ARCHITECTURAL ENGINEERING (AREN)

AREN 800 MAE Graduate Seminar
Prerequisites: Co-requisites: AREN 425 or AREN 415 or CIVE 334
Description: Intended specifically for the 1-year UNL Master of Architectural Engineering (MAE) program to prepare for the MAE Graduate Project and the MAE Interdisciplinary Team Design sequences. Focus on further developing competencies within the UNL College of Engineering's Complete Engineer framework including self-management and leadership, teamwork, communication skills, inclusive excellence, professionalism and ethics, and civic responsibility.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Grade Pass/No Pass Option
Prerequisite for: AREN 801

AREN 801 Graduate Individual Mastery Project I
Prerequisites: AREN 800
Notes: Students are permitted to enroll in this course twice. If a passing grade is not achieved after two attempts, the AE graduate committee will consider termination of the master's program for that student.
Description: This is the first of the Graduate Individual Mastery Project two-course sequence, which requires a self-directed project that results in a professionally written report and oral presentation. Successful completion of this sequence will demonstrate a high-level of written and oral communication skills and show individual student mastery of a topic related to architectural engineering.
Credit Hours: 2
Max credits per semester: 2
Max credits per degree: 2
Grading Option: Grade Pass/No Pass Option
Prerequisite for: AREN 802

AREN 802 Graduate Individual Mastery Project II
Prerequisites: AREN 801
Notes: Students are permitted to enroll in this course twice. If a passing grade is not achieved after two attempts, the AE graduate committee will consider termination of the master's program for that student.
Description: This is the second of the Graduate Individual Mastery Project two-course sequence, which requires a self-directed project that results in a professionally written report and oral presentation. Successful completion of this sequence will demonstrate a high-level of written and oral communication skills and show individual student mastery of a topic related to architectural engineering.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Grade Pass/No Pass Option

AREN 803 Interdisciplinary Team Design Project I
Prerequisites: (Acoustics/Mechanical option) AREN 415 and AREN 430 or; (Electrical/Lighting option) AREN 425 and AREN 822 or; (Structural option) CIVE 444.
Notes: Not open to non-degree graduate students. This course is the 1st semester of the capstone design sequence in architectural engineering.
Description: Develop and design the electrical, lighting, mechanical, and structural systems for a building, from programming through design development phase, as an interdisciplinary team effort.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Grade Pass/No Pass Option
Prerequisite for: AREN 804

AREN 804 Interdisciplinary Team Design Project II
Prerequisites: AREN 803
Notes: This course is intended to be taken the semester following AREN 803. AREN 804 is the 2nd semester of the capstone design sequence in architectural engineering.
Description: Develop and design the electrical/lighting, mechanical/acoustical, and structural systems for a building, through the design development phase, as an interdisciplinary team effort.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded
Offered: SPRING

AREN 805 Internship in Architectural Engineering
Description: This course requires participation in a full time summer internship associated with an Architectural Engineering related entity. The course includes weekly assignments and a final presentation designed to create interaction between the AE entity and the intern associated with the business side of the entity. General Topics include Business Plans, Marketing, Finance and Budgets, Contracts, Legal issues and professionalism.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Grade Pass/No Pass Option

AREN 806 Professional Practice and Ethics
Prerequisites: CONE 2060
Description: Investigation of issues related to the integration of building design processes with professional architectural engineering practice. Aspects of building design project finance, budgets, contracts, legal issues, professional licensure and professional responsibility. The perspective of life-cycle costing. Professional ethics will be thoroughly integrated with all course topics.
Credit Hours: 2
Max credits per semester: 2
Max credits per degree: 2
Grading Option: Grade Pass/No Pass Option

AREN 808 Applied Experimental Design and Statistical Analysis
Prerequisites: STAT 380/(UNO) 3800
Description: Overview of advanced experimental design methods and statistical analysis techniques. Application of these to the planning, execution, analysis, and description of research in architectural engineering.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

AREN 809 Sustainable Building Design
Prerequisites: CIVE 341 or ARCH 332; AREN 310 (AE 3100) or AREN 841 or ARCH 333
Description: Integrates building design with the principles of minimum resource use, energy conservation and healthy indoor environments.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

AREN 811 Indoor Air Quality Engineering
Prerequisites: AREN 310.
Description: Indoor air quality. Codes, standards, HVAC equipment, commissioning, operation, maintenance, investigation, and remediation.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Prerequisite for: AREN 918

AREN 812 Building Control and Automation Systems
Prerequisites: MATH 3350 ; AE 3100, AE 4120, AE 4120
Description: Fundamental concepts of building control theory and automation. Building control: state-variable plant and closed-loop system representation, time and frequency response, stability, root-locus methods and design of building control systems. Automation: thermostats, dampers, valves, direct digital control, control of air handling units, terminal units, primary building systems, supervisory control and system optimization, communication systems, BACnet, and DDC system design and implementation.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Prerequisite for: AREN 915

AREN 814 Building Energy III: Advanced Building Energy System Modeling
Prerequisites: AREN 310, AREN 412, or instructor permission.
Description: Advanced Analysis, Modeling, Diagnostics and Optimization of Building Energy Systems. Be familiar with Engineering Equation Solver (EES) Programming; Be able to build models for Air Handling Unit Systems and Vapor Comporession Cycle Equipment; Be able to analyze building operating efficiency and identify faulty operating conditions; Be able to conduct retrofit energy efficiency analysis and feasibility study.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

AREN 815 Building Energy Simulation and Performance Contracting
Prerequisites: AE 3100, AE 4120, AE 4140, and AE 4400 (UNO)
Description: Integrated approach to deliver energy improvement retrofit projects that provide economical and ecological benefits. Proficiency in EnergyPlus or DOE-2 and in retrofit cost estimation will be attained and integrated into an engineering economic analysis. Partnering configurations, contracts, financing, and measurement and verification. Concepts applied to a practical class project.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

AREN 820 Lighting II: Theory, Design and Application
Crosslisted with: AREN 420
Prerequisites: (UNO) AE 3200
Notes: Lab sessions include photometric measurements and computer applications.
Description: Design and analysis of lighting systems; the integration between the lighting design process and the technical foundations for building lighting; design criteria; lighting design procedures lighting modes and subjective effects; and calculation tools.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Prerequisite for: AREN 425; AREN 825

AREN 822 Electrical Systems for Buildings II
Prerequisites: AE 3220
Description: Power systems analysis and design, integration of electrical system components into functional, safe and reliable power distribution systems for commercial and industrial facilities. Per unit analysis, fault analysis, power quality, grounding, overcurrent protection coordination and complete power system design.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Prerequisite for: AREN 828

AREN 825 Daylighting
Prerequisites: AREN 420 or AREN 820
Description: Use of natural light in building design. Solar position, sky luminance, distribution models, daylighting equipment, calculation methods, and psychological concepts. Extensive use of computer modeling and scale models.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

AREN 826 Building Communication Systems
Prerequisites: AREN 322 (AE 3220)
Description: Integration of voice, data and video systems into overall building design. Scalability; wireless systems; interference; project management; current industry standards and protocols.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

AREN 828 Applied Photovoltaic and Renewable Energy Sources
Prerequisites: AREN 822 or AREN 8220 (UNO)
Description: Introduction to integration of renewable energy sources in the electric grid and built environment. Study of various renewable energy sources with a focus on photovoltaic (PV) systems detailing theory of operation, design methodologies, system components, NEC requirements and simulation software for stand-alone, utility-interactive and multi-mode systems.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

AREN 830 ADV NOISE CONTROL
Crosslisted with: AREN 430
Prerequisites: AE 3300 or equivalent
Description: Characterization of acoustic sources; use and measurement of sound power and intensity; sound-structure interaction; acoustic enclosures and barriers; muffling devices; vibration control; and active noise control.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

AREN 833 ADV ARCH ACOUSTICS
Prerequisites: AE 3300 or equivalent
Description: Advanced study of the behavior of sound in rooms. Design of acoustical spaces; physical and computational modeling; measurement techniques; and introduction to sound reinforcement in rooms.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Prerequisite for: AREN 930

AREN 835 ELECTROACUSTICS
Prerequisites: AE 3300 or equivalent
Description: Electrical-mechanical-acoustical circuit analogies; transducers, loudspeakers, microphones, and accelerometers; directivity; calibration techniques; and sound reinforcement systems in rooms.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

AREN 842 Healthcare Design and Construction
Crosslisted with: AREN 442, CNST 442, CNST 842
Prerequisites: Senior or graduate standing
Description: Introduction to the design and construction of healthcare facilities. Healthcare regulations and standards, infection control, interim life safety measures, code requirements, medical equipment selection and coordination, healthcare design and construction techniques, and best practices will be addressed. Provides guidance in preparation for the Certified Healthcare Constructor credential offered by the American Healthcare Association.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

AREN 851 Masonry and Timber Design
Prerequisites: CIVE 440 (Reinforced Concrete Design) or equivalent; CIVE 441 (Steel Design) or equivalent.
Description: Masonry as a structural material, Unreinforced Masonry Design, Reinforced Masonry Design, State-of-the-art Assessment methods for Existing Masonry Structures, Timber as a structural material, Timber Design.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

AREN 860 Smart Building Sensors and Programming
Crosslisted with: AREN 460
Prerequisites: CSCE 155A
Description: Principles of modeling, interfacing and signal conditioning of sample building sensors, and acquisition of sensor data utilizing an engineering programming language such as LabVIEW and analysis of data from different types of building sensors. Overview of current sensing technology and control in buildings.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

AREN 862 Intelligent Sensors
Prerequisites: Instructor permission
Description: Study of the dynamics of Microelectromechanical system (MEMS) beam-structures. Modeling principles and data analysis from different types of MEMS will be explained along with deep theoretical and experimental investigation of nonlinear MEMS dynamics. Learn to conduct experiments using state-of-the-art MEMS characterization tools.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

AREN 880 Graduate Seminar in Architectural Engineering and Construction
Description: The objectives of this course are to broaden student knowledge on engineering topics, improve presentation and professional skills, as well as learn about professional development resources available on campus. To pass the course, a student must attend a minimum of 15 Durham School Graduate Student Seminars, MAE project presentations, and/or MS/PhD thesis presentations in the College of Engineering. The student must also present one seminar within the Durham School Graduate Student Seminar series, prior to the final oral examination. All MS and PhD graduate students in architectural engineering must enroll within their first 3 semesters of matriculation.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Pass No-Pass

AREN 892 Individual Instruction in Architectural Engineering
Prerequisites: Permission
Description: Individual instruction in Architectural Engineering at the graduate level in a selected area, under the supervision and guidance of an Architectural Engineering faculty member.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

AREN 894 SPECIAL TOPICS
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 9
Grading Option: Grade Pass/No Pass Option

AREN 899 MASTERS THESIS
Prerequisites: Admission to AREN/AE (UNO) masters degree program and permission of major adviser
Credit Hours: 1-10
Min credits per semester: 1
Max credits per semester: 10
Max credits per degree: 99
Grading Option: Grade Pass/No Pass Option

AREN 915 MOD BLDG CONTROL APP
Prerequisites: AE 3100, AE 4120, AE 4140 ; AREN 812
Description: Neuro-dynamic programming/reinforcement learning methodology, fuzzy logic methods, and evolutionary/genetic algorithms (GA) to building control problems. Concepts applied to case studies from problem areas.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

AREN 918 FLUID DYNAMC MODELNG
Prerequisites: AREN 811, MECH 810, or permission
Description: Application of computational fluid dynamics software to modeling of indoor environments. Turbulence modeling, boundary conditions, natural and forced convection flows, species transport, and fire modeling.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

AREN 930 TOPC: ARCH ACOUSTICS
Prerequisites: AREN 833
Description: Current topics in architectural acoustics. Objective versus subjective measures in performance spaces, electronic enhancement of rooms, advanced computational modeling techniques, and auralization.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

AREN 997 RSH OTHER THAN THESI
Prerequisites: Permission
Description: Supervised non-thesis research and independent study.
Credit Hours: 1-6
Min credits per semester: 1
Max credits per semester: 6
Max credits per degree: 36
Grading Option: Grade Pass/No Pass Option

AREN 998 SPECIAL TOPICS
Prerequisites: Permission
Description: Advanced topics in architectural engineering.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 1
Grading Option: Grade Pass/No Pass Option

AREN 999 DOCTORAL DISSERTATN
Prerequisites: Admission to doctoral degree program and permission of supervisory committee chair
Credit Hours: 1-24
Min credits per semester: 1
Max credits per semester: 24
Max credits per degree: 99
Grading Option: Grade Pass/No Pass Option