

NVS 461-469. SEMINARS ON NON-VIOLENCE

4 sh

These seminars combine two or more interdisciplinary approaches to the problem of violence. Each will include exploration of non-violent approaches to conflict situations. Prerequisites: two courses in non-violence studies.

NVS 381. INTERNSHIP IN NON-VIOLENCE STUDIES

1-4 sh

Research, service and occupational internships focusing on issues relating to violence and non-violence. Prerequisites: two courses in non-violence studies and permission of the coordinator.

Philosophy

Chair, Department of Philosophy: Professor Weston
 Professor: Sullivan
 Associate Professors: Batchelor, Lubling
 Assistant Professors: Cahill, Johnston, Fowler
 Adjunct: Jegstrup

Philosophy lies at the heart of a liberal arts education. Philosophy at Elon has both a wisdom orientation for exploring enduring human concerns and a practical intent to enhance our lives together and our care for the earth.

Philosophical study at Elon focuses on three sets of skills: (1) critical and constructive thinking - aiding students in identifying, analyzing and offering solutions to problems; (2) ethical practice - exploring ways to act wisely and effectively in our life with others; and (3) interpretive understanding - allowing students to bridge the meaning and value systems of diverse individuals, cultures and epochs.

Such skills are valuable for law and leadership, ministry and the helping professions, citizenship and service, and for deepening the quality of our lives. At 36 semester hours, the philosophy major is designed to allow room for a double major or a career-related minor.

A major in Philosophy requires the following courses:

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|---|-------------------------|--------------|
| PHL 113 | Critical Thinking | 4 sh |
| PHL 115 | Ethical Practice | 4 sh |
| PHL 331 | Ancient Philosophy | 4 sh |
| PHL 333 | Modern Philosophy | 4 sh |
| One course from the following: | | 4 sh |
| PHL 431 | Contemporary Philosophy | |
| PHL 432 | American Philosophy | |
| PHL 433 | Marx, Darwin and Freud | |
| Three courses chosen from any additional philosophy offerings | | 12 sh |
| PHL 461 | Integrative Tutorial | 4 sh |
| TOTAL | | 36 sh |

A minor in Philosophy requires the following courses:

| | | |
|---------|-------------------|------|
| PHL 113 | Critical Thinking | 4 sh |
| PHL 115 | Ethical Practice | 4 sh |

| | |
|---|--------------|
| One course from the following: | 4 sh |
| PHL 331 Ancient Philosophy | |
| PHL 333 Modern Philosophy | |
| Two courses chosen from any additional philosophy offerings | 8 sh |
| TOTAL | 20 sh |

PHL 113. CRITICAL THINKING **4 sh**

This foundation course in critical thinking introduces reading and listening skills, argument analysis and evaluation and creative problem-solving methods. Such skills are valuable throughout life, from making effective presentations to promoting independent thinking. Offered fall and spring.

PHL 115. ETHICAL PRACTICE **4 sh**

Ethical practice is a foundation course exploring ways to act wisely and effectively in our life with others. Drawing on the philosophical tradition and on critical examination of life situations, students engage such topics as personal integrity, sensitivity and fairness to others and conditions for collaborative and respectful living. Offered fall and spring.

PHL 331. ANCIENT PHILOSOPHY **4 sh**

This study of the origins of Western philosophy concentrates on the Golden Age of Greece, including such topics as Socrates, his predecessors and his great successors, Plato and Aristotle. Students consider what it means to live a human life in a humane and liberating communal context. Offered at least once every two years.

PHL 332. MEDIEVAL PHILOSOPHY **4 sh**

This study focuses on 12th and 13th century European intellectual developments, showing how Platonic and Aristotelian strands blend with Jewish, Christian and Islamic elements. Special topics include Bernard and Abelard, Averroes and Maimonides, Hildegard and Mechtild, Aquinas and Bonaventure and Dante and Eckhart.

PHL 333. MODERN PHILOSOPHY **4 sh**

Discussion centers on crucial intellectual developments in the 17th and 18th centuries when the modern Western worldview arose. Specific attention is given to far-reaching changes in philosophical methods, theory of knowledge, new senses of self and world and thinkers such as Descartes, Hume and Kant. Offered at least once every two years.

PHL 334. POLITICAL PHILOSOPHY **4 sh**

Discussion focuses on the roots of modern political thought, including such key 17th- and 18th- century developments as the case for sovereignty in the modern nation state, the rise of individual rights and the rationale for modern democracy. Major thinkers such as Hobbes, Locke and Rousseau are studied against the background of their turbulent times.

PHL 337. DANTE'S JOURNEY **4 sh**

This course will follow Dante's journey as expressed in *The New Life* and *The Divine Comedy*. In the process of following Dante's journey, we will explore the phenomenon of courtly love, go through Hell together, learn the process of getting in touch with the more subtle obstacles to our growth as we climb the seven-storied mountain of Purgatory and finally explore levels of consciousness that take us through the spheres of spiritual deepening to the Love that moves the sun and other stars.

PHL 341. PHILOSOPHY OF LAW **4 sh**

This basic examination of the nature, function and limits of law gives attention to human rights and natural justice, law and morality, theories of punishment and questions of legal responsibility. The course is of particular interest to prelaw, business and political science students.

PHL 342. PHILOSOPHY AND SOCIETY **4 sh**

This course pursues a philosophical approach to the relation of individuals and social institutions. Topics considered may include the nature and possibility of the social sciences, philosophy of technology and the nature of community.

PHL 343. AGES AND STAGES OF LIFE **4 sh**

In an archetypal approach to the stages of life, this course draws from transpersonal psychology/philosophy and from myths and stories of the first and second halves of life. The study seeks practical insights from developmental psychology and various spiritual teachings to help students deal with crucial life issues.

PHL 344. PHILOSOPHY OF SCIENCE **4 sh**

Course study promotes the intelligent, critical assimilation of scientific information by developing a general framework for analyzing scientific claims. Topics include the structure of scientific reasoning, science in its cultural context and the logical and other elements shaping scientific change.

PHL 345. FEMINIST PHILOSOPHY **4 sh**

This survey and application of feminist philosophies examines central ideas in feminist thought, including the social construction of gender, the exclusion of women from traditional philosophy and the intersection of gender with other social factors such as race and class.

PHL 348. ENVIRONMENTAL ETHICS **4 sh**

Students explore the bearing of philosophical and religious ethics upon practical problems regarding the natural environment. This course also considers the possible need for new ethical frameworks to address the environmental crisis we now face. (Same course as REL 348.)

PHL 352. EASTERN PHILOSOPHY **4 sh**

Eastern Philosophy centers first on ancient China, exploring *The Book of Changes* and the thought of Lao Tzu and Confucius. The course continues with investigation of Buddha's insight, following Mahayana Buddhism into China where it becomes Zen. Finally, the course examines the spirit of Zen and its influence on Japanese arts and culture.

PHL 355. PHILOSOPHY OF RELIGION **4 sh**

This course explores Eastern and Western approaches to religious experience and notes differences between the literal, moralistic (exoteric) and the symbolic, mystical (esoteric) understandings of any religion. Students examine parable, teaching story, paradox and the problem of religious language and consider ways of assessing religious claims, communities and personal practices. (PHL 355 is the same as REL 355.)

PHL 371-379. SPECIAL TOPICS **4 sh**

Special topics are variable courses of timely and enduring interest. Past and current offerings include:

- PHL 371 Restorative Justice
- PHL 372 Philosophy of Education
- PHL 373 Philosophy and the Holocaust
- PHL 374 Philosophy of Love and Feminism
- PHL 375 Philosophical Themes in the Films of Woody Allen
- PHL 376 Philosophy of Camus
- PHL 377 Theories of Knowledge
- PHL 378 Law in Literature and Film
- PHL 379 Living Philosophically

PHL 431. CONTEMPORARY PHILOSOPHY **4 sh**

Students become acquainted with philosophical trends in the 20th century and develop appropriate skills of inquiry. The course surveys the changing landscape of philosophy in this volatile century and introduces students to key figures who have shaped that landscape.

PHL 432. AMERICAN PHILOSOPHY **4 sh**

Focusing on the rich heritage of 19th- and 20th-century American thought from such figures as Emerson, Thoreau, Pierce, James, Dewey and others, this course emphasizes the originality of American philosophy and its continuing relevance.

PHL 433. MARX, DARWIN AND FREUD **4 sh**

These revolutionary makers of the modern mind - Marx, Darwin and Freud - have had enduring influence on subsequent thought in such diverse fields as philosophy and politics, biology and religion, sociology and psychology. This course examines their work in light of more recent attempts to incorporate, reform and extend their insights.

PHL 461. INTEGRATIVE TUTORIAL **4 sh**

This capstone course integrates the student's understanding of the history, issues and demands of philosophy via readings, class discussion and individual mentoring projects with philosophy faculty. It culminates with a final project on a topic chosen by the student which requires substantial philosophical research, writing and reflection and is evaluated by all members of the department. Offered fall of senior year.

PHL 471. SEMINAR: SPECIAL TOPICS **4 sh**

PHL 481. INTERNSHIP IN PHILOSOPHY **1-4 sh**

The internship provides work experience in a setting that is rich with practical philosophical problems. The goal is to enrich the student's appreciation of the link between philosophy and life. Offered on an individual basis when suitable opportunities can be arranged. Permission of the department is required.

PHL 491. INDEPENDENT STUDY **1-4 sh**

Physical Education

Chair, Department of Health and Human Performance: Professor J.P. Brown

Professors: Beedle, Calhoun, White

Associate Professor: Davis, Parham

Assistant Professors: Morningstar, Parson, C. Smith

Instructors: Apke, Holthouser, Kennedy, Lage, Raduenz, Reilly, Spier, Stevens, Trevathan, Webster

The Physical Education curriculum located within the Health and Human Performance Department is designed to prepare students to become teachers. The program is broad-based and includes evaluating and improving the student's psychomotor and cognitive skills through a wide range of activity courses, specialized theory courses and continued opportunity for applying these skills and concepts in educational and laboratory settings.

Through this study students gain knowledge of the concepts and skills related to teaching sport and physical activity. Graduates in the major are successful teachers and coaches and many pursue graduate degrees.

A major in Physical Education requires the following courses:

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| DAN 115 | Folk, Square and Social Dance | 1 sh |
| | Select any activities course | 1 sh |
| PED 125 | Skills and Activities for Teaching | 3 sh |

| | | |
|--------------|---|--------------|
| PED 211 | History/Foundations of Sport/Physical Education | 4 sh |
| PED 305 | Legal Aspects | 2 sh |
| PED 310 | Motor Learning Theory for Teaching and Coaching | 4 sh |
| PED 321 | Biomechanics | 4 sh |
| PED 341 | Theory of Coaching | 2 sh |
| PED 360 | Elementary Physical Education (K-6) | 4 sh |
| PED 401 | Adapted Physical Education | 2 sh |
| PED 410 | Organization and Administration | 4 sh |
| PED 411 | Measurement and Evaluation | 4 sh |
| HED 220 | First Aid | 1 sh |
| ESS 422 | Physiology of Exercise | 4 sh |
| BIO 161 | Human Anatomy | 4 sh |
| BIO 162 | Human Physiology | 4 sh |
| TOTAL | | 48 sh |

Students desiring **teacher licensure in physical education** must also take the professional studies requirements listed for Special Subjects areas (K-12) under Education. (EDU 450 is not required.)

The Health Education endorsement (for students with teacher licensure) requires the following courses:

| | | |
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| EDU 427 | Materials and Methods of Teaching Health and Safety | 4 sh |
| Sixteen hours chosen from the following: | | 16 sh |
| HED 321 | Health Services and Consumerism | |
| HED 324 | Nutrition | |
| HED 325 | Substance Abuse and Human Behavior | |
| HED 326 | Human Sexuality | |
| HED 421 | Chronic and Acute Diseases | |
| TOTAL | | 20 sh |

A minor in Physical Education requires the following courses:

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| Four courses chosen from one-hour skills classes | | 4 sh or |
| PED 125 | Skills and Activities for Teaching and one skills course | |
| PED 310 | Motor Learning Theory for Teaching and Coaching | 4 sh |
| PED 360 | Elementary Physical Education (K-6) | 4 sh |
| EDU 423 | Materials and Methods of Teaching Physical Education | 4 sh |
| PED 341 | Theory of Coaching | 2 sh |
| TOTAL | | 18 sh |

PED 100. TENNIS **1 sh**

Students learn rules, skills and strategy of tennis. Offered fall and spring.

PED 101. RACQUETBALL **1 sh**

Students learn rules, skills and strategy of racquetball. Offered fall and spring.

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| PED 102. GYMNASTICS | 1 sh |
| Students learn a variety of floor and apparatus gymnastics skills. Offered as available. | |
| PED 103. RECREATIONAL SPORTS | 1 sh |
| Students learn rules, skills and strategy of a variety of recreational sports, including archery, badminton and paddle tennis. | |
| PED 105. GOLF (Beginning and Intermediate) | 1 sh |
| Students learn rules, skills and strategy of golf. Must have personal transportation. Offered fall and spring. Special fee: \$30. | |
| PED 106. BEGINNING SWIMMING AND EMERGENCY WATER SAFETY | 1 sh |
| An introduction to basic swimming techniques and general water safety instruction, including how to respond effectively in a water emergency. The goal is to create an awareness of causes and prevention of water accidents. Beginning Swimming and Emergency Water Safety certificate given. Special fee: \$13. | |
| PED 107. LIFEGUARD TRAINING | 3 sh |
| Students gain knowledge and skills for aquatic safety and non-surf life-guarding, first aid, professional rescuer CPR and head life-guarding. Students will receive Red Cross certification upon successful completion. Prerequisites: strong swimming skills. Special fee: \$28. | |
| PED 108. BASKETBALL | 1 sh |
| Students learn rules, skills and strategy of basketball. | |
| PED 109. CONDITIONING/WEIGHT TRAINING | 1 sh |
| Progressive development of physiological fitness designed to meet the needs of the individual student, including weight and cardiorespiratory training. | |
| PED 110. SOFTBALL | 1 sh |
| Students learn rules, skills and strategy of softball. | |
| PED 111. AEROBIC CONDITIONING | 1 sh |
| Students have the opportunity to improve their physical fitness level through aerobic activities using correct techniques. Offered as available. | |
| PED 112. SOCCER | 1 sh |
| Students learn rules, skills and strategy of soccer | |
| PED 113. VOLLEYBALL | 1 sh |
| Students learn rules, skills and strategy of volleyball. | |
| PED 116. OUTWARD BOUND EXPERIENCE | 1-3 sh |
| This is a course in wilderness survival, including physical survival skills, fitness, cognitive and emotional skills and study of the natural world. Offered as personnel is available or Independent Study. | |
| PED 117. EQUESTRIAN TRAINING I, BEGINNER | 1 sh |
| Students learn grooming, basic anatomy of the horse and first aid care, parts of the hoof, tacking up, mounting, dismounting, turning left and right, how to properly sit on a horse, proper use of the rider's aids, safety issues, walking and trotting on the flat and riding basic ring figures. Personal transportation, work boots, jeans and riding helmet required. Special fee \$400. Offered as available. | |
| PED 118. EQUESTRIAN TRAINING II, NOVICE | 1 sh |
| Students learn about veterinary care and disease: some breeds and colors of horses will be discussed in detail; walk, trot and canter work; ring figures, trotting poles; jumping position is introduced; refining the use of riders aids; and communication with the horse. Personal transportation, work boots, jeans and riding helmet required. Prerequisite: PED 117 or permission of instructor. Special fee \$400. Offered as available. | |

PED 125. SKILLS AND ACTIVITIES FOR TEACHING **3 sh**

Students learn skills and techniques for selected activities taught in public school physical education. Learning experiences include analyzation, organization and evaluation methods. Activities will be chosen from archery, badminton, bowling, golf, racquetball, weight training, volleyball, soccer, tennis and other team sports. As public school needs change, the curriculum for this course may be altered. Offered spring.

PED 208. WATER SAFETY INSTRUCTOR (WSI) **3 sh**

Detailed study of methods and materials used to teach Red Cross swimming and aquatics safety courses. Successful completion qualifies WSI's to teach infant and pre-school aquatics, progressive swimming courses, basic water safety and emergency water safety. Prerequisites: minimum age of 17, strong swimming skills, current certification for Emergency Water Safety or Lifeguard Training. Special fee: \$23.

PED 209. SKIN AND BASIC SCUBA DIVING **2 sh**

Students learn the art of skin and scuba diving, including the physics, physiology and mechanics of diving; safe diving practices; marine life and environment; dive planning and various aspects of sport diving. Completion of all requirements leads to P.A.D.I. open water certification. Equipment requirements: mask, fins and snorkel. Prerequisites: minimum age of 15, pass a swimming test, medical exam and payment of special fee before scuba work begins. Special fee: \$200.

PED 211. HISTORY/FOUNDATIONS OF SPORT/PHYSICAL EDUCATION **4 sh**

An introduction to the philosophical, psychological and sociological foundations and the history of physical education, including current issues, trends and the economic impact of sport and fitness on society. Offered fall.

PED 217. EQUESTRIAN TRAINING III, INTERMEDIATE **1 sh**

Students learn advanced conformation and physiology of the horse and equine nutrition. Training Level dressage tests will be covered in detail and ridden. Students will engage in more refinement of the ring figures; walk, trot, and canter work with trotting poles. An introduction to crossrails and jumping a course will complete this training. Personal transportation, work boots, jeans and riding helmet required. Prerequisite: PED 118 or Permission of instructor. Special fee \$400. Offered as available.

PED 218. EQUESTRIAN TRAINING IV, ADVANCED **1 sh**

Equine selection and training the green/unschooled horse, equine reproduction, hand galloping, gymnastic jumping, and with instructor permission, schooling the horse over varied terrain and hill work will comprise this course. Personal transportation, work boots, jeans and riding helmet required. Prerequisite: PED 217 or permission of instructor. Special fee \$400. Offered as available.

PED 265. OFFICIATING **2 sh**

This course provides a thorough study of the rules and mechanics of sport officiating. Practical experience in officiating may be provided at the community, Little League, middle school and junior varsity levels. Offered as needed.

PED 305. LEGAL ASPECTS **2 sh**

This course provides a study of the legal environment of leisure, sport, health and school organizations, emphasizing applications of tort, criminal, employment, contract, property and constitutional law. Students learn the principles of risk management and relevant applications and discuss current legislation affecting the field. Offered fall and spring.

PED 309. ADVANCED OPEN WATER SCUBA **2 sh**

The Advanced Open Water Scuba course is offered through certified and insured adjunct P.A.D.I. instructors. This course is designed to expand the knowledge base and skills acquired in PED 209. Students will complete a detailed study of all the topics covered in Basic Scuba. In addition, they will develop a knowledge base and skills for

deep diving, night diving, underwater navigation, search and recovery and rescue diving. The student will receive P.A.D.I. Certifications in Advanced Open Water and Rescue Diving upon successful completion of the course. Equipment requirements: mask, fins and snorkel. Prerequisite: P.A.D.I. Open Water Certification or equivalent. Special fee: \$275.

PED 310. MOTOR LEARNING THEORY FOR TEACHING AND COACHING **4 sh**

This course provides Physical Education teachers and coaches knowledge and understanding of how learning and optimum performance of motor skills occur. Study of the characteristics and interactions between student/athlete, teacher/coach and the learning environment coupled with synthesis of recent research, experimentation and analysis enables participants to teach motor skills efficiently. Prerequisites: PED 125, 211. Offered spring.

PED 321. BIOMECHANICS **4 sh**

Students study the musculoskeletal system and biomechanics from the point of view of Physical Education activities, exercise/sports injuries and sports skills. Laboratory activities include the use of motion analysis software for projectile analysis, gait analysis, vertical jump analysis, conservation of angular momentum, analysis of lifting and calculation of center of gravity. This course requires a two-hour laboratory. Prerequisite: Bio 161. Offered fall and spring.

PED 341. THEORY OF COACHING **2 sh**

Provides a thorough study of the role of coaches in the school and community, including coaching philosophy, ethics, relationships, motivation and responsibilities. Offered fall.

PED 360. ELEMENTARY PHYSICAL EDUCATION (K-6) **4 sh**

This class is designed to prepare students to teach physical education in grades K-6. This preparation includes knowledge of movement education, motor skills, skill analysis and pedagogy. Clinical hours in public schools are required. Offered spring.

PED 401. ADAPTED PHYSICAL EDUCATION **2 sh**

This course provides Physical Education teachers knowledge and understanding of current legislation, techniques and methods of teaching physical activities to individuals with handicapping conditions through both lecture and practical experience. Prerequisite: PED 360. Offered spring.

PED 410. ORGANIZATION AND ADMINISTRATION **4 sh**

A study of the organizational and administrative techniques needed to design and implement programs in leisure, sport and Physical Education settings, including organizational structure and theories, leadership styles, decision-making, finance management, purchasing, public relations and tournament organization. Offered spring.

PED 411. MEASUREMENT AND EVALUATION **4 sh**

Students learn to organize and interpret data from tests with and without the use of software packages. Also includes the study and administration of youth and adult physical fitness tests, sports skill tests and an overview of psychosocial testing. Prerequisites: PED 125, 211. Offered fall.

PED 491. INDEPENDENT STUDY **1-4 sh**

PED 499. RESEARCH IN PHYSICAL EDUCATION **1-4 sh**

Physics

Chair, Department of Physics: Associate Professor P. Das

Professor: F. Harris

Associate Professors: Agnew, D'Amato

Assistant Professors: Altmann, Crider, Kamela

Laboratory Manager: D. Thompson

Physics is the great intellectual web that underlies our understanding of the universe. Not only is a background in physics fundamental for all scientists, but it also develops a powerful set of mental tools that are invaluable in any field. Our majors pursue research into the mysteries of deep space, the subatomic world and the fascinating physics of everyday objects. They are also successful in business, engineering and a myriad of other careers thanks to the quality of mind that they develop while studying the most profound and engaging material there is: Physics.

One of the great strengths of Elon's Physics program is the close working relationship between faculty and students. All students are encouraged to be involved in research activities. Currently, these include a study of particle physics, the microscopic properties of crystals, simulation of mechanical and dynamical systems, the history and philosophy of science, and many other projects. The department is very interdisciplinary with experience in science pedagogy, neuroscience, computational theory, engineering, astronomy, geology and environmental studies. Majors and minors can expect a diverse and interesting range of opportunities for course work and research both within the traditional realm of physics and across disciplinary boundaries.

Our major course of study begins with a three-semester sequence that ranges from mechanics through electricity to basic nuclear physics and particle theory. Building on this base, we offer courses in the advanced theory of electromagnetic phenomena, the mysterious world of quantum mechanics and a wide range of other topical courses including classical mechanics, mathematical physics, circuit design, thermodynamics, field theory, statistical mechanics, etc.

The Department of Physics offers B.A., B.S., and Physics Engineering degrees as well as a minor in physics. All students interested in majoring or minoring in physics should take PHY 113 in the fall semester of their freshman year.

If you are fascinated by the mysteries of the universe and excited by observation, problem solving and creative thought, then the Department of Physics is the place for you.

A Bachelor of Arts degree in Physics requires the following courses:

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| PHY 113 | General Physics I with Calculus | 4 sh |
| PHY 114 | General Physics II with Calculus | 4 sh |
| PHY 213 | Introduction to Modern Physics | 4 sh |
| PHY 301 | Classical Mechanics and Dynamical Systems | 4 sh |
| PHY 311 | Classical Electrodynamics | 4 sh |
| PHY 312 | Electricity, Magnetism and Field Theory | 4 sh |
| PHY 411 | Quantum Mechanics | 4 sh |
| MTH 121 | Calculus and Analytic Geometry I | 4 sh |
| MTH 221 | Calculus and Analytic Geometry II | 4 sh |
| MTH 321 | Calculus and Analytic Geometry III | 4 sh |

TOTAL

40 sh

A Bachelor of Science degree in Physics requires the following courses:

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|--|---|------|
| PHY 113 | General Physics I with Calculus | 4 sh |
| PHY 114 | General Physics II with Calculus | 4 sh |
| PHY 213 | Introduction to Modern Physics | 4 sh |
| PHY 301 | Classical Mechanics and Dynamical Systems | 4 sh |
| PHY 311 | Classical Electrodynamics | 4 sh |
| PHY 312 | Electricity, Magnetism and Field Theory | 4 sh |
| PHY 411 | Quantum Mechanics | 4 sh |
| MTH 121 | Calculus and Analytic Geometry I | 4 sh |
| MTH 221 | Calculus and Analytic Geometry II | 4 sh |
| MTH 321 | Calculus and Analytic Geometry III | 4 sh |
| PHY 499 | Research | 1 sh |
| Choose one course from the following: | | 4 sh |
| PHY 302 | Statistical Mechanics and Thermodynamics | |
| PHY 412 | Relativity and Cosmology | |
| PHY 471 | Special Topics in Physics | |
| Competence in computer programming must be demonstrated. | | |

TOTAL **45 sh**

A Bachelor of Science degree in Engineering Physics: See requirements listed under Engineering.

A minor in Physics requires the following courses:

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|---|----------------------------------|--------------|
| PHY 113 | General Physics I with Calculus | 4 sh |
| PHY 114 | General Physics II with Calculus | 4 sh |
| PHY 213 | Introduction to Modern Physics | 4 sh |
| Select two Physics courses at the 300-400 level | | 8 sh |
| TOTAL | | 20 sh |

PHY 101. CONCEPTUAL PHYSICS **4 sh**

This course provides an introduction to the major ideas in both classical and modern Physics. Students will be introduced to experiments of the ancient Greeks, Renaissance scholars and classical natural philosophers. The formulation of gravitational and mechanical theories, thermodynamics, the particle nature of matter and aspects of elementary electromagnetism will be included. Twentieth century perspectives including the theory of relativity, quantum mechanics and chaos will be studied. Laboratory included.

PHY 102. INTRODUCTION TO ASTRONOMY **4 sh**

Astronomy examines the nature of light, astronomical instruments and our attempts to understand the origin of our solar system and its constituents: the Sun, planets, asteroids, comets and meteors. Laboratory included. Offered fall and spring.

PHY 103. INTRODUCTION TO GEOLOGY **4 sh**

This geology course includes a study of the nature and origin of rocks and minerals, evolution of the landscape, plate tectonics, coastal dynamics and geologic time. Laboratory included. Offered fall and spring.

- PHY 110. ENERGY AND THE ENVIRONMENT** 4 sh
This course provides an introduction to energy concepts and the basic modes of energy production and use, focusing on environmental problems that are a consequence of such activities. Laboratory included. Offered fall and spring.
- PHY 111, 112. GENERAL PHYSICS I AND II (each semester)** 4 sh
Designed for students majoring in the biological and/or health-related sciences, this survey of classical and modern Physics includes mechanics, waves, heat, electricity, magnetism, optics, and atomic and nuclear Physics. Labs included. Prerequisite: MTH 100 or placement exemption. Prerequisite for PHY 112: PHY 111. PHY 111 offered fall; PHY 112 offered spring.
- PHY 113, 114. GENERAL PHYSICS I AND II WITH CALCULUS (each semester)** 4 sh
This survey of topics in classical physics is designed for students majoring in math, physics or chemistry or planning to transfer into an engineering program. Topics include kinematics, dynamics, thermodynamics, electrostatics, electrodynamics and waves. Labs included. Prerequisite for PHY 114: PHY 113. Corequisite: MTH 121. PHY 113 offered fall; PHY 114 offered spring.
- PHY 117-118. FRESHMAN PHYSICS LAB**
This one-year sequence of laboratory experiences accompanies either PHY 111-112 or 113-114. PHY 117 (which must be taken at the same time as PHY 111 or 113) covers mechanical systems and thermodynamics. PHY 118 (which must be taken at the same time as PHY 112 or 114) explores the world of electricity and magnetism as well as geometrical optics. PHY 117 is taught in fall; PHY 118 is taught in spring. Corequisite PHY 111-112 or 113-114.
- PHY 211. CIRCUIT ANALYSIS** 3 sh
This course is an introduction to the theory, analysis and design of electric circuits. Studies include circuit parameters and elements: voltage, current, power, energy, resistance, capacitance and inductance. Also included is the application of Kirchhoff's laws to simple and complex circuits and the study of the steady-state and transient response of circuits to pulse, step and periodic inputs. Prerequisites: MTH 221 and PHY 114. Corequisite: EGR/PHY 212.
- PHY 212. CIRCUIT ANALYSIS LAB** 1 sh
This course involves laboratory application of concepts and principles discussed in EGR/PHY211. Corequisite: EGR/PHY 211.
- PHY 213. INTRODUCTION TO MODERN PHYSICS** 4 sh
A continuation of PHY 113 and PHY 114, this course provides further study of wave dynamics, special relativity, early quantum mechanics, wave mechanics and an introduction to solid state and nuclear physics. Laboratory included. Prerequisite: MTH 221. Offered fall.
- PHY 301. CLASSICAL MECHANICS AND DYNAMICAL SYSTEMS** 4 sh
In this introduction to Lagrangian and Hamiltonian treatments of classical mechanics students explore variational principles, conservation laws, contemporary approaches to dynamical systems and topics in chaos theory. Laboratory included. Prerequisite: PHY 114. Offered spring of alternate years.
- PHY 302. STATISTICAL MECHANICS AND THERMODYNAMICS** 4 sh
This study covers statistical methods, the concept of the ensemble and statistical averages, and explores thermodynamics using a theoretical progression from statistical analysis to thermodynamic variables. In-depth studies include conservation laws and thermodynamical variables such as entropy and free energy. Laboratory included. Prerequisite: PHY 301.

PHY 305. STELLAR ASTRONOMY **4 sh**

Stellar astronomy involves study of the universe beyond the solar system, including stars, clusters, stellar evolution, variable stars, the Milky Way and other galaxies, quasars and cosmological models. Satisfies non-laboratory General Studies requirement. No credit for Physics major or minor. Prerequisite: MTH 100 or higher. Offered winter.

PHY 310. ENGINEERING THERMODYNAMICS **4 sh**

Introduction to the concept of energy and the laws governing the transfers and transformations of energy. Emphasis on thermodynamic properties and First and Second Law analysis of systems and control volumes. Integration of these concepts into the analysis of basic power cycles is introduced. Prerequisites: MTH 321 and PHY 114.

PHY 311. CLASSICAL ELECTRODYNAMICS **4 sh**

Classical electrodynamics involves the study of electrostatics (including image methods and electric fields in the presence of dielectric media), vector analysis, continuity conditions for field quantities at interfaces, and magnetism and magnetostatics. Laboratory included. Prerequisite: PHY 213. Offered fall of alternate years.

PHY 312. ELECTRICITY, MAGNETISM AND FIELD THEORY **4 sh**

This course includes Maxwell's equations and continuation of electrodynamics and explores the natural connection of field theory and electrodynamics and basic mathematical tools, including tensor analysis. By experiments and numerical simulation, students investigate electromagnetic radiation and fields. Laboratory included. Prerequisite: PHY 311. Offered spring of alternate years.

PHY 411. QUANTUM MECHANICS **4 sh**

Study of quantum mechanics includes basic mathematical underpinnings of quantum formalisms and treats several basic problems including Hydrogen-like atoms and lasers in depth. Laboratory included. Prerequisite: PHY 301. Offered fall of alternate years.

PHY 412. RELATIVITY AND COSMOLOGY **4 sh**

This course begins by examining fundamentally electro-dynamical problems out of which special relativity was born. Students read Einstein's original paper and study the classical paradoxes in depth. Discussion of cosmological problems includes black holes, galactic red shift and early universe theory. Some aspects of the general theory of relativity are also introduced. Prerequisites: PHY 311 and 312.

PHY 471. SPECIAL TOPICS IN PHYSICS **4 sh**

These contemporary topics include, but are not limited to, chaos theory and nonlinear dynamics, solid state and condensed matter physics, optics, advanced quantum mechanics and particle physics. Prerequisite: permission of the instructor.

PHY 499. RESEARCH **1 sh**

This semester-long supervised research project involves experimental, numerical or theoretical investigation of a single problem, culminating in a detailed report describing the methods, results and analysis performed including a publication style abstract of the research. Senior majors only. Offered fall, winter and spring.