

PHYSICS

www.physics.neu.edu

SRINIVAS SRIDHAR, PHD

College of Arts and Sciences Distinguished Professor and Chair

Office: 111 Dana Research Center

Phone: 617.373.2902

Fax: 617.373.2943

E-mail contact: physics@neu.edu

Physics examines the fundamental principles that govern natural phenomena, ranging in scale from collisions of subatomic particles, through the behavior of solids, liquids, and biomolecules, to exploding stars and colliding galaxies. The program aims to help students experience the intellectual stimulation of studying physics and the excitement of frontline research; understand the basic principles and techniques of physics-related careers; and prepare for graduate study in physics or related fields.

The department offers four levels of undergraduate courses: descriptive courses for nonscience majors with limited mathematical background; general survey courses for students in scientific and engineering fields; advanced courses primarily intended for physics majors; and highly advanced courses primarily intended for prospective graduate students.

In addition to work in industrial, government, and academic high-technology laboratories in areas of applied physics, students may find opportunities in the fields of biological physics, computer science, geophysics, medical and radiation physics, and engineering. Many physics majors pursue advanced degrees in physics and related fields.

Undergraduates have the option of majoring in several programs in addition to the general physics program, including programs in applied physics, biomedical physics, and engineering physics. These programs are expanding as the need for students trained in biotechnology and nanotechnology is rapidly growing.

The biomedical physics program is relatively new. At the most basic level, biomedical physics seeks to understand the role of physical processes occurring on molecular, cellular, or macroscopic scales, in vital biological functions, ranging from the interaction of chemicals with DNA, to the extraction of oxygen from red blood cells, to the generation of complex electrical signals in the brain and nervous system. At the most practical level, biomedical physics examines how physical principles and modern instrumentation techniques can be used in medical applications.

The program in applied physics promotes study of physical processes at nanoscale dimensions. This field has many applications, including developing new green technologies, such as improving solar light-to-electricity conversion; using sunlight to split water into hydrogen and

oxygen for fuel cell technologies; building future devices for information technology such as quantum computers; and many medical applications of nanoscience to improve disease diagnosis and treatment.

An additional option is the BS/MS program in applied physics and engineering, jointly sponsored by the Department of Physics and the Department of Electrical and Computer Engineering (ECE). Students are offered strong interdisciplinary training in physics, math, and electrical engineering to achieve a BS degree in applied physics and take graduate courses in ECE in the fourth and fifth years that lead directly to an MS degree in electrical engineering.

Transferring to the Major

Same as college standards. Acceptance into the major will be based on students' meeting the department's criteria for admission and availability of space in the programs.

Academic Progression Standards

Students may not continue as physics majors beyond the end of the sophomore year unless the following courses are successfully completed:

| | | |
|---------------|------------------------------------------|------|
| PHY U161 | Physics 1 | 4 SH |
| with PHY U162 | Lab for PHY U161 | 1 SH |
| PHY U165 | Physics 2 | 4 SH |
| with PHY U166 | Lab for PHY U165 | 1 SH |
| PHY U303 | Modern Physics | 4 SH |
| PHY U305 | Thermodynamics and Statistical Mechanics | 4 SH |
| PHY U371 | Electronics | 4 SH |
| MTH U241 | Calculus 1 for Science and Engineering | 4 SH |
| MTH U242 | Calculus 2 for Science and Engineering | 4 SH |
| MTH U341 | Calculus 3 for Science and Engineering | 4 SH |
| MTH U345 | Ordinary Differential Equations | 4 SH |

or equivalent courses. *Note:* The following courses may be taken in place of PHY U161, PHY U162, PHY U165, and PHY U166:

| | | |
|---------------|---------------------------|------|
| PHY U151 | Physics for Engineering 1 | 4 SH |
| with PHY U152 | Lab for PHY U151 | 1 SH |
| PHY U155 | Physics for Engineering 2 | 4 SH |
| with PHY U156 | Lab for PHY U155 | 1 SH |

A minimum GPA of 2.500 must be achieved in these courses to remain in the major.

Students may not graduate from the physics program unless all required physics, math, and science courses are passed with a GPA of 2.500 or more. Further, no more than two grades of D+ or lower may be counted toward the graduation requirements.

BS in Physics**NU CORE REQUIREMENTS**

See page 42 for requirement list.

BREADTH COURSES FOR PHYSICS**Mathematics**

Complete the following six courses:

| | | |
|----------|-------------------------------------------|------|
| MTH U241 | Calculus 1 for Science and Engineering | 4 SH |
| MTH U242 | Calculus 2 for Science and Engineering | 4 SH |
| MTH U341 | Calculus 3 for Science and Engineering | 4 SH |
| MTH U345 | Ordinary Differential Equations | 4 SH |
| MTH U371 | Linear Algebra | 4 SH |
| MTH U481 | Probability and Statistics | 4 SH |

General Engineering

Complete one general engineering course:

| | | |
|---------|------------------------------------------------|------|
| GE U111 | Engineering Problem Solving and Computation | 4 SH |
|---------|------------------------------------------------|------|

Chemistry

Complete one introductory chemistry course with corresponding lab:

| | | |
|----------|--------------------------------|------|
| CHM U211 | General Chemistry 1 | 4 SH |
| | with CHM U212 Lab for CHM U211 | 1 SH |

Technical Electives

Complete 8 semester hours of intermediate or advanced courses from the following list:

| |
|----------------------|
| BIO U300 to BIO U699 |
| CHE U301 to CHE U699 |
| CHM U300 to CHM U699 |
| CIV U301 to CIV U699 |
| CS U300 to CS U699 |
| ECE U301 to ECE U699 |
| ENV U300 to ENV U699 |
| MIM U301 to MIM U699 |
| MTH U301 to MTH U699 |
| PHY U300 to PHY U699 |

PHYSICS MAJOR REQUIREMENTS**Introductory Physics**

Complete a lecture/lab set for Physics 1 and for Physics 2:

| | | |
|-----------|---------------------------------------|------|
| PHYSICS 1 | | |
| PHY U161 | Physics 1 | 4 SH |
| | with PHY U162 Lab for PHY U161 | 1 SH |
| | or PHY U151 Physics for Engineering 1 | 4 SH |
| | with PHY U152 Lab for PHY U151 | 1 SH |
| PHYSICS 2 | | |
| PHY U165 | Physics 2 | 4 SH |
| | with PHY U166 Lab for PHY U165 | 1 SH |
| | or PHY U155 Physics for Engineering 2 | 4 SH |
| | with PHY U156 Lab for PHY U155 | 1 SH |

Intermediate Physics

Complete the following three courses:

| | | |
|----------|---------------------------------------------|------|
| PHY U303 | Modern Physics | 4 SH |
| PHY U305 | Thermodynamics and Statistical Mechanics | 4 SH |
| PHY U371 | Electronics | 4 SH |

Advanced Physics

Complete the following five courses:

| | | |
|----------|----------------------------------|------|
| PHY U600 | Advanced Physics Laboratory 1 | 4 SH |
| PHY U601 | Classical Dynamics | 4 SH |
| PHY U602 | Electricity and Magnetism | 4 SH |
| PHY U603 | Electromagnetic Waves and Optics | 4 SH |
| PHY U617 | Quantum Mechanics | 4 SH |

Elective Course

Complete one course from the following list:

| | | |
|----------|-------------------------------------------------------|------|
| PHY U500 | Physics with Computers | 4 SH |
| PHY U606 | Mathematical and Computational Methods for Physics | 4 SH |
| PHY U611 | Astrophysics and Cosmology | 4 SH |
| PHY U613 | Particle and Nuclear Physics | 4 SH |
| PHY U614 | Condensed Matter Physics | 4 SH |
| PHY U621 | Biological Physics 1 | 4 SH |
| PHY U623 | Medical Physics | 4 SH |
| PHY U651 | Medical Physics Seminar 1 | 4 SH |
| PHY U652 | Medical Physics Seminar 2 | 4 SH |
| PHY U660 | Introduction to Nanoscience and Nanotechnology | 4 SH |

Experiential Education

Complete the following course:

| | | |
|----------|---------------------------------------|------|
| PHY U954 | Experiential Education Directed Study | 4 SH |
|----------|---------------------------------------|------|

Senior Capstone

Complete the following course:

| | | |
|----------|-------------------------------|------|
| PHY U700 | Advanced Physics Laboratory 2 | 4 SH |
|----------|-------------------------------|------|

PHYSICS MAJOR CREDIT REQUIREMENT

Complete 95 semester hours in the major.

GENERAL ELECTIVES

Additional courses taken beyond college and major course requirements to satisfy graduation credit requirements.

COOPERATIVE EDUCATION

If elected

UNIVERSITY-WIDE REQUIREMENTS

128 total semester hours required

Minimum 2.000 GPA required

BS in Applied Physics**NU CORE REQUIREMENTS**

See page 42 for requirement list.

BREADTH COURSES FOR APPLIED PHYSICS**Mathematics**

Complete the following four courses:

| | | |
|----------|-------------------------------------------|------|
| MTH U241 | Calculus 1 for Science and Engineering | 4 SH |
| MTH U242 | Calculus 2 for Science and Engineering | 4 SH |
| MTH U341 | Calculus 3 for Science and Engineering | 4 SH |
| MTH U345 | Ordinary Differential Equations | 4 SH |

General Engineering

Complete one general engineering course:

| | | |
|---------|------------------------------------------------|------|
| GE U111 | Engineering Problem Solving and Computation | 4 SH |
|---------|------------------------------------------------|------|

Chemistry

Complete one introductory chemistry course with
corresponding lab:

| | | |
|----------|--------------------------------|------|
| CHM U211 | General Chemistry 1 | 4 SH |
| | with CHM U212 Lab for CHM U211 | 1 SH |

Technical Electives

Complete 16 semester hours of intermediate or advanced
courses from the following list:

BIO U300 to BIO U699
CHE U301 to CHE U699
CHM U300 to CHM U699
CIV U301 to CIV U699
CS U300 to CS U699
ECE U301 to ECE U699
ENV U300 to ENV U699
MIM U301 to MIM U699
MTH U301 to MTH U699
PHY U300 to PHY U699

APPLIED PHYSICS MAJOR REQUIREMENTS**Introductory Physics**

Complete a lecture/lab set for Physics 1 and for Physics 2:

| | | |
|------------------|--------------------------------|------|
| PHYSICS 1 | | |
| PHY U161 | Physics 1 | 4 SH |
| | with PHY U162 Lab for PHY U161 | 1 SH |
| or PHY U151 | Physics for Engineering 1 | 4 SH |
| | with PHY U152 Lab for PHY U151 | 1 SH |
| PHYSICS 2 | | |
| PHY U165 | Physics 2 | 4 SH |
| | with PHY U166 Lab for PHY U165 | 1 SH |
| or PHY U155 | Physics for Engineering 2 | 4 SH |
| | with PHY U156 Lab for PHY U155 | 1 SH |

Intermediate Physics

Complete the following three courses:

| | | |
|----------|---------------------------------------------|------|
| PHY U303 | Modern Physics | 4 SH |
| PHY U305 | Thermodynamics and Statistical Mechanics | 4 SH |
| PHY U371 | Electronics | 4 SH |

Advanced Physics

Complete the following four courses:

| | | |
|----------|-------------------------------------------------------|------|
| PHY U600 | Advanced Physics Laboratory 1 | 4 SH |
| PHY U602 | Electricity and Magnetism | 4 SH |
| PHY U606 | Mathematical and Computational Methods for Physics | 4 SH |
| PHY U660 | Introduction to Nanoscience and Nanotechnology | 4 SH |

Advanced Physics Elective

Complete one course from the following list:

| | | |
|----------|----------------------------------|------|
| PHY U500 | Physics with Computers | 4 SH |
| PHY U601 | Classical Dynamics | 4 SH |
| PHY U603 | Electromagnetic Waves and Optics | 4 SH |
| PHY U611 | Astrophysics and Cosmology | 4 SH |
| PHY U613 | Particle and Nuclear Physics | 4 SH |
| PHY U614 | Condensed Matter Physics | 4 SH |
| PHY U617 | Quantum Mechanics | 4 SH |
| PHY U621 | Biological Physics 1 | 4 SH |
| PHY U623 | Medical Physics | 4 SH |
| PHY U651 | Medical Physics Seminar 1 | 4 SH |
| PHY U652 | Medical Physics Seminar 2 | 4 SH |

Senior Capstone and Experiential Education

Complete the following two courses:

| | | |
|----------|---------------------------------------|------|
| PHY U700 | Advanced Physics Laboratory 2 | 4 SH |
| PHY U954 | Experiential Education Directed Study | 4 SH |

APPLIED PHYSICS MAJOR CREDIT REQUIREMENT

Complete 91 semester hours in the major.

GENERAL ELECTIVES

Additional courses taken beyond college and major course
requirements to satisfy graduation credit requirements.

COOPERATIVE EDUCATION

If elected

UNIVERSITY-WIDE REQUIREMENTS

128 total semester hours required
Minimum 2.000 GPA required

BS in Biomedical Physics**NU CORE REQUIREMENTS**

See page 42 for requirement list.

BREADTH COURSES**FOR BIOMEDICAL PHYSICS MAJOR****Mathematics Courses**

Complete the following four calculus courses:

| | | |
|----------|----------------------------------------|------|
| MTH U241 | Calculus 1 for Science and Engineering | 4 SH |
| MTH U242 | Calculus 2 for Science and Engineering | 4 SH |
| MTH U341 | Calculus 3 for Science and Engineering | 4 SH |
| MTH U345 | Ordinary Differential Equations | 4 SH |

General Engineering

Complete one engineering course:

| | | |
|---------|---------------------------------------------|------|
| GE U111 | Engineering Problem Solving and Computation | 4 SH |
|---------|---------------------------------------------|------|

Biology

Complete the following two courses with corresponding labs:

| | | |
|---------------|-------------------|------|
| BIO U111 | General Biology 1 | 4 SH |
| with BIO U112 | Lab for BIO U111 | 1 SH |
| BIO U113 | General Biology 2 | 4 SH |
| with BIO U114 | Lab for BIO U113 | 1 SH |

Chemistry

Complete the following course with corresponding lab:

| | | |
|---------------|---------------------|------|
| CHM U211 | General Chemistry 1 | 4 SH |
| with CHM U212 | Lab for CHM U211 | 1 SH |

Technical Electives

Complete two intermediate or advanced courses from the following list:

| |
|----------------------|
| BIO U300 to BIO U699 |
| CHE U301 to CHE U699 |
| CHM U300 to CHM U699 |
| CIV U301 to CIV U699 |
| CS U300 to CS U699 |
| ECE U301 to ECE U699 |
| ENV U300 to ENV U699 |
| MIM U301 to MIM U699 |
| MTH U301 to MTH U699 |
| PHY U300 to PHY U699 |

BIOMEDICAL PHYSICS MAJOR REQUIREMENTS**Introductory Physics**

Complete a lecture/lab set for Physics 1 and for Physics 2:

| | | |
|---------------|---------------------------|------|
| PHYSICS 1 | | |
| PHY U161 | Physics 1 | 4 SH |
| with PHY U162 | Lab for PHY U161 | 1 SH |
| or PHY U151 | Physics for Engineering 1 | 4 SH |
| with PHY U152 | Lab for PHY U151 | 1 SH |

PHYSICS 2

| | | |
|---------------|---------------------------|------|
| PHY U165 | Physics 2 | 4 SH |
| with PHY U166 | Lab for PHY U165 | 1 SH |
| or PHY U155 | Physics for Engineering 2 | 4 SH |
| with PHY U156 | Lab for PHY U155 | 1 SH |

Intermediate Physics

Complete the following three courses:

| | | |
|----------|------------------------------------------|------|
| PHY U303 | Modern Physics | 4 SH |
| PHY U305 | Thermodynamics and Statistical Mechanics | 4 SH |
| PHY U371 | Electronics | 4 SH |

Advanced Physics

Complete the following three courses:

| | | |
|----------|----------------------------------|------|
| PHY U600 | Advanced Physics Laboratory 1 | 4 SH |
| PHY U602 | Electricity and Magnetism | 4 SH |
| PHY U603 | Electromagnetic Waves and Optics | 4 SH |

Biomedical Physics

Complete the following four courses:

| | | |
|----------|---------------------------|------|
| PHY U621 | Biological Physics 1 | 4 SH |
| PHY U623 | Medical Physics | 4 SH |
| PHY U651 | Medical Physics Seminar 1 | 4 SH |
| PHY U652 | Medical Physics Seminar 2 | 4 SH |

Senior Capstone and Experiential Education

Complete the following two courses:

| | | |
|----------|---------------------------------------|------|
| PHY U700 | Advanced Physics Laboratory 2 | 4 SH |
| PHY U954 | Experiential Education Directed Study | 4 SH |

BIOMEDICAL PHYSICS MAJOR CREDIT REQUIREMENT

Complete 101 semester hours in the major.

GENERAL ELECTIVES

Additional courses taken beyond college and major course requirements to satisfy graduation credit requirements.

COOPERATIVE EDUCATION

If elected

UNIVERSITY-WIDE REQUIREMENTS

128 total semester hours required

Minimum 2.000 GPA required

BS in Physics and Philosophy**NU CORE REQUIREMENTS**

See page 42 for requirement list.

BREADTH COURSES**Mathematics**

Complete the following four courses:

| | | |
|----------|----------------------------------------|------|
| MTH U241 | Calculus 1 for Science and Engineering | 4 SH |
| MTH U242 | Calculus 2 for Science and Engineering | 4 SH |

| | | |
|----------|--------------------------------------------------------------|------|
| MTH U341 | Calculus 3 for Science and Engineering | 4 SH |
| MTH U343 | Differential Equations and Linear Algebra for Engineering | 4 SH |

PHYSICS REQUIREMENTS FOR DUAL MAJOR

Introductory Physics

Complete a lecture/lab set for Physics 1 and for Physics 2:

PHYSICS 1

| | | |
|---------------|---------------------------|------|
| PHY U161 | Physics 1 | 4 SH |
| with PHY U162 | Lab for PHY U161 | 1 SH |
| or PHY U151 | Physics for Engineering 1 | 4 SH |
| with PHY U152 | Lab for PHY U151 | 1 SH |

PHYSICS 2

| | | |
|---------------|---------------------------|------|
| PHY U165 | Physics 2 | 4 SH |
| with PHY U166 | Lab for PHY U165 | 1 SH |
| or PHY U155 | Physics for Engineering 2 | 4 SH |
| with PHY U156 | Lab for PHY U155 | 1 SH |

Intermediate Physics

Complete the following three courses:

| | | |
|----------|---------------------------------------------|------|
| PHY U303 | Modern Physics | 4 SH |
| PHY U305 | Thermodynamics and Statistical Mechanics | 4 SH |
| PHY U371 | Electronics | 4 SH |

Advanced Physics

Complete the following three courses:

| | | |
|----------|-------------------------------|------|
| PHY U600 | Advanced Physics Laboratory 1 | 4 SH |
| PHY U602 | Electricity and Magnetism | 4 SH |
| PHY U617 | Quantum Mechanics | 4 SH |

Physics Elective

Complete one elective from the following list:

| | | |
|----------|-------------------------------------------------------|------|
| PHY U500 | Physics with Computers | 4 SH |
| PHY U606 | Mathematical and Computational Methods for Physics | 4 SH |
| PHY U611 | Astrophysics and Cosmology | 4 SH |
| PHY U613 | Particle and Nuclear Physics | 4 SH |
| PHY U614 | Condensed Matter Physics | 4 SH |
| PHY U621 | Biological Physics 1 | 4 SH |
| PHY U623 | Medical Physics | 4 SH |
| PHY U651 | Medical Physics Seminar 1 | 4 SH |
| PHY U652 | Medical Physics Seminar 2 | 4 SH |
| PHY U660 | Introduction to Nanoscience and Nanotechnology | 4 SH |

PHILOSOPHY REQUIREMENTS FOR DUAL MAJOR

Philosophy Required Courses

Complete the following four courses:

| | | |
|-------------|-----------------------|------|
| PHL U115 | Introduction to Logic | 4 SH |
| or PHL U215 | Symbolic Logic | 4 SH |
| PHL U325 | Ancient Philosophy | 4 SH |
| PHL U330 | Modern Philosophy | 4 SH |
| PHL U505 | Metaphysics | 4 SH |

Philosophy Seminar

Complete the following philosophy seminar:

| | | |
|----------|----------------------------|------|
| PHL U902 | Great Philosophers Seminar | 4 SH |
|----------|----------------------------|------|

Additional Electives

Complete four additional electives in philosophy.

PHYSICS/PHILOSOPHY INTEGRATIVE REQUIREMENTS

Complete the following two courses:

| | | |
|----------|-----------------------|------|
| PHL U510 | Philosophy of Science | 4 SH |
| PHY U601 | Classical Dynamics | 4 SH |

PHYSICS AND PHILOSOPHY MAJOR CREDIT REQUIREMENT

Complete 98 semester hours in the major.

GENERAL ELECTIVES

Additional courses taken beyond college and major course requirements to satisfy graduation credit requirements.

COOPERATIVE EDUCATION

If elected

UNIVERSITY-WIDE REQUIREMENTS

128 total semester hours required

Minimum 2.000 GPA required

BS in Computer Science and Physics

See page 279.

BSEE in Electrical Engineering and Physics

See page 304.

BS in Environmental Geology and Physics

For degree requirements, please visit the myNEU Web Portal (www.myneu.neu.edu), click on the "Self-Service" tab, then on "My Degree Audit."

BS in Geology and Physics

For degree requirements, please visit the myNEU Web Portal (www.myneu.neu.edu), click on the "Self-Service" tab, then on "My Degree Audit."

BS in Mathematics and Physics

See page 176.

BS/MS in Applied Physics and Engineering

GPA PROGRESSION REQUIREMENT

A GPA of 3.500 is required by the end of year three in order to enroll in graduate ECE courses in year four.

NU CORE REQUIREMENTS

See page 42 for requirement list.

BREADTH COURSES**Mathematics**

Complete the following four courses:

| | | |
|----------|----------------------------------------|------|
| MTH U241 | Calculus 1 for Science and Engineering | 4 SH |
| MTH U242 | Calculus 2 for Science and Engineering | 4 SH |
| MTH U341 | Calculus 3 for Science and Engineering | 4 SH |
| MTH U345 | Ordinary Differential Equations | 4 SH |

General Engineering

Complete one general engineering course:

| | | |
|---------|---------------------------------------------|------|
| GE U111 | Engineering Problem Solving and Computation | 4 SH |
|---------|---------------------------------------------|------|

Chemistry

Complete one introductory chemistry course with corresponding lab:

| | | |
|----------|----------------------------------------------------|--------------|
| CHM U211 | General Chemistry 1 with CHM U212 Lab for CHM U211 | 4 SH 1 SH |
|----------|----------------------------------------------------|--------------|

MAJOR REQUIREMENTS**Introductory Physics**

Complete a lecture/lab set for Physics 1 and for Physics 2:

| | | |
|-----------|---------------------------------------|------|
| PHYSICS 1 | | |
| PHY U161 | Physics 1 | 4 SH |
| | with PHY U162 Lab for PHY U161 | 1 SH |
| | or PHY U151 Physics for Engineering 1 | 4 SH |
| | with PHY U152 Lab for PHY U151 | 1 SH |

PHYSICS 2

| | | |
|----------|---------------------------------------|------|
| PHY U165 | Physics 2 | 4 SH |
| | with PHY U166 Lab for PHY U165 | 1 SH |
| | or PHY U155 Physics for Engineering 2 | 4 SH |
| | with PHY U156 Lab for PHY U155 | 1 SH |

Intermediate Physics

Complete the following three courses:

| | | |
|----------|------------------------------------------|------|
| PHY U303 | Modern Physics | 4 SH |
| PHY U305 | Thermodynamics and Statistical Mechanics | 4 SH |
| PHY U371 | Electronics | 4 SH |

Advanced Physics

Complete the following four courses:

| | | |
|----------|----------------------------------|------|
| PHY U600 | Advanced Physics Laboratory 1 | 4 SH |
| PHY U602 | Electricity and Magnetism | 4 SH |
| PHY U603 | Electromagnetic Waves and Optics | 4 SH |
| PHY U617 | Quantum Mechanics | 4 SH |

Experiential Education

Complete the following course:

| | | |
|----------|---------------------------------------|------|
| PHY U954 | Experiential Education Directed Study | 4 SH |
|----------|---------------------------------------|------|

Senior Capstone

Complete the following course:

| | | |
|----------|-------------------------------|------|
| PHY U700 | Advanced Physics Laboratory 2 | 4 SH |
|----------|-------------------------------|------|

Engineering Undergraduate Requirements

Complete the following three courses:

| | | |
|----------|-----------------|------|
| ECE U400 | Linear Circuits | 4 SH |
| ECE U402 | Electronics | 4 SH |
| ECE U464 | Linear Systems | 4 SH |

Engineering Graduate Requirements

Complete the following two courses:

| | | |
|----------|----------------------------------------------|------|
| ECE G200 | Linear Systems Analysis | 4 SH |
| ECE G204 | Applied Probability and Stochastic Processes | 4 SH |

Engineering Graduate Electives

Complete six courses from the ECE graduate department.

APPLIED PHYSICS AND ENGINEERING MAJOR CREDIT REQUIREMENT

Complete 115 semester hours in the major.

GENERAL ELECTIVES

Additional courses taken beyond college and major course requirements to satisfy graduation credit requirements.

COOPERATIVE EDUCATION

If elected

UNIVERSITY-WIDE REQUIREMENTS

160 total semester hours required

Minimum 3.000 GPA required

Minor in Physics**REQUIRED COURSES**

Complete one of the following sequences with corresponding labs, as indicated:

Physics 1 and 2

| | | |
|----------|--------------------------------|------|
| PHY U161 | Physics 1 | 4 SH |
| | with PHY U162 Lab for PHY U161 | 1 SH |
| PHY U165 | Physics 2 | 4 SH |
| | with PHY U166 Lab for PHY U165 | 1 SH |

Physics for Engineering 1 and 2

| | | |
|----------|--------------------------------|------|
| PHY U151 | Physics for Engineering 1 | 4 SH |
| | with PHY U152 Lab for PHY U151 | 1 SH |
| PHY U155 | Physics for Engineering 2 | 4 SH |
| | with PHY U156 Lab for PHY U155 | 1 SH |

ELECTIVE COURSES

Complete three courses from the following list:

| | | |
|----------|----------------------------------------------------|------|
| PHY U303 | Modern Physics | 4 SH |
| PHY U305 | Thermodynamics and Statistical Mechanics | 4 SH |
| PHY U371 | Electronics | 4 SH |
| PHY U600 | Advanced Physics Laboratory 1 | 4 SH |
| PHY U601 | Classical Dynamics | 4 SH |
| PHY U602 | Electricity and Magnetism | 4 SH |
| PHY U603 | Electromagnetic Waves and Optics | 4 SH |
| PHY U606 | Mathematical and Computational Methods for Physics | 4 SH |

| | | |
|----------|---------------------------------------------------|------|
| PHY U611 | Astrophysics and Cosmology | 4 SH |
| PHY U613 | Particle and Nuclear Physics | 4 SH |
| PHY U614 | Condensed Matter Physics | 4 SH |
| PHY U621 | Biological Physics 1 | 4 SH |
| PHY U623 | Medical Physics | 4 SH |
| PHY U660 | Introduction to Nanoscience and Nanotechnology | 4 SH |

GPA REQUIREMENT

2.000 GPA required in the minor