

MATH AND SCIENCE (MSCI)

MSCI-110 Intro to Physics/Chemistry - (3 Credits)

This introduction to physics and chemistry is designed to prepare architecture students for their technological courses involving building, building materials, and building infrastructure. The course is non-calculus based.

MSCI-200 Math & The Imagination - (3 Credits)

This course is a survey of basic mathematical concepts that demonstrate the nature of mathematics. Topics are chosen from areas such as the concept of paradoxes and controversies, infinities, elementary number theory, modular arithmetic, fractals and chaos, topology, elementary probability and statistics.

MSCI-201 Symmetry, Shape & Space - (3 Credits)

This course explores some visual aspects of mathematics. Topics are chosen from areas such as geometric constructions, tessellations of the plane, symmetry groups, Platonic and Archimedean solids, spirals, Fibonacci numbers, the golden mean, phyllotaxis, spaces of dimension greater than three, and non-Euclidean geometry.

MSCI-202 CAD Math - (3 Credits)

Introduces students to the mathematical principles underlying their computer programs. It familiarizes them with equations of lines and planes, forms for rotation and translation figures on a computer, transformations for 3-D, and prospective projections onto the screen.

MSCI-204C Personal Finance Mathematics - (3 Credits)

This course is designed to improve the quantitative literacy of its students by exposing students to many of the financial decision they will face in their lives. Students will work with mathematical tools that are commonly used to gain insight and clarity on these decisions, as well as how to communicate the results of their calculations. Our discussion of money will flow the way it does through adult lives, from earning an income and paying taxes to spending, saving, investing, and borrowing when we don't have money to get what we want or need. This course will lead you on the path to equipping yourself with the necessary mathematical tools and know-how to handle money in an informed way.

MSCI-220C Science of Light - (3 Credits)

This introduction to light and optical phenomena in nature and technology will acquaint students with various physical aspects of light. We will delve into optical effects in nature such as the formation of rainbows, the colors of the sky and bubbles, mirages, the formation of images by our eyes and reception of those images by the rods and cones of our retinas. The use of light in technology will be explored by examining topics such as fiber optics, light sources (from the sun to light bulbs to pixels), one-way mirrors, 3D movie glasses, and image formation with pinholes, lenses and mirrors. Special attention will be paid to the operating principles and functioning of cameras from their lenses, to their viewfinders, apertures and filters.

MSCI-221 Conceptual Physics - (3 Credits)

This course focuses on the conceptual aspects of physics and thus uses minimal mathematics. Besides providing exposure to classical, as well as quantum physics, the course also considers the influence of physics on different areas of society, and highlights research at the cutting edge.

MSCI-222C Intro. to Electronics - (3 Credits)

This is a science course intended for the student curious about modern electronics and its use in enhancing their own designs as well as in preparation for Pratt's DDA and ID courses in interactive installations and robotics. Covering basic physics and electronics theory with practical applications in circuit design and interfacing, the course requires students to use critical and logical thinking to construct working electronic circuits that provide for control of input and output devices, the safe and reliable connection of one circuit to another or to an embedded controller (Arduino, Raspberry PL, etc.) or computer port.

MSCI-223C Astronomy - (3 Credits)

This is a course in basic astronomy, which will provide an overview of our current understanding of the universe around us. Topics will include the origin of the universe, galaxies, stars, planets, interstellar matter, black holes, supernovas, space travel, and the possibility (or not) of extraterrestrial life, as well as the observational techniques we use to reveal the universe.

MSCI-224C The Physics of Acoustic Music - (3 Credits)

Music enriches our lives and plays a major role in societies, cultures and economies around the globe. In this course, we will explore the underlying physics behind music. We will start with a general description of sound waves before delving into how sound is produced by musical instruments. We will cover how we perceive music, including the functioning of our ears, and will analyze notes, musical scales and chords in terms of the frequencies involved. We will also plug in and examine the electrification of instruments, including the operation principles of speakers and microphones, and the recording of music from wax to MP3s. The surrounding in which we listen to music affect the experience as well, so we will examine the acoustics of indoor and outdoor spaces.

MSCI-225C Starstruck: Meet Our Universe - (3 Credits)

This course provides an overview of our current understanding of the universe, allowing students to explore the vastness and details of the cosmos while inviting them to integrate scientific ideas into their own works of films, podcasts, discussions, and writing include the origin of the universe and that of matter, galaxies, stars, planets in and outside of our solar system, black holes, supernovae, dark matter, dark energy, the possibility of extraterrestrial life, space travel, as well as the observational techniques used to reveal the cosmos. Students will gain perspective on our place in the universe as we explore how we know what we know, exposing how science is a process rather than an outcome. Discussions will also address the underrepresentation of minorities and women in the science.

MSCI-232C Chemistry of Artist's Materials - (3 Credits)

This is a hands-on core course that introduces students to the chemistry behind artists' materials, including the chemistry of frescoes, traditional oil paintings, dyes, inks, illuminated manuscripts and textiles. Laboratory experiments, trips to museums, molecular visualizations of materials, films and multimedia presentations also part of the course. By the end of the semester, students produce their own fresco and tempera paintings, illuminated manuscripts and dyed textiles and are able to discuss the chemistry involved in each of these processed and how these different typed of works of art deteriorate with time.

MSCI-250C Geology - (3 Credits)

This course provides a survey of the composition, structure, and history of the solid earth, with emphasis on how internal processes shape the earth. Major areas of focus include plate tectonics, the rock cycle, seismology, volcanic processes, and mineral resources.

MSCI-251C Planet Earth - (3 Credits)

In this course we analyze how the earth works: the ways in which solar energy, internal heat, and human civilization mold the earth's surface environment-its scenery, climates, and vegetation. We examine the Earth's component parts and interactions in order to better understand its past, present and future.

MSCI-252C Natural Catastrophes - (3 Credits)

Earthquakes, tsunamis, hurricanes, floods, meteors, and climate change impact our world. In this course we take a real world case history approach to examining the physical causes of natural disasters and , equally important, the human contribution to them. We also discuss the engineering, planning, and political steps necessary to prevent disasters and equally important, the human contribution to them. We also discuss the engineering, planning, and political steps necessary to prevent disasters or at least soften their impact.

MSCI-262 Botany - (3 Credits)

Botany is the scientific study of plants. This course provides an introduction to the essential components of botany. This includes: Morphology (what does a plant look like? How can we describe the differences between plants to classify them and understand how they are related to each other?), Physiological function (how does a plant work What does it need to grow? How does it respond to environmental stressors like drought?), and Cellular function and genetics (How are plant cells different from animal cells? what about plant sex? how do plants reproduce and evolve into the great diversity of plant on planet earth?)

MSCI-262C World of Plants - (3 Credits)

This is a course about plants: their evolution, their ecology, and how they impact and are impacted by human societies. Plants form the foundation of every ecosystem that humans rely upon, and their emergence sparked the diversity of life we now observe on Earth. We rely on plants, and in many ways plants rely on us. Through a series of activities that get students out into the New York City environment to explore our own world of plants, the course helps students understand how plants evolved, how plants contribute to ecosystems, and how interactions between people and plants shape the history and sustainability of our societies.

MSCI-264 Form and Design in Nature - (3 Credits)

The natural world is constructed from quite simple components. These components are however configured into increasingly complex degrees of myriad forms which are then reflective of their function within specific environments. This course will survey this diversity of form and design beginning with molecules which, in their simplest configurations, give rise to water and minerals (including fossils) and, more complexly, biological macromolecules. We will then consider more complex and interesting than just 'mushrooms') and plants (flowers are just the beginning). Finally, we will conduct a more thorough investigation of the great variety and beauty of aquatic and terrestrial animal life form the simplest sponge to humans. All of the above will be presented from an evolutionary perspective via weekly lectures and hands-on micro-and macroscopic examination and study of laboratory specimens. Trips to parks and museums will be required. There is an expectation of sustained class engagement and personal responsibility in timely and accurate completion of assignments.

MSCI-264C Form and Design in Nature, Core - (3 Credits)

The natural world is constructed from quite simple components. These components are however configured into increasingly complex degrees of myriad forms which are then reflective of their function within specific environments. This course will survey this diversity of form and design beginning with molecules which, in their simplest configurations, give rise to water and minerals (including fossils) and, more complexly, biological macromolecules. We will then consider the 'lower' life forms: protists (single-celled free-living organisms), fungi (much more complex and interesting than just 'mushrooms') and plants (flowers are just the beginning). Finally, we will conduct a more thorough investigation of the great variety and beauty of aquatic and terrestrial animal life form the simplest sponge to humans. All of the above will be presented from an evolutionary perspective via weekly lectures and hands-on micro-and macroscopic examination and study of laboratory specimens. Trips to parks and museums will be required. There is an expectation of sustained class engagement and personal responsibility in timely and accurate completion of assignments while adhering to the highest artistic standards as that befitting a student of Pratt Institute.

MSCI-265C The Human Body: Anatomy, Variation, Adaptation - (3 Credits)

The human body is an exquisite formation that structures our movements, abilities, and identities. Careful observation, description and analysis of human anatomy can inform an understanding of the most intimate and personal of our experiences as well as fostering a deeper understanding of what it means to be a human animal. By engaging with data as well as using direct observational skills, including analytical drawing of forms from life, reference and animal dissections (non-human), students will work to define both the consistent and the variable in human anatomy, physiology, and genetics. By developing an understanding of the range of variation that characterizes our species at the level of the individual, the population, and the species as a whole, students will be challenged to break away from a categorical understanding of variation to recognize continuous ranges of variation.

MSCI-266C Visual Perception and Neuroaesthetics - (3 Credits)

How do artists create the sensation of movement in a still image? Why can certain colors or sounds evoke specific emotional responses? This course seeks to provide tentative answers to these questions and others through the lens of the brain's structure and function. We will begin by laying the foundation for neuroscience: the neuron doctrine and how these specialized cells communicate and form networks. We will then apply these basic concepts to the visual system. Students will learn how light stimuli are converted to neural signals as well as the processes by which the brain forms mental images from these inputs. Students will also get to explore non-visual sensory systems. We will end the course by covering higher cognitive functions, including emotions and memory, and their relationship to evaluation of artistic works. Upon completion, this course is worth three (3) credits and fulfills the General Education MSCI CORE requirement.

MSCI-270C Environmental Science and Ecology - (3 Credits)

Like any other organism, humans rely on their environment—most prominently the living part of that environment—in order to survive. But unlike any other species, humans have the ability to re-shape the diverse environments they inhabit in profound, fundamental, and potentially destructive ways. This course explores how living ecosystems function and how that functioning provides the resources required by both individual humans and the societies we form. It also considers how we have transformed our environment in ways that can threaten both our own health and the health of the ecosystems upon which human civilization depends. Many scientists suggest that we have entered a new geologic epoch, the Anthropocene; this course explores ways in which the 'age of humanity' can become a sustainable—rather than apocalyptic—episode in evolutionary history.

MSCI-271 Ecology for Architects - (3 Credits)

Architects build structures that serve as environments for organisms: human beings. Therefore, it is crucial that architects understand the ways in which organisms interact with the environment and other organisms. This course will investigate topics in ecology that will enable students to think more broadly about what it means to design living and working spaces.

MSCI-280 Environmental Science for Construction Management - (3 Credits)

The underlying nature of our world, as revealed through science, has a controlling impact on the materials, designs, and structures available for construction of our built environment. Conversely, both the act of fabrication of our built environment and the nature of the structures we build have a profound effect on our natural environment. This course will introduce concepts in the natural, biological and physical sciences that clarify these interactions and prepare students to understand the environmental impact of their construction choices.

MSCI-281C Green Building Science-Core - (3 Credits)

To achieve a sustainable future, we need buildings that provide for our comfort and security while imposing a far smaller impact on the environment than do today's buildings. This course will use many techniques of physical science to see how this can be done, both in new construction and in today's built environment. An introduction to climate science is also included. The course is worth three (3) credits and fulfills the Math and Science CORE course requirement.

MSCI-282C Climate Change Science-Core - (3 Credits)

Human civilization is threatened by its own success at a level not seen in recorded history. The threat, climate change, is well understood scientifically, technically, and economically. Although now penetrating the cultural realm, the political response remains woefully inadequate. This course will use the techniques of science to promote a deep understanding of the nature and urgency of the threat, preparing students to take part in the struggle against climate change that will occur in their lifetimes. The course will be based largely on reports of the intergovernmental Panel on Climate Change (IPCC), augmented by recent literature findings.

MSCI-300 Calculus I - (3 Credits)

Topics in analytic geometry, functions of one variable, limiting processes, differentiation of algebraic and trigonometric functions, definite and indefinite integrals are covered.

MSCI-301 Calculus II - (3 Credits)

Applications of the definite integral; transcendental functions; methods of integration; improper integrals; curves in rectangular polar and parametric forms; interactive and numerical methods.

MSCI-302 Statistics - (3 Credits)

This is a comprehensive survey course in statistical theory and methodology. Statistical theory topics include descriptive statistics, data analysis, elementary probability, and hypothesis testing; methodology topics include sampling, goodness-of-fit testing, analysis of variance, and least squares estimation.

MSCI-306 Creative Coding for the Visual Arts - (3 Credits)

This course provides a foundation in coding for the visual arts. The course will review fundamental principles such as pseudo-code, conditional logic, loops, functions, data structures, algorithms, digital color theory, importing specialized libraries, and basic methods for data visualization and digital image manipulation. Students will develop an understanding of rule-based and generative art, and apply these methods and principles to create original work by combining building blocks such as geometric shapes, filtered photos, random color palettes, and 2D and 3D data visualizations. The roles and uses of AI in the visual art will be discussed, and students will explore some introductory applications of machine learning.

MSCI-310 Science & Storytelling - (3 Credits)

In this course, students will learn about some big topics in physics and astronomy, including motion and gravity, stars and their evolution, light and waves, thermodynamics, and the structure of our universe. Students will also learn about the importance and use of storytelling in science communication, as well as specific storytelling techniques, strategies, and skills. Interactive weekly class meetings will include lectures, videos examples, group discussions, and group work. Through in-class activities and weekly homework assignments, and feedback on both, students will gain confidence in their understanding of these scientific topics and how to effectively communicate them through storytelling. The techniques studied in this course can be applied to many different media and formats, including speaking, video, writing, visual art, and even social media. Coursework will culminate in a final project that will allow students to choose a storytelling medium in which to share knowledge with their peers on a narrow, focused scientific topic of their choice.

MSCI-320 Materials Science for Architects, Artists, and Designers - (3 Credits)

This course introduces different materials and their unique properties to students studying to become architects, artists, and designers to make informed decisions to use materials in their professional fields. The course will explore the subject's interdisciplinary nature and find the nexus between materials science and the technical history of art, design, and architecture. The course intends to explore the fundamental properties of materials, such as plasticity, hardness, toughness, brittleness, fatigue, creep, conductivity, reflectivity, and polarization in different materials, such as metals, ceramics, polymers, composites, semiconductors, and nanomaterials. The course's focus is to find the structure-properties-processing relationships of various material systems and their design and optimization for specific applications. The course will also examine renewable energy, net-zero energy, and sustainability while exploring the processing and use of the materials.

MSCI-330 Chemistry for Art History - (3 Credits)

This course introduces Art History majors to the basics of chemistry and the chemistry behind artists' materials and techniques. Students engage in guided activities, such as guided laboratory experiments, to gain insight into the properties and chemical behavior of artists' materials. Lectures are developed to reinforce the understanding of chemical principles and address their connection to artist materials. In addition, several guest speakers including art conservators and conservation scientists will introduce issues in related to their field of expertise.

MSCI-331 Chemistry of Roman Art - (3 Credits)

In this course students will gain an understanding of the chemistry involved in the art and architectural materials utilized in ancient Rome. The course will draw on research from Pompeii and Herculaneum, which provide a wealth of preserved information about the history, technology, and culture of the Roman people. Through case studies, students will learn about the chemistry of Roman building materials, glasses, and pigments. Deterioration of wall paintings and mosaics will be discussed and students will learn how scientific analysis can provide guidelines for conservators on how to preserve the art at the ancient sites.

MSCI-350 Gold, glass and Granite: the Origins of Materials - (3 Credits)

This course explores the sources and processing of materials that artists, architects, and designers employ to do their work. Because all materials have their fundamental origin in the solid Earth, the course employs basic concepts of geology to learn how rocks and minerals are generated and what technologies are required to convert them to raw materials for industry. The course will also examine issues of sustainability, including carbon emissions associated with mining and other material processing activities.

MSCI-362 The Evolution of Sex - (3 Credits)

This course explores the evolution of sexual reproduction as an alternative to nature's original means of propagating genes (asexual cloning). We'll explore why sex evolved, weighing the benefits and liabilities associated with sexual reproduction and will also look at the diversity of sexual strategies employed across all kingdoms of life, considering the conflict and cooperation inherent in the reproductive process. The course will conclude by looking at the sexual behavior of humans and our closest primate relatives.

MSCI-363 The Anatomy of Motion - (3 Credits)

In this class students will explore the underlying muscular and skeletal structures that support movement. By conducting detailed anatomical investigations, through exploration of skeletal material, models, our own bodies, and dissections, students will explore the relationship between structure and the biomechanics of animal movement. Students will be challenged to apply their understanding of the anatomy of motion to completion of a creative project in which they are the designers of their own anatomical structures and the movements that arise from these structures.

MSCI-365 Biology for Biomimicry - (3 Credits)

This course will explore biology from a functional perspective, and will teach the fundamentals of learning from the natural world. We share this planet with millions of other species, all who have adapted to their own habitat and have a unique set of strategies and mechanisms that have enabled them to survive. In this course, students will spend time learning about and learning from these organisms. Learning about refers to only understanding the basic organism information (name, habitat, natural history), whereas learning from requires a closer look into WHAT and HOW each organism survives and thrives. We will address both of these approaches in this course, in order to equip students with the skills to apply these learnings to your own design discipline.

MSCI-381 Green Building Science - (3 Credits)

To achieve a sustainable future, we need buildings that provide for our comfort and security while imposing a far smaller impact on the environment than do today's building. This course will use many techniques of physical science to see how this can be done, both in new construction and in today's built environment. An introduction to climate science is also included. Each student will carry out a detailed energy assessment of an actual building.

MSCI-382 Climate Change Modeling - (3 Credits)

Human civilization is threatened by its own success at a level not seen in recorded history. The threat, climate change, is well understood scientifically, technically, and economically. Although now penetrating the cultural realm, the political response remains woefully inadequate. This course will use the techniques of science to promote a deep understanding of the nature and urgency of the threat, preparing students to take part in the struggle against climate change that will occur in their lifetimes. Students will prepare an actual climate change mitigation plan for a city, state, or country of their choosing. The course will be based largely on reports of the Intergovernmental Panel on Climate Change (IPCC), augmented by recent literature findings.

MSCI-383 Earth, art, design and Architecture - (3 Credits)

In this course, we will examine and appreciate the links between earth and environmental sciences and cultural aspects of society. In the first half of the semester, the course focuses on select themes deriving from the geologic discourse, paying particular attention to the links between earth materials and processes of art, technology, architecture, and other aspects of culture. We will examine minerals and rocks in relation to their physical and chemical properties, and how these properties have been put into cultural applications globally and historically. In the second half of the semester, we will study the interrelationships between the natural environment and creative expression. Specifically, we will examine artworks that: a) represent or reference the earth's systems and their aesthetic appreciation and interpretation; b) engage with or draw attention to current discourses on ecology and environmental sustainability; and c) engage with, draw attention to, or aim to change social and political attitudes towards the environment. Classes are structured around selected readings, lectures, discussion, and in-class activities. These in-class activities are supplemented with a field trip, film screenings, collaborative or individual mini research assignments, frequent oral critiques, and a final research project. Upon successful completion, this course is worth 3 credits and fulfills the General Education post-CORE elective requirement and a Sustainability Studies minor elective requirement.

MSCI-432 Nature of Color - (3 Credits)

In this course we study how color is created at the atomic and molecular level by interaction of light at the physical surface of reflective objects. From there we elucidate the chemistry of the perceptive organ, the eye, via its interaction with light with some coverage of the neurological/perceptual factors of the synthesizing organ, the brain. We will perform several lab experiments treating the nature of color from both a physical and chemical perspective.

MSCI-433 Degradation of Art and Design Materials - (3 Credits)

In this course students will gain an understanding of how art and design materials degrade and how they can be preserved. Dirt plays a major role in the deterioration of materials therefore optimal cleaning methods are a necessity. Scientific methods are important for the study of art and design materials. The use of multi-spectral imaging and polarized light microscopy for characterization of art and design materials will be discussed. We will cover how to determine realistic goal for treatments. Students will choose an art or design material and get a chance to scientifically characterize, clean, degrade, and apply a treatment allowing for a deeper understanding of the materials they use in their practices.

MSCI-438 Chemistry of Modern Polymeric Materials - (3 Credits)

The development of synthetic polymers such as plastic, rubber, and nylon is one of the main achievements of the 20th century. This course introduces students to the fundamentals of organic chemistry within the context of modern polymeric materials. Students will prepare various synthetic polymers but also work with commercial available polymeric materials. Works of art made of such materials are extremely challenging to conservators since they are vulnerable towards deterioration. Signs of degradation such as discoloration, stickiness, and cracking are usually observed within less than 30 years. Analytical instrumentation will be used to identify and characterize molecular changes before and after artificial aging.

MSCI-439 Properties of Ceramics, Metal, and Glass: Explorations of Building Blocks And Degradation Mechanisms - (3 Credits)

In this course students will gain an understanding of the fundamental similarities and differences between ceramics, metals and glass. Through first exploring the similarities and differences between each material based on their crystalline structures on a microscopic level, students will learn about the related material strengths, working properties, and manufacturing techniques. Then we will focus on causes of degradation of each material with particular attention to pollution, its origins, and the resulting chemical reactions as the inorganic materials interact with pollutants in their environments and the results of increased pollutants and their origins due to climate change. Project based work will serve as a focal learning tool with semester long research projects and weekly lab work/independent work. Students will recreate degradation properties using mockups, and throughout the semester each student will observe and document how the materials change, always reflecting on our living environment.

MSCI-490 Special Topics - (3 Credits)

Focuses on areas of topical interest and current faculty research. The subject matter of these courses changes from semester to semester as a reflection of new scholarly developments and student/faculty interests. Since schedules and topics change frequently, students should seek information on current MSCI-490 offerings from the Department of Math and Science by emailing to sci@pratt.edu or checking the Department's web page: <https://www.pratt.edu/academics/liberal-arts-and-sciences/mathematics-and-science/math-science-courses>