I. COURSE CHANGES

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Civil Engineering (CE)

REVISE TO ADD CREDIT RESTRICTION

CE 562 Structural Systems (3)
Credit Restriction: Students cannot receive credit for both CE 462 and CE 562.

Rationale: CE 462 and CE 562 have similar content and are usually taught concurrently, with CE 562 having additional requirements to justify graduate level credit. Impact on other units: none. Financial impacts: none.

REVISE SECONDARY CROSS-LISTED COURSE TO REVISE/CHANGE NAME OF PRIMARY COURSE

CE 585 Introduction to Fire Protection Engineering (3)
Cross-Listed: (See Engineering Fundamentals 563.)

Formerly:
Cross-Listed: (See Electrical and Computer Engineering (ECE) 563).

Rationale: Engineering Fundamentals 563 is being added and will become primary course (replacing ECE 563). Civil Engineering 585 and Nuclear Engineering 584 will become secondary cross listed to the new Engineering Fundamentals 563. Impact on other units: none. Financial impact: None.

Environmental Engineering (ENVE)

ADD CREDIT RESTRICTION

ENVE 531 Hydrology (3)
Credit Restriction: Students cannot receive credit for more than one of the following ENVE 495, ENVE 498, and ENVE 531.

ENVE 558 Solid and Hazardous Waste Management (3)
Credit Restriction: Students cannot receive credit for more than one of the following ENVE 456, ENVE 458, and ENVE 558.

ENVE 574 Air Pollution Engineering and Control (3)
Credit Restriction: Students cannot receive credit for more than one of the following ENVE 474, ENVE 477, and ENVE 574.

Rationale: ENVE 495 (and ENVE 498) has similar content as ENVE 531. ENVE 456 (and ENVE 458) have similar content as ENVE 558. Similarly, ENVE 474 (and ENVE 477) have similar content as ENVE 574. These sets of courses are usually taught concurrently, with the graduate versions having additional requirements. Impact on other units: none. Financial impacts: none.
DEPARTMENT OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

Computer Science (COSC)

DROP 400-LEVEL COURSE FOR GRADUATE CREDIT

COSC 422 Applied Machine Learning (3)
Rationale: This course covers introductory material concerning applications of machine learning. It should not be in the graduate catalog. It will remain in the undergraduate catalog. Impact on other units: none. Financial impact: none.

REVISE DESCRIPTION AND RECOMMENDED BACKGROUND

COSC 561 Compilers and Runtime Systems (3) Topics in compilers and runtime systems, including lexical analysis, parsing, program representations, code generation, static and dynamic program analysis, compiler optimization, runtime environments, high-level language virtual machines, dynamic compilation, and garbage collection. Recommended Background: Undergraduate coursework in computer programming, computer architecture, and operating systems.
Formerly: Topics in compilers and runtime systems, including: static and dynamic program analysis, performance measurement and characterization, compiler optimization, high-level language virtual machines, instruction set emulation, JIT compilation, explicit vs. automated memory management, and garbage collection. Recommended Background: Introductory coursework in computer architecture, operating systems, and compilers.
Rationale: The course description and recommended background are being changed to align better with course content. Impact on other units: none. Financial impact: none.

REVISE REPEATABILITY

COSC 593 Independent Study (1-3)
Repeatability: May be repeated. Maximum 6 hours.
Formerly: COSC 593 Independent Study (1-3)
Repeatability: May be repeated. Maximum 9 hours.
Rationale: Students should only be allowed to take 6 hours of independent study. This revision also makes it so COSC 593 has the same repeatability as ECE 593. Impact on other units: none. Financial impact: none.

Electrical and Computer Engineering (ECE)

DROP 400 LEVEL COURSE GRADUATE CREDIT

ECE 463 Introduction to Datacenters (3)

DROP PRIMARY CROSS LISTED COURSE

ECE 563 Introduction to Fire Protection Engineering (3)
Cross-listed: (Same as Civil Engineering 585, Nuclear Engineering 584)

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<tr>
<th>Current Courses Electrical and Computer Engineering (ECE)</th>
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<tbody>
<tr>
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<td>CE 585</td>
<td>EF 563</td>
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</table>
Rationale: Engineering Fundamentals 563 is being added and will become primary course (replacing ECE 563). Civil Engineering 585 and Nuclear Engineering 584 will become secondary cross listed to the new Engineering Fundamentals 563. Impact on other units: None. Financial impact: None.

DROP COURSES

ECE 548 Fundamentals of Radio and Satellite Communications Theory and Design (3)
ECE 564 Enclosure Fire Dynamics (3)
ECE 565 Principles of Electrical Arc Flash Hazards and Explosions (3)
ECE 567 Forensic Engineering (3)
ECE 575 High Performance Computer Modeling and Visualization (3)
ECE 646 Advanced Applications of Software-Defined Radio for Remote Sensing and Satellite Communications (3)
ECE 661 Wildland and Hostile Fire Threats to Electrical Power Grids, Distribution, and Generation Facilities (3)

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Rationale: EF courses are being added to replace the ECE courses being dropped. Impact on other units: None. Financial impact: None.

REVISE TITLE

ECE 545 Microwave Circuits (3)

Formerly:
ECE 545 Microwave Circuits I (3)

Rationale: The catalog no longer includes Microwave Circuits II, so it is not necessary to list “I” after the title of this course. Impact on other units: none. Financial impact: none.

ENGINEERING FUNDAMENTALS (EF)

ADD NEW 400 LEVEL COURSE FOR GRADUATE CREDIT

EF 463 Data Center Design and Management (3) Technologies and best practices in data center structure, management, and maintenance. Topics include datacenter structure and design, requirements, performance, security, power & cooling, storage systems, networking, fire protection and life safety, capacity/workload management, testing, and analysis. Students from engineering disciplines that can take this course include electrical, computer, industrial, mechanical, nuclear engineering, and computer science.

(Re) Prerequisite(s): Computer Science 130.

Rationale: This course is an important component of safety engineering and is being added as an elective into other existing and future BS, MS, and PhD Concentrations. Impact on other units: None. Financial impact: None.
ADD PRIMARY CROSS-LISTED COURSE

EF 563 Introduction to Fire Protection Engineering (3) The application of fire protection engineering principles to the safe design, wiring, and construction of buildings and infrastructure. Topics include safety and performance-based design, fire dynamics, fire hazard, and risk analysis, national electrical codes, public fire service operations, detection and alarm systems, and transportation fire safety.

Cross-Listed: (Same as Civil Engineering 585, Nuclear Engineering 584).

Registration Permission: Consent of Instructor.

Rationale: ECE 563 is being dropped. Course EF 563 is being added and will become primary course to replace the dropped ECE 563. Impact on other units: None. Financial impact: None.

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<th>Current Course</th>
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<td>Electrical and Computer Engineering (ECE)</td>
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ADD

EF 548 Fundamentals of Radio and Satellite Communications Theory and Design (3) The theory and design of radio and satellite communications systems. Course topics include communications modes (AM, FM, SSB, CW, SSTV, PSK, FT8, and Digital), antenna design, weak signal radio propagation, RF safety, Software Defined Radio (SDR), and FCC regulations. Class lectures consist of presentations, labs, and demonstrations (Lectures are archived for distance learning formats).

EF 564 Enclosure Fire Dynamics (3) The application of fire protection engineering principles to enclosure fire dynamics. Topics include estimating the energy release rates of a fire, fire plumes characteristics, pressure and flows through openings, fire gas temperatures, smoke filling rates and species production, and fire modeling.

(Re) Corequisite(s): 563.

EF 565 Principles of Electrical Arc Flash Hazards and Explosions (3) Provides a detailed understanding of changing engineering standards for arc flash hazards and resulting explosions as covered by the US Nuclear Regulatory Commission (NRC), the US Department of Energy (DOE), Institute of Electrical and Electronics Engineers (IEEE), Underwriters Laboratories (UL), National Fire Protection Association (NFPA), and Occupational Safety and Health Administration (OSHA). Addresses industry standards and advanced calculation methods recommended by IEEE 1584, NFPA 70E, and OSHA during electrical power generation, transmission, and distribution. Class lectures consist of presentations, labs, and demonstrations (Lectures are archived for distance learning formats).

EF 567 Forensic Engineering (3) The application of forensic engineering tools to the comprehensive investigation and analysis of materials, products, structures, or components that fail or do not operate or function as intended, causing personal injury or damage to property. Tools used include root cause analysis, timelines, fault trees, and failure mode and effects analysis. This is the third prerequisite course for students interested in pursuing the Fire Protection Engineering Graduate Certificate.

EF 575 High-Performance Computer Modeling and Visualization (3) Application of high-performance computer modeling to assess and visualize the impact of smoke and heat transfer to buildings, electronic equipment, and on human survivability. In-depth fire hazard analysis and case studies. Advanced topics include software performance analysis and parallel processing.

EF 646 Advanced Applications of Software-Defined Radio for Remote Sensing and Satellite Communications (3) Emerging engineering approaches for the application of Software-Defined Radio (SDR) to remote sensing using field-deployed and satellite communications systems, wireless transceiver architectures, digital communications modes, smart antennas, and remote sensing platforms for thermal, radiation, and other phenomenon using field-deployed and low earth orbit satellites. Class lectures consist of presentations, labs, and demonstrations (Lectures are archived for distance learning formats).

(Re) Prerequisite(s): 563.

EF 661 Wildland and Hostile Fire Threats to Electrical Power Grids, Distribution, and Generation Facilities (3) The study of uncontrolled wildland fires and other hostile threats posed to the nation’s critical infrastructures, particularly electrical power grids, substations, and power generation systems. Covers fire spread theory, risk mapping, ignition
sources, remote sensing technologies that predict, prevent, and suppress wildland fires. Class lectures consist of presentations, labs, and demonstrations (Lectures are archived for distance learning formats).

(RE) Prerequisite(s): 563.

Rationale:
The above (9) courses are an important component of safety engineering and are being added as an elective into other existing and future BS, MS, and PhD Concentrations.

In Fall Term 2020, Fire Protection Engineering concentration courses in the Department of Electrical Engineering and Computer Science (EECS) became available for listing under UT’s Distance Education component, Vols Online (https://volsonline.utk.edu/online-programs/). This educational initiative is open for registration by both UT Knoxville-based students and students enrolled in Distance Education campus programs.

In addition, there is a successful Fire Protection Engineering concentration in Electrical Engineering major under EECS at the MS and Ph.D. level (https://www.eecs.utk.edu/graduate/graduate-concentration-in-fire-protection-engineering/). Discussions at the TCE department and deans’ level desires to expand the accessibility of these program courses and the online Graduate Certificate (https://volsonline.utk.edu/programs-degrees/fire-protection-engineering-gc/).

This proposal for these program changes establishes an equivalent course listing for the following EECS courses under the Engineering Fundamentals Curriculum (EF) in the Tickle College of Engineering (TCE).

The primary purpose of this program modification is to allow students in all TCE departments and other UT curriculums to access these courses easily. Examples include, but are not limited to, the College of Architecture and Design (Fire codes as applied to Building Information Modeling), College of Law (Forensic engineering), and the Herbert College of Agriculture (Wildland fire safety). Impact on other units None. Financial impact None.

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REVISE TITLES AND DESCRIPTIONS

**EF 501 Engineering and Computing Education Theory for Research and Practice (3)** Addresses foundational principles of engineering and computing education through relevant theories of teaching and learning, curriculum development, assessment, and student development. Broad categories of engineering and computing courses (laboratories, design courses, and lectures) are examined with respect to course design, learning objectives, instructional methods, and assessment and accreditation.

Formerly:
Engineering Education Theory for Research and Practice (3) Addresses foundational principles of engineering education through relevant theories of teaching and learning, curriculum development, assessment, and student development. Broad categories of engineering courses (laboratories, design courses, and lectures) are examined with respect to course design, learning objectives, instructional methods, and assessment and accreditation.

**EF 503 Engineering and Computing Teaching Theory and Practice in Higher Education (3)** Students will learn to apply research- and theory-based educational methods to develop course materials and assess learning consistent with engineering and computing accreditation standards in higher education contexts. This will include discussions of specific teaching methods, pedagogical content knowledge, and the assessment and evaluation of student learning. The course will use the human-centered design process as a mechanism to guide course development and continued improvement.

Formerly:
Engineering Instruction and Practice (3) Will learn to apply research- and theory-based educational methods to develop course materials and assess learning consistent with engineering accreditation standards. This will include discussions of specific teaching methods, pedagogical content knowledge, and the assessment and evaluation of student learning. Will use the human-centered design process as a mechanism to guide course development and continued improvement.
EF 505 Preparing the Future Professoriate in Engineering and Computing (3) Will prepare students for obtaining a faculty position and achieving tenure in engineering and computing disciplines, discuss faculty roles and responsibilities, changing demographics and nature of the students/learners, and diversity and inclusiveness. Students will develop a professional portfolio, prepare for the application/interview process and write a mini-proposal.

Formerly: Preparing the Future Professoriate in Engineering (3) Prepares students for obtaining a faculty position and achieving tenure in engineering disciplines, discuss faculty roles and responsibilities, changing demographics and nature of the students/learners, and diversity and inclusiveness. Students will develop a professional portfolio, prepare for the application/interview process and write a mini-proposal.

EF 506 Advanced Research in Engineering and Computing Education (3) Will guide students through the process of conducting their research project. Guidance will include implementation of planned data collection and data analysis as well as preparing for dissemination in an academic publication. This is a combination of seminar topics and independent study to guide students towards a review-ready manuscript in engineering and computing education.

Formerly: Advanced Research in Engineering Education (3) Will guide students through the process of conducting their research project. Guidance will include implementation of planned data collection and data analysis as well as preparing for dissemination in an academic publication. This course is a combination of seminar topics and independent study to guide students towards a review-ready manuscript in engineering education.

EF 507 Curriculum Development in Engineering and Computing Education (3) Will guide students through the process of developing an engineering or computing course that integrates research-based instructional strategies and modern assessment practices. Guidance will include the development of learning objectives, course activities, and assessment. This course is a combination of seminar topics and independent study to guide students towards a completed course design in their field of interest.

Formerly: Curriculum Development in Engineering Education (3) Will guide students through the process of developing an engineering course that integrates research-based instructional strategies and modern assessment practices. Guidance will include the development of learning objectives, course activities, and assessment. This course is a combination of seminar topics and independent study to guide students towards a completed course design in their field of interest.

Rationale: The above (6) courses (EF 501, 503, 504, 505, 506, 507) were reviewed and changes were needed to expand their content to pull from computing education. We have multiple faculty (two of which started in fall 2022) with backgrounds in computing who will be consulted as we make these changes to our courses.

REVISE TITLE AND DESCRIPTION; AND ADD (DE) PREREQUISITE(S)

EF 504 Engineering and Computing Education Research Methods (Quan, Qual, and Mixed) (3) Students will be introduced to a variety of methods and tools available for conducting strong engineering and computing education research studies. The course will cover multiple qualitative, quantitative, and mixed methods approaches. Students will gain knowledge of the theoretical underpinnings of the methods as well as the practical knowledge needed to use the methods in engineering and computing education research.

(DE) Prerequisite(s): EF 501.

Formerly: Engineering Education Research Methods (Quan, Qual, and Mixed) (3) Will be introduced to a variety of methods and tools available for conducting strong engineering education research studies. Covers multiple qualitative, quantitative, and mixed methods approaches. Students will gain knowledge of the theoretical underpinnings of the methods as well as the practical knowledge needed to use the methods in engineering education research.

Rationale: Currently, there are no prerequisite courses for this course. However, students need to have a background in education theory to be successful in this research methods course. Without this background, we are not able to cover the depth of content that is needed to meet the course objectives.

DEPARTMENT OF INDUSTRIAL AND SYSTEMS ENGINEERING

Industrial Engineering (IE)

ADD

IE 567 Introduction to Quantum Algorithms (3) Introduces fundamental quantum computing topics such as entanglement and gate-based quantum computation. These topics will be integrated to study quantum algorithms and their applications, including solving linear systems of equations, simulating molecules, and solving combinatorial optimization problems.
IE 612 Statistical Learning for Complex Systems (3) Will introduce the theory, algorithms, and practice of statistical learning and focus on its interaction and integration with complex systems in science and engineering. With an emphasis of predictability, computability and stability, this course will provide new learning-based tools being developed for the modeling, design, control, estimation, and optimization of complex systems including time, event and decision-driven dynamic systems, manufacturing systems, and scientific experimentation. Real-world and hands-on examples are used to illustrate the methods taught, and further reinforce and facilitate the integration of statistical learning and systems theory in science and engineering.

Rationale: Course fills a need for graduate students in the college. Impact on other units: None. Financial and staffing impact: None.
DEPARTMENT OF MECHANICAL, AEROSPACE, AND BIOMEDICAL ENGINEERING

AEROSPACE ENGINEERING (AE)

ADD

AE 584 Nuclear Space Propulsion (3) Introductory course covering nuclear thermal propulsion and nuclear electric propulsion. The primary focus is on propulsion aspects of nuclear thermal rockets. Topics covered include: rocket engine fundamentals, nuclear rocket engine cycles, thermal fluid aspects of nuclear rockets, materials for nuclear rockets, and an introduction to interplanetary mission analysis. Nuclear electric propulsion will be introduced, leaving in-depth coverage of electric propulsion to AE566 Electric Propulsion. Recommended Background: AE 581 Rocket Propulsion I is recommended, but not required.

Rationale: Course has been taught (Spring 21) as a special topics course with 15 enrolled. It is a key part of both a broad offering in the MABE propulsion curriculum and also the Nuclear Security Science and Analysis Graduate Certificate program with the NE department. Impact on other units: None. Financial impact: None.

ADD PRIMARY CROSS-LISTED COURSES

AE 501 Advanced Engineering Mathematics (3) Provides new graduate students with a review and introduction of mathematics necessary for engineering problems in heat transfer, fluid dynamics, and more. Topics include solution of ODEs, Eigenvectors and Eigenvalues, Complex Variables Calculus, Fourier Analysis and Orthogonal functions, and PDES. Cross-listed: (Same as Biomedical Engineering 501 and Mechanical Engineering 501.)

Rationale: Course has been taught (Fall 2020, Fall 2021, and upcoming Fall 2022) as a special topics course with consistent enrollment (Total Students: Fall 2020=26, Fall 2021=21, Fall 2022 = 23 across the three cross-listed AE, ME, and BME sections) to warrant the catalog addition and enhance the program's ability to equip students with relevant knowledge and skills. The course addresses the department's need for graduate engineering mathematics course necessary for MS and Ph.D. students. Furthermore, it is one of a few mathematics electives available for UTSI graduates students (also open to UTK students). Impact on other units: None. Financial impact: None.

AE 504 Introduction to Uncertainty Quantification (3) Provides a foundational knowledge of uncertainty and propagation, quantification methodologies. It consists of 2 modules: I: Probability Concepts, Basic Statistical Operations, and Set Operations and II: Probabilistic UQ Methods with introduction to non-Probabilistic Methods Cross-listed: (Same as Biomedical Engineering 504 and Mechanical Engineering 504.)

Rationale: Course was taught during Spring 2022 as a special topic with 6 enrolled students. Impact on other units: None. Financial impact: None.

AE 526 Combustion and Propulsion for Future Aviation (3) Focuses on combustion dynamics and unsteady combustion process in gas turbine engines for commercial aviation. The goal is to describe the fundamentals of combustion processes at work in these propulsion systems including turbulent combustion and combustion instability. A major emphasis is on flame stabilization and combustion dynamics. Flame stabilization includes non-reacting flow processes and chemical reactions complexities associated to the flame front which are described. Combustion dynamics include phenomenon such as flashback, combustion oscillation, and blowoff. Elements of analytical, computational modeling and experimental measurements in the field are introduced and discussed. The operation and principles of gas turbines engines are also described. Finally, the perspective for research and development are outlined and include clean propulsion, sustainable aviation fuel, premixed combustion, and hydrogen combustion. Some of the materials presented in this course are also relevant to other combustion and propulsion systems (fighter aircraft and rocket engines) and will be discussed too.

Cross-listed: (Same as Mechanical Engineering 526.)

Recommended Background: Mechanical Engineering 525 - Combustion and Chemically Reacting Flows I.

Rationale: This course has been taught (Spring 2022) as a special topics course with 5 enrolled students. It is expected to grow further. It will enhance the program's ability to equip students with relevant knowledge and skills in combustion and propulsion for clean/decarbonized aviation. Impact on other units: None. Financial impact: None.
AE 544 Engineering Laser Spectroscopy (3) Covers state-of-the-art topics involving laser spectroscopy for engineering applications. It will include, but not limit to, fundamental optics, electromagnetic wave, principle of laser, laser induced fluorescence, laser scattering, Rayleigh scattering, Raman scattering, nonlinear optical spectroscopy and novel nanophotonics.
Cross-listed: (Same as Mechanical Engineering 544.)
Registration Permission: Consent of instructor.
Rationale: This course has been taught (Fall 2020, Fall 2019, Fall 2018) as a special topics (or advanced topics) course with consistent enrollment (3-5) to warrant the catalog addition and enhance the program’s ability to equip students with relevant knowledge and skills. Impact on other units: None. Financial impact: None.

ADD SECONDARY CROSS-LISTED COURSES

AE 520 Fundamentals of Gas Dynamics (3) Fundamentals of gas dynamics including varying area flow, flow through nozzles, standing normal shocks, Oblique shocks, flow with friction, flow with heat addition and an introduction to propulsion.
Cross-listed: (See Mechanical Engineering 520.)

AE 528 Applications of Partial Differential Equations in Engineering Systems (3) Mathematical and numerical solutions to classic problems in partial differential equations and their physical interpretation. Topics to be covered include: the heat equation, separation of variables methods, Fourier series, vibrating strings and membranes, the wave equation, Sturm-Liouville eigenvalue and eigenfunction problems, and introduction to finite difference methods.
Cross-listed: (See Mechanical Engineering 528.)

AE 551 Hybrid Materials (3) The overarching theme of the class is hybrid materials. We will start with a general overview of how engineering materials are classified and selected for design (Ashby-type analysis), then introduce the different classes of hybrid materials along with basic models for predicting limit behavior. We will then dive more deeply into each class of hybrid material (composites, laminates, sandwich structures, cellular materials, and segmented structures) and introduce models for mechanical and transport behavior, where applicable. At the end of this class the student should have a working knowledge of basic mechanics models for all classes of hybrid materials and be able to apply these models to design hybrid materials given a set of functional and material constraints (e.g. mass, volume, cost, strength, etc.). At the end of this course, the student should also have a working knowledge of the engineering materials landscape and a familiarity with resources available for more in-depth analysis and design of hybrid materials.
Cross-listed: (See Mechanical Engineering 551.)

REVISE TITLE AND DESCRIPTION, DELETE (DE) PREREQUISITE, AND ADD RECOMMENDED BACKGROUND AND CREDIT RESTRICTION

AE 511 Advanced Fluid Dynamics (3) Students will learn foundational materials of fluid dynamics. Topics covered include indicial notation, derivation of Navier-Stokes (N-S) equations, and operations on N-S equations to yield kinetic energy, vorticity, and other equations. Simplification to Euler, boundary layer, and potential flow are also covered. Similarity solutions, stability analysis, and numerical approximations are also introduced.
Credit Restriction: Students cannot receive credit for both Aerospace Engineering 511 and Aerospace Engineering 541 / Mechanical Engineering 541.
Recommended Background: A course in fluid mechanics.
Formerly:
Inviscid Flow (3) Kinematics and dynamics of inviscid fluids, potential flow about body, conformal mapping.
(DE) Prerequisite(s): 541 and Mathematics 425.
Rationale: The topics covered in AE512 Viscous Flow, AE532 Introduction to Turbulence, AE525 Hypersonic Flow, and other courses currently under development all require a strong understanding of both the Navier-Stokes equations and the assumptions/approaches used to transform them into the equations used in 512, 532, 525, etc. The has led to unnecessary repetition of the same material across these courses, along with the corresponding loss of time to provide more deeper coverage new course material. The updated AE 511 will provide this material, allowing instructors teaching 512, 532, 535, etc., more time to provide a deeper presentation/understanding of their specific topics. The material taught in the existing AE511 will still be covered either 511 or 512, of which are fundamental courses for AE graduate students. Academically, the overall impact of the update to AE511 will reduce repetition of material in multiple graduate level AE courses.
**REVISE DESCRIPTION, DELETE (DE) PREREQUISITE, AND ADD RECOMMENDED BACKGROUND**

**AE 513 Experimental Methods in Fluid Mechanics (3)** Experimental methodology and techniques emphasizing measurements in high-speed flows; wind tunnel facilities; data acquisition principles; modern optical and laser diagnostics (e.g., schlieren, pressure-sensitive paint, particle image velocimetry, molecular tagging velocimetry).

*Recommended Background: Undergraduate courses in compressible flow and fluid mechanics.*

Formerly: Experimental techniques with laboratory experiments; representative experiments: hot wire anemometry and turbulence measurements, flow visualization, wind tunnel tests, water table experiments, supersonic flow experiments, boundary layer measurements, laser-optical measurements.

*(DE) Prerequisite(s): Aerospace Engineering 541.*

**Rationale:** To more accurately describe the course content as delivered by the new instructor. Prof. Kreth has taught the course once before (Fall 2021) and is teaching it for the second time now (Fall 2022). The course was last offered by Prof. Ahmad Vakili in 2017.

**Impact on other units:** None. **Financial impact:** None.

**REVISE REPEATABILITY, ADD CREDIT RESTRICTION, AND ADD REGISTRATION PERMISSION**

**AE 599 Special Topics in Aerospace Engineering (1-3)**

*Repeatability: May be repeated. Maximum 9 hours.*

*Credit Restriction: Students cannot receive credit for more than 9 hours combined of Aerospace Engineering 599, Biomedical Engineering 599, and Mechanical Engineering 599.*

*Registration Permission: Consent of instructor.*

Formerly: AE 599 - Special Topics in Aerospace Engineering (1-3)

*Repeatability: May be repeated. Maximum 6 hours.*

**Rationale:** These changes are necessary to close the loophole recently exploited by graduate students to register for additional hours in a different program within the same department. **Impact on other units:** None. **Financial impact:** None.

**BIOMEDICAL ENGINEERING (BME)**

**ADD**

**BME 583 Systems Neuroscience and Neurotechnology (3)** An engineering approach to systems-level functions of the human nervous system as well as the current and emerging neurotechnologies to restore neural functions lost by disease or injury. Ethical considerations and clinical application challenges including relevant regulatory (FDA) guidelines and chronic viability of promising technologies.

*Credit Restriction: Students cannot receive credit for both Biomedical Engineering 483 and 583.*

**Rationale:** This course has been taught (Spring 2019 - Spring 2022) as a special topics course with consistent enrollment (3-4 students) to warrant the catalog addition and enhance the program’s ability to equip students with relevant knowledge and skills. **Impact on other units:** None. **Financial impact:** None.

**BME 605 Artificial Organs (3)** Current artificial organs include Heart, Liver, Kidney, Lung, Pancreas, Skin, Bladder, Auditory brainstem, Bionic contact lens, Cochlear implant and Retinal implant. This course will cover a different organ each week with student led discussions after an introduction of required foundational information.

*(DE) Prerequisite(s): Biomedical Engineering 486 and Biomedical Engineering 530.*

**Registration Permission: Consent of instructor can be given if the student does not have the suggested prerequisites.*

**Rationale:** This course was taught (Fall 2017) as an advanced course with enormous interest. At the time teaching was restricted to UTSI only but now we teach by Zoom I feel that it will have large numbers and warrant the catalog addition and enhance the program’s ability to equip students with relevant knowledge and skills. **Impact on other units:** None. **Financial impact:** None.

**BME 634 Advanced Biomechanics III (3)** Students will develop an advanced (Kane’s Dynamics) forward solution joint model using concepts learned from Advanced Biomechanics I (BME 531) and Advanced Biomechanics II (BME 631).

*(DE) Prerequisite(s): Biomedical or Mechanical Engineering 531 and Biomedical Engineering 631.*

**Rationale:** This course has been taught consistently since 2017 as an advanced topics course with a consistent enrollment of 2. Opening this course as a catalog course will allow more students to take the course and better understand the fundamentals of forward solution modeling. **Impact on other units:** None. **Financial impact:** None.
ADD SECONDARY CROSS-LISTED COURSES

BME 501 Advanced Engineering Mathematics (3) Provides new graduate students with a review and introduction of mathematics necessary for engineering problems in heat transfer, fluid dynamics, and more. Topics include solution of ODEs, Eigenvectors and Eigenvalues, Complex Variables Calculus, Fourier Analysis and Orthogonal functions, and PDES.
Cross-listed: (See Aerospace Engineering 501.)

Cross-listed: (See Aerospace Engineering 504.)

BME 551 Hybrid Materials (3) The overarching theme of the class is hybrid materials. We will start with a general overview of how engineering materials are classified and selected for design (Ashby-type analysis), then introduce the different classes of hybrid materials along with basic models for predicting limit behavior. We will then dive more deeply into each class of hybrid material (composites, laminates, sandwich structures, cellular materials, and segmented structures) and introduce models for mechanical and transport behavior, where applicable. At the end of this class the student should have a working knowledge of basic mechanics models for all classes of hybrid materials and be able to apply these models to design hybrid materials given a set of functional and material constraints (e.g. mass, volume, cost, strength, etc.). At the end of this course, the student should also have a working knowledge of the engineering materials landscape and a familiarity with resources available for more in-depth analysis and design of hybrid materials.
Cross-listed: (See Mechanical Engineering 551.)

BME 568 Polymer Processing and Rheology (3) Evaluation of flow mechanics and rheological properties that govern viscoelastic properties of polymer processes such as extrusion and 3D printing.
Cross-listed: (See Mechanical Engineering 568.)
Recommended Background: Undergraduate degree in engineering-related field.

REVISE REPEATABILITY AND ADD CREDIT RESTRICTION

BME 599 Special Topics in Biomedical Engineering (1-3)
Repeatability: May be repeated. Maximum 9 hours.
Credit Restriction: Students cannot receive credit for more than 9 hours combined of Aerospace Engineering 599, Biomedical Engineering 599, and Mechanical Engineering 599.

Formerly:
BME 599 Special Topics in Biomedical Engineering (1-3)
Repeatability: May be repeated. Maximum 12 hours.
Rationale: These changes are necessary to close the loophole recently exploited by graduate students to register for additional hours in a different program within the same department. Impact on other units: None. Financial impact: None.

MECHANICAL ENGINEERING (ME)

ADD

ME 523 Fracture Mechanics for Analysis and Design (3) Designed for students to gain hands-on experience with real world analysis. Students will learn to apply basic principles to solve practical problems. Intended as an introductory class for students prior to taking a theory based class and for students wanting to obtain a practical knowledge of fracture mechanics for industry applications.
Recommended Background: Mechanics of Materials.
Rationale: This class was previously taught with an enrollment of 8. Impact on other units: None. Financial impact: None.

ME 558 Nature-Inspired Surfaces (3) Will introduce a wide variety of nature-inspired functional surfaces. The unique surfaces of different biological species such as lotus leaves, springtails, sharks, water striders, and pitcher plant leaves will be discussed. The surface functionalities of these biological species will be analyzed by examining the detailed roles of surface texture and surface composition. We will discuss how the nature-inspired principles can be used to design functional surfaces for various applications such as self-cleaning fabrics, anti-icing and de-icing coatings, water harvesting, and drag reduction.
ME 561 Machining Dynamics (3) Course objective is to apply mechanical vibrations theory, including modal techniques and beam theory, to analysis of machining processes while emphasizing the practical significance of the results. Course topics include: review of mechanical vibrations, including free and forced vibrations of multiple degree of freedom systems; experimental and computational modal analysis; vibrations in machining operations; receptance coupling; and tool wear.

Recommended Background: Mechanical vibrations is beneficial, but not required.

Rationale: Course has been taught (Spring 2021 and Spring 2022) as a special topics course with consistent enrollment (10) to warrant the catalog addition and enhance the program’s ability to equip students with relevant knowledge and skills. Impact on other units: None. Financial impact: None.

ADD PRIMARY CROSS-LISTED COURSE

ME 520 Fundamentals of Gas Dynamics (3) Fundamentals of gas dynamics including varying area flow, flow through nozzles, standing normal shocks, Oblique shocks, flow with friction, flow with heat addition and an introduction to propulsion.

Cross-listed: (Same as Aerospace Engineering 520.)

Rationale: Course has been taught every year since 2017 to entering MS students who have not taken a gas dynamics class as an undergraduate. The course is necessary for almost every aerospace type course such as Turbomachinery, Rocket Propulsion, or advanced compressible flow courses. Impact on other units: None. Financial impact: None.

ME 528 Applications of Partial Differential Equations in Engineering Systems (3) Mathematical and numerical solutions to classic problems in partial differential equations and their physical interpretation. Topics to be covered include: the heat equation, separation of variables methods, Fourier series, vibrating strings and membranes, the wave equation, Sturm-Liouville eigenvalue and eigenfunction problems, and introduction to finite difference methods.

Cross-listed: (Same as Aerospace Engineering 528.)

Rationale: Course has been taught (Summer 2020, Spring 2021, Fall 2021, Summer 2022) as a Special Topics course with enrollment of over 30 students each time. It teaches students fundamental mathematical skills needed to solve graduate-level problems in thermodynamic and mechanical systems. Impact on other units: None. Financial impact: None.

ME 548 Optimal Control and Optimization with Engineering Applications (3) Designed for graduate students who are interested in advanced optimal control theory and numerical optimization algorithms for wide engineering applications. Topics include the basic principles of optimal control and optimization, calculus of variations, Pontryagin’s minimum principle, dynamic programming, direct and indirect methods, numerical optimization, convex optimization, model predictive control, learning-based control, and their applications for engineering problems from different fields.

Cross-listed: (Same as Aerospace Engineering 548 and Biomedical Engineering 548.)

(DE) Prerequisite(s): Mechanical Engineering 451 or equivalent.

Rationale: Course has been taught as a special topics (Spring 2020, Spring 2021) course and an advanced topics (Spring 2022) course with consistent enrollment (6–7 average section size) to warrant the catalog addition and enhance the program’s ability to equip students with relevant knowledge and skills. Impact on other units: None. Financial impact: None.

ME 551 Hybrid Materials (3) The overarching theme of the class is hybrid materials. We will start with a general overview of how engineering materials are classified and selected for design (Ashby-type analysis), then introduce the different classes of hybrid materials along with basic models for predicting limit behavior. We will then dive more deeply into each class of hybrid material (composites, laminates, sandwich structures, cellular materials, and segmented structures) and introduce models for mechanical and transport behavior, where applicable. At the end of this class the student should have a working knowledge of basic mechanics models for all classes of hybrid materials and be able to apply these models to design hybrid materials given a set of functional and material constraints (e.g. mass, volume, cost, strength, etc.). At the end of this course, the student should also have a working knowledge of the engineering materials landscape and a familiarity with resources available for more in-depth analysis and design of hybrid materials.

Cross-listed: (Same as Aerospace Engineering 551 and Biomedical Engineering 551.)


Rationale: Course has been taught four times (Fall 2016, Spring 2018, Spring 2020, Spring 2022) as a special topics course with consistent and increasing enrollment (4, 4, 7, 15, respectively) to warrant addition to the catalog and assignment of a permanent number. This course covers topics that support the advanced structural materials/advanced manufacturing research that is a strength within the MAE department. Impact on other units: None. Financial impact: None.
ME 568 Polymer Processing and Rheology (3) Evaluation of flow mechanics and rheological properties that govern viscoelastic properties of polymer processes such as extrusion and 3D printing. Recommended Background: Undergraduate degree in engineering-related field.

Rationale: Course was taught (Fall 2020) as a special topics course with enrollment of 12 students. It has been consistently requested by students in future semesters, some of whom cannot get credit for it as a ME 599 course. Altering the course # would enhance the program’s ability to equip students with relevant knowledge and skills. Impact on other units: None. Financial impact: None.

ADD SECONDARY CROSS-LISTED COURSES

ME 501 Advanced Engineering Mathematics (3) Provides new graduate students with a review and introduction of mathematics necessary for engineering problems in heat transfer, fluid dynamics, and more. Topics include solution of ODEs, Eigenvectors and Eigenvalues, Complex Variables Calculus, Fourier Analysis and Orthogonal functions, and PDES.

Cross-listed: (See Aerospace Engineering 501.)

ME 504 Introduction to Uncertainty Quantification (3) Provides a foundational knowledge of uncertainty and propagation, quantification methodologies. It consists of 2 modules: I: Probability Concepts, Basic Statistical Operations, and Set Operations and II: Probabilistic UQ Methods with introduction to non-Probabilistic Methods

Cross-listed: (See Aerospace Engineering 504.)

ME 526 Combustion and Propulsion for Future Aviation (3) Focuses on combustion dynamics and unsteady combustion process in gas turbine engines for commercial aviation. The goal is to describe the fundamentals of combustion processes at work in these propulsion systems including turbulent combustion and combustion instability. A major emphasis is on flame stabilization and combustion dynamics. Flame stabilization includes non-reacting flow processes and chemical reactions complexities associated to the flame front which are described. Combustion dynamics include phenomenon such as flashback, combustion oscillation, and blowoff. Elements of analytical, computational modeling and experimental measurements in the field are introduced and discussed. The operation and principles of gas turbines engines are also described. Finally, the perspective for research and development are outlined and include clean propulsion, sustainable aviation fuel, premixed combustion, and hydrogen combustion. Some of the materials presented in this course are also relevant to other combustion and propulsion systems (fighter aircraft and rocket engines) and will be discussed too.

Cross-listed: (See Aerospace Engineering 526.)

Recommended Background: Mechanical Engineering 525 - Combustion and Chemically Reacting Flows I.

ME 544 Engineering Laser Spectroscopy (3) Covers state-of-the-art topics involving laser spectroscopy for engineering applications. It will include, but not limit to, fundamental optics, electromagnetic wave, principle of laser, laser induced fluorescence, laser scattering, Rayleigh scattering, Raman scattering, nonlinear optical spectroscopy and novel nanophotonics.

Cross-listed: (See Aerospace Engineering 544.)

Registration Permission: Consent of instructor.

REVISE TO ADD CREDIT RESTRICTION ON CROSS-LISTED COURSE

ME 541 Fluid Mechanics I (3) Credit Restriction: Students cannot receive credit for both Aerospace Engineering 511 and Aerospace/Mechanical Engineering 541.

Formerly: (Same as Aerospace Engineering 541.)

Rationale: Revisions to AE 511 created more convergence of initial topics with AE/ME 541 but then distinctly diverging to AE-only student content for AE 511 to warrant this change so that students are not taking both courses. Impact on other units: None. Financial impact: None.

REVISE REPEATABILITY AND ADD CREDIT RESTRICTION

ME 599 Special Topics in Biomedical Engineering (1-3) Repeatability: May be repeated. Maximum 9 hours. Credit Restriction: Students cannot receive credit for more than 9 hours combined of Aerospace Engineering 599, Biomedical Engineering 599, and Mechanical Engineering 599.
Formerly:
Repeatability: May be repeated. Maximum 6 hours.
Rationale: These changes are necessary to close the loophole recently exploited by graduate students to register for additional hours in a different program within the same department. Impact on other units: None. Financial impact: None.

DEPARTMENT OF NUCLEAR ENGINEERING

Nuclear Engineering (NE)

ADD

NE 515 Introduction to Radiochemistry (3) An introduction into the fundamental principles of radiochemistry and modern applications. This an undergraduate and graduate course (NE 515) taught concurrently, where graduate students will have additional requirements and assignments.
Credit Restriction: Students cannot receive credit for both NE 415 and NE 515.

NE 516 Introduction to Radiochemistry Lab (1) An introduction to fundamentals principles of radiochemistry. This class will cover basic techniques and analytical measurements ranging from detection of radioactive material to design of experiments for modern applications, including medicine. This an undergraduate and graduate lab course (NE 516) taught concurrently, where graduate students will have additional requirements and assignments.
Credit Restriction: Students cannot receive credit for both NE 416 and NE 516.
Rationale: These two courses are being added to our curriculum because we’ve hired a new professor in this area. Impact on other units: None. Financial impact: None.

DROP

NE 543 Selected Topics in Nuclear Criticality Safety (3)
Rationale: Course was taught by professor who has retired. No reason to keep it. Impact on other units: none. Financial Impact: none.

REVISE CREDIT HOURS

NE 494 Special Topics in Nuclear Engineering (1-3)
Formerly:
(3)
Rationale: Adding flexibility to students and professors who may not always need to have 3-credit special topics courses. Impact on other units: None. Financial impact: None.

REVISE CREDIT RESTRICTION

NE 501 Graduate Seminar (1)
Credit Restriction: For MS students, a maximum of 3 hours may be applied to the major. For PhD students with an MS external to UTNE, a maximum of 3 hours of NE 501 may be applied to the major. For PhD students directly from BS, a minimum of 3 hours and a maximum of 6 hours may be applied to the major. For PhD students with a UTNE MS, the sum of all NE 501 credits cannot exceed 6 hours.
Formerly:
Credit Restriction: For MS students, a maximum of 3 hours may be applied to the major. For PhD students with MS, a maximum of 3 hours may be applied to the major. For PhD students directly from BS, a maximum of 6 hours may be applied to the major.
Rationale: Adding clarification for students entering the PhD program without an MS degree, they can take a minimum of 3 hours of NE 501 but up to 6 credits of NE 501. Impact on other units: None. Financial impact: None.
REVISE SECONDARY CROSS-LISTED COURSE TO REVISE NAME OF PRIMARY COURSE

**NE 584 Introduction to Fire Protection Engineering (3)**  
*Cross-Listed: (See Engineering Fundamentals 563.)*

Formerly:
Cross-Listed: (See Electrical and Computer Engineering (ECE) 563).

Rationale: Engineering Fundamentals 563 is being added and will become primary course (replacing ECE 563). Civil Engineering 585 and Nuclear Engineering 584 will become secondary cross listed to the new Engineering Fundamentals 563. Impact on other units: None. Financial impact: None.

REVISE CREDIT HOURS

**NE 597 Special Topics in Nuclear Engineering (1-3)**

Formerly:
NE 597 Special Topics in Nuclear Engineering (3)

Rationale: Adding flexibility to students and professors who may not always need to have 3-credit special topics courses. Impact on other units: None. Financial impact: None.

**NE 697 Special Topics in Nuclear Engineering (1-3)**

Formerly:
NE 697 Special Topics in Nuclear Engineering (3)

Rationale: Adding flexibility to students and professors who may not always need to have 3-credit special topics courses. Impact on other units: None. Financial impact: None.

II. PROGRAM CHANGES

DEPARTMENT OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

❖ DROP CONCENTRATIONS – COMPUTER SCIENCE MAJOR, MS

Applied Cybersecurity  
Computational Imaging  
Computer-Human Interaction  
Cyberinfrastructure  
Data Mining  
Data Visualization  
Discrete Optimization  
High Performance Computing  
Life Science Applications  
Software Systems

In the 2023-24 Graduate Catalog, revise to drop 10 of the 15 concentrations:

**Concentrations (Optional) and Options Available**

Cybersecurity – (DE only), Coursework Only Without Comprehensive Exams  
Data Analytics – Thesis, Project, Coursework Only Without Comprehensive Exams  
Data Mining and Intelligent Systems – Thesis, Project, Coursework Only Without Comprehensive Exams  

Formerly:
Applied Cybersecurity
Computational Imaging
Computer-Human Interaction
Cybersecurity
Cyberinfrastructure
Data Analytics
Data Mining
Data Mining and Intelligent Systems
Data Visualization
Discrete Optimization
High Performance Computing
Intelligent Systems and Machine Learning
Life Science Applications
Software Engineering
Software Systems

Rationale: The faculty decided to drop 10 of our 15 concentrations that do not have any course (or other) requirements attached to the concentration. The remaining 5 concentrations are Cybersecurity, Data Analytics, Data Mining and Intelligent Systems, Intelligent Systems and Machine Learning, and Software Engineering. The faculty plans to define requirements for Data Analytics and ISML in a subsequent revision. Impact on other units: none. Financial impact: none.

REVISE CAMPUS CODE – COMPUTER SCIENCE MAJOR, MS (CYBERSECURITY CONCENTRATION)

In the 2023-24 Graduate Catalog, revise campus code for the Cybersecurity concentration as a DE only option.

Campus Code
Distance Education – Cybersecurity – (DE only), Coursework Only Without Comprehensive Exams

Rationale: Revising the Cybersecurity concentration to remove Knoxville campus option and revise it to Distance Education option. Impact on other units: none. Financial impact: none.

REVISE ADMISSIONS STANDARDS/PROCEDURES – COMPUTER SCIENCE MAJOR, MS

In the 2023-24 Graduate Catalog, for the Computer Science Major, MS, under the Admissions Standards/Procedures heading, remove first subset bullet:

Formerly:
Two semesters of calculus plus two additional semesters of college mathematics (e.g. linear algebra, differential equations, probability) and a course in formal languages, as well as in systems programming, are required for admission.

Rationale: This requirement is not necessary because admitted students will either hold a bachelor’s degree in Computer Science or will be required to take select undergraduate courses as determined by the applicant’s prior education and experience. Impact on other units: none. Financial impact: none.

In the 2023-24 Graduate catalog, Admissions Standards/Procedures heading, revise the next to last bullet as follows:

• The student will be admitted under non-degree status until the required undergraduate courses are successfully completed with a grade of B or better.

Formerly:
The student will be admitted under non-degree status until the required undergraduate courses are successfully completed with a 3.00 GPA average.

Rationale: This revision makes it so students who are admitted under non-degree status must complete all required undergraduate courses with a grade of B or better, rather than with a 3.0 average. Students who cannot obtain at least a B in the required undergraduate coursework are not ready for this graduate program. Impact on other units: none. Financial impact: none.

REVISE REQUIRED COURSES – COMPUTER SCIENCE MAJOR, MS

In the 2023-24 Graduate Catalog, for the Computer Science Major, MS, under the Required Courses heading, revise the Option Specific Courses as follows:

Option Specific Courses:
• Thesis Option: 24 credit hours graduate coursework, plus 6 credit hours of COSC 500 (6 credit hours).
• Project Option: 27 credit hours graduate coursework, plus 3 credit hours of COSC 501 (3 credit hours), with a minimum grade of B.
Formerly:
Option Specific Courses:
Thesis Option: COSC 500 (6 credit hours)
Project Option: COSC 501 (3 credit hours), a minimum grade of B.

Rationale: This revision makes the description of option specific courses consistent across the CS, CPE, and EE MS programs. Impact on other units: none. Financial impact: none.

REVISE COMPUTER SCIENCE MAJOR, MS – CYBERSECURITY CONCENTRATION FOR OPTIONS AVAILABLE

In the 2023-24 Graduate Catalog, revise the Cybersecurity concentration to
1) remove the Thesis Option and the Project Option. This concentration will now be: Coursework Only Without Comprehensive Exams Option.
2) Also, revise the heading, text, and requirements for the dropped Applied Cybersecurity to now show as Cybersecurity as shown below:

Cybersecurity – Coursework Only Without Comprehensive Exams Option

The Cybersecurity concentration focuses on the theory and practice of cybersecurity, with an emphasis on its application in modern technological business, government, and society.

Campus Code: Distance Education

Credit Hours Required: 30 graduate credit hours

Required Courses
Cybersecurity students take a total of 30 graduate credit hours as shown below. All courses are 3 credit hours each.

- Core courses - Students must take both core courses.
  - COSC 530
  - COSC 566

- Focus area courses – Students much take four of the focus area courses.
  - COSC 534
  - COSC 569
  - COSC 583
  - ECE 559
  - ECE 569

- Elective courses - Students must take four of the elective courses (or from the focus area courses above).
  - COSC 522
  - COSC 523
  - COSC 524
  - COSC 525
  - COSC 526
  - COSC 533
  - COSC 540
  - COSC 545
  - COSC 557
  - COSC 558
  - COSC 559
  - COSC 561
  - COSC 562
  - COSC 563
  - COSC 565
  - COSC 581
  - ECE 517
  - ECE 553
  - ECE 574

Students can take coursework in a manner that best fits their schedule. The Cybersecurity concentration does not strictly use a cohort system, so students can complete the concentration as their schedule and finances allow. This flexibility would allow students to complete the concentration in as little as 18 months or more slowly based upon individual situations.

Rationale: The faculty has decided to add requirements for the Cybersecurity concentration. Impact on other units: none. Financial impact: none.
¡ DROP CONCENTRATIONS - COMPUTER SCIENCE MAJOR, PHD ¡

Computational Imaging
Computer-Human Interaction
Cybersecurity
Cyberinfrastructure
Data Mining
Data Visualization
Discrete Optimization
High Performance Computing
Life Science Applications
Software Systems

In the 2023-24 Graduate Catalog, revise to drop 10 of our 12 Concentrations:

Concentrations (Optional)
  Data Analytics
  Intelligent Systems and Machine Learning

Formerly:
Computational Imaging
Computer-Human Interaction
Cybersecurity
Cyberinfrastructure
Data Analytics
Data Mining
Data Visualization
Discrete Optimization
High Performance Computing
Intelligent Systems and Machine Learning
Life Science Applications
Software Systems

Rationale: The faculty decided to drop 10 of the 12 concentrations that do not have any course (or other) requirements attached to the concentration. The faculty plans to define requirements for the 2 concentrations being retained: Data Analytics, and Intelligent Systems and Machine Learning, in a subsequent revision. Impact on other units: none. Financial impact: none.

REVISE ADMISSIONS STANDARDS/PROCEDURES - COMPUTER SCIENCE MAJOR, PHD

In the 2023-24 Graduate Catalog, Computer Science Major, PhD, under the Admissions Standards/Procedures heading, revise to add subset bullet under 2nd bullet:

Admissions Standards/Procedures
  • Exceptional students holding the bachelor’s degree may be admitted to the doctoral program without first obtaining a master’s degree.
  • Applicants are required to submit scores from the general Graduate Record Examination (GRE) within the past three years and to have these scores sent to the Office of Graduate Admissions.
    o Applicants who have received a degree from an accredited U.S. institution are exempt from the GRE requirement.

Formerly:
Exceptional students holding the bachelor’s degree may be admitted to the doctoral program without first obtaining a master’s degree.
Applicants are required to submit scores from the general Graduate Record Examination (GRE) within the past three years and to have these scores sent to the Office of Graduate Admissions.

Rationale: regarding the GRE for students holding a degree from a US institution is being added to be consistent with department policy. Impact on other units: none. Financial impact: none.

In the 2023-24 Graduate Catalog, Computer Science Major, PhD, under the Admissions Standards/Procedures heading, at the 4th bullet, remove the 2nd sub-bullet.

Formerly:
Two semesters of calculus plus two additional semesters of college mathematics (e.g. linear algebra, differential equations, probability) and a course in formal languages, as well as in systems programming, are required for admission.
Rationale: This requirement is not necessary because admitted students will either hold a bachelor’s degree in Computer Science or will be required to take select undergraduate courses as determined by the applicant’s prior education and experience. Impact on other units: none. Financial impact: none.

In the 2023-24 Graduate Catalog, Computer Science Major, PhD, under the Admissions Standards/Procedures heading, revise the next to last sub-bullet as follows:

- The student will be admitted under non-degree status until the required undergraduate courses are successfully completed with a grade of B or better.

Formerly:
The student will be admitted under non-degree status until the required undergraduate courses are successfully completed with a 3.00 GPA average.

Rationale: This revision makes it so students who are admitted under non-degree status must complete all required undergraduate courses with a grade of B or better, rather than with a 3.0 average. Students who cannot obtain at least a B in the required undergraduate coursework are not ready for this graduate program. Impact on other units: none. Financial impact: none.

REVISE REQUIRED COURSES – COMPUTER SCIENCE MAJOR, PHD

In the 2023-24 Graduate Catalog, Computer Science Major, PhD, under the Required Courses heading revise sub-bullet 1 and 3 as shown below.

- Complete COSC 530, either COSC 540, COSC 561, or COSC 562, and either COSC 580 or COSC 581 with a grade of B or better.
- For students holding an MS degree, a maximum of 6 credit hours at the 400-level may be applied toward the Ph.D. degree; other students may apply 12 credit hours at the 400-level. All 400-level courses applied towards the degree must be listed in the Graduate Catalog.

Formerly:
Complete COSC 530, either COSC 540, COSC 561, or COSC 562, and either COSC 580 or COSC 581.

For students holding an MS degree, a maximum of 6 credit hours at the 400-level may be applied toward the Ph.D. degree; other students may apply 12 credit hours at the 400 level (these 400-level courses must be listed in the Graduate Catalog for graduate credit)

Rationale: The requirement that the core courses are passed with a grade of B or better was inadvertently dropped from a previous catalog revision. The revision regarding the 400-level courses improves clarity. Impact on other units: none. Financial impact: none.

REVISE NON-COURSE REQUIREMENTS - COMPUTER SCIENCE MAJOR, PHD

In the 2023-24 Graduate Catalog, under the Non-Course Requirements heading, remove the 1st bullet and the 12 bullets that references the dropped concentrations.

Formerly:
In consultation with their advisor, students may select one of the following concentrations. Concentrations reflect research focus area and do not include specific course requirements:
- Computational Imaging
- Computer-Human Interaction
- Cybersecurity
- Cyberinfrastructure
- Data Analytics
- Data Mining
- Data Visualization
- Discrete Optimization
- High Performance Computing
- Intelligent Systems and Machine Learning
- Life Science Applications
- Software Systems

Rationale: The faculty has decided to remove all concentrations that do not have any course (or other) requirements attached to the concentration. Impact on other units: none. Financial impact: none.

REVISE NON-COURSE REQUIREMENTS – COMPUTER SCIENCE MAJOR, PHD

In the 2023-24 Graduate Catalog, under the Non-Course Requirements heading, at the 2nd bullet, revise the 3rd sub-bullet concerning the written and oral parts of the comprehensive exam as shown below:
• The comprehensive examination consists of both written and oral parts.
  - The Written Part:
    ▪ The written part includes a complete review of the literature in the student's dissertation topic, a review of the major tools to be used in the dissertation work, and proposed research.
    ▪ The student's committee may require additional written sections.
    ▪ The student must demonstrate a mastery of the dissertation area, ability to think analytically and creatively, skill in using academic resources, and ability to complete the dissertation satisfactorily.
  - The Oral Part:
    ▪ The oral part of the comprehensive examination consists primarily of a professional presentation of a proposal for dissertation work and its defense.
    ▪ The committee may cover additional topics in the oral part.
  - The comprehensive exam must be completed within five years of the date of the student's first enrollment in this program.

Formerly:
The comprehensive examination consists of both written and oral parts.
The written part includes a complete review of the literature in the student's dissertation topic and a review of the major tools to be used in the dissertation work, and proposed research.
The student's committee may require additional written sections.
The student must demonstrate a mastery of the dissertation area, ability to think analytically and creatively, skill in using academic resources, and ability to complete the dissertation satisfactorily.
The oral part of the comprehensive examination consists primarily of a professional presentation of a proposal for dissertation work and its defense.
The committee may cover additional topics in the oral part.

Rationale: This revision reiterates the need for students to complete their comprehensive exams within five years of their first enrollment and edits the description of the comprehensive exam to be consistent with the CPE and EE PhD programs. Impact on other units: none. Financial impact: none.

❖ DROP ALL CONCENTRATIONS - COMPUTER ENGINEERING MAJOR, MS

Computer Architecture
Computer Networks
Computer Vision
Cybersecurity
Data Analytics
Embedded Systems
Image Processing
Information Systems
Signal Processing
VLSI System Design

In the 2023-24 Graduate Catalog, revise to drop all ten (10) Concentrations:

Concentrations – None available

Formerly:
Concentrations (Optional) and Options Available
Computer Architecture
Computer Networks
Computer Vision
Cybersecurity
Data Analytics
Embedded Systems
Image Processing
Information Systems
Signal Processing
VLSI System Design

Rationale: The faculty decided to drop/remove all concentrations that do not have any course (or other) requirements attached to the concentration. Impact on other units: none. Financial impact: none.
REVISE ADMISSIONS STANDARDS/PROCEDURES - COMPUTER ENGINEERING MAJOR, MS

In the 2023-24 Graduate Catalog, Computer Engineering, MS, under the Admissions Standards/Procedures heading, revise the next to last bullet as follows:

- The student will be admitted under non-degree status until the required undergraduate courses are successfully completed with a grade of B or better.

Formerly:
The student will be admitted under non-degree status until the required undergraduate courses are successfully completed with a 3.00 GPA average.

Rationale: This revision makes it so students who are admitted under non-degree status must complete all required undergraduate courses with a grade of B or better, rather than with a 3.0 average. Students who cannot obtain at least a B in the required undergraduate coursework are not ready for this graduate program. Impact on other units: none. Financial impact: none.

REVISE REQUIRED COURSES – COMPUTER ENGINEERING MAJOR, MS

In the 2023-24 Graduate Catalog, Computer Engineering, MS, under the Required Courses heading, Option Specific Courses, remove third bullet referencing “Coursework Only”. Revising to two options: Thesis Option and Project Option.

Option Specific Courses:
- Thesis option = 24 credit hours graduate coursework, plus 6 credit hours of ECE 500 (6 credit hours).
- Project option = 27 credit hours graduate coursework, plus 3 credit hours of ECE 501 (3 credit hours) - with minimum grade of B.

Formerly:
Option Specific Courses:
- Thesis option = 24 credit hours graduate coursework, plus 6 credit hours of ECE 500 (6 credit hours).
- Project option = 27 credit hours graduate coursework, plus 3 credit hours of ECE 501 (3 credit hours) - with minimum grade of B.
- Coursework Only Without Comprehensive Exams = 30 credit hours of graduate coursework.

Rationale: This revision (dropping the 3rd bullet) makes the description of option specific courses consistent across the CS, CPE, and EE MS programs. Impact on other units: none. Financial impact: none.

REVISE NON-COURSE REQUIREMENTS - COMPUTER ENGINEERING MAJOR, MS

In the 2023-24 Graduate Catalog, under the Non-Course Requirements heading, remove 1st bullet and the 10 bullets listed referencing the 10 dropped concentrations.

Formerly:
Non-Course Requirements
In consultation with their advisor, students may select one of the following concentrations. Concentrations reflect research focus area and do not include specific course requirements.
- Computer Architecture
- Computer Networks
- Computer Vision
- Cybersecurity
- Data Analytics
- Embedded Systems
- Image Processing
- Information Systems
- Signal Processing
- VLSI System Design

Rationale: The faculty decided to drop/remove all concentrations that do not have any course (or other) requirements attached to the concentration. Impact on other units: none. Financial impact: none.

❖ DROP CONCENTRATIONS - COMPUTER ENGINEERING MAJOR, PHD

- Computer Architecture
- Computer Networks
- Computer Vision
- Cybersecurity
- Data Analytics
In the 2023-24 Graduate Catalog, revise to drop 10 of our 11 concentrations:

**Concentration (Optional)**
- Energy Science and Engineering

Formerly:
- Computer Architecture
- Computer Networks
- Computer Vision
- Cybersecurity
- Data Analytics
- Embedded Systems
- Energy Science and Engineering
- Image Processing
- Information Systems
- Signal Processing
- VLSI System Design

Rationale: The faculty decided to drop/remove all concentrations that do not have any course (or other) requirements attached to the concentration. The only concentration remaining is Energy Science and Engineering. Impact on other units: none. Financial impact: none.

REVISE ADMISSIONS STANDARDS/PROCEDURES - COMPUTER ENGINEERING MAJOR, PHD

In the 2023-24 Graduate Catalog, Computer Engineering, PhD, under the Admissions Standards/Procedures heading revise as follows:

**Admissions Standards/Procedures**
- Exceptional students holding the bachelor’s degree may be admitted to the doctoral program without first obtaining a master’s degree.
- Applicants are required to submit scores from the general Graduate Record Examination (GRE) within the past three years and to have these scores sent to the Office of Graduate Admissions.
  - Applicants who have received a degree from an accredited U.S. institution are exempt from the GRE requirement.
- A TOEFL score of 550 on the written exam or 80 on the Internet-based Test is required for non-native speakers of English, including those who have earned degrees at U.S. institutions.
  - The score must be no more than two years old from the requested date of entry.
  - Applicants who have received a degree from an accredited U.S. institution within the past two years are exempt from the TOEFL requirement.
- Applicants who hold the bachelor’s degree in fields other than electrical or computer engineering will be required to take selected undergraduate courses as determined by the applicant’s prior education and experience.
  - The student will be admitted under non-degree status until the required undergraduate courses are successfully completed with a grade of B or better.

Formerly:
Admissions Standards/Procedures
Exceptional students holding the bachelor’s degree may be admitted to the doctoral program without first obtaining a master’s degree.
Applicants are required to submit scores from the general Graduate Record Examination (GRE) within the past three years and to have these scores sent to the Office of Graduate Admissions.
A TOEFL score of 550 on the written exam or 80 on the Internet-based Test is required for non-native speakers of English, including those who have earned degrees at U.S. institutions.
The score must be no more than two years old from the requested date of entry.
Applicants who have received a degree from an accredited U.S. institution within the past two years are exempt from the TOEFL requirement.

Rationale: Indentation is being updated to improve clarity. Text regarding the GRE for students holding a degree from a US institution is being added to be consistent with department policy. The text regarding students with non-degree status is being added to make the CPE Admissions Standards consistent with the other MS and PhD programs in EECS. Impact on other units: none. Financial impact: none.
REVISE REQUIRED COURSES - COMPUTER ENGINEERING MAJOR, PHD

In the 2023-24 Graduate Catalog, under the Required Courses, revise fourth bullet (and sub-bullet) as follows:

- For students holding an MS degree, a maximum of 6 credit hours of graduate courses at the 400-level may be applied toward the PhD degree. Other students may apply 12 credit hours of graduate courses at the 400-level selected in consultation with major professor and/or committee. All 400-level courses applied towards the degree must be listed in the Graduate Catalog.

Formerly:
For students holding an MS degree, a maximum of 6 credit hours of graduate courses at the 400-level may be applied toward the PhD degree.
Other students may apply 12 credit hours of graduate courses at the 400-level (must be listed in the Graduate Catalog for graduate credit) selected in consultation with major professor and/or committee.


REVISE NON-COURSE REQUIREMENTS - COMPUTER ENGINEERING MAJOR, PHD

In the 2023-24 Graduate Catalog, under the Non-Course Requirements heading, revise to remove the first bullet and the sub-bullets listing the 10 concentrations:

Formerly:
Non-Course Requirements
In consultation with their advisor, students may select one of the following concentrations. Concentrations reflect research focus area and do not include specific course requirements:
- Computer Architecture
- Computer Networks
- Computer Vision
- Cybersecurity
- Data Analytics
- Embedded Systems
- Image Processing
- Information Systems
- Signal Processing
- VLSI System Design

Rationale: The faculty has decided to remove all concentrations that do not have any course (or other) requirements attached to the concentration. Impact on other units: none. Financial impact: none.

REVISE NON-COURSE REQUIREMENTS – COMPUTER ENGINEERING MAJOR, PHD

In the 2023-24 Graduate Catalog, under the Non-Course Requirements heading, at the 3rd bullet, under the 8th sub-bullet, revise text under bullet “The Oral Part” as shown below:

- The Oral Part:
  - The oral part of the comprehensive examination consists primarily of a professional presentation of a proposal for dissertation work and its defense.
  - The committee may cover additional topics in the oral part.
- The comprehensive exam must be completed within five years of the date of the student’s first enrollment in this program.

Formerly:
The Oral Part
The oral part of the comprehensive examination consists primarily of a professional presentation of a proposal for dissertation work and its defense. The committee may cover additional topics in the oral part.

Rationale: Adding the second bullet for the Oral Part reiterates the need for students to complete their comprehensive exams within five years of their first enrollment and edits the description of the comprehensive exam to be consistent with the CS and EE PhD programs. Impact on other units: none. Financial impact: none.
DROP CONCENTRATIONS - ELECTRICAL ENGINEERING MAJOR, MS

Automotive Manufacturing and Technology
Communications
Control Systems
Electromagnetics and RF Circuits
Fire Protection Engineering
Power Systems
Signal Processing
Solid-state Electronics

In the 2023-24 Graduate Catalog, revise to drop 8 of our 9 concentrations.

Concentration (Optional)

Power Electronics - Thesis Option, Project Option, Coursework Only Without Comprehensive Exams Option

Formerly:
Automotive Manufacturing and Technology
Communications
Control Systems
Electromagnetics and RF Circuits
Fire Protection Engineering
Power Electronics
Power Systems
Signal Processing
Solid-state Electronics

Rationale: The faculty decided to drop 8 of our 9 concentrations that do not have any course (or other) requirements attached to the concentration. The remaining concentration is Power Electronics. Impact on other units: none. Financial impact: none.

REVISE ADMISSIONS STANDARDS/PROCEDURES - ELECTRICAL ENGINEERING MAJOR, MS

In the 2023-24 Graduate Catalog, under the Admissions Standards/Procedures heading, revise the next to last bullet as follows:

- The student will be admitted under non-degree status until the required undergraduate courses are successfully completed with a grade of B or better.

Formerly:
The student will be admitted under non-degree status until the required undergraduate courses are successfully completed with a 3.00 GPA average.

Rationale: This revision makes it so students who are admitted under non-degree status must complete all required undergraduate courses with a grade of B or better, rather than with a 3.0 average. Students who cannot obtain at least a B in the required undergraduate coursework are not ready for this graduate program. Impact on other units: none. Financial impact: none.

REVISE REQUIRED COURSES – ELECTRICAL ENGINEERING MAJOR, MS

In the 2023-24 Graduate Catalog, under the Required Courses heading, under the Option Specific bullet revise as follows:

Option Specific Courses:
- Thesis Option: 24 credit hours graduate coursework, plus 6 credit hours of ECE 500 (6 credit hours).
- Project Option: 27 credit hours graduate coursework, plus 3 credit hours of ECE 501 (3 credit hours), with a minimum grade of B.

Formerly:
Option Specific Courses
Thesis Option: ECE 500 (6 credit hours)
Project Option: ECE 501 (3 credit hours), with a minimum grade of B.

Rationale: This revision makes the description of option specific courses consistent across the CS, CPE, and EE MS programs. Impact on other units: none. Financial impact: none.
REVISE NON-COURSE REQUIREMENTS - ELECTRICAL ENGINEERING MAJOR, MS

In the 2023-24 Graduate Catalog, under the Non-Course Requirements heading, revise the 1st bullet and remove the sub-bullets listing the dropped concentrations as follows:

Non-Course Requirements
- In consultation with their advisor, students may select the following concentration. Concentration reflects research focus area and does not include specific course requirements:
  - Power Electronics

Formerly:
Non-Course Requirements
In consultation with their advisor, students may select one of the following concentrations. Concentrations reflect research focus area and do not include specific course requirements:
- Automotive Manufacturing and Technology
- Communications
- Control Systems
- Electromagnetics and RF Circuits
- Fire Protection Engineering
- Power Systems
- Signal Processing
- Solid-state Electronics

Rationale: The faculty decided to drop/remove all concentrations that do not have any course (or other) requirements attached to the concentration. The remaining concentration is Power Electronics. Impact on other units: none. Financial impact: none.

REVISE ELECTRICAL ENGINEERING MAJOR, MS, TO ADD HEADING AND REQUIREMENTS FOR POWER ELECTRONICS CONCENTRATION

In the 2023-24 Graduate Catalog, insert heading, text and requirements for the Power Electronics concentration.

Power Electronics Concentration - Thesis Option, Project Option, Coursework Only Without Comprehensive Exams Option

Select 4 courses from the following:
- ECE 581, ECE 582, ECE 583, ECE 585, ECE 586, ECE 625, ECE 682, ECE 683, ECE 684, ECE 686
- Or ECE 599 and ECE 692 with approval of the faculty

Rationale: This revision establishes course requirements for the Power Electronics concentration for the EE MS. Impact on other units: none. Financial impact: none.

❖ DROP CONCENTRATIONS - ELECTRICAL ENGINEERING MAJOR, PHD

Automotive Manufacturing and Technology
Communications
Control Systems
Electromagnetics and RF Circuits
Fire Protection Engineering
Power Systems
Signal Processing
Solid-state Electronics

In the 2023-24 Graduate Catalog, drop 8 of the 10 concentrations. Two concentrations to remain active are shown below.

Concentrations (Optional)
- Energy Science and Engineering
- Power Electronics

Formerly:
Automotive Manufacturing and Technology
Communications
Control Systems
Electromagnetics and RF Circuits
Energy Science and Engineering
Fire Protection Engineering
Rationale: The faculty decided to drop concentrations that do not have any course (or other) requirements attached to the concentration. The remaining concentrations include Energy Science and Engineering, and Power Electronics. Impact on other units: none. Financial impact: none.

REVISE ADMISSIONS STANDARDS/PROCEDURES - ELECTRICAL ENGINEERING MAJOR, PHD

In the 2023-24 Graduate Catalog, revise the Admissions Standards/Procedures section as follows:

Admissions Standards/Procedures

• Exceptional students holding the bachelor’s degree may be admitted to the doctoral program without first obtaining a master’s degree.
• Applicants are required to submit scores from the general Graduate Record Examination (GRE) within the past three years and to have these scores sent to the Office of Graduate Admissions.
  o Applicants who have received a degree from an accredited U.S. institution are exempt from the GRE requirement.
• A TOEFL score of 550 on the written exam or 80 on the Internet-based Test is required for non-native speakers of English, including those who have earned degrees at U.S. institutions.
  o The score must be no more than two years old from the requested date of entry.
  o Applicants who have received a degree from an accredited U.S. institution within the past two years are exempt from the TOEFL requirement.
• Applicants who hold the bachelor’s degree in fields other than electrical or computer engineering will be required to take selected undergraduate courses as determined by the applicant’s prior education and experience.
  o The student will be admitted under non-degree status until the required undergraduate courses are successfully completed with a grade of B or better.

Formerly:
Admissions Standards/Procedures
Exceptional students holding the bachelor’s degree may be admitted to the doctoral program without first obtaining a master’s degree.
Applicants are required to submit scores from the general Graduate Record Examination (GRE) within the past three years and to have these scores sent to the Office of Graduate Admissions.
A TOEFL score of 550 on the written exam or 80 on the Internet-based Test is required for non-native speakers of English, including those who have earned degrees at U.S. institutions.
The score must be no more than two years old from the requested date of entry.
Applicants who have received a degree from an accredited U.S. institution within the past two years are exempt from the TOEFL requirement.

Rationale: Indentation has been updated for clarity. Text regarding the GRE for students holding a degree from a US institution is being added to be consistent with department policy. The text regarding students with non-degree status is being added to make the CPE Admissions Standards consistent with the other MS and PhD programs in EECS. Impact on other units: none. Financial impact: none.

REVISE REQUIRED COURSES – ELECTRICAL ENGINEERING MAJOR, PHD

In the 2023-24 graduate catalog, Electrical Engineering Major, PhD, under the Required Courses heading revise the 4th bullet and sub-bullet into one bullet as follows.

• For students holding an MS degree, a maximum of 6 credit hours of graduate courses at the 400-level may be applied toward the PhD degree. Other students may apply 12 credit hours of graduate courses at the 400-level selected in consultation with major professor and/or committee. All 400-level courses applied towards the degree must be listed in the Graduate Catalog.

Formerly:
For students holding an MS degree, a maximum of 6 credit hours of graduate courses at the 400-level may be applied toward the PhD degree. Other students may apply 12 credit hours of graduate courses at the 400 level selected in consultation with major professor and/or committee. All 400-level courses applied towards the degree must be listed in the Graduate Catalog.

REVISE NON-COURSE REQUIREMENTS - ELECTRICAL ENGINEERING MAJOR, PHD

In the 2023-24 Graduate Catalog, under the Non-Course Requirements heading, remove the 1st bullet and the 10 bullets associated with the dropped concentrations.

Formerly:
Non-Course Requirements
In consultation with their advisor, students may select one of the following concentrations. Concentrations reflect research focus area and do not include specific course requirements:
Automotive Manufacturing and Technology
Communication
Control Systems
Electromagnetics and RF Circuits
Energy Science and Engineering
Fire Protection Engineering
Power Electronics
Power Systems
Signal Processing
Solid-state Electronics

Rationale: The faculty decided to drop/remove all concentrations that do not have any course (or other) requirements attached to the concentration. Impact on other units: none. Financial impact: none.

REVISE NON-COURSE REQUIREMENTS – ELECTRICAL ENGINEERING MAJOR, PHD

In the 2023-24 Graduate Catalog, under the Non-Course Requirements heading, at the 3rd bullet, then at the 8th sub-bullet, revise text under bullet “The Oral Part” as shown below:

- The comprehensive examination consists of both written and oral parts.
  - The Oral Part:
    - The oral part of the comprehensive examination consists primarily of a professional presentation of a proposal for dissertation work and its defense.
    - The committee may cover additional topics in the oral part.
  - The comprehensive exam must be completed within five years of the date of the student’s first enrollment in this program.

Formerly:
The Oral Part
The oral part of the comprehensive examination consists primarily of a professional presentation of a proposal for dissertation work and its defense.
The committee may cover additional topics in the oral part.

Rationale: Adding the second bullet reiterates the need for students to complete their comprehensive exams within five years of their first enrollment and edits the description of the comprehensive exam to be consistent with the CS and CPE PhD programs. Impact on other units: none. Financial impact: none.

REVISE ELECTRICAL ENGINEERING MAJOR, PHD – TO ADD HEADING AND REQUIREMENTS FOR POWER ELECTRONICS CONCENTRATION

In the 2023-24 Graduate Catalog, insert heading, text, and requirements for the Power Electronics concentration.

Power Electronics concentration
Select 4 courses from the following:
• ECE 581, ECE 582, ECE 583, ECE 585, ECE 586, ECE 625, ECE 682, ECE 683, ECE 684, ECE 686
• Or ECE 599 and ECE 692 with approval of the faculty

Rationale: This revision establishes course requirements for the Power Electronics concentration for the EE PhD. Impact on other units: none. Financial impact: none.

REVISE FIRE PROTECTION ENGINEERING CERTIFICATE

In the 2023-24 Graduate Catalog, revise the Required Courses as shown below:

Required Courses
• The graduate courses are cross-listed in participating departments and consist of EF 563 (3 credit hours)
• Technical concentration of the following three courses (9 credit hours)
  EF 564 (3 credit hours)
  EF 567 (3 credit hours)
  EF 575 (3 credit hours)

Formerly:
Required Courses
The graduate courses are cross-listed in participating departments and consist of
ECE 563 (3 credit hours)
Technical concentration of the following three courses (9 credit hours)
ECE 564 (3 credit hours)
ECE 567 (3 credit hours)
ECE 575 (3 credit hours)

Rationale: The ECE courses are dropped and added under the Engineering Fundamentals (EF) courses. Impact on other units: None.
Financial impact: None.

REVISE POWER AND ENERGY SYSTEMS GRADUATE CERTIFICATE

In the 2023-24 Graduate Catalog, under the Additional Course Requirements heading, under the Technical concentration bullet, add the following three courses to the current list of courses.

Additional Course Requirements
Technical concentration at least four courses (12 graduate credit hours) selected from the following:
ECE 585
ECE 586
ECE 684

Rationale: This revision adds three new courses to the list of required courses (ECE 585, ECE 586 and ECE 684) and reorders the list so that course numbers appear in numerical order. Impact on other units: none. Financial impact: none.

REVISE WIDE BANDGAP (WBG) POWER ELECTRONICS CERTIFICATE

In the 2023-24 Graduate Catalog, under the Required Courses heading, under the Technical concentration bullet, add two courses to the current list as follows:

Technical concentration in WBG Power Electronics. Select at least four courses from
ECE 586 (3 credit hours)
ECE 684 (3 credit hours)

Rationale: This revision adds two new courses to the list of required courses (ECE 586 and ECE 684) and reorders the list so that course numbers appear in numerical order. Impact on other units: none. Financial impact: none.

ENGINEERING FUNDAMENTALS

❖ DROP CERTIFICATE
Engineering Education

➕ ADD CERTIFICATE
Fundamentals of Engineering and Computing Teaching in Higher Education

In the 2023-2024 Graduate Catalog, remove text for the dropped Engineering Education Certificate and replace with heading, text, and requirements for the renamed certificate as shown below.

Fundamentals of Engineering and Computing Teaching in Higher Education Graduate Certificate
The 12-credit hour graduate certificate in Fundamentals of Engineering and Computing Teaching in Higher Education is intended for individuals who have completed an undergraduate degree and wish to develop knowledge and skills in teaching and learning principles for application in engineering and computing education. Through participation in the certificate, students will:
  • Be exposed to a diverse set of educational theories applicable to learning in engineering contexts
• Write a research proposal for an education-based research project
• Evaluate the quality of existing engineering education research publications
• Develop effective, evidence-based teaching, learning, and mentoring practices
• Create learning-centered syllabi, activities, and assignments
• Identify research-based strategies to teach diverse populations

Campus Code
Knoxville Campus

Graduate Certificate Type
Add-On (Masters or doctoral students)
Stand-Alone

Admissions Standards/Procedures
Individuals must have an undergraduate degree and be admitted to the University of Tennessee Graduate School.

Academic Standards
Individuals must earn at least a 3.50 graduate GPA in the certificate courses.

Credit Hours Required
12 graduate credit hours

Required Courses
Complete the following three courses (9 credit hours)
EF 501
EF 503
EF 504

Additional Course Requirements
Choose one of the following courses (3 credit hours)
EF 505
EF 506
EF 507
EDPY 522
EDPY 523
EDPY 572
GEOL 690
Or a similar course (You must seek approval from the graduate certificate director for a course substitution.)
Contact Dr. Courtney Faber, Certificate Coordinator for questions.

Non-Course Requirements
• All courses must be completed within five years of admission to the certificate program.

To receive the certificate, students must:
1) complete the Graduate Certificate Course Verification Form (located on the Graduate School webpage under the Forms Central tab) and 2) through MyUTK, apply to graduate from the certificate program.

Rationale: We are renaming our certificate and the corresponding EF courses. Currently, our program and course names only include engineering. By adding computing into our name, we will ensure that engineering as well as computer science graduate students see that our program will support their development of the skills and knowledge needed to teach in their discipline. With these changes we will review our courses and expand their content to pull from computing education. We have multiple faculty (two of which started in fall 2022) with backgrounds in computing who will be consulted as we make these changes to our courses.

The new requirements provide more choices for the elective course so that students can choose which area they want advanced experience in. Additional Documentation: none.

DEPARTMENT OF MECHANICAL, AEROSPACE, AND BIOMEDICAL ENGINEERING

(ES) ENGINEERING SCIENCE – INTERDEPARTMENTAL PROGRAM

❖ DROP CONCENTRATION – ENGINEERING SCIENCE MAJOR, MS

Flight Test Engineering

In the 2023-24 Graduate Catalog, drop the concentration: Flight Test Engineering (UTSI only)

Formerly: Flight Test Engineering (UTSI only) — Thesis, Coursework Only With Comprehensive Exams
In the 2023-24 Graduate Catalog, under Campus Code, drop Flight Test Engineering

Formerly:
UTSI Campus
Flight Test Engineering

Rationale: The department faculty determined that required concentration changes are necessary to reflect the needs of potential and current students as well as reflecting current faculty and resources. Impact on other units: None. Financial impact: None.

REVISE UTSI CAMPUS CODE, ENGINEERING SCIENCE MAJOR, MS

In the 2023-24 Graduate Catalog, revise to show UTSI Campus Code for three concentrations: Aerospace Engineering, Biomedical Engineering, and Mechanical Engineering.

Campus Code
UTSI Campus
   Aerospace Engineering
   Biomedical Engineering
   Mechanical Engineering

Rationale: The department faculty determined that required concentration changes are necessary to reflect the needs of potential and current students as well as reflecting current faculty and resources. Impact on other units: None. Financial impact: None.

DEPARTMENT OF NUCLEAR ENGINEERING

REVISE NUCLEAR ENGINEERING MAJOR, PHD

In the 2023-24 Graduate Catalog, under the Required Courses heading revise (second bullet subset) as follows:

Required Courses
   o A minimum of 27 credit hours of graduate courses in nuclear engineering at or above the 500-level
     ▪ For PhD students with an MS external to UTNE, a maximum of 3 hours of NE 501 may be applied to the major.
     ▪ For PhD students directly from BS, a minimum of 3 hours and a maximum of 6 hours may be applied to the major. For PhD students with a UTNE MS, the sum of all NE 501 credits cannot exceed 6 hours.
     ▪ Excludes thesis, practice project, or dissertation credit

Formerly:
A minimum of 27 credit hours of graduate courses in nuclear engineering at or above the 500-level
To include 3 credit hours (1+1+1) of NE 501
Excludes thesis, practice project, or dissertation credit

Rationale: This bullet is being revised to add clarity to the number of NE 501 (Seminar) credits allowed toward the PhD degree in NE for students with an MS, and for students directly entering the PhD program. Impact on other units: None. Financial impact: None.