LTC LAKESHORE TECHNICAL COLLEGE

WIND ENERGY TECHNOLOGY

Program Number 10-482-1
Associate Degree in Applied Science • Five Terms

ABOUT THE PROGRAM
The wind energy industry is the fastest growing segment of renewable energy production. The U.S. and Canadian wind industry is experiencing annual growth of 25%. Employers seek skilled technicians for operation and maintenance activities in wind farms. There is also a demand for advanced technicians with U.S. and international wind turbine manufacturers; these include: installation technicians, quality control technicians, and warranty and commissioning technicians. Operation and maintenance positions generally remain with a given wind farm location; other technicians travel extensively with the construction of new wind farms and repair/retrofitting of wind turbines around the world.

PROGRAM OUTCOMES
- Install, test, service, and repair wind turbine components.
- Troubleshoot and maintain control and PLC systems.
- Wear PPE for climbing and identify safe practices for climbing.
- Safely climb wind turbine towers.

ADMISSIONS STEPS
- Work with Admissions Specialist to:
  - Submit application and $30 fee.
  - Complete an assessment for placement (Accuplacer or ACT).
  - Submit official transcripts (high school and other colleges).
- Meet with program advisor/counselor to discuss program details.

APPROXIMATE COSTS
- $132 per credit (resident)
- $198 per credit (out-of-state resident)
- Other fees vary by program (books, supplies, materials, tools, uniforms, health-related exams, etc.) Visit gotoltc.edu/financial-aid/tuition-and-fees for details.

PLACEMENT SCORES
Accuplacer/ACT scores will be used to develop your educational plan. Contact your program advisor/counselor for details.

SPECIAL NOTE
This program is an official shared program with students from FVTC, MPTC, and NWTC. Students attend electro-mechanical and general education classes at their local technical colleges. During the summer months, these students attend Wind Energy Technology specific courses at LTC in Cleveland and may graduate with both a degree from their respective colleges as well as a degree in Wind Energy Technology from LTC. Please note that an online Intro to Wind Systems course runs each fall and spring as a prerequisite to the summer term. LTC welcomes transfer students who are graduates of electro-mechanical and energy-related programs at LTC and other WTCS colleges. Interested transfer/dual-degree students are encouraged to contact the LTC program advisor/counselor at 920-693-1206 for more information and to determine eligibility to attend the summer program courses.

CAREER & EDUCATION ADVANCEMENT OPPORTUNITIES
LTC credits transfer to over 30 universities. For more information visit gotoltc.edu/future-students/transfer.

CONTACT
Chou Yang, Admissions Specialist
920.693.1851 • chou.yang@gotoltc.edu

Catalog No.	Class Title	Credit(s)
	Term 1	
10482101	Introduction to Wind Systems	3
10482120	Wind Technician 1 Lab **	1
10620120	Basic Tools and Measurement	1
10620122	Industrial Controls Introduction	2
10620103	Fluid Power 1	2
10660105	DC Fundamentals	2
10804115	College Technical Math 1	5
		16
	Term 2	
10413110	Energy Introduction to	2
10482113	Wind Technician Health and Safety **	2
10482122	Wind Technician 2 **	1
10620104	Fluid Power 2	3
10620138	Programmable Controllers - Allen Bradley	3
10660110	AC Fundamentals	2
10620141	Industrial Controls & Motors	3
		16
	Summer Term	
10482132	Small Turbine Maintenance/Site Assessment ** OR 10482103 Wind Farm Internship (2 cr) **	2
		2
	Term 3	
10482124	Wind Technician 3 **	1
10620130	Mechanisms Mechanics Introduction to	3
10620164	Electromechanical Systems	2
10620193	NEC Codes	1
10806154	General Physics 1	4
10806112	Principles of Sustainability	3
10801195	Written Communication OR 10801197 Technical Reporting OR 10801136 English Composition 1	3
		17
	January Term	
10442109	Wind Turbine Structural Weld Inspection	1
		1
	Term 4	
10482126	Wind Technician 4 **	3
10482128	Wind Technician 5 **	2
10620139	PLC Practical Applications	2
10620192	Frequency Drives	1
10620195	Industrial Troubleshooting	1
10801196	Oral/Interpersonal Communication	3
10809198	Introduction to Psychology	3
		15
		TOTAL 67

**These class dates and times may be rescheduled due to inclement weather. Students must be within safe-climbing, unequipped body weight of 100 to 275 pounds.

Curriculum and Program Acceptance requirements are subject to change. Program start dates vary; check with your advisor/counselor for details.

The Hire in HIGHER EDUCATION

2015-16

AC FUNDAMENTALS...prepares the student to analyze electrical circuits using 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

BASIC TOOLS AND MEASUREMENT...prepares the learner to use hand tools, precision measuring instruments, and torque tools.

COLLEGE TECHNICAL MATHEMATICS 1...prepares the student to solve linear, quadratic, and rational equations; graphing; formula rearrangement; solve systems of equations; percent; proportions; measurement systems; computational geometry; right and oblique triangle trigonometry; trigonometric functions on the unit circle; and operations on polynomials. Emphasis will be on the application of skills to technical problems. This course is the equivalent of successful completion of College Tech Math 1a and 1b. PRERQUISITES: 10834110 Elementary Algebra w Apps or equivalent

DC FUNDAMENTALS...prepares the student to 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 lead components. COREQUISITES: 10804115 College Technical Math 1 or 10804113 College Tech Math 1A and 10804114 College Tech Math 1B or 10804118 Intermediate Algebra w Applications and 1624105 or 10624105HS Health Physics Calculations and Statistics

ELECTROMECHANICAL SYSTEMS...prepares the student to communicate with, tune, run, and troubleshoot Allen-Bradley servos; utilize electrical control of hydraulic systems, explore PID control of motor speed; and investigate open and closed loop control systems. PREREQUISITES: Fluid Power 2 and 10660110 AC Fundamentals

ENERGY INTRODUCTION TO...provides the learner with an overview of electrical energy generation and distribution. Topics include electricity from the following modes: photovoltaic, wind, coal-fired, hydro, and natural gas. Career awareness for maintenance technicians and plant operators is explored.

FLUID POWER 1...prepares the learner to identify hydraulic and pneumatic 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 and pneumatic circuits; analyze meter-in, meter-out, and bypass flow control circuits; identify basic hydraulic and pneumatic control valves; and assemble hydraulic circuits. COREQUISITES: 10804115 College Technical Math 1 or 10804113 College Tech Math 1A and 10804114 College Tech Math 1B

FLUID POWER 2...enhances the learner's ability to read schematics containing fluid power component symbols; assemble systems using schematics; analyze system's operation using a schematic; evaluate the general characteristics and terms of fluids under pressure, fluid conditioning, conductors, reservoirs, accumulators, pressure control; and troubleshoot malfunctioning pressurized systems. PREREQUISITE: 10620103 Fluid Power 1

FREQUENCY DRIVES...prepares the learner to explain the function, construction and troubleshoot frequency drives as well as select and change parameters to meet operational characteristics for the drive application. PREREQUISITE: 10620141 Industrial Controls and Motors or 10620141C1 Industrial Controls and Motors(3 cr)

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: 10804114 College Tech Math 1B or equivalent

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 and apply motor control techniques and introduces the student to three-phase power motor circuits for industrial applications. COREQUISITES: 10660110 AC Fundamentals

INDUSTRIAL CONTROLS INTRODUCTION...prepares the learner to follow safety procedures; maintain a safe and healthy work environment; construct electrical circuits; measure electrical quantities using a VOM and/or DVM; analyze measured values using electrical circuit laws; construct typical industrial control circuits; and analyze typical industrial control circuits.

INDUSTRIAL TROUBLESHOOTING...prepares the learner to conduct effective machine control troubleshooting techniques with an understanding of preventive maintenance methods designed to minimize motor and controls issues between preventive maintenance measures. PREREQUISITE: 10620141 Industrial Controls and Motors

INTRODUCTION 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. COREQUISITE: 10838105 Intro Reading and Study Skills or equivalent

INTRODUCTION TO WIND SYSTEMS...prepares the learner to assess the global energy picture, analyze the causes of wind flow and wind flow properties, write a site assessment, explore small, medium, and large wind turbine designs, assess the environmental effects of wind turbines, perform business assessments for wind energy projects, plan a wind energy project, evaluate the operation and maintenance requirements of wind turbines and their components, and analyze the future of wind energy.

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 and laser methods; identify various gear drives; calculate gear ratios; and analyze first-, second-, and third-class levers.

NEC CODES...introduces the student to National Electric Codes NFPA 70. Prepares the learner to apply NFPA 70 to motor and control installations and repairs. PREREQUISITE: 10620141 Industrial Controls and Motors

ORAL/INTERPERSONAL COMMUNICATION...provides students with the skills to develop speaking, verbal and nonverbal communication, and listening skills through individual speeches, group activities, and other projects. COREQUISITE: 10838105 Intro Reading and Study Skills or equivalent

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: 10482126 Wind Technician 4 and 10482128 Wind Technician 5

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.

PROGRAMMABLE CONTROLLERS - ALLEN BRADLEY...prepares the student to understand basic PLC structure and terminology; learn to create and troubleshoot basic PLC programs using the RSLOGIX 500 software and the RSLINX communication software; become familiar with communicating with programming SLC-500 and Micrologix PLCs. This course is highly computer based.

SMALL TURBINE MAINTENANCE/SITE ASSESSMENT...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. Covers techniques and details involved in a thorough site assessment using industry quality standards. Travel is required. PREREQUISITES: 10660110 AC Fundamentals and 10620138 Programmable Controllers-Allen Bradley and 10804115 College Tech Math 1 or 10804114 College Tech Math 1B and 10482120 Wind Technician 1 Lab and 10620104 Fluid Power 2

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. COREQUISITE: 10482101 Wind Systems Introduction to

WIND TECHNICIAN 2...will allow the learner to obtain S.A.F.E.R. certification in tower safe access, rescue, and confined space awareness. The learner will review legislation and best practices 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 blade; perform an evacuation; complete a confined space permit; assemble and test a respirator; and use an air monitor to test air quality. COREQUISITES: 10482120 Wind Technician 1 Lab and 10482113 Wind Tech Health and Safety

WIND TECHNICIAN 3...certifies the learner in torque tool 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 a test bench; apply proper technique with the Techangle® wrench; and demonstrate safe and proper torque technique using the Hytorc® equipment. COREQUISITE: 10482122 Wind Technician 2 and 10482132 Small Turbine Maintenance/Site Assessment or 10482103 Wind Farm Internship

WIND TECHNICIAN 4...strengthens the learner's electromechanical skills 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 asynchronous 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

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 may 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. COREQUISITE: 10482126 Wind Technician 4

WIND TECHNICIAN HEALTH AND SAFETY...familiarizes learners with Federal Safety and Health Regulations (OSHA) related to the wind energy 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 10-hour OSHA for General Industry certification upon completion of the course. PREREQUISITE: 10482101 Wind Systems Introduction to

WIND TURBINE STRUCTURAL WELD INSPECTION...provides wind energy students with theory and practice to perform structural weld assessments on towers and turbine components. Topics include part location from prints, visual inspection, weld theory, fault determination, documentation, and action items. PREREQUISITE: 10482101 Wind Systems Introduction and COREQUISITE: 10482120 Wind Technician 1 Lab

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 Wrtg equivalent and COREQUISITE: 10838105 Intro Rdg & Study Skills or equivalent