EDUC 302: Understanding Exceptional Individuals (3)

Prerequisites: Sophomore standing; EDUC 200 and/or POV 101. This course addresses education for exceptional individuals by examining the key issues surrounding instruction for children and adolescents with disabilities or special talents. Students study the identification, etiology, and incidence of exceptionality. Through case-study review and individual research projects, students investigate the educational, social, and cultural dimensions of life in American society for exceptional individuals. Required for teacher licensure in Virginia. *Ojure.*

Fall, Winter

ENGINEERING (ENGN)

(Department of Physics and Engineering)

PROFESSORS **VAN NESS,** WILLIAMS
ASSISTANT PROFESSORS KUEHNER, MAZILU

MAJORS

Reminder: Majors leading to a Bachelor of Science degree from The College require at least 50 credits total in the natural sciences, mathematics, and computer science.

A **major in physics-engineering** leading to a Bachelor of Science degree requires completion of at least 47 credits, no more than three of which may be from 400-level courses, and including the following:

1. ENGN 203, 204, 207 (PHYS 207), 225 (PHYS 225), 240 (PHYS 240), 301, 311, 351; MATH 332; and PHYS 111, 112, 113, 114
2. Three additional credits from 200-level courses in engineering
3. Three additional credits from 300-level courses in engineering
4. Six additional credits from courses numbered 200 or above in biology, chemistry, computer science, engineering, geology, or physics; from Mathematics 300 or above; or from CHEM 111, 112; CSCI 121.

Additional courses required as prerequisites for completion of the above include MATH 101, 102, and 221.

A **major in chemistry-engineering** leading to a Bachelor of Science degree requires completion of at least 47 credits, no more than three credits of which may be from 400-level courses, and including the following:

1. CHEM 241 or 241S
2. CHEM 242; ENGN 203, 204, 240 (PHYS 240), 311; MATH 221, 332; PHYS 111, 112, 113, 114
3. CHEM 260 or 261
4. Eight additional credits chosen from courses numbered 200 or above in biology, chemistry, engineering, and physics. No more than three of these credits may be numbered 400 or above.

Additional courses required as prerequisites for completion of the above include CHEM 111 and 112 and MATH 101 and 102.

HONORS: An Honors Program in engineering is offered for qualified students; see department head for details.

ENGN 100 (PHYS 100): Computing in Physics and Engineering (1)

Pass/Fail only. Prerequisite: Permission of the instructor. An introduction to the use of computing tools essential to degree work in physics and engineering. Students are instructed in the use of microcomputers, the university network, word processing, spreadsheets, computer algebra packages, and advanced symbolic mathematics tools. *Staff.*

Offered when interest is expressed and departmental resources permit.

ENGN 101: How It Works, How It's Made (3)
Designed for non-science and non-major students. An introduction to the engineering and science behind devices that students use or are exposed to everyday. Contemporary equipment and technology, along with their applications, are presented first, gaining familiarity with a subject before studying the underlying scientific aspects. By investigating "how it works," students become aware of fundamental physical principles. Examining "how it's made," students are exposed to the engineering design criteria which govern all manufactured objects. (SC, GE5c) *Kuehner.*
Offered when interest is expressed and departmental resources permit.

ENGN 160: CADD: Computer-Aided Drafting and Design (3)
Prerequisite: MATH 102 with C or better. An introduction to engineering and architectural drawing using a CADD program. Basic orthographic projection, pictorials, and assembly drawings. Introduction to the use of solid modeling in three dimensions. (SC, GE5c) *Kuehner.*
Offered when interest is expressed and departmental resources permit.

ENGN 203: Mechanics I: Statics (3)
Prerequisite: MATH 102. Pre- or corequisite: PHYS 111. The science of mechanics is used to study bodies in equilibrium under the action of external forces. Emphasis is on problem solving: trusses, frames and machines, centroids, area moments of inertia, beams, cables, and friction. *Van Ness.*
Fall

ENGN 204: Mechanics II: Dynamics (3)
Prerequisite: ENGN 203. A study of kinetics of particles and rigid bodies including force, mass, acceleration, work, energy, momentum. A student may not receive degree credit for both ENGN 204 and PHYS 230. *Kuehner.*
Winter

ENGN 207 (PHYS 207): Electrical Circuits (4)
Prerequisite: ENGN/PHYS 225. A detailed study of electrical circuits and the methods used in their analysis. Basic circuit components, as well as devices such as operational amplifiers, are investigated. The laboratory acquaints the student both with fundamental electronic diagnostic equipment and with the design and behavior of useful circuits. Laboratory course. *Sukow.*
Fall

ENGN 208 (PHYS 208): Electronics (3)
Prerequisite: ENGN/PHYS 207. An introduction to basic analog and digital electronics. Topics may include diodes, transistors, logic gates, flip-flops, counters and timers, and phase-locked loops. The integrated laboratory component of this course acquaints the student with the design of basic analog and digital circuits, and with the diagnostic techniques used to study these circuits. Laboratory course. *Staff.*
Offered when interest is expressed and departmental resources permit.

ENGN 225 (PHYS 225): Mathematical Methods for Physics and Engineering (3)
Prerequisites: PHYS 112, MATH 221. Study of a collection of mathematical techniques particularly useful in upper-level courses in physics and engineering: vector differential operators such as gradient, divergence, and curl; functions of complex variables; Fourier analysis; orthogonal functions; matrix algebra and the matrix eigenvalue problem. *I. Mazilu.*
Winter

ENGN 240 (PHYS 240): Thermodynamics (3)
Prerequisites: PHYS 112 and MATH 221. A study of the fundamental concepts of thermodynamics, thermodynamic properties of matter, and applications to engineering processes. *Van Ness.*
Winter

ENGN 250: Introduction to Engineering Design (4)
Prerequisite: PHYS 112. This course introduces students to the principles of engineering design through firsthand experience with a design project that culminates in a design competition. In this project-based course, the students will gain an understanding of computer-aided drafting, machining techniques, construction methods, design criteria, progress and final report writing, and group presentations. Students are engaged using various methods, including traditional lectures, seminars, apprenticing, group work, and peer critiquing. *Kuehner.*
Spring 2010 and alternate years

ENGN 251 (PHYS 251): Experimental Methods in Physics and Engineering (3)
Prerequisite: PHYS 112 or permission of the instructor. An introduction to the design and implementation of experimental methods. Execution of the methods focuses on current data acquisition techniques, along with a study of standard data reduction and analysis. Results are examined in order to review the experimental method employed and to redesign the method for future experiments. This course is intended for any science major interested in performing experimental research on campus or in graduate school. *Kuehner.*
Fall

ENGN 255 (PHYS 255): C++ for Engineering and Physics (3)
Prerequisite: PHYS 112. An introduction to the C++ computing language, with applications characteristic of computation-intensive work in engineering and physics. Difference approximations to differential equations, stochastic methods, graphical presentation, and nonlinear dynamics are among the topics covered. Students need not have previous experience with C++. *Williams.*
Offered when interest is expressed and departmental resources permit.

ENGN 260 (PHYS 260): Materials Science (3)
Prerequisite: PHYS 112. An introduction to solid state materials. A study of the relation between microstructure and the corresponding physical properties for metals, ceramics, polymers, and composites. *Van Ness.*
Winter

ENGN 265 (BIOL 265): Integrative Science: Cardiovascular Disease (4)

Prerequisite: BIOL 111 or PHYS 112. This course integrates biology, physics, engineering and mathematical modeling through the study of the cardiovascular system and cardiovascular disease. A variety of cardiovascular disease states are used to reinforce basic mechanical and electrical principles of cardiovascular physiology. Treatments using these physiological and/or engineering principles are also considered, such as cardiovascular drugs and drug delivery systems, heart and blood vessel transplantation, defibrillators and heart monitors, etc. Laboratories provide an opportunity to investigate fluid dynamics, cardiovascular monitoring using physiological transducers, computer heart/vessel modeling software, diagnostic imaging (ultrasound/MRI), etc. Speakers and site visits highlight cardiovascular medicine (clinical and/or veterinary), epidemiology, FDA medical device approval and testing, vascular stent design, etc., to provide a wider relevance to our discussions. Laboratory course. *I'Anson.*

Offered when interest is expressed and departmental resources permit.

ENGN 295: Intermediate Special Topics in Engineering (3)

Prerequisites: PHYS 111 and 112. Intermediate work in bioengineering, solid mechanics, fluid mechanics or materials science. May be repeated for a maximum of six credits with permission and if the topics are different. *Staff.*

Offered when interest is expressed and departmental resources permit.

ENGN 301: Solid Mechanics (3)

Prerequisite: ENGN 203. Internal equilibrium of members; introduction to mechanics of continuous media; concepts of stress, material properties, principal moments of inertia; deformation caused by axial loads, shear, torsion, bending and combined loading. *Van Ness.*

Fall

ENGN 302: An Introduction to the Finite Element Method (3)

Prerequisites: ENGN 301 and MATH 332. An introduction to the finite element method using a variational approach to obtain numerical solutions of differential equations governing physical problems. Examples will be drawn from solid mechanics, fluid mechanics and electrostatics. *Staff.*

Offered when interest is expressed and departmental resources permit.

ENGN 311: Fluid Mechanics (4)

Prerequisite: ENGN 204 or PHYS 230. Fluid statics; application of the integral mass, momentum, and energy equations using control volume concepts; introduction to viscous flow and boundary layer theory. Laboratory course. *Kuehner.*

Winter

ENGN 312: Heat Transfer (3)

Prerequisites: ENGN 311 and MATH 332. Principles of heat transfer by conduction, convection, and radiation. Topics include transient and steady state analysis, boiling, condensation, and heat exchanger analysis. Application of these principles to selected problems in engineering. *Kuehner*.

Fall

ENGN 330: Mechanical Vibrations (3)

Prerequisites: ENGN 204 or PHYS 230, MATH 332. Analysis of lumped parameter and continuous systems (free and forced, damped and undamped, single- and multi-degree-of-freedom); transient response to shock pulses; simple linear systems; exact and approximate solution techniques; and solution to continuous systems using partial differential equations. *Williams.*

Offered when interest is expressed and departmental resources permit.

ENGN 351: Solid Mechanics Laboratory (1)

Corequisite: ENGN 301. Experimental observation and correlation with theoretical predictions of elastic behavior of structures under static loading; statically determinate and indeterminate loading of beams and trusses; shear; and torsion. Laboratory course. *Van Ness.*

Fall

ENGN 361 (PHYS 361): Polymer Science and Engineering (3)

Prerequisite: ENGN/PHYS 240 or CHEM 261 or permission of the instructor. Science and engineering of large molecules. Physical and chemical structure of polymers correlated with mechanical properties. Crystal morphology. Theory of rubber elasticity. Time and temperature dependent properties of polymers. Relevance to polymer physics and chemical and mechanical engineering. *Van Ness.*

Offered when interest is expressed and departmental resources permit.

ENGN 395: Special Topics in Engineering (3)

Prerequisite: Junior standing. Advanced work in solid mechanics, fluid mechanics, heat transfer, or materials science. Topics selected based on student interest. May be repeated for a maximum of six credits with permission and if the topics are different. *Staff.*

Offered when interest is expressed and departmental resources permit.

ENGN 401, 402, 403: Engineering Problems (1,2,3)

Prerequisites: Junior standing and approval of the instructor. A special course of instruction, reading and investigation designed to serve the needs of individual students in a selected field of proposed engineering endeavor. May be repeated for degree credit with permission. *Staff.*

ENGN 421, 422, 423: Directed Individual Research (1,2,3)

Prerequisite: Permission of the instructor. Directed research in engineering. May be repeated for degree credit with permission of the instructor. *Staff.*

ENGN 493: Honors Thesis (3-3)

Prerequisites: Permission of the instructor and departmental honors candidacy. Staff.

Fall-Winter