Department of Engineering

Faculty

Don Van (2001). Associate Professor and Department Chair of Engineering. B.S. and M.S., University of Illinois in Chicago; M.S. and Ph.D., New Jersey Institute of Technology, P.E., CEM.

James Kirk (2001). Assistant Professor of Computer Science. B.M., Union University; M.M. and M.A., and Ph.D., Indiana University.

Jeannette Russ (2002). Assistant Professor of Engineering. B.S., Mississippi State University; M.B.A., Colorado State University; Ph.D., Vanderbilt University.

Seungwon (Chris) Song (2002). Instructor of Engineering. B.S., Yonsei University; M.S., KAIST; Ph.D., Northwestern University. Additional study, University of Toronto.

The Engineering Department seeks to prepare graduates for the practice of engineering at the professional level and lead to Union's first degree in engineering, which should be conferred in 2005. Union will offer the Bachelor of Science in Engineering, B.S.E., with emphases in electrical and mechanical engineering. Union's engineering program will be eligible for accreditation review by the Accrediting Board for Engineering and Technology once students have graduated from its program. "If it is determined that the program followed by these graduates is essentially the same as that reviewed, then accreditation may be extended to the graduates of the program in the academic year prior to the visit" (ABET's Accreditation Policy and Procedure Manual II.C4). The curriculum review process at Union assures a high level of consistency between the program implemented and the program approved.

Students begin their preparation for engineering by enrolling in prerequisites and introductory engineering courses in the Fall Semester, thus assuring them an adequate foundation for engineering. These prerequisites provide students with a strong background in the physical sciences and mathematics, (physics, calculus, chemistry, differential equations), as well as the fundamental humanities and social studies areas. Incoming students are expected to have completed the necessary requirements that will allow them to begin mathematics at the level of calculus. Ideally, engineering students will have been introduced to calculus in high school. These courses are combined with engineering courses to fully prepare the student for a successful professional engineering career.

Curriculum

Pre-requisite courses to the Engineering major complete some General Core Curriculum requirements and all Bachelor of Science in Engineering Specific Core requirements. CHE 111, ECF 211, and MAT 211 must be completed and in doing so complete the Group A. Science, Social Science/Humanities Option and Math requirements of the General Core respectively. The remaining pre-requisites comprise the B.S.E. Specific Core: PHY 231-232 (10 hours); MAT 212, 213, 314 (11); MAT 315 or 208 (3); CSC 115 (3).

Engineering Major Requirements—67 or 68 hours

I. Major core requirements - 49 hours + an emphasis
- A. EGR 101, 105, 250, 262, 270, 275, 290
- B. EGR 330, 342, 350, 352, 360, 385
- C. EGR 491, 492, 498

II. Mechanical Engineering Emphasis—18 hours
- A. EGR 320
- B. EGR 410, 450, 455, 470

III. Electrical Engineering—19 hours
A. EGR 370
B. EGR 405, 420, 430, 460

Mission Statement

The Engineering Program will not only prepare students with a sound technical base that will make state licensure achievable but also educate them with a distinctive liberal arts orientation and with a view towards integration of faith and learning. An education in engineering at Union University aims to produce a socially and morally responsible citizen who is uniquely prepared to carry out public and global service opportunities as an individual committed to his/her faith and community.

Course Offerings in Engineering (EGR)

()—Hours Credit; F–Fall; W–Winter; S–Spring; Su–Summer

101. Introduction to Engineering Design and Analysis (3)
Prerequisite: Admission to the engineering program.
An introduction to engineering as a profession with technical and legal responsibilities. Discussion of the Engineering Design and Analysis method. Applying the engineering process in solving electrical, mechanical, energy, environmental engineering problems. Design and present project.

105. Engineering Graphics (3) S
Prerequisite: Admission to the engineering program.
Introduction to computer aided design and drafting (CADD). Learn to project objects orthographically, isometrically and obliquely. Dimensioning and sectioning of engineering objects solid modeling. Design and present project.

250. Thermo-fluid Dynamics I (4)
Prerequisite: CHE 111, PHY 232; Corequisite: MAT 314.
Introduction to macroscopic concepts of thermodynamics; first and second laws, properties of pure, simple compressible substances, applications using system and control volume energy analysis. Introduction to hydrostatics and fluid dynamics including pressure distribution, integral and differential relations for fluid particles, development of conservation theorems, dimensional analysis and similarity; open channel flow. Lab included.

262. Electric Circuit Analysis and Design (4)
Prerequisite: PHY 232; Corequisite: MAT 213. Reciprocal credit: PHY 317.
Basic concepts, theorems and laws of DC and AC circuits. Methods of analysis of circuits. Laplace transform. Fourier transform. Design and present project. Lab included.

270. Electrical Power Systems (3)
Prerequisite: EGR 262
Introduction to basic principles of power system including generator transformer model, transmission, line parameters, power flow analysis, dispatching optimization of generation, system stability, system control and economic operation of power system.

275. Engineering Statics (3)
Prerequisite: MAT 212, EGR 101, PHY 231.
General principles of engineering mechanics. Analyze force vectors. Equilibrium of rigid body. Trusses. Centroid. Moments of inertia. Work. Design and present project.

290. Engineering Dynamics (3)
Prerequisite: EGR 275.
Kinematics and Kinetics of particles with respect to force, acceleration, work, energy, impulse, momentum. Planar kinematics and kinetics. Design and present project.

320. Solid Mechanics (4)
Prerequisite: EGR 290.
Relationships between internal stresses and changes of form produced by external forces acting on solid bodies. Normal and shear stresses. State of stress and strain. Elasticity and plasticity. Deformations of beams, torsion, combined leading and principal stresses. Design and present project. Lab included.

330. Engineering Economy (3)
Prerequisite: Permission of instructor.
The importance of conducting, presenting, and discussing engineering alternatives to capital investment using economic and financial principles. Among these are corporate hurdle rate, return on investment, payback period, present worth, annual cash flow, rate of return, benefit-cost ratio, and replacement considerations. Analyze and present project.

342. Engineering Experimental Methods (3)
Prerequisite: EGR 250, EGR 362, EGR 275.
Tools for data analyses in engineering design will be discussed and experienced through laboratory experiments. Among these data analysis tools are probability, statistical analysis, measurement errors, and graphical presentation.

350. Control Theory and Design (4)
Prerequisite: EGR 262.
Introduction to the control of engineering systems. Analysis and design of linear control systems using root locus and frequency response techniques. System representation and control-system characteristics. Design and present project. Lab included.

352. Engineering in Laboratory (3)
Prerequisite: EGR 342, EGR 250, EGR 362, EGR 275.
Applying knowledge from EGR 342, this engineering laboratory course is devoted to conducting in depth mechanically or electrically related topics depending on the discipline's selective emphasis of the student. Design and present own experiment for concluding project.

360. Computational Engineering (3)
Prerequisite: EGR 250, EGR 262, EGR 290.
Complementing computer programming skills in FORTRAN and C++, this course teaches the students to conduct engineering functions, studies and analyses using the desktop packages such as Excel, Matlab, Access database.

370. Electrical Machines (4)
Prerequisite: EGR 262.
Principles of DC and AC rotating machines in the industry. Analysis and characteristics of transformer, induction motor, and synchronous machine. Lab included.

385. Energy Conversion (3)
Prerequisite: EGR 250.
Comprehensive analysis of energy systems in use in the industry today. Discussion of the Rankine cycle, steam generators, combustion of fossil fuels, steam and gas turbines, principle systems in a fossil power plant. Discussion of different nuclear plant design in the US. Other forms of renewable energy sources and conversion such as solar energy and environmental impacts from energy generation will be discussed. Design and present project.

405. Electronic Circuit Analysis and Design (4)
Prerequisite: EGR 262.
Fundamentals and basic techniques of modern electronic design will be covered. Solid-state electronics, diodes and diode circuits, field-effect transistors and bipolar junction transistors. Logic design. Metal-Oxide-Semiconductor memory and bipolar logic circuits. Design and present project. Lab included.

410. Materials Engineering (4)
Prerequisite: CHE 111, EGR 320.
Introduction to material structure from the atomic structure viewpoint. Examine how their physical, thermal, and mechanical properties will affect the behavior of materials specified in engineering design. Lab included.

420. Physical Principles of Solid State Devices (3)
Prerequisite: EGR 405.
Introduction to material science concepts and quantum physics. Modern theory of solids. Semiconductors and semiconductor devices. Discussion of dielectrical materials, magnetic properties, superconductivity, and optical properties of materials.

430. Communication Systems (4)
Prerequisite: EGR 262, EGR 405.
Introduction to signal modeling and systems realization theory. Discussion of spectral content of a signal, Fourier and Laplace transform, Properties of systems, Signal transmission and Filtering. Applications to practical systems such as television and data communications. Lab included.

450. Thermo-fluid Dynamics II (4)
Prerequisite: EGR 250.
Further study into properties of the ideal gas, incompressible and corresponding states models. Gas-vapor mixtures, availability and irreversibility. Power and refrigeration cycles. Application in current engineering problems. Further study into viscous and boundary-layer flow, inviscid incompressible flow, compressible flow and turbomachinery. Lab included.

455. Vibration Analysis (3)
Prerequisite: EGR 296, MAT 314.
Analyze free and forced vibration, including damped and transient, of single and multi-degree of freedom systems. Lagrange's equation, Fourier series and Laplace transformation. Application of Vibration Analysis.

460. Electromagnetism Theory & Applications (4)
Prerequisite: EGR 262, MAT 314.
Discussion of electric and magnetic field and their relationships to transmission lines, wave propagation, attenuation, antennas, radiation, and radar and wireless. Maxwell's equations and applications. Lab included.

470. Heat Transfer (3)
Prerequisite: EGR 450.
Different modes of heat transfer mechanism are analyzed including conduction, natural and forced convection, and radiation. Applications of heat transfer in the industry are discussed including heat exchangers, heat pipes, thermal wheel for waste recovery, steam generators in a nuclear plant or in a gas turbine electrical generator. Design and present project.

491. Major Project Design I (3)
Prerequisite: Permission of instructor.
Individual student will choose a real world engineering problem either assigned by instructor or a sponsoring industry. Student is expected to solve the problem by applying the engineering design and analysis method. Design portfolio will be prepared for the documentation of work from beginning to end. Full engineering study will be prepared. The student will prepare the oral presentation of his or her project.

492. Major Project Design II (3)
Prerequisite: Permission of instructor.
Team of students will choose a real-world engineering problem either assigned by the instructor or a sponsoring industry. Students are expected to solve the problem by team effort via project management. Design portfolio will be prepared for the documentation of work from beginning to end. Full engineering study will be prepared. The project team will prepare the oral presentation of its project. The event will be publicly announced.

498. Engineering Seminar (1)
Prerequisite: senior standing.
Comprehensive review of all engineering fundamentals, mathematics, physics, chemistry, and economics and prepare engineering seniors for the Fundamentals of Engineering (FE) national examination. Review and discuss code of engineering ethics and Christian conducts in the work place.

180-280-380-480. Study Abroad (1-4) As Needed
All courses and their application must be defined and approved prior to travel.

195-6-7. Special Studies (1-4) On Demand
Lower-level group studies which do not appear in the regular department offerings.

395-6-7. Special Studies (1-4) On Demand
Upper-level group studies which do not appear in the regular department offerings.

495-6-7. Independent Study (1-4) On Demand
Individual research under the guidance of a faculty member's.

499. Seminar (1-3) On Demand
To be used at the discretion of the department.