ENGR 101 Grand Challenges in Engineering Credits: 3 (3-0-0)
Course Description: National Academy of Engineering’s Grand Challenges in Engineering: overview, roles of engineering disciplines, engineering and societal challenges.
Prerequisite: None.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ENGR 102 Problem Solving for Engineers Credits: 3 (3-0-0)
Course Description: Engineering problem solving: dimensional analysis; precision, accuracy, repeatability; problems from all major engineering disciplines.
Prerequisite: MATH 160, may be taken concurrently.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ENGR 298 Undergraduate Research Credits: Var[1-3] (0-0-0)
Course Description: Directed undergraduate research with a faculty mentor.
Prerequisite: None.
Registration Information: Written consent of research mentor; written consent of department chair.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Traditional.
Special Course Fee: No.

ENGR 300 3D Printing Lab for Engineers Credit: 1 (0-3-0)
Course Description: Basics of 3D printing, technology, workflows, techniques and related software, focused on practical usage and project development in engineering. Topics include technology of devices, usage, calibration and tuning, repair and maintenance, and techniques for maximizing part quality with minimal waste.
Prerequisite: BIOM 101 or CBE 101 or CIVE 102 or ECE 102 or ENGR 101 or MECH 103.
Registration Information: Credit not allowed for both ENGR 300 and ENGR 381A1.
Terms Offered: Fall, Spring, Summer.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.

ENGR 382A Study Abroad: Grand Challenges in Engineering--China Credits: 3 (0-0-3)
Course Description: Faculty-led study abroad program that includes cultural, language, and engineering instruction. Course will be held at a host institution in China.
Prerequisite: None.
Registration Information: Credit not allowed for both ENGR 382 and ENGR 382A.
Term Offered: Summer.
Grade Mode: Traditional.
Special Course Fee: No.

ENGR 389 Engineering Cooperative Experience Credit: 1 (0-0-40)
Course Description: Semester-long full-time industry engineering experience in a position relevant to the student's major field.
Prerequisite: None.
Registration Information: Written consent of instructor. May be taken up to 9 times.
Terms Offered: Fall, Spring, Summer.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.

ENGR 422 Technology Entrepreneurship Credits: 3 (3-0-0)
Course Description: Principles of technology-based entrepreneurship, including recognizing, analyzing, and acting on technology-based business opportunities; and development of an opportunity analysis.
Prerequisite: MGT 340.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ENGR 423 Intellectual Property and Invention Systems Credits: 3 (3-0-0)
Course Description: Focused on the appropriate application of "patterns for patenting" together with intuition, inspiration, and cross-disciplinary connecting. De-mystify "inventing" as applied to science, engineering and technology.
Prerequisite: None.
Registration Information: Junior standing. Sections may be offered: Online.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ENGR 486 Practicum Credits: Var[1-3] (0-0-0)
Course Description:
Prerequisite: None.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ENGR 496 Group Study Credits: Var[1-3] (0-0-0)
Course Description:
Prerequisite: None.
Terms Offered: Fall, Spring.
Grade Modes: Instructor Option, Traditional.
Special Course Fee: No.

ENGR 498 Undergraduate Research Credits: Var[1-3] (0-0-0)
Course Description: Directed undergraduate research with a faculty mentor.
Prerequisite: None.
Registration Information: 30 credits in engineering and/or science; written consent of instructor.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Traditional.
Special Course Fee: No.

ENGR 501 Foundations of Systems Engineering Credits: 3 (3-0-0)
Course Description: Functional components of systems engineering; application of systems engineering to practical problems, system life-cycle process.
Prerequisite: None.
Registration Information: Credit not allowed for both ECE 501 and ENGR 501. Sections may be offered: Online.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.
ENGR 502  Engineering Project and Program Management  Credits: 3 (3-0-0)
Course Description: Engineering program management fundamentals, program planning and control strategies, risk assessment, work breakdown structures and costing options.
Prerequisite: None.
Registration Information: Credit not allowed for both ENGR 502 and MECH 501. Sections may be offered: Online.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ENGR 508  Introduction to Power System Markets  Credits: 3 (3-0-0)
Also Offered As: ECE 508.
Course Description: Deregulated electrical power systems, system security, investments in generation and transmission, ancillary services, and nodal pricing.
Prerequisite: ECE 461.
Registration Information: Credit not allowed for both ECE 508 and ENGR 508. Sections may be offered: Online.
Term Offered: Fall (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

ENGR 509  Signal Processing for Power Systems  Credits: 3 (3-0-0)
Also Offered As: ECE 509.
Course Description: Signal processing tools for analyzing power systems, voltage frequency, magnitude variations, unbalance, waveform distortion.
Prerequisite: ECE 312 and ECE 461.
Registration Information: Credit not allowed for both ENGR 509 and ECE 509. Sections may be offered: Online.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ENGR 510  Engineering Optimization: Method/Application  Credits: 3 (3-0-0)
Course Description: Optimization methods; linear programming, network flows, integer programming, interior point methods, quadratic programming, engineering applications.
Prerequisite: MATH 261 and MATH 229.
Registration Information: Credit not allowed for both ENGR 510 and MATH 510. Sections may be offered: Online.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ENGR 522  Object-Oriented GIS Programming for Engineers  Credits: 3 (3-0-0)
Course Description: Object-oriented GIS programming with C# & .NET framework; integration of GIS libraries; development of custom desktop GIS applications in engineering.
Prerequisite: CIVE 577.
Restriction: Must be a: Graduate, Professional.
Registration Information: Sections may be offered: Online.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ENGR 532  Dynamics of Complex Engineering Systems  Credits: 3 (3-0-0)
Also Offered As: ECE 532.
Course Description: Higher-level behavior and issues that emerge from interaction between components in complex socio-technical systems.
Prerequisite: ENGR 501, may be taken concurrently or ECE 501, may be taken concurrently.
Registration Information: Credit not allowed for both ENGR 532 and ECE 532. Sections may be offered: Online.
Term Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ENGR 550  Numerical Methods in Science and Engineering  Credits: 3 (3-0-0)
Also Offered As: MATH 550.
Course Description: Finite elements, finite differences, spectral methods, method of lines, conservation laws; stability and convergence analysis for PDEs.
Prerequisite: MATH 340 or MATH 345 or MATH 530.
Registration Information: Credit not allowed for both ENGR 550 and MATH 550.
Term Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.
ENGR 565 Electrical Power Engineering Credits: 3 (3-0-0)
Also Offered As: ECE 565.
Course Description: Analysis of power systems in terms of current, voltage, and active/reactive power; introduction of computer-aided tools for power systems.
Prerequisite: ECE 332 and ECE 342.
Registration Information: Credit not allowed for both ECE 565 and ENGR 565. Sections may be offered: Online.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ENGR 567 Systems Engineering Architecture Credits: 3 (3-0-0)
Course Description: Observation/classification of systems architecture.
Systems architecture principles and critical evaluation through design studies.
Prerequisite: ECE 501 or ENGR 501.
Registration Information: Credit not allowed for both ECE 567 and ENGR 567. Sections may be offered: Online.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ENGR 559 Cybersecurity Awareness for Systems Engineers Credits: 3 (3-0-0)
Course Description: Cybersecurity principles, practices, technologies, design approaches, and terminology needed to incorporate cybersecurity principles into effective systems designs.
Prerequisite: ENGR 501.
Registration Information: Bachelor’s degree required. Sections may be offered: Online. Credit not allowed for both ENGR 559 and ENGR 580A4.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ENGR 569 Coupled Electromechanical Systems Credits: 3 (3-0-0)
Course Description: Coupled electrical and mechanical systems and the analysis of energy transfer between these systems. Analysis of field energy and the relationship between electrical, mechanical and electromagnetic forces.
Prerequisite: ECE 202 or ECE 204.
Registration Information: Sections may be offered: Online. Credit not allowed for both ENGR 569 and ENGR 581A2.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ENGR 570 Analytics in Systems Engineering Credits: 3 (3-0-0)
Course Description: Focus on the appropriate application of data mining, knowledge generation, data analytics and data algorithmics to large complex systems. Demystify "big data" for systems engineers as applied to intelligent systems.
Prerequisite: None.
Restriction: Must be a: Graduate.
Registration Information: Bachelor’s degree required. Sections may be offered: Face-to-Face, Mixed Face-to-Face, or Online.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ENGR 597 Group Study in Systems Engineering Credits: 3 (0-0-3)
Course Description: Capstone study experience in systems engineering.
Prerequisite: (CIS 600) and (ENGR 530 or ECE 530) and (ENGR 531 or ECE 531).
Registration Information: Sections may be offered: Online.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ENGR 602 Systems Requirements Engineering Credits: 3 (3-0-0)
Course Description: Introduction to the rigorous requirements process within systems engineering, including system requirements analysis, requirements decomposition, allocation, tracking, verification, and validation.
Prerequisite: ENGR 501 and ENGR 530.
Restriction: Must be a: Graduate, Professional.
Registration Information: Sections may be offered: Online. Credit not allowed for both ENGR 602 and ENGR 680A2.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ENGR 603 Introduction to Systems Test and Evaluation Credits: 3 (3-0-0)
Course Description: Test and evaluation of systems at both the component and systems levels to provide insights into how systems succeed or fail based on test methodologies.
Prerequisite: ENGR 502 and ENGR 531.
Restriction: Must be a: Graduate, Professional.
Registration Information: Bachelor’s degree required. Sections may be offered: Face-to-Face, Mixed Face-to-Face, or Online. Credit not allowed for both ENGR 603 and ENGR 680A3.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ENGR 622 Energy Networks and Power Distribution Grids Credits: 3 (3-0-0)
Also Offered As: ECE 622.
Course Description: Energy networks: generation, storage, consumers. Systems approach to analysis of distribution networks and transition to intelligent grid systems.
Prerequisite: ECE 461 or ECE 508 or ENGR 508 or ECE 565 or ENGR 565.
Restriction: Must be a: Graduate, Professional.
Registration Information: Credit not allowed for both ECE 622 and ENGR 622. Sections may be offered: Online.
Term Offered: Spring (even years).
Grade Mode: Traditional.
Special Course Fee: No.

ENGR 623 Electric Power Quality Credits: 3 (3-0-0)
Also Offered As: ECE 623.
Course Description: Interconnecting power electronic devices and renewable energy sources to power systems.
Prerequisite: ECE 461 or ECE 562.
Restriction: Must be a: Graduate, Professional.
Registration Information: Sections may be offered: Online. Credit not allowed for both ECE 623 and ENGR 623.
Term Offered: Spring (odd years).
Grade Mode: Traditional.
Special Course Fee: No.
ENGR 695  Independent Study  Credits: Var[1-18]  (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Registration Information: Sections may be offered: Online.
Terms Offered: Fall, Spring, Summer.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.

ENGR 697  Group Study Credits: Var[1-6]  (0-0-0)
Also Offered As: ECE 697.
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Registration Information: Credit not allowed for both ENGR 697 and ECE 697.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Traditional.
Special Course Fee: No.

ENGR 699  Thesis Credits: Var[1-18]  (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Registration Information: Sections may be offered: Online.
Terms Offered: Fall, Spring, Summer.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.

ENGR 710  Leadership/Innovation in Systems Engineering Credits: 3  (3-0-0)
Course Description: Background in technical leadership skill sets, systems engineering skillssets, and intellectual toolkit to develop a successful applied and translational research project/practicum.
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Registration Information: Bachelor’s degree required. Sections may be offered: Online. Course is not available for credit toward the PhD in Systems Engineering.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ENGR 711  Ethics in Systems Engineering Credit: 1  (0-0-1)
Course Description: Ethical principles and their application to systems engineering.
Prerequisite: ENGR 501.
Restriction: Must be a: Graduate, Professional.
Registration Information: Offered as an online course only.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ENGR 786  Applied Systems Engineering Practicum Credits: Var[1-9]  (0-0-0)
Course Description: Research techniques, critical thinking, evaluation criteria, and methods of technical writing.
Prerequisite: (ENGR 502) and (ENGR 531 or CIS 600 or CIS 670).
Restriction: Must be a: Graduate, Professional.
Registration Information: Written consent of advisor.
Terms Offered: Fall, Spring, Summer.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.