INDUSTRIAL SOLUTIONS LABORATORY

Department Project Information

Department Name	_MEES_	Date Submitted	_04/19/2023_
Project Title	_WIND TURBINE DESIGN_ **(UNCC ME WIND2)**	**Planned Starting Semester**	_Fall 2023_

Senior Design Project Description

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project. Assume 10 hours per week per student.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills:

Discipline	Number	Discipline	Number
Mechanical	5	Electrical	2
Computer	1	Systems	1
		Civil	1

Project Overview:

This multidisciplinary project will be of interest to students from a variety of backgrounds such as mechanical, electrical, computer and civil engineering. The team will participate in the DOE collegiate wind competition (CWC) which is an opportunity for students to develop their abilities to identify, formulate and make decisions to solve real-world engineering problems independently. This unique hands-on experience involves students in i) designing the mechanical and electrical subsystems of a wind turbine according to design specifications, and ii) building the turbine prototype and components, and iii) testing the structural, electrical and electronic characteristics of the subsystems, and iv) the experimental evaluation of the performance of the final turbine prototype and thus allows students to demonstrate proof-of concept for their designs and gives previously abstract concepts tangibility. The turbine must be designed, and mechanical loads analyzed, to withstand continuous winds of up to a specified wind speed. The electrical and control systems must be designed to maintain regulated output voltage to meet variable electrical load demands. Besides, the dimensions of a test-facility and the overall project cost will serve as a set of design constraints. The turbine prototype must be designed for testing inside a given wind-tunnel facility with specified dimensions while meeting the cost constraint. The project also requires community outreach throughout the project duration as well as preparing written documentation as part of the CWC.

Project Requirements:

All team members must be available to conduct field/laboratory testing on weekends and evenings and over school breaks, as well as travel to the competition in May. The team members will be required to take the laboratory safety tests to access the university machine shops, electrical labs etc. All students on the team are required to participate in on and off campus outreach and fundraising events.

Expected Deliverables/Results:

Deliverables include:
1. All senior design course deliverables
2. All competition deliverables as specified by DOE CWC
3. System block diagrams
4. System mechanical model, including stress analysis and static performance
5. System electrical load model and electrical diagrams
6. Turbine concept ideation sketches
7. System detailed drawings
8. System assembly drawings and procedure
9. System / subsystem testing plan
10. Financial plan
11. Outreach plan
12. System installation procedure and checklist
13. System operation procedure and checklist
14. Operable Hardware (turbine prototype and electrical subsystems assembly)
15. Title I Outreach (40% of Progress Evaluation grade): The team is required to conduct a minimum of two outreach events at Title I schools in Fall 2023, and participate in at least two other outreach events conducted by other UNC Charlotte student organizations/teams at Title I schools in Fall 2023. The specific requirements for Spring 2023 will be announced in late Fall.

Disposition of Deliverables at the End of the Project:

The product can be displayed at the Senior Design Expo and then handed over to the mentor.

List here any specific skills, requirements, specific courses, knowledge needed or suggested (If none please state none):
Student should have an interest in one or more of the following:
Aero/Fluid Dynamics, Mechanical Design, Electrical Circuit Design, Power Electronics, Power Systems, Microcontrollers, Structural Analysis, Instrumentation and Controls, Dynamic Systems, Wind Energy
Knowledge of or ability to learn one or more of the following software:
CAD - Pro/e and/or Solidworks
Circuit Design: Eagle or similar
Power Electronics & Power System Analysis: MATLAB SIMULINK , PSSE, or similar
CFD: ANSYS FLUENT/STAR CCM

FEA: Abaqus or similar
Programming: C/Java/Python , microcontroller programming
Engineering analysis: Matlab/Mathcad
Data Acquisition: Labview
Microsoft Project, Microsoft Word, LaTeX