NATURAL & APPLIED SCIENCES ELECTIVES (NASE)

NASE 301 Planetary Exploration in the Space Age  (3 credits)
This course carefully examines our successful interplanetary space missions, which image planets, and establish their histories and evolution. A key theme in these investigations is a detailed study of the Earth, in order to perform "comparative planetology" with other planets. Various themes in this comparison approach include planetary formation, temperature and environment, atmosphere and greenhouse effects, terrestrial evolution and sustainability, magnetic fields, and planetary mass consequences. The most recent NASA missions, including those to Mars, Jupiter and Saturn, will be covered in great detail. Topics include their technologies, flight paths, scientific goals and results, and key business aspects relating to their funding, construction and operation.
Note: Satisfies the MA/NS or Arts and Sciences elective requirement

NASE 303 Life in the Universe  (3 credits)
To better understand where we should search for life beyond Earth, we must first establish the key astronomical characteristics which support Earth's sustained habitability. This quest continues by studying Venus and Mars, the two planets near the Sun's "habitable zone," as well as several potentially habitable Jovian satellites, using information provided by NASA space probes. Beyond the solar system, stellar and planetary characteristics will be used to evaluate which types of stars might host Earth-like planets, and which of those planets could possibly support life. Incorporating other astronomical, biological, and philosophical concepts, we develop the "Drake Equation" to estimate the potential number of current, intelligent and communicative civilizations that may exist in the galaxy right now. We will also examine newly discovered exoplanets, and discuss methods that have been used in attempting to detect signals from extraterrestrial civilizations.
Note: Satisfies the MA/NS or Arts and Sciences elective requirement

NASE 305 U.S. Space Program: Going Beyond  (3 credits)
The National Aeronautics and Space Administration, better known as NASA, has made substantial contributions to our world, many of which are not known, recognized, understood or fully appreciated by the general public. This course is designed to introduce students to the full scope of the U.S. space program by presenting NASA's organizational structure, strategic plan and exploration policy, by focusing on its current and future projects in various fields of astronomical research, robotic and human exploration, and by carefully examining its many achievements that impact society on a daily basis, at the intersection of science, technology and business.
Note: Satisfies the MA/NS or Arts and Sciences elective requirement

NASE 308 Health of Nations: Anatomy and Function of Health Systems in the United States and Around the World  (3 credits)
Good health systems contribute to the prosperity of nations. The U.S. stands nearly alone among developed nations in not providing universal healthcare to its citizens. Although no system is perfect, more than 35 countries rated higher in quality, equity and efficiency than the U.S. according to a World Health Organization assessment conducted in 2001. Yet Americans pay far more per capita for healthcare than citizens of any other country. What factors account for this disparity? This course will examine how healthcare is currently delivered in the U.S., how this differs from other countries, and what we might learn from other countries about improving our system. Thus, we will compare the strengths and weaknesses of the present U.S. healthcare system to the healthcare experiences of selected countries around the world toward learning what works in other places, and what might or might not be applicable here as we move closer to reform.
Focus: INTL
LSM: AMP; GP; HIND

NASE 309 The Science and Business of Biotechnology  (3 credits)
Pre-Req: GB 112.
This course integrates science and business in studying all aspects of the current "biotechnology revolution." Using the case study method, the formation, organization, production, financing and marketing of biotech companies, as well as the selling of biotech products are examined. In addition to lectures, case discussions, guest speakers and a field trip to a local biomanufacturing facility, students will be responsible for one short presentation on a biotechnology company as well as for researching and writing their own due diligence analysis report analyzing one specific marketplace. The potential long-range medical, economic, legal and ethical implications of applying this science are also examined.
Focus: CI
LSM: HIND; QP
Note: May be used as an FI, MG or MK elective with department chairperson's approval, or as an MA/NS or Arts and Sciences elective requirement

NASE 311 Ecology: Principles and Applications  (3 credits)
This course introduces the principles of ecology that are relevant to environmental science, including variation in the environment, energy flow, biogeochemical cycling, productivity, population growth and regulation, and interactions between organisms and their environment. The evolutionary nature of species interactions and its implications for conservation biology will be explained. The course will include study and discussion of environmental problems confronting the world, field trips to local environments, exercises designed to teach ecological concepts, and writing assignments, particularly a paper on the application of ecological principles to a current environmental issue. The course will prepare the student to function as an ecologically aware citizen and to appreciate the natural environment more.
LSM: EEGS
Note: Satisfies the MA/NS or Arts and Sciences elective requirement.
NASE 313 Human Nutrition: From Science to Life  (3 credits)
Every day we are bombarded with information about diet and health, often confusing and contradictory. As consumers, it is difficult to separate fact from fad, truth from fiction. This science course covers the fundamental principles of nutrition science and its application to personal fitness. The course will provide a foundation in introductory nutrition, including basic anatomy and physiology of the digestive tract, macro and micronutrients, and the development of disease. Emphasis is placed on acquiring both scientific and practical knowledge of the essentials of nutrition with the goal of learning to think critically about nutrition issues as lifelong consumers.
LSM: HIND
Note: Satisfies the MA/NS or Arts and Sciences elective requirement.

NASE 314 Coastal Biology of Cape Cod  (3 credits)
MANDATORY Pre-SESSION 4/20, 6-8 PM.
This is a field-oriented course investigating various ecosystems of Cape Cod, focusing on the variety and types of organisms found in each area and their interrelationships with their natural surroundings. The ecosystems to be studied in this one-week intensive course on Cape Cod include sandy beaches and dunes, salt marshes, estuaries, rocky intertidal habitats, saltwater and freshwaterponds, and a rare Atlantic White Cedar swamp.
LSM: EEGS
Note: Satisfies the MA/NS or Arts and Sciences elective requirement. There is an additional fee associated with this class.

NASE 315 Human Health and Disease in Today’s World  (3 credits)
This course examines human health and disease from the structure and function of the human body to its interaction with the environment. The genetic, physiological and behavioral factors that influence the physical and mental well-being of individuals is explored on all levels, including molecules, cells, organs, individuals and communities. Risk factors such as diet, sexuality, occupation, tobacco, alcohol and drugs are similarly evaluated, with an emphasis on behavioral changes that optimize personal health or help manage adverse conditions. Modern challenges such as emerging diseases, pandemic flu and bioterrorism and their potential impact on students’ lives are discussed. The healthcare system, from research and development, healthcare markets, access to insurance, and alternative and complementary medicines are presented with the goal of helping students become more discerning consumers.
LSM: EEGS; ESR; HIND
Note: Satisfies the MA/NS or Arts and Sciences elective requirement.

NASE 316 Biology of Mind  (3 credits)
This seminar explores the evolutionary origins and structures of mind, brain and consciousness. Students will critically review recent studies from diverse disciplines, including evolutionary biology and psychology, physical anthropology, the brain and cognitive sciences, and neurology, as well as examine the questions raised by philosophy of mind. The biology underlying perception, emotions, language, memory, learning and consciousness will be studied though both readings and laboratory exercises.
LSM: HIND
Note: Satisfies the MA/NS or Arts and Sciences elective requirement.

NASE 317 Economic Botany  (3 credits)
Human survival is dependent on plants because the vast majority of our basic resources for food, beverage, fuel, clothing, shelter, medicine and decoration are derived from botanical sources. This course discusses basic plant structure and function as it relates to economically important products; agriculture from its earliest beginnings to promising plants of the future; and the importance of plant breeding, propagation and conservation to modern economy. Examples of plants and plant products used around the world will be illustrated through the use of fresh material, purchased products, videos, slides, internet links, and visits to appropriate businesses. Each student will choose a botanical industry to visit and will prepare a “fact book” of relevant material.
LSM: EEGS
Note: Satisfies the MA/NS or Arts and Sciences elective requirement.

NASE 318 Global Health Challenges  (3 credits)
The forces of environmental, social and political change are expected to intensify in the decades to come. The reverberations of these inevitable changes will impact not only the magnitude of domestic and global health threats, but also their specific nature. Citizens and health systems must be prepared to deal with public health risks and consequences that they have never had to face before. Yet, as these challenges intensify, healthcare technologies are providing new tools for protecting human health. The balance between these evolving risks and our ability to deal with them will be critical in determining our future quality of life. This course will investigate public health from a community-based, global perspective, looking at health issues beyond our shores as well as the unwelcome risks and intrusions that global phenomena introduce into our lives at home.
Focus: INTL
LSM: EEGS; ESR; GP; HIND
Note: Satisfies the MA/NS or A&S elective requirement.

NASE 319 Human Inheritance  (3 credits)
This course introduces students to the basic principles of human inheritance and modern genetics, and the practical applications of this science in understanding one’s own characteristics, health, disease risk, and even behaviors. Recent advances in genetics have revolutionized our understanding of human biology as well as many aspects of everyday life including insurance, reproduction and medicine. This course challenges students to examine the personal, medical, social, legal and ethical dilemmas arising from an understanding of human genetics and the human genome.
LSM: HIND; QP
Note: Satisfies the MA/NS or Arts and Sciences elective requirement.

NASE 320 Bugs in the System  (3 credits)
Insects may be small, but they ubiquitous and abundant, and as such exert enormous impacts, both positive and negative on all aspects of human livelihood. They consume and destroy crops and stored food, degrade real estate and claim more lives per year than all wars and natural disasters combined. This course will examine in detail the economic importance of insects in all aspects of human endeavor, both in the harm they cause and the many ways they benefit people. Starting with an introduction to the unique biology of these organisms, we examine their role in natural cycles as well as their various impacts on human affairs including health, agriculture, forestry and as natural resources for important materials and food products. Taking advantage of double block sessions, this course will include field excursions and exercises at several sites within walking distance of the Bentley campus and each week will integrate lectures with interactive laboratory sessions.
LSM: EEGS; HIND
Note: Offered once per academic year in the fall or summer.
NASE 328 Water Quality  (3 credits)
All of us should be concerned about the quality and cost of our drinking water. Many wars – political and physical – have historically concerned the use and misuse of drinking water. Drinking water is the focus of this course, which examines the sources, delivery and treatment received as water is delivered to us, as well as the treatment and disposal of wastewater. This course has a lab-oriented project where students select a topic and do specific chemical analysis on their samples and compare them with EPA guidelines. Common water pollutants such as bacteria, heavy metals, pesticides and fertilizers are described and many are tested as part of as part of in-lab activities. Samples from such places as Bentley Pond, the Charles River, and Walden Pond are collected and purified through accepted treatment methods to see if they can be made “drinkable.” Water softeners and other in-home filtration methods are examined. Student projects include a lab component, a written paper and an oral presentation.

LSM: EE GS
Note: Satisfies the MA/NS or Arts and Sciences elective requirement.

NASE 334 Coastal Geology of Cape Cod  (3 credits)
MANDATORY Pre-SESSION 4/20, 6-8 PM.
This is a one-week field-based course that studies the geologic origins, coastal processes, environmental systems, and human impacts on Cape Cod. Through field observations, measurements, data collection and analysis, students will learn about the dynamic coastal landscape and the geologic processes that formed and continually alter the coastline. Participants will study the beaches, seascapes, coastal wetlands and environmental geology at various locations on the Cape, and compare the dynamic coastal environments along the Atlantic Seashore, Cape Cod Bay and Nantucket Sound. Students will gain an understanding of the different geologic processes, development hazards and environmental protection challenges that each location represents.

LSM: EE GS
Note: Satisfies the MA/NS or Arts and Sciences elective requirement. There is an additional fee associated with this class.

NASE 335 Oceanography  (3 credits)
This course examines chemical and physical aspects of oceans and sea water, including geologic history of ocean basins, ocean currents, waves, tides, composition of sea water, types and movement of marine sediments, natural resources that oceans provide, and human impacts, such as pollution in the coastal and deep marine environment.

LSM: EE GS
Note: Satisfies the MA/NS or Arts and Sciences elective requirement.

NASE 336 Water and the Environment  (3 credits)
This course examines the origin, distribution and supply of water on the Earth. Topics include field measurement of runoff processes (including stream velocity, discharge and sediment load); bathymetry, temperature, oxygen, and conductivity profiles of a pond or reservoir; and snowpack volume, density and water content (in season). Laboratory exercises include drainage basin analysis and estimation of flood frequency, and magnitude from air photos and topographic maps; experimental groundwater modeling from flow tubes to test Darcy’s law; and flow-net construction for prediction of groundwater pollution. Overlying case study concerns “A Civil Action,” a famous water contamination court proceeding. This course is offered in both one-week intensive and semester formats.

LSM: EE GS; QP
Note: Satisfies the MA/NS or Arts and Sciences elective requirement.

NASE 337 Global Climate Change  (3 credits)
This course examines the basic concepts of weather and climate, such as structure of the atmosphere, ocean and atmospheric circulation, and latitudinal and seasonal changes in relationship to distribution of land and water bodies on Earth. Also considered are temporal changes in large-scale climatic phenomena, such as atmospheric carbon dioxide, glaciations, sea-level change, monsoons, impact of volcanoes, El Niño/ Southern Oscillation (El Niño), greenhouse effect, stratospheric ozone depletion, desertification, as well as human impacts on climate.

LSM: EE GS; ESR; GP
Note: Satisfies the MA/NS or Arts and Sciences elective requirement.

NASE 339 Weather and Climate  (3 credits)
This course examines the fundamentals of meteorology, including solar and terrestrial radiation; temperature; air pressure; atmospheric moisture, stability and circulation; fronts and air masses; thunderstorms; tornadoes; hurricanes; floods and droughts; El Niño; and global warming. The goals of the course include the ability to read a weather map; understand the basis for five-day forecasts; and to be a better weather forecaster than the media stars on TV by simply using a barometer and cloud observations.

LSM: EES; QP
Note: Satisfies the MA/NS or Arts and Sciences elective requirement.

NASE 342 Light and Color  (3 credits)
This course examines the fundamentals of meteorology, including solar and terrestrial radiation; temperature; air pressure; atmospheric moisture, stability and circulation; fronts and air masses; thunderstorms; tornadoes; hurricanes; floods and droughts; El Niño; and global warming. The goals of the course include the ability to read a weather map; understand the basis for five-day forecasts; and to be a better weather forecaster than the media stars on TV by simply using a barometer and cloud observations.

LSM: EES; QP
Note: Satisfies the MA/NS or Arts and Sciences elective requirement.

NASE 344 Energy Alternatives  (3 credits)
This course examines the fundamentals of meteorology, including solar and terrestrial radiation; temperature; air pressure; atmospheric moisture, stability and circulation; fronts and air masses; thunderstorms; tornadoes; hurricanes; floods and droughts; El Niño; and global warming. The goals of the course include the ability to read a weather map; understand the basis for five-day forecasts; and to be a better weather forecaster than the media stars on TV by simply using a barometer and cloud observations.

LSM: EES; QP
Note: Satisfies the MA/NS or Arts and Sciences elective requirement.
**NASE 350 Industrial Ecology**  (3 credits)
Industrial ecology examines the relationships between the production of material goods and the effect this process has on humans and the environment. The course systematically examine the practices of extraction, processing, production, distribution and consumption of goods by quantifying material and energy flows through every step of the cradle to grave process. Students will examine readings, case-studies and models to assess and develop an understanding of the complex balance between the Earth’s natural resources and satisfying human wants and needs. The course emphasizes that the solutions to global ecological sustainability are not found in the abandonment of technology, but through the embrace and proliferation of it. Specific topics covered in the course may include a survey of material flow analysis, life cycle assessment, energy policy, urban ecosystems, and the circular economy.

LSM: EEGS; HIND
Note: Satisfies the MA/NS or Arts and Sciences elective requirement.

**NASE 363 Innovative Tech & Society**  (3 credits)
Innovation in technology is an ever-changing, improving process. A look at the latest news cycle reveals an exciting frontier in technological development. Scientists and engineers harness advanced electronic, chemical, and mechanical properties to make revolutionary technologies. This course introduces students to principles, applications, and societal implications of a selected technology. Students will characterize types of technologies and strategies for fabricating and characterizing materials. In addition, students will evaluate current applications of innovative technologies in many topical areas. Finally, students will evaluate risks, intellectual property, ethical concerns, business implications, and regulatory issues of innovative technologies. Through structuring a business plan and "pitch" based on an innovative technology, students will demonstrate a viable consumer need, identify a target market, and explain how to operate and manage a technology-based business.

LSM: HIND
Note: Offered once per year.

**NASE 364 Science of Sustainability**  (3 credits)
This course examines the scientific basis for human development that provides people with a better life without sacrificing and/or depleting Earth’s resources or causing environmental impacts that will undercut future generations. Examples of the Earth’s resources to be studied include air, water, soil, forests, energy, minerals, fish, wildlife and agriculture. A service-learning project concerning conservation, recycling and reuse of everyday materials and products in the local area is a major component of the course.

LSM: EEGS; ESR; GP; QP
Note: Satisfies the MA/NS or Arts and Sciences elective requirement.

**NASE 370 The Biological Fate of Drugs**  (3 credits)
Many of us do not hesitate to take Advil for a headache or Robitussin when we have a cough, yet we rarely think about what these drugs actually are. What is it in Advil that reduces pain? Which ingredient in Robitussin eases a cough? We take these drugs by mouth, yet their effects are noted throughout the body. This course will analyze how drugs taken by mouth are able to have these systemic, whole-body effects. First, we will look at what drugs actually are, and how their chemical structure will impact their ability cause a biological effect. Next, we will look at how drugs are formulated for dissemination and how the chemical principles that underlie these formulations influence the potential market for the drug. We will seek to understand the biological barriers that a drug molecule must overcome before being ‘available’ in the body. Students will use state-of-the-art software to design a novel drug using structure-based design principles.

LSM: HIND

**NASE 380 Science of Environmental Policy**  (3 credits)
National laws protecting the environment and governing the use, conservation and preservation of natural resources are partly based on current scientific understanding, but almost always affect the way businesses operate profoundly. The U.S. has a long history of attempting to balance economic growth with the preservation of the environment and human health by passing new laws and creating new regulations. This course will explore the science behind environmental and natural resource policy, from its historical roots to bills being debated in the U.S. Congress today. In addition to covering the role of science in the legislative process, specific topics will include major environmental laws and amendments, as well as proposals dealing with energy production and climate change.

LSM: EEGS

**NASE 398 Experimental Course in NS**  (3 credits)
Experimental courses explore curriculum development, with specific content intended for evolution into a permanent course. A topic may be offered twice before it becomes a permanent course. Students may repeat experimental courses with a different topic for credit.

**NASE 399 Experimental course in NAS**  (3 credits)
Experimental courses explore curriculum development, with specific content intended for evolution into a permanent course. A topic may be offered twice before it becomes a permanent course. Students may repeat experimental courses with a different topic for credit.

**NASE 401 Directed Study in Natural and Applied Sciences**  (1 to 4 credits)
Directed Study topics must be submitted for approval by the instructor, chair and associate dean of Arts and Sciences.
Note: Satisfies the MA/NS or Arts and Sciences elective requirement.

**NASE 402 Seminar in Natural and Applied Sciences**  (3 credits)
The course permits small-group study of selected topics by advanced students. (May be repeated for credit.)
LSM: AMP; EEGS
Note: Satisfies the MA/NS or Arts and Sciences elective requirement. Not offered regularly. Check with department chair for availability.

**NASE 403 Special Topics in Applied and Natural Sciences**  (3 credits)
This course examines a different theme or themes during each semester related to natural and applied sciences. Currently planned are topics related to the environment, sustainability, psychology and healthcare.
Note: Instructor permission required.

**NASE 415 Research in Natural and Applied Sciences**  (1 to 3 credits)
This course provides the student an opportunity to develop an independent research project on an environmental issue. In this hands-on experience, students will expand analytical and critical-thinking skills, writing ability and computer experience. Students will learn how to operate state-of-the-art laboratory and field equipment if appropriate to the project. Students are expected to exercise their own initiative in both planning the project and relating it to specific issues of environmental science.
Note: Satisfies the MA/NS or Arts and Sciences elective requirement.
NASE 421 Internship in Natural and Applied Sciences  (3 credits)
This course provides the students with an opportunity to gain on-the-job experience and apply scientific principles and concepts learned in the classroom to specific work environments. Students are required to attend pre-internship workshops sponsored by the Center for Career Services, meet regularly with a faculty advisor, keep weekly logs of activities, write a final paper or complete a special project, and provide an evaluation of the experience at the end of the internship.

Note: Satisfies the MA/NS or Arts and Sciences elective requirement.