FIRST SEMINAR NATURAL WORLD (FSNA)

FSNA 103. Energy and Society. 4 Units.
This four-credit-hour course provides an introduction to collegiate writing and to various dimensions of academic life, but will focus on the critical appreciation of the world of energy. Currently, most of the world runs on non-renewable resources; this course is designed to help students develop viewpoints about these issues, and to express themselves in a clear, coherent way. The class will involve both literacy and numeracy, and students will learn to become comfortable handling some of the quantitative measures of energy use. The class will be characterized by intense yet open-ended intellectual inquiry, guided by reading, lectures and discussion, and will include practice in written and oral communication individually and in small groups.

FSNA 104. Archaeoastronomy: Monuments and Ideas. 4 Units.
The unifying theme of this course is how astronomical practice and knowledge is central to ancient civilizations and how that emphasis continues today as manifested through scientific endeavor and also as strongly through the power of unifying myth.

FSNA 111. Chemical Aspects of the Aging Mind. 4 Units.
This seminar will focus on three age-related neurological disorders: Alzheimer’s, Parkinson’s and Huntington disease. These diseases pose enormous social and economic impact, and current drug-based therapeutic approaches are limited and may not be suited to deal with the imminent problems. The seminar will examine lifestyle changes (i.e., diet, exercise, vitamins, and other habits such as reading) that are implicated in preventing or slowing down these disorders. The focus on a medical topic with important socioeconomic ramifications will provide a novel approach to enhancing critical thinking and communication skills.

FSNA 112. Talking Brains: The Neuroscience of Language. 4 Units.
J speaks both Italian and English. After suffering a stroke, he finds himself switching to Italian in the middle of a sentence, even when he knows the person he’s talking to doesn’t speak Italian! He can’t stop himself no matter how hard he tries. In this discussion-based seminar, we’ll use cases like J’s to understand how a mass of cells can give rise to something as complicated as human language. We’ll use primary source readings from neuroscience to study topics such as the typical organization of language in the brain, bilingualism, sign language, and problems with language resulting from brain injury.

FSNA 113. Facts and Values in Environmental Decisions. 4 Units.
This four-credit seminar will guide students to critically evaluate the evidence, uncertainties, and value judgments pertinent to some of the world’s pressing environmental issues. We will begin by studying climate change. Students will decide the topics of exploration to follow. Through reading, field trips, discussions and writing we will investigate natural environmental processes and how they have changed with the growth in human population and technology. Students will learn about the scientific process and will consider the role of science and technology and their limits in making decisions about shared resources.

FSNA 116. Cities (Under Construction). 4 Units.
Based on the premise that cities are never “finished,” and constantly being remade, we will look at the technological and cultural history of cities from the ancient world to the present day. Students will explore the history of building materials—wood, brick, steel, concrete, and glass—used in the construction of cities. We will also trace the development of city infrastructure such as water and sewage systems; streets, bridges, and subways; electricity, telephone and the internet. Specific technological innovations, such as the elevator and the automobile, will receive special consideration. We will move both geographically and temporally to visit the world’s great cities, Athens, Mexico City, Tokyo, and New York City. As we do, we will study the examples of significant building projects, such as the Brooklyn Bridge, the Chicago World’s Fair, Washington, DC’s Metro, and Cleveland’s first skyscraper, the Rockefeller Building. The course will cover the history of the professions—engineering, architecture, and urban planning—that have contributed to the construction of cities, and will review the works of these practitioners, as well as that of artists, reformers, and utopians that have imagined new directions for the city. We will also explore first person narratives of the city, the impact of the city on personal and collective memory, and the possibilities and pitfalls of the “virtual” city. Through lecture, discussion, textual analysis, computer simulations, and writing assignments, Cities (Under Construction) will help students gain a deeper understanding of their role in remaking and sustaining the built environment.

FSNA 120. The Impact of Materials on Societal Development. 4 Units.
This four credit-hour SAGES seminar provides an introduction to various dimensions of academic life through open-ended intellectual inquiry and guided by reading from primary and secondary sources. The course will require practice in written and oral communications in small groups. A primary focus of the seminar will be to examine the impact of engineering materials on societal development through human history using a few specific materials of interest as examples: concrete, steel, and semiconductors. At the conclusion of the course, students will be encouraged to explore the impact of other materials on the development of specific technologies as a group project.

FSNA 126. Urban Ecology. 4 Units.
This course will explore the natural world in an urban context. Urban spaces are defined by the interaction between human creation (the built environment) and the natural world. We will explore how those definitions can be complicated by human innovation meant to re-create nature, such as engineered wetlands. We’ll read some classical ecology to understand how ecological issues differ in cities. Some topics we’ll cover include: wildlife management; human/organism conflict and interdependence; urban heat islands; watershed, stormwater, and sewer management; and how trees grow in urban conditions. We’ll also explore ethical issues such as environmental justice and sustainable development. Our field trips are meant to illuminate how urban planners, park managers, and others deal with such issues to create positive and healthy environments for their communities. Students will apply arguments and concepts learned in the course readings to the sites we visit.
FSNA 129. Engineering Design to Alleviate Extreme Poverty. 4 Units.
Almost half (47%) of the people in Africa have incomes less than $1.25 per day. Most of these people live as subsistence farmers in small villages with no electricity, running water or automobiles (but with cell phones). Through readings, group discussions, writing assignments, and open-ended experiential learning activities, the course will address ways that engineering solutions can improve peoples’ lives within these severe economic constraints. A hands-on component of the course will involve designing and building affordable devices to meet specific needs. We have developed interactions with villages in Senegal, Malawi, and Botswana, and the engineering solutions will be explored within the context of these villages.

FSNA 133. Engineering Innovation and Design. 4 Units.
Innovation and design are cornerstones of the engineering profession and are responsible for many of the improvements in the quality of life that have taken place over the last century. Innovation is also viewed as the essential skill that will drive economies and solve many of the challenges facing societies around the globe. This seminar-based course will provide a disciplined approach to engineering innovation and design. The course requires students to engage in written and oral communications as well as working in small teams to complete open-ended design/build-related assignments. The course will culminate in the design, fabrication and validation of a prototype product to meet an identified need. The design, fabrication and validation of these products will be carried out in think[box] 1.0 (Prentke-Romich Collaboratory), and the Reinberger Design Studio.

FSNA 134. Fuel Cells. 4 Units.
Fuel Cells convert hydrogen and other fuels directly to electricity and are viewed as a key technology for non-polluting, oil-independent energy in the future. In this course, we will study and critically analyze the prospects, technical and economic barriers, and impact of broad implementation of fuel cells, focusing on the transportation sector and portable power. Major topics of the course include: (i) World and US energy outlook; (ii) Potential role and impact of fuel-cells; their advantages, principles of operation, design and materials issues, limitations and prospects for improvements; (iii) Special focus on details of a polymer type fuel cells (PEMFCs) for transportation and portable power; (iv) Modeling fuel cell performance and evaluation of controlling mechanisms that limit performance. The course is designed for students from all disciplines. Students will be expected to read assigned texts and articles and critically analyze statements and points of view presented. Quantitative analysis will be encouraged and developed. Student teams will develop a hypothesis to improve fuel cell performance by modifying the design of a component of the fuel cell. The new component design with then be fabricated and tested in an operating prototype fuel cell. Data analysis, hypothesis conclusion, and reporting of results are expected.

BioDesign basics explores the art of finding patient needs. No prior clinical or medical education is required, as we focus on acquiring and refining the underpinning critical thinking skills needed to identify and articulate unmet clinical patient needs in contemporary healthcare settings. Many—if not a majority of—ideas leading to healthcare innovation are derived from issues that arise during the daily activities of caring for patients. Whether it is frustration with the use of a specific surgical instrument, processes that interfere with health care delivery, better waiting rooms for the family, designing more comfortable hospital gowns, or materials inadequate for intended outcomes, patient needs cover a broad range of physical and emotional states. Many students find the idea of identifying a "patient need" quite ambiguous at first, but the BioDesign process for defining patient need is a widely use national model developed at Stanford University that the student will find contains easy-to-follow steps that are simple and appealing. As an interactive and "hands-on" course, students will be engaged in discussions, events and activities to promote a first-hand understanding of "needs finding" to support individual mastery of writing and oral presentation skills. The Fourth Hour will be centered on "walking tours" of local medical institutions around University Circle as well as actual use of medical devices (wheelchairs and crutches) on campus as ways to help your efforts identify a patient need based on those observations. In short, you will create your own experiences leading to stories that make writing fun. The course requires students to engage in written and oral communications as well as working in small teams to complete open-ended assignments.

FSNA 136. Saving the World from Poverty, Disease, Injustice and Environmental Exploitation. 4 Units.
Half of the world’s population lives in poverty. The causes of poverty and injustice are complex and the ramifications are numerous and serious and include grave risk to human health and to the environment. Through reading, analysis, writing, and rigorous discussion the class will investigate issues surrounding poverty and disparities in health and opportunity. We will also explore how innovation and engineering design can help address causes of poverty and disparity and meet needs of people at risk. Design teams will work throughout the semester to identify an unmet need to engineer a solution to benefit an under-served or under-resourced population. Fourth-hour activities will include interviewing knowledgeable stakeholders (locally and abroad via teleconference), learning about and volunteering with service organizations, and visiting local institutions and/or companies addressing these issues.

FSNA 144. Is Mind What the Brain Does?. 4 Units.
Together we will explore the nature of the human mind by asking the question, "Is the mind what the brain does?" Through an exploration of neurological and psychological case studies, empirical research studies, direct experimentation, and readings and films about brain structure and function, we will form hypotheses about the relationship between the mind and the brain and gather evidence to test our hypotheses. Writing assignments will explore ideas about your own mind and brain, examples of other individuals with unusual or atypical brains and minds, and a research topic of your choice.
FSNA 150. Hobbies - Engineering fun. 4 Units.
This seminar introduces students to the idea that engineering can be found in all sorts of unexpected places, even in our hobbies. To test our hypothesis, we will examine the hobbies enjoyed by the course instructors: baseball and building synthetic coral reef aquariums. Students will then work under the instructors' guidance to analyze how principles of engineering can be used to understand the successes and failures they have encountered in their own hobbies, with the ultimate goal of developing a proposal for improving their experience of these hobbies.

FSNA 154. The Green Energy Transformation in Germany. 4 Units.
This seminar introduces students to the development and successes of green technologies in Germany. We will examine the proactive development of renewable energy and energy conservation technologies, commonly referred to as Energiewende, that was started by the German Green movement and promoted by Germany's innovative renewable energy policies. We will consider such questions as: What are the implications of this German success story, both for the US and the rest of the world? What lessons can be applied to other situations? What factors might limit the utility of those lessons? In the process of our investigation, we will examine such important issues as globalization, resource finiteness, and sustainability challenges, including economic crises, climate change, energy insecurity, and global competition.

FSNA 157. Plastics Recycling: Re-use of Plastic Waste. 4 Units.
About 300 million tons of plastics are produced globally each year, but only about 10 percent of these products are recycled, despite the fact that recycling uses significantly less energy and produces fewer greenhouse gas emissions than does manufacture of the virgin materials. This course will address the scientific, economic, environmental, and political issues involved in plastics recycling. Following an introduction to the chemical structures and properties of commodity plastics, we will discuss the actual recycling of plastics in municipal waste including the problems faced in collection and sorting of plastic waste and recycling economics. Then we will address the commercial applications and properties of recycled plastics and why they generally have inferior properties to virgin materials, which significantly reduces their market value. Finally we will look at biodegradable alternatives to oil-based materials as well as some options to plastics recycling, including land filling, burning for power generation, and monomer reclamation.

FSNA 158. What is Making and Manufacturing Today and Why is Innovation Part of the Story?. 4 Units.
The rise of the creative class into the world of "making" has resulted in new economic models, new definitions of manufacturing, and new ways of working. "Making" is inclusive of a wide variety of activities, from the arts and crafts, to woodworking, to high technology integrating with traditional craftsmanship, to products with embedded sensors in traditional materials, to the use of 3D printing of everything from polymers to metals to chocolate. Within all of these approaches, "innovation" is often the buzzword, the common denominator. What does innovation mean in this context? Are innovators and makers today any different from the innovators and manufacturers of the past? What role does science and math have in making and manufacturing? Through both a hands-on and historical approach, we will explore the commonalities between today's makers and yesterday's manufacturers, and arrive at an understanding of innovation and apply this understanding to a project that could continue throughout your time at CWRU.

FSNA 159. Nanotechnology in Medicine: The Fantastic Voyage. 4 Units.
This seminar is designed to introduce students to Nanoscience and Nanotechnology, their application in the world of biomedicine, and the fundamental science and engineering principles that guide the current state-of-art and future approaches. The course will begin with an introduction to the history, science and terminology of 'Nano scale', 'Nanotechnology' and 'Nanomedicine'. It will then focus on the historical advancements in the field and describe why and how the field became an exciting component of medical technologies. The course will draw on a variety of texts including book sections, newspaper articles, editorials, scientific journal articles and internet-sourced information to understand the realm of nanoscience and nanotechnology in various STEM areas and their specific application in biomedicine. The course will also correlate science fiction with reality, pertaining to the Nanomedicine area, via two classic movies: Fantastic Voyage (1966) and Inner Space (1987). The students will be asked to interpret components/sections of the movies in terms of 'conceptual correctness', 'scientific correctness' and 'challenges in nanomedicine'.

FSNA 160. Technological Development and Popular Perception. 4 Units.
The central theme of this seminar is the basic functioning of engineered devices and systems. The devices/systems covered will be 1) automobiles, 2) airplanes, and 3) production of electric power. Material for the seminar will come from a wide range of sources, including a reference book "How Things Work", historical references, popular pseudo-technical periodicals, and technical journal articles. We will discuss topics ranging from a) how to characterize the basic physical principles at work in the devices/systems to b) how popular opinion can affect the adoption or abandonment of sound technology.

FSNA 162. The Root of All Technology: Natural and Synthetic Materials. 4 Units.
We all rely on technologies such as smartphones, wireless and wired communication, and embedded electronics. But access to these technologies depends on the availability and affordability of the materials used to make them. Rapid technological development and sustainability concerns have created novel demands on the infrastructure that extracts raw materials and converts them into useful devices. As a result, new classes of materials offering unique properties have been developed. This seminar examines the development and life cycle of materials. Key to our analysis will be a framework for understanding materials flow, including the prospect of closed loop production. Topics will include: patterns in raw material extraction around the world, including the north-south divide; shifts in socioeconomic drivers underlying shifts in demand for materials; material properties needed for today's technologies; methods for predicting demand for materials and constraints of meeting that demand.
FSNA 163. Design Thinking: Influence of Art and Engineering on Design. 4 Units.
For designers, the "wicked problem" is the recognition that decision-making is full of contingencies, including multiple perspectives and approaches, and while problems may be solved, elegant solutions are rarely without faults. This course investigates how these contingencies affect the design process in art and engineering, ultimately looking at the overlap between these two disciplines. What are the differences between artistic and engineering approaches to design? How can a hybrid approach that integrates aspects from each discipline solve persistent design challenges? Working with students from the Cleveland Institute of Art (CIA) in a seminar-studio setting, students will experience first-hand the importance of disciplinary diversity and innovative thinking in the design process. Collaboratively and individually, students will reveal and explore ways of design thinking shared by art and engineering in written, digital, and fabricated assignments.

FSNA 165. Silicon and Its Applications. 4 Units.
Silicon is the second most abundant element found on the planet. Over the last century, science has taught us to take this common material and create the products on which our modern society depends. Quantum mechanics gave birth to the electronic age and the computer. The absorption, emission and reflection of quanta of light (photons) underlie solar cells, light emitting diodes, radiation detectors, and optical fibers. The driving forces behind these discoveries are fascinating. The history of the scientific revolution—the conversion of sand into silicon ingots then into computer chips—is extraordinary. The advancement of computer chips and accessories based on silicon technology now enables your smartphone to direct you to the nearest Taco Bell through its connection to a satellite orbiting the Earth. There are basic processing steps that change an ingot of pure silicon into a practical device such as a chemical sensor or a solar cell. Major topics of this course will include discussion of the history of silicon, from the simple transistor to complex microprocessor, solar cells, and sensors, as well as how the swift changes in computing power and the communications revolution powered by it have impacted our daily modern life. Excellent examples of this silicon-based technology include the use of silicon in solar panels and their place in the green energy revolution, and the expanding role of silicon microsensors as one of the fastest growing areas of technology, especially in the area of biochips for healthcare. Students in this class will have the opportunity to design and construct a simple device on a silicon chip for their group project. This course is designed and intended for students of all disciplines, and each student is expected to participate actively in a group project to make a silicon device in a clean room. Students will participate in a laboratory experience where chemicals and reagents will be used for typical silicon technology processing. During Fourth Hour, students will have the chance to visit the University Solar Farm, laboratories at CWRU that are actively involved in silicon research, listen to guest speakers whose research involve silicon, watch films on usage of silicon technology and master oral presentation skills.

FSNA 168. Exploring the Ocean. 4 Units.
Most of our planet is ocean: beautiful, powerful, mysterious, deadly. Why do we risk going to sea? How did people begin to explore the ocean, and how do we explore today? What have we learned, what can we learn, and what questions about the ocean must remain unanswered? In this course we will read scholarly and popular narratives of ocean exploration; learn how sailors found their way at sea, centuries before satellite navigation; consider what it takes to equip a voyage, then and now; and learn about the instruments and submarines that let us probe the ocean depths, and what we find there.

FSNA 173. Biology in Translation: From the Lab to Our Lives. 4 Units.
Biological research informs many of our everyday decisions. Notably, we relied on biologists to learn about the spread of COVID-19 and what actions might reduce our risk of infection, often without having access to or the technical expertise to understand the original research. Instead, we relied on science journalists and science communicators to translate this research for us. Science communication at its best empowers people and communities to make informed decisions. At its worst, it perpetuates misleading information. What is the role of science communicators in making science accessible? What questions do they ask? How do they transform technical information into engaging narratives? How do they acknowledge the social, political, and economic forces acting on the scientific process? In this course, we will study the articles that scientists write for each other and the popular articles, podcasts, blogs, and documentaries that science communicators compose for a broader audience. In the last unit, you’ll be writing your own feature-length science essay that addresses, contextualizes, and responds to an independently chosen question grounded in the biological sciences.