

DAEN - DATA ENGINEERING (DAEN)

DAEN 210 Uncertainty Modeling

Credits 3. 3 Lecture Hours. Models and methods for exploration of data based on probability and statistics; random variables, expectation, data collection, distribution fitting, goodness of fit tests, point estimates and interval estimates and central limit theorem. **Prerequisite:** Grade of C or better STAT 211.

DAEN 300 Data Engineering Coding Experience I

Credit 1. 0 Lecture Hours. 3 Lab Hours. Application of computational tools to model and solve data engineering problems primarily involving machine learning and optimization techniques. **Prerequisite:** Grade of C or better in ECEN 360; concurrent enrollment in DAEN 321 and DAEN 331; junior or senior classification.

DAEN 301 Data Engineering Coding Experience II

Credit 1. 0 Lecture Hours. 3 Lab Hours. Application of computational tools to model and solve data engineering problems involving stochastic systems, reinforcement learning, ensemble learning and data visualization. **Prerequisites:** Grade of C or better in DAEN 300; concurrent enrollment in DAEN 323 and DAEN 328; junior or senior classification.

DAEN 321 Quantitative Models for Statistical and Machine Learning

Credits 3. 3 Lecture Hours. Principles of parameter estimation, confidence interval, p-values, hypothesis testing, design of experiments, model building, multiple regression, ANOVA, statistical quality control, Shewhart charts, CUSUM, EWMA, and residual-based control charts. **Prerequisite:** Grade of C or better DAEN 210; junior senior classification.

DAEN 323 Statistical Learning and Decisions

Credits 3. 3 Lecture Hours. Stochastic systems components; stochastic process models using Markov chains; Markov-decision processes; use of multi-armed bandit problems; exploration and exploitation; reinforcement learning; Bayesian updates; ensemble learning with bagging, boosting and stacking. **Prerequisite:** Grade of C or better in DAEN 321; junior or senior classification.

DAEN 328 Data Engineering for Humans

Credits 3. 3 Lecture Hours. Human considerations and constraints for data engineering, including human factors of data visualization; data processing and analysis of human physiological, psychological and performance data; the role of human biases in model development, analysis and interpretation; human factors of interactions with machine learning-based artificial intelligence tools in complex systems such as healthcare, manufacturing and transportation. **Prerequisites:** Junior senior classification.

DAEN 331 Optimization of Analytics

Credits 3. 3 Lecture Hours. Mathematical optimization algorithms with applications to data analytics; primary topics include convexity, gradient and subgradient methods and their variants, Newton's and quasi-Newton methods, Frank-Wolfe, duality, derivative-free optimization. **Prerequisites:** Grade of C or better in MATH 251 or MATH 253; grade of C or better in MATH 304 or MATH 323.

DAEN 399 Professional Development

Credits 0. 0 Lecture Hours. Participation in an approved high-impact learning practice; reflection on professional outcomes from the National Society of Professional Engineers' Engineering Body of Knowledge; documentation and self-assessment of learning experience at mid-curriculum point. Must be taken on a satisfactory/unsatisfactory basis. **Prerequisite:** Junior or senior classification.

DAEN 400 Case Studies in Data Engineering

Credits 3. 3 Lecture Hours. Exploration of a set of diverse case studies; application of analytical and computational tools to model and develop solutions to open ended problems from different application areas; development of writing capabilities through the writing of case study reports. **Prerequisite:** Grade of C or better DAEN 301.

DAEN 410 Optimization Algorithms for Data Engineering

Credits 3. 3 Lecture Hours. . Development of optimization skills for solving problems faced in data engineering; introduction to quantitative solution of optimization problems; exploration of branch and bound, and other IP techniques; methodologies for network flow algorithms, dynamic programming, and nonlinear optimization algorithms, and their applications in data engineering problems. **Prerequisite:** Grade of C or better in DAEN 331; junior or senior classification.

DAEN 420 Smart Manufacturing

Credits 3. 3 Lecture Hours. Hands-on learning experiences of sensing, measurement and elementary prognostic technologies for modern manufacturing operations; introduction to the emerging challenges and opportunities for harnessing information to substantially improve quality assurance, process design and discovery resulting from advances in sensors, machine tool and plant-floor and a range of system-wide sensor technologies. **Prerequisites:** Grade of C or better DAEN 321; junior or senior classification.

DAEN 427/ISEN 427 Decision and Risk Analysis

Credits 3. 3 Lecture Hours. Overview of the state of the art in descriptive and prescriptive theories of decision making under uncertainty with emphasis on the ways in which human decisions depart from normative models of rationality; analytical foundations stemming from several disciplines, economics, psychology, management science; application in engineering systems will be considered. **Prerequisites:** Grade of C or better in ISEN 310, DAEN 321, or STAT 212. **Cross Listing:** ISEN 427/DAEN 427.

DAEN 429 Data Analytics II

Credits 3. 3 Lecture Hours. Deep learning, including basic machine learning, supervised learning, logistic regression, loss functions, neural networks, optimization, error back-propagation, regularization and generalization, convolutional neural networks, recurrent neural networks, attention models, applications to natural language processing and computer vision. **Prerequisites:** Grade of C or better in DAEN 301 and DAEN 323; junior or senior classification.

DAEN 430 Forecasting Using Machine-Learning Approaches

Credits 3. 3 Lecture Hours. Forecasting principles and methods, including point and interval forecasts; accuracy; statistical methods in the context of forecasting, including exponential smoothing and Auto Regressive Integrated Moving Average (ARIMA), exogenous variables, seasonality and trends; tree-based models for predictions, prophet models, probabilistic forecasts and predictive and prescriptive analytics. **Prerequisites:** Grade of C or better in DAEN 321; junior or senior classification.

DAEN 459 Capstone Senior Design Planning

Credits 3. 2 Lecture Hours. 3 Lab Hours. First in a two-course sequence for the capstone senior design experience; formation of a senior design team, visitation with the team sponsor, preparation of the groundwork for the project, preparation of the project charter and collection or acquisition of initial set of data; provision of instructions on different aspects of capstone design, including ethics, design constraints, applicable standards, project management, report writing specifications and requirements, and oral and visual presentations. **Prerequisite:** Grade of C or better in DAEN 301; concurrent enrollment in DAEN 400, ISEN 427/DAEN 427, and DAEN 429.

DAEN 460 Capstone Senior Design

Credits 3. 1 Lecture Hour. 6 Lab Hours. Second course in a two-course sequence for the capstone senior design experience; continuation of work on the senior design project in teams; data collection, analysis, application of data engineering methods and tools and development of recommendations considering design constraints, evaluation of alternative design, and application of relevant standards; engagement in oral presentations and creation of the project report, with relevant feedback provided during the semester. **Prerequisite:** Grade of C or better in DAEN 459.

DAEN 489 Special Topics in...

Credits 1 to 4. 0 Lecture Hours. 1 to 4 Other Hours. Selected topics in an identified area of data engineering. May be repeated for credit. **Prerequisite:** Junior or senior classification; approval of instructor.

DAEN 491 Research

Credits 1 to 4. 1 to 4 Other Hours. Research conducted under the direction of faculty member in data engineering. May be repeated for credit. **Prerequisites:** Junior or senior classification and approval of instructor.