

**HRD 485. Development of Materials and Programs.** 3 credits. *Offered fall and spring.*

This course is designed to provide the basic skills necessary to design and develop performance-based training programs and courses. Emphasis will be placed on the actual design and development of training materials.

**HRD 490. Special Study in Human Resource Development.** 1-3 credits.

Designed to provide in-depth and up-to-date exposure to the topics/issues pertinent to human resource development and allow students to explore topics of special interest in human resource development. *Prerequisite: HRD 240 or permission of the instructor.*

## Human Science

College of Arts and Letters, College of Integrated Science and Technology, College of Science and Mathematics

**HSC 400. Human Science.** 1 credit.

Seminar course in which current topics in human science will be examined from the multiple perspectives of anthropology, biology and psychology. Students can expect to study, and attempt to synthesize, proximate (mechanistic), ontogenetic and evolutionary explanations for each of the topics examined. Open only to human science minors.

## Industrial Design

School of Art and Art History

**INDU/INDE 220. CAD I: Digital Design.** 3 credits. *Offered fall and spring.*

A studio course introducing computer-aided design experiences. Exploration of CAD, including terms, conventions and drawing techniques from beginning to intermediate concepts to two and three-dimensional tools and commands. Formerly INDU 222.

**INDU/INDE 320. CAD II: Digital Design.** 3 credits. *Offered fall and spring.*

An intermediate studio course incorporating computer-aided design experience in digital design. Continuation of CAD design processes from the foundation course toward advanced three-dimensional drawing techniques, solid modeling and rendering, lighting theory, plotting, and animation. *Prerequisite: INDU/INDE 220.* Formerly INDU 322.

**INDU/INDE 420. CAD III: Digital Design.** 3 credits. *Offered fall and spring.*

An advanced studio course expanding computer-aided design knowledge. Continued exploration of the digital virtual space from intermediate to advanced concepts of the design process, communication with diverse design programs, animation, sound and digital transformation. *Prerequisite: INDU/INDE 320.* Formerly INDU 422.

**INDU 490. Independent Studies Interior Design.** 1-3 credits, repeatable.

*Offered fall and spring.*

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 consent of the instructor.

**INDU 491. Studio Assistant.** 1-3 credits, repeatable. *Offered fall and spring.*

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 Industrial Design.** 3 credits. *Offered fall and spring.*

Study of selected topics in industrial design at the advanced level. May be repeated when course content changes. See e-campus for current topics. Formerly INDU 489.

**INDU 496. Internship in Interior Design.** 1-8 credits. *Offered fall and spring.*

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.* Formerly INDU 495.

## Information Analysis

College of Integrated Science and Technology

**IA 200. Introduction to National Security Intelligence.** 3 credits. *Offered yearly.*

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/CIS 210. Introduction to Global Competitive Intelligence.** 3 credits. *Offered yearly.*

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.

**IA 261. Hypothesis Testing.** 3 credits. *Offered yearly.*

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 Information Analysis.** 3 credits. *Offered yearly.*

This course will examine projects of interest to lower-division students in information (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 standing.*

**IA/PHIL 312. Causal Analysis.** 3 credits. *Offered yearly.*

Examines causal analysis in national, military, counter, and competitive intelligence. By assessing a factor's amount and kind of efficacy, students will learn the most reliable methods for distinguishing between relevant/irrelevant events and factors, identifying and excluding "pseudo-causes," and anticipating higher order effects of a causal process.

**IA/PHIL 313. Counterfactual Reasoning.** 3 credits. *Offered yearly.*

Examines counterfactual reasoning in national, military, counter, and competitive intelligence. By analyzing alternate scenarios and their consequences, students will learn the most relevant methods for employing creative thinking in generating, developing, and assessing possibilities; substantiating "after-action" reports, and structuring futures analysis.

**IA/PHIL 314. Strategy Assessment.** 3 credits. *Offered yearly.*

Examines strategy assessment in national, military, counter, and competitive intelligence. By applying probabilities and goals to potential threats and opportunities (short and long-term), students will learn the most relevant methods for formulating and evaluating possible courses of action, and projecting and explaining actions by assessing an agents' strategic interests and circumstances.

**IA 340. Data Mining, Modeling and Knowledge Discovery.** 3 credits. *Offered yearly.*

Data mining is the nontrivial extraction of previously unknown and potentially useful information from (large) data sets to help explain current behaviors and anticipate future outcomes. Students will apply data mining and knowledge discovery methods to data sets from business, industry and government. The course is team-oriented, project-based and grounded in the relevant legal and ethical context. *Prerequisites: ISAT 251, ISAT 252.*

**IA 341. System Dynamics Modeling, Simulation and Analysis.**

3 credits. *Offered yearly.*

System dynamics analysis is a perspective and a set of conceptual and computing tools to help us understand the structure and dynamics of complex systems. This course will apply system dynamics analysis to complex systems (problems) that involve the interplay of physical and social-political factors. The course is team-oriented, project-based and grounded in the relevant legal and ethical context. *Prerequisites: ISAT 251, ISAT 252.*

**IA 342. Visualization Methods, Technologies and Tools for Information Analysis.** 3 credits. *Offered yearly.*

Data visualization presents laboratory or simulation data or the results from sensors out in the field in a way that aids reasoning about and hypothesis building in complex data sets. This course will apply data visualization technologies and tools to timely data sets from business, industry and government. The course is team-oriented, project-based and grounded in the relevant legal and ethical context. *Prerequisites: ISAT 251, ISAT 252.*

**IA 400. Cognitive Science and Information Analysis.** 3 credits. *Offered yearly.*

Cognitive science examines a wide range of mind/brain processes, including thinking, learning, language acquisition, pattern recognition, memory, creativity, volition, etc. This course will take an information processing systems approach to study cognitive processes that comprise information analysis. The course is team-oriented, project-based and grounded in the relevant legal and ethical context. *Prerequisites: ISAT 251, ISAT 252, IA 340 and either IA 341 or IA 342.*

**IA 405. Ethics, Law and Information Analysis.** 3 credits. *Offered yearly.*  
This course will examine ethical and legal issues raised in the practice of information analysis. It will draw on philosophical ethical theories and reasoning to explicate the issues addressed, and will explore the relevant constitutional and other legal constraints on the practice of information analysis, particularly issues of information privacy, civil liberties and limitations on government action. *Prerequisites: Senior standing.*

**IA 440. Seminar in Information Analysis.** 3 credits. *Offered yearly.*  
This course will focus on important issues in the theory and practice of information analysis as the basis for implementing team projects in the IA Capstone Seminar. Students will individually identify, analyze, plan and report on a feasible capstone seminar project. Students will then organize teams and develop plans to complete a subset of the most promising projects in the Capstone Seminar. *Prerequisites: Senior standing in the IA program.*

**IA 450. Capstone Project in Information Analysis.** 3 credits. *Offered yearly.*  
Building on the Seminar on Issues in Information Analysis students will complete and present solutions for team-based intelligence community or competitive intelligence IA projects. Students will produce written and oral technical reports/briefs of their results. *Prerequisites: IA 440.*

**IA 480. Selected Topics in Information Analysis.** 3 credits. *Offered yearly.*  
This course will examine topics of interest to upper-division students in information (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 standing.*

## Individualized Study

### Outreach Programs

**IS 200. Individualized Studies Major Program Development.** 3 credits.  
An introductory course designed to prepare students for transition into higher education programs. Specific content includes focusing a concentration, selecting an academic adviser, creating an individualized program, technology in higher education, accessing career resources, career decision making skills, self-awareness, life planning, identifying college level experiential learning, documenting experiential learning, determining a credit request and organizing a portfolio for assessment. *Prerequisite: Individualized studies majors and individualized studies special students only.*

**IS 202. Orientation to Career and Life Planning.** 1 credit.  
A short orientation course designed to prepare students for transition into higher learning education programs. Specific content includes accessing career resources, career decision-making skills, self-awareness and life planning. *Prerequisites: BIS major or BIS special student only.*

**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 experiential learning, 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 competence will be assessed by the Center for Leadership, Service and Transition and credit awarded as appropriate. *Prerequisite: IS 203.*

**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 departments/schools. Course content will vary. *Prerequisites: Approval of the "Course Agreement Form" by the Individualized Study department head.*

**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 "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. *Prerequisite: Approval of the "Course Agreement Form" by the Individualized Study department head.*

**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.*

## Integrated Science and Technology

### Department of Integrated Science and Technology

#### First Year Student – Sophomore Sequence

**ISAT 101. ISAT Freshman Seminar.** 1 credit. *Offered fall.*  
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. *Offered fall and spring.*

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. Issues in Science and Technology: Living Systems (2, 2).** 3 credits. *Offered fall and spring.*

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. *Offered spring.*  
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 I (3, 2).** 4 credits. *Not offered 2008-2009.*  
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. *Corequisite: GISAT 112 or permission of instructor.*

**ISAT 142. Analytical Methods II (2, 2).** 3 credits. *Not offered 2008-2009.*  
This course includes the use of calculus through differentiation and an introduction to integration in order to model continuous systems in the physical sciences, modeling of one and two-dimensional motion, use of the computer to numerically solve selected problems in mechanics. *Prerequisite: GISAT 141 or permission of instructor.*

**GISAT 151. Analytical Methods I: Applied Calculus.** 4 credits.  
This course introduces the concepts of differential and integral calculus and ordinary differential equations to model real-world problems in the sciences, business, and economics. Includes a laboratory component emphasizing numerical applications on the computer. Course assumes familiarity with algebra and trigonometry.

**ISAT 152. Analytical Methods II: Topics in Applied Physics for**ISAT. 4 credits. *Offered spring.*

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, differential and integral calculus, and differential equations are used to model physical system behavior. Laboratory experiments and computer exercises enhance understanding of the concepts. *Prerequisite: GISAT 151 or permission of instructor.*

**GISAT 160. Problem Solving Applications in Science and**Technology. 3 credits. *Offered fall and spring.*

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 180. Topics in Integrated Science and Technology.** 1-4 credits.*Offered fall and spring.*

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 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 an assessment of the non-technical issues that surround the technical problem.

**ISAT 211. Issues in Modern Production (2, 2).** 3 credits. *Offered fall.*

This course introduces the structure and function of a manufacturing enterprise, 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: GISAT 151 or consent of instructor.*

**ISAT 212. Energy Issues in Science and Technology (2, 2).** 3 credits. *Offered spring.*

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. *Offered fall.*

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 241. Analytical Methods III (2, 2).** 3 credits. *Not offered 2009-2009.*

This course is a continuation of ISAT 142 with a focus on single-variable calculus (including an introduction to differential equations) to model systems involving work, energy, waves, electricity and magnetism. Applications are made to lasers and optics. *Prerequisite: ISAT 142 or equivalent.*

**GISAT 251. Analytical Methods III: Introduction to Statistical Reasoning and Data Analysis.** 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 sectors and health related fields. *Prerequisite: Sophomore standing or permission of instructor.*

**ISAT 252. Analytical Methods IV: Programming and Problem Solving (2, 2).** 3 credits. *Offered spring.*

Use of formal logic to represent and assess properties of natural language constructs important to scientific inquiry, with application to the development and use of knowledge-based systems; introduction to procedural programming and its uses for producing and tailoring information systems supporting scientific, technical and business problem solving. *Prerequisite: Sophomore standing or permission of instructor.*

**ISAT 253. Analytical Methods V: Instrumentation and Measurement**(2, 2). 3 credits. *Offered spring.*

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. *Prerequisite: ISAT 251 and ISAT 152.*

**ISAT 280. Projects in Integrated Science and Technology.**1-4 credits. *Offered fall and spring.*

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 instructor.*

**Junior–Senior Sequence****ISAT 301. Instrumentation and Measurement in Energy (0, 2).** 1 credit.*Offered fall.*

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 instructor.*

**ISAT 302. Instrumentation and Measurement of the Environment**(0, 2). 1 credit. *Offered fall and spring.*

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 (0, 2).** 1 credit. *Offered spring.*

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 emphasized. *Prerequisites: ISAT 211 and ISAT 253 or permission of instructor.*

**ISAT 305. Instrumentation and Measurement in Biotechnology (0, 2).**1 credit. *Offered fall.*

This course provides a hands-on experience of the techniques and instrumentation used in the modern biotechnology laboratory. Topics include aseptic 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 310. Energy Fundamentals I.** 3 credits. *Offered fall.*

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 311. Role of Energy in Modern Society.** 3 credits. *Offered spring.*

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. *Offered fall.*

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 wastewater quality, management, and treatment are then addressed, culminating in independent team projects in this area. *Prerequisite: GISAT 112 or permission of instructor.*

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

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 instructor.*

**ISAT 330. Manufacturing Systems: Techniques and Technologies.** 3 credits. *Offered fall.*

The course will introduce students to the various manufacturing systems within a manufacturing organization. The systems studied will be selected from the following areas: (a) manufacturing/production management – batch and continuous (b) resources utilization, (c) material management and (d) scheduling and inventory control. *Prerequisites: ISAT 152 and ISAT 211 or permission of instructor.*

**ISAT 331. Automation in Manufacturing.** 3 credits. *Offered spring.*

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: ISAT 152 and ISAT 211 or permission of instructor.*

**ISAT 340. Software Development.** 3 credits. *Offered fall.*

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. *Offered spring.*

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 instructor.*

**ISAT/CS 344. Intelligent Systems.** 3 credits. *Offered fall and spring.*

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: Junior standing and ISAT 340 or CS 139.*

**ISAT/CS 345. The Software Industry.** 3 credits. *Offered fall and spring.*

Study of means for the development and maintenance of high quality software products delivered on time and within budget. Topics include requirements analysis and specification, software design, implementation, testing, maintenance, project management, ethics, and the responsibilities of software engineering professionals. *Prerequisites: CS 139 or ISAT 340 and sophomore standing.*

**ISAT 348. The Multimedia Industry.** 3 credits. *Offered fall and spring.*

Students are introduced to a variety of tools for viewing multimedia and to the issues in designing effective human-computer interactions. This includes an introduction to the many forms of media that occur in computing systems (text, graphics, images, sound, animation) and to the characteristics of well-produced media. *Prerequisite: CS 139, ISAT 340 or permission of the instructor.*

**ISAT 350. Biotechnology for the New Millennium I.** 3 credits. *Offered fall.*

This course covers the scientific foundations and historical development of biotechnology. Specific topics include living system nanotechnology; cell structure and function; origins of genetic engineering; and recombinant DNA technology. *Prerequisite: GISAT 113 or equivalent.*

**ISAT 351. Biotechnology for the New Millennium II.** 3 credits. *Offered spring.*

This course is a continuation of ISAT 350 and describes applications of biotechnology in agriculture, industry and medical science as well as associated social, ethical and philosophical issues. Topics include study of an emerging infectious disease; energy transduction in living systems; and novel applications of biotechnology. *Prerequisite: ISAT 350. Corequisite: ISAT 305.*

**ISAT 360. Fundamentals of Telecommunication.** 3 credits. *Offered fall.*

An introduction to telecommunications systems, including principles of electromagnetism and electromagnet waves, transmission media, encoding systems, and information theory; the social impacts of telecommunications systems and an overview of telecommunication policy and regulation; and the telecommunications industry sectors, major corporate players and regulatory agencies. *Prerequisite: ISAT 152, PHYS 250 or permission of instructor.*

**ISAT 399. Instrumentation and Measurement in Telecommunications.** 1 credit. *Offered fall.*

This course is designed to prepare students to safely and intelligently use laboratory and field instrumentation (with associated software) commonly encountered in the telecommunications field. The student will also be required to plan, design, build and present a semester project involving the use of principles learned in the course. *Prerequisite: ISAT 152 or PHYS 250.*

**ISAT 401. Advanced Computer-Based Instrumentation I.** 3 credits. *Offered fall.*

This is largely a laboratory course in which students build and program their own instruments. Topics include programming techniques for real-time instrumentation programming; buffered analog and digital input and output; timing considerations; passive analog filters and active analog filters; digital-filtering techniques; and real-time programming issues. *Prerequisites: ISAT 253 and ISAT 252 or permission of instructor.*

**ISAT 402. Advanced Computer-Based Instrumentation II.** 3 credits. *Offered spring.*

Students design and build their own instruments. Topics include representative sensor techniques as applied to physical, chemical and biological systems as well as basic and advanced circuits for signal manipulation: buffers, amplifiers and active and passive filters. An instrument design project is the capstone of the course. *Prerequisites: ISAT 253 and ISAT 252 or the permission of the instructor.*

**ISAT 406. Transmission Electron Microscopy.** 3 credits. *Not offered 2008-2009.*

This practical laboratory course provides hands-on experience in the preparation and examination of biological specimens with the transmission electron microscope. Techniques to be mastered include support film preparation for negative staining of bacteria and viruses, fixation, embedding, and thin sectioning of tissues, electron optical alignment and microscope operation. *Prerequisite: ISAT 253 or permission of instructor.*

**ISAT 410. Sustainable Energy Development.** 3 credits. *Offered spring.*

This course is concerned with science and the applications of solar and other renewable technologies, e.g., solar thermal electric, photovoltaics, wind power, biomass-derived alcohols, solar hydrogen and ocean thermal energy conversion Energy storage systems and materials, combined renewable-conventional systems for peaking and load management and alternative energy sources for transportation will be studied. *Prerequisite: ISAT 310 or permission of instructor.*

**ISAT 411. Energy Economics and Policy.** 3 credits. *Offered fall.*

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, cost-benefit 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 instructor.*

**ISAT 412. Dynamic Control of Energy Systems.** 3 credits. *Offered spring.*

This course considers 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. *Offered fall.*

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. *Offered once a year.*

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 instructor.*

**ISAT 416. International Energy Studies.** 3 credits. *Offered summer as study abroad course only.*

Study-abroad course examining international energy problems and providing team-oriented project experiences. Course addresses energy issues associated with economic and social development. Project participation, tours and meetings with local experts illustrate energy-related problems that are compared with those in the United States. *Prerequisites: ISAT 212 and ISAT 253.*

**ISAT 420. Environmental Analysis and Modeling.** 3 credits. *Offered fall.*

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 instructor.*

**ISAT 421. Environmental Policy and Regulation.** 3 credits. *Offered spring.*

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 instructor.*

**ISAT 422. Environmental Management.** 3 credits. *Offered fall.*

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. *Offered spring.*

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 instructor.*

**ISAT 424. Natural Resource Management.** 3 credits. *Offered fall.*

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 planning 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. *Offered spring.*

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 instructor.*

**ISAT 426. Environmental Information Systems.** 3 credits. *Offered summer.*

This course provides students with practical experience applying advanced environmental informational 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 instructor.*

**ISAT 427. Industrial Hygiene.** 3 credits. *Offered spring.*

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. *Offered summer.*

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. The course addresses 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.*Offered spring.*

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 instructor.*

**ISAT/MATS 430. Materials Science in Manufacturing.** 3 credits. *Offered fall.*

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 211 and ISAT 152 or permission of instructor.*

**ISAT/MATS 431. Manufacturing Processes.** 3 credits. *Offered spring.*

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 instructor.*

**ISAT/MATS 432. Selection and Use of Engineering Materials.***3 credits. Offered fall.*

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 211 or permission of instructor.*

**ISAT 433. Selected Problems in Manufacturing.** 3 credits. *Offered fall.*

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 instructor.*

**ISAT 435. Integrated Product and Process Development.** 3 credits.*Offered spring.*

This courses 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 instructor.*

**ISAT/MATS 436. Micro-Nanofabrication and Applications.** 3 credits.*Offered spring.*

This course examines processes used in the manufacture of microelectronic devices (VLSI integrated circuits, optoelectronic devices, flat panel displays), microelectromechanical devices (micromotors, 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 instructor.*

**ISAT 440. Seminar in Knowledge Management.** 3 credits. *Offered fall and spring.*

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. *Offered fall.*

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. *Offered fall.*

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. *Offered fall and spring.*

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 or ISAT 350.*

**ISAT 452. Medical Biotechnology.** 3 credits. *Offered fall.*

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, imaging technologies, lasers in medicine and relevant regulatory and legal issues. *Prerequisite: ISAT 351 or permission of instructor.*

**ISAT 453. Energy and Living Systems.** 3 credits. *Offered spring.*

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, ISAT 351 or permission of instructor.*

**ISAT 454. Computer Applications in Biotechnology.** 3 credits. *Offered fall and spring.*

Students learn how complex biological molecules support and regulate processes in living systems through building interactive computer models of protein and nucleic acid structures. Other computer applications include image processing, genome data manipulation and NMR data processing. Written and oral presentations are also required. *Prerequisite: ISAT 350 or permission of instructor.*

**ISAT 455. Regulatory Issues in Biotechnology.** 3 credits. *Offered fall.*

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 permission of instructor.*

**ISAT 456. Ethical, Legal and Social Implications of Biotechnology.**

3 credits. *Offered spring.*

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 231 or permission of instructor.*

**ISAT 457. Business of Biotechnology.** 3 credits. *Not offered 2008-2009.*

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/CS 460. Local Area Networks.** 3 credits. *Offered fall and spring.*

An overview of LAN hardware, LAN topology and design, and LAN protocols. Installation and management of LAN operating systems and LAN services (address management, name management, file and print sharing, account management). *Prerequisite: CS 350, CIS 320 or equivalent.* Formerly CS 451.

**ISAT/CS 461. Internetworking.** 3 credits. *Offered spring.*

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. Network Applications Development.** 3 credits. *Offered fall and spring.*

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: CS 239 or CIS 344 and ISAT/CS 460.*

**ISAT/CS 463. Network Analysis and Design.** 3 credits. *Offered spring.*

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: CS/ISAT 460 and ISAT 340 or equivalent.*

**ISAT/CS 464. Issues in the Telecommunications Business.**

3 credits. *Offered fall.*

Addresses complex business concepts and issues in the telecommunications industry. Explores the interrelation of the economics of the telecommunications industry with ensuing social, ethical and security issues. Discusses topics in product and service creation, marketing, customer service and billing, and electronic commerce. *Prerequisites: CIS 320, SMAD 356 and ISAT 340 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. *Offered once a year.*

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 477. Complex Systems and How They Fail.** 3 credits. *Offered fall.*

Interdisciplinary study of complex system operation, interdependencies and failure focusing on real-world critical infrastructure systems (e.g. electric power, telecommunications and health). Systems response to natural and human-induced hazards, including cascading effects. Examination of risk management strategies including technical and policy solutions.

**ISAT 480. Selected Topics in Integrated Science and Technology.**

1-4 credits. *Offered fall and spring.*

Topics in integrated science and technology which are of interest to the upper-division student but not otherwise covered in the regular course offerings. Offered only with the approval of the program coordinator. May be repeated for credit when course content changes. Students should consult the instructor prior to enrolling for the course. *Prerequisite: Junior or senior standing required. Topic selected may dictate prerequisite.*

**ISAT 489. Awareness and Understanding of Chemical, Biological and Radiological Weapons of Mass Destruction.** 3 credits. *Offered spring.*

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: ISAT 350 or BIO 214.*

**ISAT 491, 492, 493. Senior Thesis.** 6 credits. *Offered fall and spring.*

Three-course sequence. Student performs an independent research project, either alone or within an investigative team, to identify and analyze a technologically based problem, develop alternative solutions, recommend the best solution, and provide a written and oral technical report. ISAT 491 (one credit) is for project identification and proposal. ISAT 492 (two credits) and ISAT 493 (three credits) follow.

**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 499. Honors Thesis.** 6 credits. *Offered fall and spring.*

Three-course sequence. Student performs an independent research project that meets the requirements set forth by the Honors program. Student must identify and analyze a technologically based problem, develop alternative solutions, recommend the best solution, and provide a written and oral technical report of the effort. May be taken in lieu of ISAT 491, ISAT 492, ISAT 493 sequence.

## Interdisciplinary Liberal Studies

### Cross Disciplinary Studies

**IDLS 400. Seminar in Liberal Studies.** 3 credits.

Capstone seminar for IDLS students in the humanities/social sciences content area. Students will apply different disciplinary perspectives to a single topic. Course requirements will emphasize superior written and oral communication skills and the integration and application of content area knowledge to the teaching environment. *Prerequisites: Students must have completed their IDLS core requirements and be within one course of completing the track. Education students should be in their third semester of their teacher education program.*

**IDLS 490. Independent Study in Interdisciplinary Liberal Studies.** 3 credits.

Individualized projects in interdisciplinary liberal studies. *Prerequisite: Permission of the director.*

**IDLS 499A and B. Honors.** 1-6 credits.

## Interdisciplinary Social Science

### Cross Disciplinary Studies

**ISS 200. Introduction to the Social Sciences.** 3 credits.

The course serves as an introduction to the social sciences. It includes a review of the general content of selected social sciences with emphasis on primary foci, methods employed and perspectives guiding each disciplinary approach. The course will vary each semester according to the interests and specialization of the instructor(s).

**ISS 300. Experiential/Service Applications.** 3 credits.

Provides students with practical work experience through an internship, service learning program, etc. This experience culminates in the application of knowledge and skills emerging from previous courses. *Prerequisite: Requires junior standing.*

**ISS 400. Senior Seminar in Social Science.** 3 credits.

The course builds upon all previous course listings and serves as the final integrating experience providing closure to the interdisciplinary social sciences. Students are expected to integrate theories, research and/or methods from several social science disciplines to present a senior level research paper. The course will vary each semester according to the interests and specialization of the instructor.

## Interior Design

### School of Art and Art History

**INDE 200. Interior Design Studio I.** 3 credits. *Offered fall and spring.*

Studio focusing upon the design process and creating interior spaces. Projects involve investigations into syntax and design language, program interpretation, ritual, use and the constructed order of built space. Emphasis is upon experimentation, risk and play. Design studies will incorporate drawing, diagramming, models and writing. Formerly INDE 201.

**INDE 202. Interior Design Studio II.** 3 credits. *Offered fall and spring.*

Design studio building on the fundamentals of INDE 201. Projects will address both three-dimensional design of spaces and the objects within the spaces. Projects will include questions of ritual, ergonomics, material properties and full-scale prototypes. Introduction of workshop, digital graphics and photography incorporated in studio work. *Prerequisite: INDE 200.*

**INDE 208. Portfolio Review.** 0 credits. *Offered spring.*

Portfolio review required to enroll in interior design courses at 300 level and above. *Prerequisite: INDE 200. Corequisite: INDE 202. Formerly INDE 250.*

**INDE 210. Architectural Graphics.** 3 credits. *Offered fall and spring.*

Introduction to the tools and craft of the constructed drawing. Drawing types include plan, elevation, section, axonometric and perspective with emphasis upon synthesis and understanding of volumetric space. Media explorations used to increase sensitivity to materials, craft and precision of drawing. Formerly INDE 221.

**INDE/INDU 220. CAD I: Digital Design.** 3 credits. *Offered fall and spring.*

A studio course introducing computer-aided design experiences. Exploration of CAD, including terms, conventions and drawing techniques from beginning to intermediate concepts to two and three-dimensional tools and commands. Formerly INDE 222.

**INDE 300. Interior Design Studio III.** 3 credits. *Offered fall and spring.*

Intermediate design studio building upon skills of INDE 201-202 sequence. Projects will be of greater complexity, scope and technical requirement. Design studies will incorporate drawing, diagramming, models, digital studies and writing. Legal, industry and engineering requirements will be integrated into the learned poetics of design. *Prerequisite: INDE 208. Formerly INDE 301.*

**INDE 302. Interior Design Studio IV.** 3 credits. *Offered fall and spring.*

Intermediate design studio building upon skills of INDE 302. Projects will be an extension of INDE 301 but with greater complexity, scope and technical requirement. Design studies will incorporate drawing, diagramming, models, digital studies and writing. Legal, industry and engineering requirements will be integrated into the learned poetics of design. *Prerequisite: INDE 300.*

**INDE/INDU 320. CAD II: Digital Design.** 3 credits. *Offered fall and spring.*

An intermediate studio course incorporating computer-aided design experience in digital design. Continuation of CAD design processes from the foundation course toward advanced three-dimensional drawing techniques, solid modeling and rendering, lighting theory, plotting, and animation. *Prerequisite: INDE 220. Formerly INDE 322.*

**INDE 330. Materials and Methods I.** 3 credits. *Offered fall and spring.*

A lecture course introducing components and materials used in construction and building systems. *Prerequisite: INDE 208. Formerly INDE 331.*

**INDE 332. Materials and Methods II.** 3 credits. *Offered fall and spring.*

The second lecture class in a required sequence focused on building systems and materials. Topics introduced in INDE 331 are studied in greater depth with an emphasis on understanding the interrelationships among elements found in a complete construction documents package. *Prerequisite: INDE 330.*

**INDE 370. History of Interior Design.** 3 credits. *Offered fall and spring.*

Survey of the evolution of design in interiors from ancient to modern times with emphasis on period and furniture styles and architectural backgrounds.

**INDE 390. Independent Studies in Interior Design.** 1-3 credits. *Offering varies.*

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.

**INDE 392. Topics in Interior Design.** 3 credits. *Offering varies.*

Study of selected topics in interior design at the intermediate level. May be repeated when course content changes. See e-campus for current topics. Formerly INDE 389.

**INDE 400. Interior Design Studio V.** 3 credits. *Offered fall and spring.*

An upper-level design studio building upon the design rigor and technical craft acquired in the INDE 301-302 sequence. Expansion of the design role into collaborative teams, interdisciplinary teams, actual clients, service projects and competition projects. *Prerequisite: INDE 302. Formerly INDE 401.*

**INDE 402. Interior Design Studio VI.** 3 credits. *Offered fall and spring.*

Final upper-level interior design studio culminating in a thesis project. Complete student initiative across every phase of the project. *Prerequisite: INDE 401.*

**INDE/INDU 420. CAD III: Digital Design.** 3 credits. *Offered fall and spring.*

An advanced studio course expanding computer-aided design knowledge. Continued exploration of the digital virtual space from intermediate to advanced concepts of the design process, communication with diverse design programs, animation, sound and digital transformation. *Prerequisite: INDE 320. Formerly INDE 422.*

**INDE 440. Professional Practices in Interior Design.** 3 credits. *Offered fall and spring.*

Procedures and practices involved in the interior design profession. *Prerequisite: INDE 302. Formerly INDE 492.*

**INDE 490. Independent Studies Interior Design.** 1-3 credits, repeatable. *Offered fall and spring.*

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 consent of the instructor.

**INDE 491. Studio Assistant.** 1-3 credits, repeatable. *Offered fall and spring.*

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.*

**INDE 492. Topics Interior Design.** 3 credits. *Offered fall and spring.*

Study of selected topics in interior design at the advanced level. May be repeated when course content changes. See e-campus for current topics. Formerly INDE 489.

**INDE 496. Internship in Interior Design.** 1-8 credits. *Offered fall and spring.*

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. Formerly INDE 495.*

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## International Affairs

### College of Arts and Letters

**INTA 295. Cross-National Research Skills.** 4 credits.

Students learn how to conduct research from theory formulation through data collection and hypothesis testing in the field of international affairs. Special emphasis on research and computer literacy. *Prerequisite: MATH 220.*

**INTA 489. Seminar in International Affairs.** 4 credits.

This is the capstone course in the international affairs major. It provides an interdisciplinary overview of the fields within international affairs and an opportunity for students to complete individual research projects on international problems. Fulfills the College of Arts and Letters writing-intensive requirement for the major. *Prerequisites: Completion of all courses in the core requirement of the major and senior standing.*

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## International Business

### College of Business

**IBUS 298. Special Topics in International Business.** 3 credits. *Offered fall, spring and summer.*

The course is designed to allow exploration of current topics in international business. Course content will vary. See the program director for current content.

**IBUS 480. International Business Theory and Policy.** 3 credits. *Offered fall and spring.*

The course is designed to serve as an application of theory for business students to allow them to put the total picture of international business together. *Prerequisites: Senior standing and permission of instructor.*

**IBUS 490. Special Studies in International Business.** 1-3 credits. *Offered fall and spring.*

Designed to give capable students in international business an opportunity to complete independent study under faculty supervision. *Prerequisites: GPA of 2.8, recommendation of the instructor and approval of the director prior to registration.*

**IIBUS 494. International Business Internship.** 3 credits. *Offered fall, spring and summer.*

A course providing students an opportunity to work in and with an organization in order to gain insight into the practical side of modern international business operations. *Prerequisites: IBUS major, completion of 85 credit hours and COB 300, minimum cumulative GPA of 3.0, and approval of director of International Business program prior to registration.*

**IBUS 498. Special Topics in International Business.** 3 credits. *Offered fall and spring.*

An advanced course designed to allow exploration of current topics in international business. Course content will vary. See the program director for current content. *Prerequisite: COB 300 and permission of the instructor.*

**IBUS 499. Honors.** 6 credits. Year course. *Offered fall and spring.*

See catalog description entitled "Graduation with Distinction" and "Graduation With Honors."

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## International Liberal Studies

### Division of Academic Affairs

**ILS 290. Selected Topics in International Liberal Studies.**

3 credits. *Offering varies.*

Directed exploration of the literature, history, contemporary life and general culture in London, Paris, Florence, Martinique, Salamanca and other international studies programs sponsored by JMU. Approved topics will vary.

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## Interscience Research

### Departments of Biology, Chemistry and Biochemistry, Geographic Science, Mathematics, Physics and Astronomy, and Computer Science

**ISCI 450 A, B, C. Interscience Research.** 1-4 credits, repeatable to 6 credits.

An investigative experience spanning more than one field of science which may require supervision by multiple faculty members from different disciplines. Students must get prior approval for this course from each of the supervising faculty members and the department head of their program. *Prerequisites: Junior status and permission of the instructors.*

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## Italian

### Department of Foreign Languages, Literatures and Cultures

**ITAL 101-102. Elementary Italian (4, 1).** 4 credits each semester. *Offered fall and spring.*

The fundamentals of Italian through listening, speaking, reading and writing. Practice in pronunciation and development of comprehension. One hour's work a week in the language laboratory.

**ITAL 111-212. Intensive Italian.** 6 credits each term. *Offered May and summer.*

The fundamentals of Italian through listening, speaking, reading and writing. The first semester is the equivalent to ITAL 101-102 and the second is the equivalent to ITAL 231-232.

**ITAL 231-232. Intermediate Italian.** 3 credits each semester. *Offered fall and spring.*

A thorough review of grammar, vocabulary building, conversation, composition and reading. *Prerequisite: One year of college Italian or equivalent.*

**ITAL 300. Italian Grammar and Communication.** 3 credits. *Offered fall and spring.*

Intensive training in grammatical structures and their application to oral and written communication. Instruction is in Italian. Fulfills the College of Arts and Letters writing-intensive requirement for the major. *Prerequisite: ITAL 232.*

**ITAL 307. Italian Civilization.** 3 credits. *Offered fall and spring.*

A study of Italian society, economics, politics and the arts from the Roman Republic to 1814. *Prerequisite: ITAL 300.*

**ITAL/HIST 308. Contemporary Italian Civilization.** 3 credits. *Offered fall and spring.*

A study of Italian society, economics, politics and the arts from 1814 to the present. Instruction in English. (Research papers for Italian majors/minors in the language.)

**ITAL 315. Italian Phonetics.** 3 credits. *Offered fall.*

Intensive drill in Italian sounds and intonation patterns. Instruction is in Italian. *Prerequisite: ITAL 232 or equivalent.*

**ITAL 320. Italian Oral and Written Communication.** 3 credits. *Offered fall and spring.*

Intensive training in the use of modern, everyday Italian with emphasis on conversation and composition. Readings in Italian will provide a context for discussion and writing. *Prerequisite: ITAL 300.*

**ITAL 330. Business Italian.** 3 credits. *Offered fall and spring.*

A study of commercial and technical vocabulary and trade customs in conjunction with practice in the art of commercial communication, including interviews, letter writing and simultaneous interpretation. Instruction is in Italian. *Prerequisite: ITAL 300.*

**ITAL 335. Introduction to Italian Literature.** 3 credits. *Offered fall and spring.*

A survey of Italian literature from its beginning to the present. Textual analysis of sample writings representative of the most important literary movements. Instruction is in Italian. *Prerequisite: ITAL 300.*

**ITAL 351. Italian-English Technical/Commercial Translation.** 3 credits. *Offered fall and spring.*

Italian-English translation applied in several commercial (i.e. marketing, finance) and technical (i.e., electricity and electronics, software, hardware) fields. Focus will be on the acquisition of specialized knowledge (both linguistic and extralinguistic) and the delivery of professional documents in real-market conditions. Fulfills the College of Arts and Letters writing-intensive requirement for the major. *Prerequisites: ITAL 330 or permission of the instructor.*

**ITAL 375. Business and Society in Italy.** 3 credits. *Offered fall.*

This course studies Italian business, economy, politics and the influence the Italian society has on them. *Prerequisite: ITAL 300.*

**ITAL 397. Creative Writing in Italian.** 3 credits. *Offered fall.*

This course will develop strategies both for writing well and for writing creatively. Another opportunity to practice speaking skills. *Prerequisite: ITAL 300.*

**ITAL 400. Advanced Conversation.** 3 credits. *Offered fall.*

Discussions deal with topics of current interest. *Prerequisite: ITAL 320.*

**ITAL 410. Italian Through Media.** 3 credits. *Offered fall or spring.*

This course is designed to improve fluency and accuracy in speaking, reading and understanding. *Prerequisite: ITAL 320 or permission of the instructor.*

**ITAL 425. Modern Italian Literature.** 3 credits. *Offered fall and spring.*

A study of the works of major Italian writers of the 20th century. Instruction is in Italian. *Prerequisite: Three years of college Italian or equivalent.*

**ITAL/ENG 437. Studies in Italian Literature.** 3 credits. *Offered fall and spring.*

A study of selected works of Italian literature. Instruction is in English. May be repeated for credit when course content changes. (Research papers for Italian majors/minors in the language).

**ITAL 446. Special Topics in Linguistics, Literature or Civilization.** 3 credits. *Offered fall and spring.*

Study of a particular topic in Italian linguistics, literature or civilization. May be taught in English or in the language but cannot be counted for the major, minor or licensure unless taught in the language. *Prerequisite: ITAL 300.*

**ITAL 465. Italian Cinema.** 3 credits. *Offered fall and spring.*

A study of the evolution of Italian cinema. Emphasis given to the following directors: Rossellini, Visconti, De Sica, Fellini, Antonioni, Bertolucci, Wertmuller, Scola, Taviani, Salvatores. Instruction is in Italian. *Prerequisite: Three years of college Italian or the equivalent.*

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## Japanese

**Department of Foreign Languages, Literatures and Cultures****JAPN 101-102. Elementary Japanese.** 4 credits each semester. *Offered fall and spring.*

The fundamentals of Japanese through listening, speaking, reading and writing. Practice in pronunciation and development of comprehension. One hour of work each week in the language laboratory.

**JAPN 231-232. Intermediate Japanese.** 3 credits each semester.

*Offered fall and spring.*

A thorough review of grammar, vocabulary building, conversation, composition and reading. *Prerequisite: One year of college Japanese or equivalent.*

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## Justice Studies

**Department of Justice Studies****JUST 100. Justice Studies Proseminar.** 1 credit. *Offered fall and spring.*

This course is designed to introduce students to the justice studies major by focusing on academic and career advisement. Topics will include: how to select a meaningful program of study, defining and pursuing advanced research projects, identifying and arranging internships, finding and using literature in justice related academic fields, and anticipating a career in justice related fields. *Prerequisites: JUST 200 and admission to the justice studies major.*

**JUST 200. Introduction to Justice Studies.** 3 credits. *Offered fall and spring.*

This course offers students an introduction to the field of justice studies. It includes an examination of moral, philosophical and political definitions of justice and injustice and a history of their development; the distinctions and commonalities between various "kinds" of justice, e.g., criminal social, environmental; a discussion of classic and contemporary theorists and practitioners of justice and their impact on societal understanding of the concepts of justice and injustice. *Prerequisites: Declaration of justice-preparation.*

**JUST 201. Justice Research Methods.** 4 credits. *Offered fall and spring.*

This course provides students with the tools necessary for conducting independent research in the area of justice studies. Both quantitative and qualitative methods are covered. A term project, in which the skills covered in the course are applied, is a significant part of the class. *Prerequisites: JUST 200 and MATH 220.*

**JUST 210. Crime and Criminal Justice.** 3 credits. *Offered fall and spring.*

This course provides an introduction to the nature of the crime problem in the United States, including patterns of victimization and offending and the ways in which the criminal justice system responds to these behaviors. *Prerequisites: JUST 200 and admission to the major.*

**JUST 212. Theories of Crime and Criminal Justice.** 3 credits. *Offered fall and spring.*

This course provides an in-depth exploration of theoretical perspectives pertaining to the two central realms of criminological inquiry: crime and the response to crime (criminal justice). Both classic and contemporary perspectives are examined. The course will examine why people commit crime, why crime occurs, why it differs across groups and the objective underlying crime control policy. *Prerequisite: JUST 200.*

**JUST 221. Social Justice Theories.** 3 credits. *Offered fall and spring.*

This course serves as a theoretical introduction to the social justice track of the justice studies major. It includes an examination of the major concepts regarding inequality. How do we define and create inequality? Can we rid ourselves of inequality or should we accept it as a necessary element in society? *Prerequisite: JUST 200.*

**JUST 223. Social Justice Interventions and Policies.** 3 credits.

*Offered fall and spring.*

This class provides a review of the general structures of American social justice interventions and policies including governmental, corporate and not-for-profit organizations. Emphasis will be placed on macro-structures such as entitlement programs and micro-structures such as neighborhood and grassroots organizations. *Prerequisite: JUST 200.*

**JUST 225. Justice and American Society.** 3 credits. *Offered fall and spring.*

This course introduces the student to the concept and reality of justice in America. It is a broad-based, interdisciplinary consideration of justice: What it is, what it means, and how it intersects with society and social institutions in American. Philosophical and theoretical underpinnings of the notion of justice and the historical context of justice in American society will be considered.

**JUST 235. Justice in the Global Community.** 3 credits. *Offered fall and spring*

A survey of different definitions of justice relating to the operation and development of a global community in international affairs. *Prerequisite: JUST 200 or permission of instructor.*

**JUST/PSYC 255. Abnormal Psychology for Law Enforcement**

**Personnel.** 3 credits. *Offered fall and spring.*

This course for students interested in becoming law enforcement professionals critically examines psychological normality and abnormality. The course focuses on description and causes of abnormal behavior likely to be encountered by law enforcement professionals and on intervention options for police officers. May not be taken by psychology majors or students who have completed PSYC 250 or PSYC 335. *Prerequisites: GPSYC 101 and JUST 200.*