# Wind Energy Technology

**Program No: 10-482-1**
Associate Degree in Applied Science
Degree Completion Time: Four Terms
2011-2012

| Catalog No. | Class Title | Credit(s) |
|---|---|---|
| | **Term 1** | |
| 10482101 | Intro to Wind Systems | 3.00 |
| 10413110 | Energy Introduction to | 2.00 |
| 10620159 | Hydraulics 1 | 2.00 |
| 10660105 | DC Fundamentals | 3.00 |
| 10809118 | Intermediate Algebra with Applications | 4.00 |
| 10809198 | Introduction to Psychology | 3.00 |
| | **Total** | **17.00** |
| | **Term 2** | |
| 10482120 | Wind Technician 1 Lab | 1.00 |
| 10449113 | Wind Technician Health and Safety` | 2.00 |
| 10620120 | Basic Tools and Measurement | 1.00 |
| 10620122 | Practical Wiring Applications | 1.00 |
| 10620160 | Hydraulics 2 | 2.00 |
| 10620138 | Programmable Controllers - Allen Bradley | 3.00 |
| 10660110 | AC Fundamentals | 3.00 |
| 10801195 | Written Communication | 3.00 |
| 10804114 | College Technical Mathematics 1B | 2.00 |
| | **Total** | **18.00** |
| | **Summer** | |
| 10482103 | Wind Farm Internship OR 10482130 Wind Site Assessment (1 Credit-offered Term 4) AND 10482132 Wind Turbine Maintenance Lab (1 Credit-Offered Term 4) | 2.00 |
| | **Total** | **2.00** |
| | **Term 3** | |
| 10482122 | Wind Technician 2 | 1.00 |
| 10482124 | Wind Technician 3 | 1.00 |
| 10620130 | Mechanisms Mechanics Introduction to | 3.00 |
| 10620141 | Industrial Controls and Motors | 3.00 |
| 10620164 | Electromechanical Systems | 3.00 |
| 10806154 | General Physics 1 | 4.00 |
| 10103174 | Excel 2007 - Level 1 | 1.00 |
| | **Total** | **16.00** |
| | **Term 4** | |
| 10482126 | Wind Technician 4 | 3.00 |
| 10482128 | Wind Technician 5 | 2.00 |
| 10620139 | PLC Practical Applications | 2.00 |
| 10620192 | Industrial Codes Troubleshooting and Frequency Drive Procedures | 3.00 |
| 10801196 | Oral/Interpersonal Communication | 3.00 |
| 10809112 | Principles of Sustainability | 3.00 |
| | **Total** | **16.00** |
| | **Program Total** | **69.00** |

**Note:** Program start dates vary; check with your counselor for details.

Curriculum and program acceptance requirements are subject to change.

## About the Career

The wind energy industry is the fastest growing segment of renewable energy production. The U.S. and Canadian commercial wind farms are experiencing annual growth of 25%. Employers seek skilled technicians for operation and maintenance activities in local wind farm settings. There is also intense demand for upper-level technicians within U.S. and international wind turbine manufacturers; these include: installation technician, quality control technician, and warranty and commissioning technicians. Operation and maintenance positions remain with a given wind farm location; other technicians travel extensively with the development of new wind farms and repair/retrofitting of wind farms around the world.

## Careers

- Wind Turbine Technician/Mechanic/Tower Climber
- Installation Technician
- Operation and Maintenance Technician
- Wind Farm Maintenance Manager

## Admissions Steps

- Application
- Application Fee
- Entrance Assessment Scores
- Transcripts
- Program Advising Session
- Functional Abilities Statement of Understanding Form

## Program Outcomes

You'll learn to:

- Install, test, service and repair wind turbine components
- Troubleshoot and maintain control and PLC systems
- Troubleshoot and maintain SCADA systems
- Wear PPE for climbing and identify safety practices for climbing
- Practice safe wind turbine tower climbing skills

## Approximate Costs

- $120 per credit (resident)
- $173 per credit (out-of-state resident)
- Other fees vary by program (books, supplies, materials, tools, uniforms, and health-related exams)

## Notes

Internships—students are responsible for securing an internship and are encouraged to apply for positions well in advance of the summer term. Internship positions are generally paid and often are out of state.

Class dates and times may be rescheduled due to inclement weather.

## Functional Abilities

Functional abilities are the basic duties that a student must be able to perform with or without reasonable accommodations. At the postsecondary level, students must meet these requirements, and they cannot be modified. Please see program website for specific functional abilities.

## Entrance Assessment Scores

| Accuplacer | ACT |
|---|---|
| Arithmetic - 100 | Mathematics - 20 |
| Reading - 74 | Reading - 18 |
| Sentence Skills - 86 | English - 18 |
| Elem. Algebra - 55 | Elem. Algebra - NA |

# Transfer agreements are available with the following institutions:

Capella University
Lakeland College
Silver Lake College
University of Phoenix
Upper Iowa University
UW-Green Bay
UW-Oshkosh
UW-Stout

IMPORTANT: For more information on these agreements, visit gotoltc.edu/transfer.

***ALERT: Beginning with Summer 2011, many General Education course prerequisites have changed. Check the LTC website at gotoltc.edu and click on "Find a Class" for updated prerequisite information.***

***10103174 Excel 2007 - Level 1***
...introduces the learner to the following basic techniques: creating, modifying and formatting worksheets; entering formulas; working with functions; sorting, filtering and editing lists; working with charts; and developing multiple-sheet workbooks. This course is offered in a self-paced format.

***10413110 Energy Introduction to***
…provides participants with an overview of electrical energy generation and distribution. Topics include electricity from the following systems: photovoltaic, wind, coal-fired, hydro, and natural gas. Career awareness for maintenance technicians and plant operators is explored.

***10449113 Wind Technician Health and Safety***
…familiarizes students with the Federal Safety and Health Regulations (OSHA) related to the wind power generation industry. It introduces the student to proper methods and procedures to eliminate and control hazards related to potential injury/illness in the industry. Students will receive training in first aid, CPR, rigging, and confined space and will receive a 30-hour OSHA for General Industry certification upon completion of the course.
*PREREQUISITE: 10482101 Wind Systems Introduction to*

***10482101 Introduction to Wind Systems***
...prepares the learner to assess the global energy picture; analyze the causes of wind and wind flow properties; explore small, medium, and large wind turbine designs; assess the environmental effects of wind turbines; perform business and site assessments for a wind turbine project, plan your wind turbine project, evaluate, operation and maintenance of the turbine system, and analyze the future of wind energy.

***10482103 Wind Farm Internship***
...will allow participants to deveop skill portfolios through hands-on activities in the maintenance, installation and troubleshooting of commercial wind turbines. Employment in the wind industry equires safe tower clumbing practices beyond 300 feet. Internship locations vary across the United States. Extended travel is necessary.
*PREREQUISITE: 10468102 Wind Systems Technician I or 10482102 Wind Systems Technician I and 10482102C1 Wind Systems Technician I, 10482102C2 Wind Systems Technician I, 10660110 AC Fundamentals, and 10620138 Programmable Controllers-Allen Bradley*

***10482120 Wind Technician 1 Lab***
...prepares the learner for work at height. Students will perform equipment maintenance on climbing and fall arrest gear; wear required PFPE, PPE and outdoor apparel when working on a wind energy system; review the causes and results of workplace accidents and injuries; demonstrate adequate health and wellness for climbing and working at height; demonstrate safe climbing methods; demonstrate proper "ground crew" working habits; and tie basic rigging knots.
*PREQUISITE: 10482101 Wind Systems Introduction to and COREQUISITE: 10449113 Wind Tech Health and Safety*

***10482122 Wind Technician 2***
...will give the learner ENSA certification in safe access, rescue, and confined spaces. The learner will review current legislation and requirements for work at height; complete a risk assessment; demonstrate proper rigging techniques for rescue equipment; perform a ladder rescue; perform rescues from a wind turbine nacelle, hub and glade; perform a self-rescue; complete a confined space permit; assemble and test a respirator; and use a monitor to test air quality.
*PREREQUISITES: 10482120 Wind Technician 1 Lab and 10449113 Wind Tech HEalth and Safety and COREQUISITE: 10482124 Wind Technician 3*

***10482124 Wind Technician 3***
...certifies the learner in torque techniques through Snap-On Tools. The student will apply safe and proper technique with use of a click-type torque wrench, dial-type torque wrench, torque screwdriver, torque adapter, and torque extensions; verify appropriate torque techniques on electronic test bench; apply proper technique with the Techangle* wrench; and demonstrate safe and proper torque technique using the Hytorc* equipment.
*PREREQUISITE: 10620120 Basic Tools and Measurement and COREQUISITE: 10482122 Wind Technician 2*

***10482126 Wind Technician 4***
...strengthens the electromechanical skills of the learner by reviewing arc flash requirements, power quality, power factor correction, transformer calculations, and electrical distribution and transmission systems. Students will explore drive trains used in wind turbines; analyze the causes and results of gear failures; demonstrate proper techniques for gearbox and generator alignment; and compare and contrast synchronous and induction generators.
*PREREQUISITES: 10482124 Wind Tech 3, 10620141 Industrial Controls & Motors, 10620130 Mech Mech Intro, 10620138 Prog Controllers-Allen Bradley and COREQUISITES: 10482128 Wind Tech 5 and 10620139 PLC Practical Applications*

***10482128 Wind Technician 5***
...will have the learner working with data collected from wind energy systems at LTC using Microsoft Excel, wind energy calculators, and MET tower software. Participants will determine energy production, wind speeds, and wind direction; produce power curves; calculate wind shear; analyze rotor wash, estimate availability and capacity factor of a wind system; estimate payback and return on investment for wind systems, and create charts and graphs to summarize the data.
*PREREQUISITE: 10103174 Excel 2007-Level 1 and COREQUISITE: 10482126 Wind Technician 4*

***10482130 Wind Site Assessment***
...reviews the basics of site assessment covered in Intro to Wind, but adds more details and techniques on doing a thorough site assessment that is the same quality standard used by the MREA and Focus on Energy*, Similar Site Assessment requirements are found throughout the United States for those who want to use grant money to install a wind energy system. This course prepares the learner to become a certified site assessor.
*PREREQUISITE: 10482101 Wind Systems Introduction to*

***10482132 Wind (Small) Turbine Maintenance Lab***
...prepares the learner for servicing a variety of small wind turbines. Participants will climb and inspect towers, torque fasteners, check lubrication in gearboxes, add grease to moving and exposed parts, verify good electrical connections, and perform an overall "system check" on a wind energy system as part of routine maintenance. Some work will be done on campus; other turbines are located off site. Travel is required.
*PREREQUISITE: 10482122 Wind Technician 2*

***10620120 Basic Tools and Measurement***
...prepares the learner to use hand tools, fasteners, and simple shaft alignments. Participants identify and describe the function and learn to adjust simple mechanisms.

***10620122 Practical Wiring Applications***
...prepares the learner to construct electrical circuits; measure electrical quantities using a VOM and/or DVM; analyze measured values using electrical circuit laws; construct typical residential circuits; and analyze typical residential electrical circuits.
*COREQUISITES: 10660105 DC Fundamentals (3 cr) or 10660105C1 DC Fundamentals (3 cr)*

***10620130 Mechanisms Mechanics Introduction to***
...prepares the learner to use tools and fasteners safely; identify belt and chain drive components; install and adjust belt and chain drives; apply bearing and lubrication information; perform coupling alignment using straight edge, feeler gauge, and dial indicator methods; identify various gear drives; calculate gear ratios; and analyze first-, second-, and third-class levers.

***10620139 PLC Practical Applications***
...will investigate the underlying concepts of industrial sensors and interface these sensors with Allen-Bradley PLCs to crate and troubleshoot event-driven programs.
*PREREQUISITE: 10620138 Programmable Controllers-Allen Bradley and COREQUISITES: 10 482126 Wind Technician 4, 10482128 Wind Technician 5, 10620139 PLC Practical Applications*

***10620140 Programmable Controllers - Allen Bradley Advanced***
...prepares the student to develop applications utilizing subroutine instructions, analog modules and RTD and Thermocouple modules; gain a basic understanding of creating and troubleshooting programs using the ControlLogix, RSLOGIX5000 software.
*PREREQUISITE: 10620138 Prog Cntrls/AB or 10620138C1 Prog Cntrls/AB (3 cr)*

***10620141 Industrial Controls and Motors***
...prepares the learner to select control devices by function and operation; illustrate electrical circuits using symbols, diagrams, and abbreviations; explain the operation of magnetic solenoids; apply motor control techniques; select relay type for industrial application; apply the basic rules of line and wiring diagrams; compare the types of timers and timing circuits used in control and explain the coding systems used; explain each type of control device and how it is used in an electrical circuit. Also prepares the learner to verify DC motor operational theories; select DC and AC motor types for general applications; identify AC motor components and wiring applications; verify single-phase operational theory; identify three phase motor components and wiring applications; verify three-phase motor operational theory; identify motor starting methods for industrial applications; verify electro-mechanical motor starting principals of operation; select the motor breaking method for industrial applications; verify the operatinal theory of speed and acceleration methods for motors used in industrial applications; design three-phase power motor circuits for industrial applications; design control circuits for three phase power motor circuits.
*COREQUISITES: 10660110 AC Fundamentals or 10660110C1 AC Fundamentals (3 cr) or 10605110 AC Fundamentals or 10605110C1 AC Fundamentals (3 cr)*

***10620159 Hydraulics 1***
...prepares the learner to identify hydraulic component symbols; adjust a pressure relief valve; analyze the operation of a pilot operated relief valve; analyze Pascal's law; evaluate flow, velocity, work and power in industrial hydraulic circuits; analyze meter-in, meter-out, and bypass flow control circuits; evaluate the characteristics of hydraulic pumps, motors; directional and control valves; identify basic hydraulic control valves; and assemble hydraulic circuits.

***10620160 Hydraulics II***
...enhances the learner's ability to read schematics containing hydraulic component symbols; assemble a hydraulic system using a hydraulic schematic; analyze a hydraulic system's operation using a hydraulic schematic; evaluate the general characteristics and terms of hydraulic fluids, hydraulic conditioning (filtering), hydraulic fluid conductors, hydraulic reservoirs, hydraulic accumulators, hydraulic pressure control valves, and regenerative circuits; troubleshoot regenerative circuits; identify general types of accumulators; analyze the operation of hydraulic pressure control valves in various hydraulic circuits; apply manufacturer's specifications to test the main components of a hydraulic system; and troubleshoot a malfunctioning hydraulic system.
*COREQUISITES: 10620159 Hydraulics I or 10620159C1 Hydraulics (2 cr)*

***10620164 Electromechanical Systems***
…prepares the student to communicate with, tune, run and troubleshoot Allen-Bradley Ultra 3000 servos; utilize electrical control of hydraulic systems; explore PID control of motor speed; and investigate loop and closed loop control systems.
*PREREQUISITES: 10620160 Hydraulics II or 10620160C1 Hydraulics II (2 cr) and 10620161 Pneumatics I or COREQUISITE: 10620162 Pneumatics*

***10620192 Industrial Codes Troubleshooting and Frequency Drive Procedures***
...prepares the learner to conduct effective machine control roubleshooting techniques; apply proper methods and specifications to install or replace a motor; and apply the National Eelectrical Code and the NFPA to practical motor installations. It also prepares the learner to explain the function and construction of a variable speed drive as well as program and modify the operational characteristics of the drive for practical applications.
*PREREQUISITES 10620141 Motor Operation & Control or 10620141C1 Motor Operation & Control (3 cr)*

***10660105 DC Fundamentals***
...prepares the student to follow safety procedures; maintain a safe and healthy work environment; convert values to scientific and engineering notations; calculate math quantities; describe basic atomic theory; identify basic electrical terms; use established symbols standards; describe DC voltage characteristics and current sources and electrical resistance; measure and analyze electrical quantities in series and parallel circuits; and desolder/solder single and multi-lead components.

***10660110 AC Fundamentals***
...prepares the student to analyze electrical circuits using phasers and AC math, analyze AC waveforms, measure and analyze AC power, analyze capacitors and inductors in DC and AC circuits, analyze AC circuits containing reactance and calculate resonance, apply the elements and properties of basic measuring circuits, and describe transformer characteristics.
*PREREQUISITES: 10660105 DC Fundamentals or 10660105C1 DC Fundamentals (3 cr) or 10605105 DC Fundamentals or 10605105C1 DC Fundamentals (3 cr)*

***10801195 Written Communication***
...teaches the writing process, which includes prewriting, drafting, revising, and editing. Through a variety of writing assignments, the student will analyze audience and purpose, research and organize ideas, and format and design documents based on subject matter and content. Keyboarding skills are required for this course. It also develops critical reading and thinking skills through the analysis of a variety of written documents.
*PREREQUISITE: 10831103 Intro to College Writing or CONDITION: Accuplacer Writing minimum score of 86 or Equivalent*

***10801196 Oral/Interpersonal Comm***
...provides students with the skills to develop speaking, verbal and nonverbal communication, and listening skills through individual speeches, group activities, and other projects.

***10804114 College Technical Math 1B***
...is a continuation of College Technical Math 1A. Topics include: measurement systems; computational geometry; right and oblique triangle trigonometry; and trigonometric functions on the unit circle. Emphasis will be on the application of skills to technical problems. Successful completion of College Technical Mathematics 1A and College Technical Mathematics 1B is the equivalent of College Technical Mathematics 1.
*PREREQUISITE: 10804196 College Tech Math 1A, or 10804109 Algebra Computation or COREQUISITE: 10804113 College Tech Math 1A*

***10804118 Intermediate Algebra with Applications***
…offers the learner algebra content with applications. Topics include properties of real numbers, order of operations, algebraic solution for linear equations and inequalities, operations with polynomial and rational expressions, operations with rational exponents and radicals, algebra of inverse, logarithmic and exponential functions.
*PRERQUISITES: Accuplacer Math score of 100 + 55 Elementary Algebra or Equivalent or 10804110 Elementary Algebra w Apps*

***10806154 General Physics 1***
...presents the applications and theory of basic physics principles. This course emphasizes problem-solving, laboratory investigation, and applications. Topics include unit conversions and analysis, vectors, translational and rotational kinematics, translational and rotational dynamics, heat and temperature, and harmonic motion and waves.
*COREQUISITE: 10804197 College Tech Math 1B or 10804114 College Tech Math 1B or 10804115 College Tech Math 1*

***10809112 Principles of Sustainability***
...prepares the student to develop sustainable literacy, analyze interconnections among physical and biological sciences and environmental systems, summarize effects of sustainability on health and well-being, analyze connections among social, economic, and environmental systems, employ energy conservation strategies to reduce use of fossil fuels, investigate alternative energy options, evaluate options to current waste disposal/recycling in the U.S., and analyze approaches used by your community.

***10809198 Intro to Psychology***
...introduces students to a survey of the multiple aspects of human behavior. It involves a survey of the theoretical foundations of human functioning in such areas as learning, motivation, emotions, personality, deviance and pathology, physiological factors, and social influences. It directs the student to an insightful understanding of the complexities of human relationships in personal, social, and vocational settings.



Revised
7-15-10