

B.S. IN ELECTRICAL ENGINEERING

Code	Title	Credits
Major in Electrical Engineering (B.S.)		
ENR 160	Introduction to Engineering	3
ENR/PHY 260	Careers in Engineering and Physics Seminar	1
ENR 306 & ENR 307	Digital Logic and Design and Digital Logic and Design Lab	4
ENR 316 & ENR 317	Analog Circuitry and Design and Analog Circuitry & Design Lab	4
ENR/PHY 320	Mathematical Methods in Physics and Engineering	4
ENR 326	Circuit Analysis & Simulations	4
ENR 336	Signals and Systems	4
ENR/PHY 352	Computer Methods in Physics and Engineering	3
ENR/PHY 353	Computer Methods in Physics and Engineering Lab	1
ENR 424 & ENR 425	Electronic Materials and Devices and Electronic Materials and Devices Laboratory	4
PHY 292 & PHY 292D	General Physics I and General Physics I Lab	4
PHY 296 & PHY 297	General Physics II and General Physics II Lab	4
PHY 302 & PHY 303	Electronics and Electronics Lab	4
PHY 312 & PHY 313	Modern Physics and Modern Physics Lab	4
PHY 400	Electricity and Magnetism	4
Choose one course from Optical Science:		4
PHY 332 & PHY 333	Optics and Optics Lab	
PHY 432 & PHY 433	Laser Fundamentals and Laser Fundamentals Lab	
COS 205	Scientific Computing	3
ENR 436 & ENR 437	Microprocessors and Microprocessors Lab	4
ENR 446 & ENR 447	Control Systems and Control Systems Lab	4
ENR 465	Engineering Design Seminar	1
ENR 490	Engineering Design Project	3
MAT 124M	Calculus 1 ¹	4
MAT 125	Calculus 2	4
MAT 223	Multivariable Calculus	3
MAT 224	Differential Equations with Linear Algebra	4

B.S. in Electrical Engineering 2

Code	Title	Credits
Major		86
General Education		42-43
Total Credits		128-129

¹ MAT 123M or successful completion of the Math and Computer Science department placement exam is a prerequisite for this course.

Courses whose number is followed by a letter fulfill a General Education requirement.

Students may not declare a B.S. in Electrical Engineering and a Minor in Engineering.

ENR 160 • Introduction to Engineering 3 Credits

Introduction to engineering fields, practicing engineers, engineering work, and the tools that engineers use. Topics such as process and methodology, statistical analysis, and the use of computer software (e.g., CAD) in the development of specifications, design, and prototyping. Emphasis on the ethics and responsibilities of the engineering process.

Offered: Interim.

ENR 260 • Careers in Engineering and Physics Seminar 1 Credit

Developing careers in high-technology fields such as engineering and physics. Explores the wide variety of specific careers possible through video, lecture, tours, and guest speakers. Develops practical professional skills such as writing resumes and cover letters, accumulating connections and experience, and techniques for interviewing.

Prerequisites: PHY 296/PHY 297. Offered: Fall. Special Notes: Carries cross-credit in physics.

ENR 265 • Computer Aided Design and Engineering 3 Credits

An introduction to computer aided design tools and techniques. Emphasizes the generation of engineering graphics necessary for the engineering design process, such as two-dimensional drawing and three-dimensional modeling. Advanced topics may include simulation modeling, parametric modeling, and manufacturing considerations.

Offered: Interim. Special Notes: ENR 160 is a recommended prerequisite.

ENR 304 • Engineering Materials and Manufacturing 3 Credits

Introductory course helping students to understand material properties and selection for engineering applications. Topics related to materials and their characteristics; design-based material selection; crystallography; material properties; fracture; fatigue; phase diagrams; engineering alloys; forming, separation, and shaping as manufacturing process for materials; processing of materials according to their properties; surface treatments.

Prerequisites: MAT 125; CHE 113/CHE 113D or CHE 208/CHE 208D; PHY 292/PHY 292D. Corequisites: Concurrent enrollment in ENR 305 is required. Offered: Fall, odd # years.

ENR 305 • Engineering Materials and Manufacturing Lab 1 Credit

Laboratory experience accompanying ENR 304 .

Corequisites: Concurrent enrollment in ENR 304 is required. Offered: Fall, odd # years.

ENR 306 • Digital Logic and Design 3 Credits

Topics may include Boolean algebra, design and optimization of combinational and sequential logic, the use of programmable logic devices such as FPGA, VHDL or Verilog modeling, and an introduction to processors and memory. Extensive lab experience in the simulation, design, construction and testing of digital circuits.

Prerequisites: PHY 302/PHY 303 and MAT 125. Corequisites: Concurrent enrollment in ENR 307 is required. Offered: Spring, even # years.

ENR 307 • Digital Logic and Design Lab 1 Credit

Lab experience accompanying ENR 306 .

Corequisites: Concurrent enrollment in ENR 306 is required. Offered: Spring, even # years.

ENR 308 • Statics and Mechanics of Materials 4 Credits

Force and moment vectors, equilibrium of rigid bodies in two and three dimensions; trusses, friction, centroids, and moments of inertia. Linear elasticity; introduction to stress and strain analysis applied to beams, vessels, pipes, and combined loading; stress and strain; axial, flexural, and torsional deflections for linear elastic materials.

Prerequisites: MAT 223 (may be taken concurrently) and PHY 292/PHY 292D. *Offered:* Spring, odd # years.

ENR 316 • Analog Circuitry and Design 3 Credits

Feedback principles and electronic circuit theory and device theory applied to multistage transistor amplifiers. Detailed study of operational amplifiers. Power supply design. Nonlinear circuits. Introduction to filter theory. Introduction to noise analysis and low noise design. Circuit design and construction experience emphasized in projects and the laboratory.

Prerequisites: PHY 302; PHY 303; [MAT 222 or MAT 224 (may be taken concurrently)] *Corequisites:* Concurrent enrollment in ENR 317 is required. *Offered:* Fall, odd # years.

ENR 317 • Analog Circuitry & Design Lab 1 Credit

Lab experience accompanying ENR 316.

Corequisites: Concurrent enrollment in ENR 316 is required. *Offered:* Fall, odd # years.

ENR 318 • Engineering Thermal Science 3 Credits

Fundamental laws of thermodynamics. Energy transfer modes. The properties, equations of state, processes, and cycles for reversible/irreversible thermodynamic systems. Equations for conservation of mass and energy, plus entropy balances. Application of thermodynamic principles to modern engineering systems.

Prerequisites: PHY 292/PHY 292D and MAT 223. *Offered:* Spring, even # years.

ENR 320 • Mathematical Methods in Physics and Engineering 4 Credits

Development of skill in mathematical techniques useful in the solution of physics and engineering problems. Included are vector analysis; line and surface integrals; Fourier analysis; partial differential equations; and probability and statistics.

Prerequisites: [MAT 222 or MAT 224 (may be taken concurrently)] and MAT 223. *Offered:* Fall. *Special Notes:* Carries cross-credit in physics.

ENR 326 • Circuit Analysis & Simulations 4 Credits

Circuit analysis techniques as applied to: sinusoidal steady state analysis with power calculations, first and second order transient analysis in both time and Laplace domains, three-phase circuits and magnetically coupled circuits. Additional topics include: frequency response, resonance, filters, Bode plots. Simulation of electrical and electronic circuits will be emphasized.

Prerequisites: [MAT 222 or MAT 224 (May be taken concurrently)] and PHY 302 and PHY 303. *Offered:* Spring, odd # years.

ENR 336 • Signals and Systems 4 Credits

Continuous-and discrete-time signals and systems. Topics include: definitions and properties of signals and systems, convolution, solution of differential and difference equations, Laplace and Z transforms, and Fourier analysis. Emphasis is on applications to signal processing, communication and control systems.

Prerequisites: MAT 222 or MAT 224; PHY 302/PHY 303; ENR 352/PHY 352/ENR 353/PHY 353. *Offered:* Fall, even # years. *Special Notes:* This course carries cross-credit with physics.

ENR 340 • Mechanics 4 Credits

Particle and rigid body dynamics, conservative and nonconservative forces, central forces, accelerated coordinate systems, and Lagrange's equations of motion.

Prerequisites: PHY 296/PHY 297 with a C grade or higher; MAT 223. *Offered:* Fall. *Special Notes:* Carries cross credit in physics.

ENR 348 • Heat Transfer 3 Credits

Further development of the understanding of thermodynamics, fluid mechanics, mathematics, and physics. Problems in heat transfer and system design are emphasized for systems in which thermal transport processes are important.

Prerequisites: ENR 318 and MAT 222 or MAT 224. *Offered:* Spring, odd # years.

B.S. in Electrical Engineering 4

ENR 352 • Computer Methods in Physics and Engineering 3 Credits

Application of the computer to solve applied problems of interest to physicists and engineers. Computer techniques are developed for numerical methods, simulation models, and data acquisition and control in the laboratory.

Prerequisites: COS 205 and MAT 223 or MAT 224 (both recommended) and PHY 296/PHY 297 (with a grade of C or better) or Consent of instructor. Corequisites: Concurrent enrollment in ENR 353 is required. Offered: Spring. Special Notes: PHY 302/PHY 303 is a recommended prerequisite. Carries cross-credit in physics.

ENR 353 • Computer Methods in Physics and Engineering Lab 1 Credit

Laboratory experience accompanying ENR 352.

Corequisites: Concurrent enrollment in ENR 352 is required. Offered: Spring. Special Notes: Carries cross-credit in physics.

ENR 356 • Applied Strength of Materials 3 Credits

How the fundamental concepts of stress, strain, and deformation associated with mechanical loading are used in mechanical design. Topics include axial tensile and compressive effects, torsion, and bending; stress-strain relationships, safety factor, beam deflection methods, buckling, failure prevention theories for ductile and brittle materials, fatigue-life methods and fatigue failure criteria.

Prerequisites: ENR 265; ENR 304/ENR 305 (may be taken concurrently); ENR 308; MAT 223. Offered: Fall, odd # years.

ENR 358 • Design of Mechanical Components 3 Credits

Emphasizes product design. Developing a mechanical component design problem. Selecting standard mechanical components such as bearings, gears, springs, and fasteners. Analysis and synthesis of motion in machines. Displacement, velocity, and acceleration of mechanisms. Introduction to lubrication theory, flexible mechanical elements, and power transmissions.

Prerequisites: ENR 356 (PHY 340 is a recommended prerequisite). Corequisites: Concurrent enrollment in ENR 359 is required. Offered: Spring, even # years.

ENR 359 • Design of Mechanical Components Lab 1 Credit

Laboratory experience accompanying ENR 358.

Corequisites: Concurrent enrollment in ENR 358 is required. Offered: Spring, even # years.

ENR 402 • Mechanical Measurements Lab 3 Credits

A laboratory course focused on careful measurements of physical properties such as temperature, pressure, stress, force, emissivity, and vibration modes. Emphasis is placed on experimental methods, statistical estimates of experimental uncertainty, methods of calibration, transducers for mechanical measurement, data acquisition and processing. Appropriate written and oral presentations of measurements.

Prerequisites: ENR 304/ENR 305; MAT 223; PHY 296/PHY 297. Offered: Spring, even # years.

ENR 420 • Software Process 3 Credits

Balancing the various real-world challenges that a software engineer encounters, including ambiguity, conflicting requirements, task-time estimation, team dynamics, requests from customers, product managers or architects. A team-based software project on a modern computer science topic will be developed during the semester.

Prerequisites: COS 216. Special Notes: Carries cross credit with computer science. ENR 477 is a recommended prerequisite. Offered: Spring, odd # years.

ENR 422 • Fluid Mechanics 3 Credits

Laws of statics, kinematics, and dynamics applied to fluid mechanics. Integral and differential conservation laws for mass, momentum, and energy. Dimensional analysis, viscous pipe flow, boundary layers, separated flows, and potential flow.

Prerequisites: MAT 223 and PHY 296/PHY 297 (with a grade of C or better) or Consent of instructor. Corequisites: Concurrent enrollment in ENR 423 is required. Special Notes: Carries cross-credit in physics. Offered: Fall.

ENR 423 • Fluid Mechanics Lab 1 Credit

Laboratory experience accompanying ENR 422.

Corequisites: Concurrent enrollment in ENR 422 is required. Offered: Fall. Special Notes: Carries cross-credit in physics.

ENR 424 • Electronic Materials and Devices 3 Credits

Theory and application of condensed matter and materials. Physical origin of electrical, optical, mechanical, thermal, and magnetic properties. Emphasis on devices such as pn junction diodes, LEDs, piezoelectrics, and sensors. An accompanying lab explores characterization of materials and the design, fabrication, and testing of devices.

Prerequisites: PHY 302/PHY 303 or PHY 312/PHY 313. Corequisites: Concurrent enrollment in ENR 425 is required. Offered: Fall, even # years. Special Notes: Carries cross-credit in physics.

ENR 425 • Electronic Materials and Devices Laboratory 1 Credit

Laboratory component of ENR 424 .

Corequisites: Concurrent enrollment in ENR 424 required. Offered: Fall, even # years. Special Notes: Carries cross-credit in physics.

ENR 436 • Microprocessors 3 Credits

Advanced principles of microcomputer hardware and software. Topics include computer organization, instruction sets and addressing modes, assembly language programming, arithmetic and logic operations, input/output, buffers, interrupts and special purpose features such as A/D converters.

Prerequisites: ENR 306 and ENR 307. Corequisites: Concurrent enrollment in ENR 437 is required. Offered: Fall, even # years.

ENR 437 • Microprocessors Lab 1 Credit

Lab experience accompanying ENR 436.

Corequisites: Concurrent enrollment in ENR 436 is required. Offered: Fall, even # years.

ENR 446 • Control Systems 3 Credits

Time and frequency domain representation of feedback control systems. Topics include: stability criteria, root locus methods, frequency response techniques, digital implementation and hardware considerations.

Prerequisites: PHY 302/PHY 303; MAT 222 or MAT 224 (may be taken concurrently). Corequisites: Concurrent enrollment in ENR 447 is required. Offered: Spring, odd # years.

ENR 447 • Control Systems Lab 1 Credit

Lab experience accompanying ENR 446.

Corequisites: Concurrent enrollment in ENR 446 is required. Offered: Spring, odd # years.

ENR 450 • Topics in Physics and Engineering 3-4 Credits

Topics selected from various fields of engineering and physics for the purpose of illustrating the practical application of physical principles. Emphasis on developing the skills and viewpoints commonly used by engineers and physicists. The field of engineering or physics is announced prior to registration.

Prerequisites: Related courses as specified. Repeatable course: Course may be repeated when a different topic is emphasized. Special Notes: Carries cross-credit in physics. Offered: Occasionally.

ENR 465 • Engineering Design Seminar 1 Credit

Prepares students for engineering practice through a major design experience. Design projects have a major engineering component to them and are intentionally multi-disciplinary in nature. Students work in teams to design a system to meet a given specification that requires the incorporation of relevant engineering standards.

Prerequisites: Senior standing and a declared major in engineering. Offered: Fall.

B.S. in Electrical Engineering 6

ENR 477 • Software Engineering 3 Credits

Formal approach to the design and development of software. Design methodologies include object-oriented design, components, design patterns, and event-driven design. Project management, walkthroughs, documentation, team programming, and the development of a significant software project.

Prerequisites: COS 216. Offered: Fall, odd # years. Special Notes: Carries cross credit with computer science.

ENR 490 • Engineering Design Project 3 Credits

Prepares students for engineering practice through a major design and prototyping experience. The design produced in ENR 465 will be the basis for building a prototype system. The prototype will incorporate relevant engineering standards. Final designs and prototypes are documented in a professional manner and presented publicly.

Prerequisites: ENR 465. Offered: Spring.

PHY 102 • Physics of Everyday Life 3 Credits

Explores how physics concepts can be used to understand everyday phenomena in the world around us. Topics include mechanics, waves (including sound and light), thermodynamics, and atomic and nuclear physics. Lecture demonstrations and laboratories stress a clear understanding of observed phenomena.

Corequisites: Concurrent registration in PHY 102D is required. Offered: Interim.

PHY 102D • Physics of Everyday Life-Lab 1 Credit

Laboratory experience accompanying PHY 102.

Corequisites: Concurrent registration in PHY 102 is required. Offered: Interim.

PHY 112 • Introduction to Astronomy 3 Credits

The concepts, techniques, and tools of astronomy and astrophysics for nonscience students. Includes historical overview; identification of constellations; telescopes; the nature of light, atomic spectra, and structure; the nuclear physics of stars; the life cycle of stars; and current theories of the fate of the universe.

Corequisites: Concurrent registration in PHY 112D is required. Offered: Fall.

PHY 112D • Introduction to Astronomy Lab 1 Credit

Laboratory experience accompanying PHY 112. Includes optics, atomic spectra, and observations with simple instruments and telescopes.

Corequisites: Concurrent registration in PHY 112 is required. Offered: Fall.

PHY 202 • Introductory Physics I 3 Credits

Mechanics, thermal properties of matter and mechanical waves.

Prerequisites: MAT 123M, MAT 124M, or solid understanding and competency in high school mathematics as demonstrated by at least one of the following: a Math ACT score of at least 23, 519 on the Math portion of the SAT, a Math Placement Test score of at least 3. Corequisites: Concurrent registration in PHY 202D is required. Offered: Fall.

PHY 202D • Introductory Physics I Lab 1 Credit

Laboratory experience accompanying PHY 202.

Corequisites: Concurrent registration in PHY 202 is required. Offered: Fall.

PHY 206 • Introductory Physics II 3 Credits

Electricity and magnetism, sound waves, optical phenomena, and modern physics.

Prerequisites: PHY 202/PHY 202D. Corequisites: Concurrent registration in PHY 207 is required. Offered: Spring.

PHY 207 • Introductory Physics II Lab 1 Credit

Laboratory experience accompanying PHY 206.

Corequisites: Concurrent registration in PHY 206 is required. Offered: Spring.

PHY 260 • Careers in Engineering and Physics Seminar 1 Credit

Developing careers in high-technology fields such as engineering and physics. Explores the wide variety of specific careers possible through video, lecture, tours, and guest speakers. Develops practical professional skills such as writing resumes and cover letters, accumulating connections and experience, and techniques for interviewing.

Prerequisites: PHY 296/PHY 297. Offered: Fall. Special Notes: Carries cross-credit in engineering.

PHY 292 • General Physics I 3 Credits

Kinematics, mechanics, oscillations, fluids, and conservation principles.

Prerequisites: MAT 124M (may be taken concurrently). Corequisites: Concurrent registration in PHY 292D is required. Offered: Fall.

PHY 292D • General Physics I Lab 1 Credit

Laboratory experience accompanying PHY 292.

Corequisites: Concurrent registration in PHY 292 is required. Offered: Fall.

PHY 296 • General Physics II 3 Credits

Electricity, magnetism, thermodynamics, sound waves, and optics.

Prerequisites: PHY 292/PHY 292D (with a grade of C or better); MAT 125 (may be taken concurrently).

Corequisites: Concurrent registration in PHY 297 is required. Offered: Spring.

PHY 297 • General Physics II Lab 1 Credit

Laboratory experience accompanying PHY 296.

Corequisites: Concurrent registration in PHY 296 is required. Offered: Spring.

PHY 302 • Electronics 3 Credits

Fundamentals of digital and analog electronics intended for scientists and engineers.

Prerequisites: PHY 296/PHY 297 with C grade or higher and MAT 125 or Consent of instructor. Corequisites: Concurrent registration in PHY 303 is required. Offered: Fall.

PHY 303 • Electronics Lab 1 Credit

Laboratory experience accompanying PHY 302. Extensive laboratory exercises and a choice of projects provide hands-on experience with circuits using transistors, operational amplifiers, logic gates, flip-flops, and other devices.

Prerequisites: PHY 296/PHY 297 with C grade or higher and MAT 125 or Consent of instructor. Corequisites: Concurrent registration in PHY 302 is required. Offered: Fall.

PHY 312 • Modern Physics 3 Credits

Relativity, quantum theory, introductory wave mechanics, nuclear processes, elementary particles, and cosmology.

Prerequisites: PHY 296/PHY 297 with C grade or higher and MAT 223. Corequisites: Concurrent registration in PHY 313 is required. Offered: Spring.

PHY 313 • Modern Physics Lab 1 Credit

Laboratory experience accompanying PHY 312.

Corequisites: Concurrent registration in PHY 312 is required. Offered: Spring.

PHY 320 • Mathematical Methods in Physics and Engineering 4 Credits

Development of skill in mathematical techniques useful in the solution of physics and engineering problems. Included are vector analysis; line and surface integrals; Fourier analysis; partial differential equations; and probability and statistics.

Prerequisites: MAT 222 or MAT 224 (may be taken concurrently) and MAT 223. Offered: Fall. Special Notes: Carries cross-credit in engineering.

PHY 332 • Optics 3 Credits

Principles of geometrical and physical optics.

Prerequisites: PHY 312/PHY 313 and MAT 223. Corequisites: Concurrent registration in PHY 333 is required. Offered: Spring, even # years.

PHY 333 • Optics Lab 1 Credit

Laboratory experience accompanying PHY 332 emphasizing physical optics measurements, laser technology, and holography.

Corequisites: Concurrent registration in PHY 332 is required. Offered: Spring, even # years.

PHY 336 • Signals and Systems 4 Credits

Continuous- and discrete-time signals and systems. Topics include: definitions and properties of signals and systems, convolution, solution of differential and difference equations. Laplace and Z transforms, and Fourier analysis. Emphasis is on applications to signal processing, communication, and control systems.

Prerequisites: MAT 222 or MAT 224; PHY 302/PHY 303; ENR/PHY 352/PHY 353. Offered: Fall, even # years.

Special Notes: This course carries cross-credit with engineering.

PHY 340 • Mechanics 4 Credits

Particle and rigid body dynamics, conservative and nonconservative forces, central forces, accelerated coordinate systems, and Lagrange's equations of motion.

Prerequisites: PHY 296/PHY 297 with C grade or higher; MAT 223. Offered: Fall. Special Notes: Carries cross credit in engineering.

PHY 352 • Computer Methods in Physics and Engineering 3 Credits

Application of the computer to solving applied problems of interest to physicists and engineers. Computer techniques are developed for numerical methods, simulation models, and data acquisition and control in the laboratory.

Prerequisites: COS 205 and MAT 223 or MAT 224 (both recommended) and PHY 296/PHY 297 with C grade or higher or Consent of instructor. Corequisites: Concurrent registration in PHY 353 is required. Offered: Spring.

Special Notes: Carries cross-credit in engineering and PHY 302/PHY 303 is a recommended prerequisite.

PHY 353 • Computer Methods in Physics and Engineering Lab 1 Credit

Laboratory experience accompanying PHY 352.

Corequisites: Concurrent registration in PHY 352 is required. Offered: Spring. Special Notes: Carries cross-credit in engineering.

PHY 365 • Physics Research Seminar 1 Credit

An introduction to research in physics and the development of scientific writing skills. Emphasis placed on preparing for departmental research experiences such as PHY 490 and external research experiences such as those found in industry, summer fellowship programs, and graduate schools.

Prerequisites: PHY 260; PHY 312/PHY 313; Junior standing; A major in the Physics and Engineering department. Offered: Spring.

PHY 400 • Electricity and Magnetism 4 Credits

Electrostatics and magnetostatics, electric and magnetic fields in free space and in materials, electromagnetic waves, and transmission lines.

Prerequisites: PHY 296/PHY 297 with C grade or higher; MAT 222 or MAT 224; MAT 223. Offered: Fall, odd # years.

PHY 410 • Thermodynamics 4 Credits

Laws of thermodynamics, conditions for thermodynamic equilibrium, and fundamentals of statistical mechanics.

Prerequisites: PHY 296/PHY 297 with C grade or higher and MAT 223. Offered: Spring, odd # years. Special Notes: PHY 312/PHY 313 is strongly recommended as a prerequisite.

PHY 422 • Fluid Mechanics 3 Credits

Laws of statics, kinematics, and dynamics applied to fluid mechanics. Integral and differential conservation laws for mass, momentum, and energy. Dimensional analysis, viscous pipe flow, boundary layers, separated flows, and potential flow.

Prerequisites: PHY 296/PHY 297 with C grade or higher and MAT 223. Corequisites: Concurrent registration in PHY 423 is required. Offered: Fall. Special Notes: Carries cross-credit in engineering.

PHY 423 • Fluid Mechanics Lab 1 Credit

Laboratory experience accompanying PHY 422.

Corequisites: Concurrent registration in PHY 422 required. Offered: Fall. Special Notes: Carries cross-credit in engineering.

PHY 424 • Electronic Materials and Devices 3 Credits

Theory and application of condensed matter and materials. Physical origin of electrical, optical, mechanical, thermal, and magnetic properties. Emphasis on devices such as pn junction diodes, LEDs, piezoelectrics, and sensors. An accompanying lab explores characterization of materials and the design, fabrication, and testing of devices.

Prerequisites: PHY 302/PHY 303 or PHY 312/PHY 313. Corequisites: Concurrent registration in PHY 425 is required. Offered: Fall, even # years. Special Notes: Carries cross-credit in engineering.

PHY 425 • Electronic Materials and Devices Laboratory 1 Credit

Laboratory component of PHY 424.

Corequisites: Concurrent registration in PHY 424 required. Offered: Fall, even # years. Special Notes: Carries cross-credit in engineering.

PHY 432 • Laser Fundamentals 3 Credits

Properties and types of lasers; lasing dynamics; modern applications.

Prerequisites: PHY 312/PHY 313 and MAT 223. Concurrent registration in PHY 433 is required. Offered: Spring, odd # years.

PHY 433 • Laser Fundamentals Lab 1 Credit

Laboratory experience accompanying PHY 432.

Corequisites: Concurrent registration in PHY 432 is required. Offered: Spring, odd # years.

PHY 440 • Quantum Mechanics 4 Credits

Concepts and techniques of quantum mechanics.

Prerequisites: PHY 312/PHY 313; MAT 222 or MAT 224; MAT 223. Offered: Fall, even # years.

PHY 450 • Topics in Physics and Engineering 3-4 Credits

Topics selected from various fields of engineering and physics for the purpose of illustrating the practical application of physical principles. Emphasis on developing the skills and viewpoints commonly used by engineers and industrial physicists. The field of engineering or physics is announced prior to registration.

Prerequisites: Related courses as specified. Repeatable course: Course may be repeated when a different topic is emphasized. Special Notes: Carries cross-credit in engineering. Offered: Occasionally.

PHY 481 • Internship in Physics 1-4 Credits

A practical experience in an off-campus professional setting in which the student applies the skills and perspectives of a physicist. Designed by student in consultation with a faculty member.

Prerequisites: Major in applied physics or physics and Junior or senior standing. Offered: Fall, Spring.

PHY 490 • Research 3 Credits

An opportunity for individual student projects under the supervision of the faculty.

Prerequisites: Senior standing; PHY 365; Major in Physics and Engineering department. Offered: Fall, Spring.