mass, energy and momentum. Discussion of heat transfer by one-dimensional conduction, convection and radiation. Fluid statics, internal and external fluid flow. Pipe networks and heat exchanger analysis. Prerequisite: ISAT 310 or permission of the instructor.

ISAT 416. International Energy Studies. 3 credits.
Study-abroad course examining international energy problems and providing team-oriented project experiences. Addresses energy issues associated with economic and social development. Projects involve visits to factories and government offices, tours and meetings with local experts illustrate energy-related problems that are compared with those in the United States. Prerequisites: ISAT 212 and ISAT 252.

ISAT 420. Environmental Analysis and Modeling. 3 credits.
This course explores applications of mathematical techniques and computer models to the environmental field. The course introduces the principles underlying environmental analysis and modeling, including limitations and pitfalls. Several environmental models and analytical systems are then discussed and applied, using a variety of computational platforms. Prerequisite: ISAT 321 or permission of the instructor.

ISAT 421. Environmental Policy and Regulation. 3 credits.
This course will familiarize students with basic environmental laws and regulations. The course discusses the purpose of environmental policy, the role of environmental economics in policy decisions and the policy instruments available to environmental regulators. Current federal and state statutes affecting waste disposal, air quality and water quality are discussed. Corequisite: ISAT 321 or permission of the instructor.

ISAT 422. Industrial Environmental Management. 3 credits.
This course addresses environmental issues faced by industry, including such topics as waste management, chemical inventories, pollution prevention and discharge permitting. Industrial ecology is introduced as an approach to the development of a sustainable industrial society, including treatment of life cycle analysis, design for environment, environmentally conscious manufacturing and ISO14000.

ISAT 423. Environmental Remediation. 3 credits.
This course will examine chemical, physical, economic and regulatory aspects of the remediation of contaminated soil and groundwater. Topics include chemical properties of major contaminants, environmental site assessment, remediation design, and current and emerging remediation technologies and their limitations in soil and groundwater restoration. Prerequisites: ISAT 320 and ISAT 321 or permission of the instructor.

ISAT 424. Natural Resource Management. 3 credits.
This course focuses on how resource management decisions affect the human and natural communities involved. Topics include definition and importance of natural resources, resource management styles and policies, and trends for resource conservation. Conservation biology is introduced as a tool for developing sustainable resource use policies. Mandatory weekend field trip. Prerequisite: ISAT 320 and ISAT 321 or permission of the instructor.

ISAT 425. Environmental Hydrology. 3 credits.
This course integrates the study of surface water and ground water hydrology and examines current technologies used to assess the behavior and quality of water in the environment. Topics include monitoring and management at the watershed level, the influence of wetlands on water quality, and the impact of current regulations. Prerequisite: ISAT 320 or permission of the instructor.

ISAT 426. Environmental Information Systems. 3 credits.
This course provides students with practical experience applying advanced environmental information systems technologies to environmental problems. Students will employ such technologies as decision support systems, geographic information systems, expert systems, relational databases, multimedia systems, and modeling and simulation. This course is often offered in a study-abroad format. Prerequisite: ISAT 320 or permission of the instructor.

ISAT 427. Industrial Hygiene. 3 credits.
This course provides an introductory survey of the field of industrial hygiene. Chemical hazards are addressed first, focusing on respiratory and dermal exposures, followed by a treatment of physical hazards including sound, radiation and temperature. The course includes industrial case studies illustrating administrative and engineering controls in common use.

ISAT 428. Industrial Ecology. 3 credits.
Industrial ecology, the science of sustainability, seeks to encourage the development of a sustainable industrial society. This course introduces and examines this relatively new field of inquiry and practice. We address various practical topics which are associated with industrial ecology, including life cycle assessment, design for environment and environmentally conscious manufacturing.

ISAT/GEOG 429. Sustainability: An Ecological Perspective. 3 credits.
This course examines present global environmental impacts and efforts made to change production and consumption patterns toward those that reduce impact on ecosystems or promote increased ecosystems health. The focus lies in understanding the basic resources of productivity including soils, agricultural systems, agroforestry, forestry and aquatic environments and applying solutions on a personal and community level. Prerequisite: ISAT 320 or permission of the instructor.

ISAT/MATS 430. Materials Science in Manufacturing. 3 credits.
This course is the study of engineering materials used in the fabrication of products including metals, polymers, ceramics, composites and elastomers. Topics include physical, mechanical and electrical properties of materials, elements of strength of materials, failure criteria and materials selection. Prerequisites: ISAT 152 or permission of the instructor.

ISAT/MATS 431. Manufacturing Processes. 3 credits.
This course provides an introduction to the processes used for fabricating parts, such as machining, grinding, and casting and sheet-metal fabrication, including both traditional and nontraditional processes. Topics include interaction of materials, processing and design, economics of manufacturing, design for improved processing. Manufacturing processes for metals, plastics and composites are addressed. Prerequisite: ISAT 430 or permission of the instructor.

ISAT/MATS 432. Selection and Use of Engineering Materials. 3 credits.
This course deals with the interplay between engineering product specification, design, economics, environment, energy, materials selection, fabrication route, manufacturing cost and product service requirements. Students will be taught how to perform design projects that involve understanding the behavior of materials and selection of materials for a specific function. Prerequisite: ISAT 430 or permission of the instructor.

ISAT 433. Selected Problems in Manufacturing. 3 credits.
This course addresses selected problems in manufacturing and their solutions. Materials, processes and systems will be stressed. Solutions may involve laboratory experiments and/or other analytical tools, such as modeling, system selection and evaluation, and process selection and improvement. Case studies and current projects from industry will be used. Prerequisite: ISAT 330 or permission of the instructor.

ISAT 435. Integrated Product and Process Development. 3 credits.
This course focuses on the integrated approach for developing products simultaneously with manufacturing processes. Students learn about successful product development techniques and effective organization of product development teams. Topics include design for manufacturing, design for the environment, rapid prototyping, economics of product development and managing of development projects. Prerequisite: ISAT 331 or permission of the instructor.
This course examines processes used in the manufacture of microelectronic devices (VLSI integrated circuits, optoelectronic devices, flat panel displays), micro/nanomechanical devices (membranes, microactuators), data storage media (magnetic and optical disks, including CDs), optical fibers, and some sensors and transducers. Principles of operation of semiconductor and other devices are also studied. Prerequisite: ISAT 253, PHYS 150, PHYS 250 or permission of the instructor.

ISAT 440. Seminar in Knowledge Management, 3 credits.
Philosophical, ethical, social, and political issues in information and knowledge management, the information and knowledge management industries and information and knowledge management systems. Prerequisite: Senior standing.

ISAT/CS 447. Interaction Design, 3 credits.
Study of and practice with processes, principles, tools, models and techniques for designing interactions between humans and digital products and systems. Topics include physiological and psychological factors affecting interaction design, interaction design processes, interaction models, styles, and paradigms, design notations and representations, prototyping and interaction design evaluation. Prerequisite: Junior standing.

ISAT 450. Biotechnology and the Environment, 3 credits.
This course will examine the impact of biotechnology on the environment, biotechnology solutions to environmental challenges as well as associated regulatory, ethical and legal issues. Topics include bioremediation, biosensors, release of engineered organisms and risk assessment. Prerequisite: ISAT 320 or ISAT 350.

ISAT 451. Biotechnology in Industry and Agriculture, 3 credits.
This course illustrates the applications of biotechnology in agriculture and industry, linking scientific discoveries to business and manufacturing practices. Topics include pharmaceutical product development, genetic engineering in agriculture, biotechnology in food processing and regulatory issues. Prerequisite: ISAT 330, ISAT 360 or BIO 214.

ISAT 452. Medical Biotechnology, 3 credits.
This course will survey the research development and implementation of select biomedical technologies, including genetic-based medical technologies, biomedical diagnostics, bioengineering at the macroscopic and microscopic levels, including imaging technologies, lasers in medicine and relevant regulatory and legal issues. Prerequisite: ISAT 351 or BIO 214 or permission of the instructor.

ISAT 453. Energy and Living Systems, 3 credits.
The potential of living systems as alternative energy sources will be explored by describing energy production and transduction in living systems in the context of current and anticipated applications of biotechnology to energy production. Prerequisite: ISAT 310 and ISAT 351 or BIO 214 or permission of the instructor.

ISAT 454. Computer Applications in Biotechnology, 3 credits.
Students learn how complex biological molecules support and regulate processes in living systems, through building interactive computer models of protein and nucleic acid structure and function. The course requirements include written and oral presentations and creation of web pages. Prerequisite: ISAT 351 or BIO 214 or permission of the instructor.

ISAT 455. Regulatory Issues in Biotechnology, 3 credits.
This course examines the policies and guidelines of federal government agencies that regulate the use of recombinant DNA technology, genetically engineered organisms and the manufacturing of biotechnology products. Issues of product safety, product labeling, physical and biological containment, environmental release, and mammalian cloning are presented. Prerequisite: ISAT 351 or BIO 214 or permission of the instructor.

ISAT 456. Ethical, Legal and Social Implications of Biotechnology, 3 credits.
The ethical, legal and social implications of the field of biotechnology and its applications are explored in this course. Students will analyze at an in-depth level the social impacts and ethical implications of human subjects and biological materials research, cloning, human genetic engineering and transgenic agricultural crops. Prerequisites: ISAT 131 and ISAT 221 or BIO 280 or permission of the instructor.

ISAT 457. Business of Biotechnology, 3 credits.
This course will discuss the business concepts behind the biotechnology industry. Specifically, students will learn how the industry was born, how product concepts arise and develop, how biotech products are developed and marketed, what factors lead to company success and/or failure, and what the role of intellectual property protection and regulatory issues play in the industry. Prerequisite: ISAT 351 or permission of the instructor.

ISAT/IA 459. Awareness and Understanding of Chemical, Biological and Radiological Weapons of Mass Destruction, 3 credits.
This course introduces awareness, science and societal impact of weapons of mass destruction (WMD) agents. Students study the development of vaccines and therapeutic and diagnostic drugs used in the detection and treatment of these agents. The course consists of lectures and safety training sessions that introduce tactical and logistical techniques used against chemical, biological and radiological WMD. Prerequisite: Basic chemistry and/or biology.

ISAT/CS 460. TCP/IP Networks, 3 credits.
An overview of Local Area Network hardware, LAN topology and design, and LAN protocols. Includes installation and management of network operating systems and TCP/IP services (address management, name management, file and print sharing, account management). Prerequisite: CS 350 or CS/CIS 320 or equivalent.

ISAT/CS 461. Internetworking, 3 credits.
Wide Area Network (WAN) and Metropolitan Area Network (MAN) design. Audio, voice, data and TV transmission over ATM/B-ISDN networks. The SONET signal hierarchy and Q3 standard interface model. Network security. Performance analysis of a given network. Prerequisite: ISAT/CS 460.

ISAT/CS 462. Networks Applications Development, 3 credits.
Design and implementation of network-based applications using languages and architectures such as sockets, JAVA, TL1 and CORBA. Concepts in distributed processing, including synchronization of interprocess communication and management of replicated data. Analysis of performance issues related to distributed applications. Prerequisites: ISAT/CS 460 and either CS 159, CS 239 or CIS 344.

In-depth introduction to the techniques and tools used to design and analyze computer and telecommunications networks. Overview of issues related to network performance, including the impact on cost, reliability and security. Prerequisites: ISAT/CS 460 and either CS 159, CS 239 or ISAT 340.

ISAT/CS 464. Telecommunications in the Public Interest, 3 credits.
Examines the role of telecommunications in society, and the social institutions that facilitate and regulate telecom, including an analysis of the industry and the regulatory entities and other institutions that affect it. A primary focus of the course will be on the social values that shape the industry, the economics of the industry, and on the regulation of telecom. Prerequisites: Junior standing or permission of the instructor.

ISAT 465. Wireless Networking, Security and Forensics, 3 credits.
An introduction to wireless networking and wireless LAN security and forensics. Radio frequency fundamentals are introduced with emphasis on applications and services. Hands-on network configurations and analysis tools for wireless LAN are introduced and exercised with emphasis on network performance, security and forensic applications. Prerequisite: ISAT 360 or CS/CIS 320 or equivalent.

ISAT 471. Transportation: Energy, Environment and Society, 3 credits.
This course provides an overview of transportation’s role in energy demand, environmental change and economic development. Domestic and global transportation trends are compared and their impacts on fossil fuel consumption, air pollution, climate, ecosystems and social structure are analyzed. Contemporary technological, policy and behavioral solutions are critically examined with an emphasis on alternative fuels, advanced vehicle architectures and regulatory measures.

ISAT 472. Transportation: Air Quality Modeling and Regulation, 3 credits.
This course introduces transportation as a CLIOS (complex, large-scale, integrated, open system) that has bi-directional interactions with the social, political and economic aspects of society. Fundamental systems operation principles, institutions and regulations are explored with respect to environmental, energy, economic, land use and developmental issues. Building upon this foundation, students develop an understanding of regional planning and regulatory measures. They gain practical experience utilizing transportation and air quality models to quantify transportation impacts and to compare the effectiveness of various transportation control measures. Prerequisite: Junior standing.

ISAT 473. Local Agriculture and Farm Internships, 4 credits.
The objectives for this course include understanding local ecology and its impacts on farming, as well as how farming impacts local ecology; practicing diversified farming techniques; understanding how small-scale farms operate as businesses; examining localization and slow-food movements and recognizing the impacts of globalized or industrial food and fiber production; identifying the strengths and limitations of small-scale farming. Prerequisite: Permission of the instructor.
Intelligence Analysis

College of Integrated Science and Technology

IA 412. Introduction to National Security Intelligence. 3 credits.

Intelligence analysis is a complex, dynamic process that includes determining the intelligence needs, data collection, pre-processing, analysis and production of the customer’s product. This is an introduction to the history, structure and practices of the national security intelligence community (IC). The course is team-oriented, project-based and grounded in the relevant legal and ethical context.

IA 210. Introduction to Global Competitive Intelligence. 3 credits.

This course will focus on global competitive intelligence (CI) the tools and methods that enhance strategic and tactical decision making in the analysis and interpretation of business data related to current and emerging competitors. The course is team-oriented, project-based and grounded in the relevant legal and ethical context. Not open to students in the College of Business. Prerequisites: Grades of “C” or better in IA 200, IA 261 and ISAT 252. Not open to students pursuing a major or minor in CIS. Not open to any major in the COB other than international business.

IA 261. Hypothesis Testing. 3 credits.

Examines hypothesis testing in national, military, counter, and competitive intelligence. By comparing alternate theories in terms of their explanatory power and predictive success, students will learn the most relevant methods for integrating facts into unified theories, assessing theories, and properly qualifying and reevaluating theories to compensate for risk and uncertainty.

IA 280. Selected Project in Intelligence Analysis. 3 credits.

This course will examine projects of interest to lower-division students in intelligence analysis not otherwise offered in regular course offerings. They are offered only with the approval of the program director and they may be repeated when course content changes. Students should consult with the instructor prior to enrolling in the course. Prerequisites: Junior or senior standing required. Topic selected may dictate prerequisite.

IA/WMST 485. Gender Studies in Science. 3 credits.

An interdisciplinary course that looks at the scientific process, science practitioners and science students through the lens of gender analysis. Students read literature, lead discussions, perform experiments and analyze both data and processes to address the effects of educational systems on the preparation and careers of scientists, the influence of politics and culture on scientific inquiry, and the effects of critiques grounded in gender analyses on understanding the scientific process.

ISAT 491. Senior Capstone Project I. 1 credit.

First course in a three-course sequence. Student generates an idea for and writes a proposal for an independent or team-based research project. Student must identify and analyze a science- or technology-based problem (broadly defined), identify potential solutions, recommend an approach, and prepare a written proposal.

ISAT 492. Senior Capstone Project II. 2 credits.

Second course in a three-course sequence. Student performs the bulk of the research needed for an independent research project, either alone or within an investigative team, to address a technologically based problem.

ISAT 493. Senior Capstone Project III. 3 credits.

Third course in a three-course sequence. Student finishes the research and prepares an oral and a written report on the work (either alone or within an investigative team), addressing a technologically based problem and developing alternative solutions.

ISAT 495. Technology in our World: Better by Design. 3 credits.

Students explore the importance of design in technology and engineering and contrast the design process with the scientific method. This includes evaluating functional requirements, ergonomics, usability, cost, risk and environmental impact. Students complete a design project integrating these factors to address a real-world problem. Prerequisite: Completion of IDLS core science course work.

ISAT 496A. Senior Honors Thesis I. 1 credit.

First course of a three-course sequence. Student generates an idea for and writes a proposal for an independent research project that meets the requirements set forth by the Honors program. Student must identify and analyze a science- or technology-based problem (broadly defined), identify potential solutions, recommend an approach, and prepare a written proposal. Equivalent to ISAT 491 for ISAT department credit.

ISAT 496B. Senior Honors Thesis II. 2 credits.

Second course in a three-course sequence. Student begins the research necessary for an independent research project that meets the requirements set forth by the Honors program. Student pursues the approach described in his or her proposal from ISAT 496A. Fulls all requirements as ISAT 492.

ISAT 496C. Senior Honors Thesis III. 3 credits.

Third course in a three-course sequence. Student completes the research for and prepares an oral and written presentation of their results for an independent research project that meets the requirements set forth by the Honors program. Student completes and presents (in written and oral form) the project described in his or her proposal from ISAT 496A. Fulls all requirements as ISAT 493.