Advanced Manufacturing for Energy Systems (AMES)

me.engr.uconn.edu

5101. Engineering Analysis

Three credits. Prerequisite: Open only to graduate students. Taught with ENGR 5314.

Advanced math topics including Laplace, Fourier and z-Transform methods, probability theory, ordinary differential equations and systems of ODEs, partial differential equations, vector calculus, elements of statistics, linear and non-linear optimization, matrix theory, and special functions like Bessel, Legendre, and gamma. This course is set up as modules. Students will be required to complete certain modules depending on their background and concentrations.

5111. Computer Aided Engineering

Three credits. Prerequisite: Open only to graduate students.

Introduction to computational methods in design and analysis of materials, processes, and systems related to advanced manufacturing and energy systems. Topics covered include computational materials, process simulation, computational fluid dynamics, finite element analysis, and manufacturing process simulation.

5121. Engineering Communication

Three credits. Prerequisite: Open only to graduate students. Taught with ENGR 5311.

Development of the advanced communication skills as well as the information management required of engineers and engineering managers in industry, government and business. Focus on the design and writing of technical reports, articles, proposals, and the memoranda that address the needs of diverse organizational and professional audiences; the preparation and delivery of organizational and technical oral and multimedia presentations and briefings; team building skills with an emphasis on communications; and knowledge management.

5410. Introduction to Energy Management in Manufacturing

Three credits. Prerequisite: Open only to graduate students.

Introduction to foundational concepts and methods of energy management in manufacturing including: the motivation of energy efficient manufacturing, systematic methods for energy consumption modeling and analysis in manufacturing enterprises and facilities, including lighting, motors and drives, compressed air, process heating/cooling, HVAC, identification of energy sinks and energy saving opportunities in manufacturing, ISO 50001 standards on energy management, and a basic introduction of the whole building energy simulation program EnergyPlus™.

5420. Introduction to Smart and Green Manufacturing

Three credits. Prerequisite: Open only to graduate students.

Introduction to foundational concepts and methods of smart manufacturing and green manufacturing. Discusses the impacts of smart technologies and initiatives such as Industry 4.0 in Europe, National Network of Manufacturing Innovation Institutes established in the U.S., and Made-in-China 2025 on manufacturing. Includes the architecture of smart manufacturing, sensing technology, internet-of-things, cloud manufacturing/manufacturing as a service, basic data analytics for diagnosis and prognosis in manufacturing. Covers fundamental issues in green manufacturing, such as the metrics, principles, and societal/business/policy impacts, as well as fundamental methods such as lifecycle assessment and sustainability assessment of manufacturing.

5441. Reliability Engineering

Three credits. Prerequisite: Open only to graduate students.

Reliability theory with specific application to manufacturing or complex systems. Generalized and probabilistic basics of reliability theory. Basic reliability modeling and analysis tools including fault trees, reliability diagrams, and Markov reliability models. Faults specific to electric drive components, i.e., electric machines, power electronics, control, and sensing. Techniques for evaluating or estimating failure rates of these components along with factors that impact these failure rates such as the environment, humidity, temperature, etc. Application to a simple process as a course project.

5451. Optimization-based Production Management

Three credits. Prerequisite: Open only to graduate students.

An introduction to models and methods for production management in modern manufacturing systems. Topics include manufacturing in America and lessons from history; basic factory dynamics; production planning and scheduling; Just-In-Time and lean operations; manufacturing resource planning; capacity management; aggregate planning; supply chain management; project management; energy modeling in manufacturing; Industry 4.0 and its impacts. Most topics will be presented within a unifying optimization framework, and solved by using methods such as linear programming, branch-and-cut, and our latest decomposition and coordination approach plus formulation tightening.

5461. Production Systems Engineering for Energy Efficient Manufacturing

Three credits. Prerequisite: Open only to graduate students.

Production Systems Engineering (PSE) is a branch of Engineering intended to uncover fundamental laws that govern manufacturing systems (e.g., serial production lines and assembly systems) and exploit them for the purposes of analysis, design, and management. Fundamental principles in PSE will be described along with numerous case studies in large volume industries (such as automotive, electronics, consumer productions, etc.). The material presented is based on first principles rather than on recipes. How to apply the PSE theory in analysis and control of manufacturing systems for energy efficient production will be covered. The PSE Toolbox and Simul8 will be used to facilitate the application of the theoretical material.