Offshore Wind Energy Graduate Certificate Program

Certificate Coordinators-
Assistant Prof. Dr. Amrit Verma amrit.verma@maine.edu (207-281-5126)

Requirements

The Certificate requires completion of 12 credits (4 courses) through a combination of 400- and graduate-level courses as described in the course sequence section below. A maximum of one course (or 3 credits) at 400 or 500 level may be transferred from outside of UMaine to the program for credit.

- Students must complete 12 credits with a minimum grade of C in no more than one course (all other earned grades must be a B or above). At least three courses (9 credits) must be at 500 or 600 level.
- At least 6 credits must be taken from the core course category. No more than 6 credits may be taken from the supporting course category.

The Certificate program shall be completed within 3 years from the date of acceptance into the program.

Eligibility Criteria

An earned baccalaureate degree or its equivalent from an accredited college or university is required for admission. The earned baccalaureate degree must possess sufficient prerequisite coursework that would enable the student to enroll in the coursework required for the certificate. A minimum grade point average of 3.0 applies to all candidates and international applicants must satisfy University of Maine English proficiency requirements.

The courses completed for this certificate program may be counted towards a graduate degree per the guidelines of the respective graduate degree program.

Course Sequence

a. Core Courses (6 credits minimum)

Note: At least one core course from those marked below with an * must be taken

MEE 480/580, CIE 480 Wind Energy Engineering*
This course presents the theory and design of modern wind turbines. Theoretical aspects of the course cover the fundamentals of assessing the aerodynamic loads and efficiency of a wind turbine. Design procedures for wind turbines are outlined with an emphasis on maximizing performance, assuring structural integrity and minimizing the cost of energy. Current trends in offshore wind are also covered as well as the social and environmental issues of a burgeoning wind energy industry. Lec. 3 cr.

MEE 489/565 Offshore Floating System Design*
The course introduces the basics of naval architecture and offshore engineering design concepts to senior engineering students. A broad introduction is provided on the topics of floating

platform stability, structural strength, global performance, mooring systems and installation. Use of industry guest lecturers will complement regular lectures for the course. Emphasis is placed on applying recommended practices by regulatory bodies into hands-on design projects. Lec. 3 cr.

MEE 491/591 Offshore Wind Farm Engineering*
This course introduces the basics of offshore wind farm engineering and design. A broad introduction is provided on the topics of offshore climate, turbine selection criteria, substructure design, installation processes, operation, maintenance, electrical infrastructure, environmental impacts, and decommissioning aspects of offshore wind farms. The basic theory together with state-of-the-art industrial practices and future technologies driving the offshore wind farm development will be addressed. Lec. 3 cr.

CIE 551 Water Wave Mechanics
This course introduces the mechanics of coastal and ocean waves, small-amplitude water wave boundary value problem formulation and solution, wave particle kinematics, wave superposition, geostrophic and frictional affects experiences by long waves in engineered and natural systems and wave propagation over real seabeds. Lec. 3 cr.

ECE 498/498 Smart Grid and Enabling Technologies
Course is currently offered as a Selected Topics in Electrical and Computer Engineering course. Lec. 3 cr. Covers smart grids and enabling technologies. It is anticipated that this course will be developed into a regularly-scheduled ECE course in the future.

b. Supporting courses (6 credits maximum)

MEE 459/559 Engineering Optimization
This course covers analytical, graphical, and numerical approaches for solving unconstrained or constrained optimization problems involving linear or nonlinear functions. Application of optimality criteria and mathematical programming techniques to problems involving multiple design variables. Lec. 3 cr.

MEE 477/577 Introduction to Structural Dynamics
This course provides an introduction to the fundamental and applied aspects of structural dynamics. Axial, flexural and torsional vibration characteristic for continuous structural members and machine elements using analytical and numerical methods. Finite element analysis of the steady state and transient response of structural elements and systems. Application of theoretical and numerical techniques to the dynamic analysis of mechanical and aerospace structural members. Lec. 3 cr.

MEE 490/590 Modern Control Theory & Applications
This course introduces state-space methods for analysis and design of linear control systems. The assumed prerequisites are undergraduate courses in linear algebra and dynamic systems and controls. The analysis part of this course is concerned with stability, controllability, observability, realization, and minimality of the state-space model, while the control design part delves into the methods of pole placement for state feedback and observer design, and optimal methods such as linear quadratic regulator (LQR) and Kalman filter. Students will also learn

how to apply the theory to engineering problems using MATLAB for both continuous-time and discrete-time systems. Lec. 3 cr.

MEE 564 Fluid Structure Interaction
This course introduces the basics of fluid-structure interaction (FSI) by a series of progressively complex problems. In the process, basics of fluid mechanics, wave hydrodynamics, floating system dynamics, and vibrations are also covered. Topics covered include linear wave theory, linear and non-linear oscillators, potential flow methods, wave force prediction methods, vortex-induced vibration and seakeeping. Lec. 3 cr.

CIE 557 Measurement Techniques in Water Resources
This course is an introduction into measuring dynamic variables in coastal, riverine and lake environments. Topics include accuracy, precision, aliasing: instrumentation set up, communication and troubleshooting; participation in a field campaign; preliminary data processing procedures, presentation, and organization. Lec. 3 cr.

CIE 558 Coastal Engineering
An introductory course on the principles of coastal engineering problems in lakes, river mouths, inlets, estuaries and other coastal area. Topics include linear water wave theory; wave generation and forecasting, wave shoaling, refraction and diffraction; wave loading on structures; design wave calculation; stability and design of coastal structure; sediment transport; coastal hazards and environments. Lec. 3 cr.

CIE 640 Advanced Structural Analysis
This course considers the linear and nonlinear finite-element analysis of framed structures using the principles of minimum potential energy and virtual work as bases. Topics include thermal effects, shear deformations, constraints, beams on elastic foundations, buckling, geometrically nonlinear analysis, materially nonlinear analysis, and an introduction to frequency-based and time-history dynamic analysis. Significant computer programming is required. Lec. 3 cr.

ECE 427/EET 422 Electric Power Systems
Power system models, power flow solutions, fault analysis, protective relaying. Lec. 4 cr.

ECE 455 Electric Drives
This course is an introduction to electric drive and their control. The course covers mechanical dynamics associated with electric drive systems, analysis and control of DC motors, induction motors, and permanent magnet AC motors, four quadrant motor operations, feedback control design for torque, speed and position. Lec. 3 cr.

EET 460/560 Renewable Energy and Electricity Production
This course covers an overview of renewable energy resources, energy conversion and storage for stationary and transportation applications. Topics include: Basics of electrical energy and power generation, load specification, history of electric utilities, distributed generation, the economics of energy, biomass duels, wind and solar power and fossil fuel limits, and battery storage. Lec. 3 cr.