

COURSE ELT1010: ELECTRO-ASSEMBLY 1

Level: Introductory

Prerequisite: None

Description: Students apply basic fabricating and servicing techniques to construct and test electronic and electromagnetic devices and cables.

Parameters: Access to basic hand tools, soldering equipment, voltmeter, ohmmeter/test light and related resources.

Outcomes: The student will:

- 1. create a health and safety plan with special emphasis on conditions and factors related to the specific pathway or series of courses**
 - 1.1 research and identify the following eight common elements of a health and safety management system:
 - 1.1.1 management, leadership and organizational commitment including policies, guidelines and responsibilities
 - 1.1.2 hazard identification and assessment
 - 1.1.3 hazard control
 - 1.1.4 worker competency and training including: technical competence, safe work practices and procedures, personal protective equipment
 - 1.1.5 work site inspection
 - 1.1.6 incident investigation
 - 1.1.7 emergency response
 - 1.1.8 management system administration including: evaluation, records and statistics, maintenance of system
 - 1.2 explain each of the elements reflecting on occupational health and safety implications
 - 1.3 define health and safety elements relevant to the world-of-work
 - 1.4 present a health and safety plan clarifying its relevance to the work world and society in general
- 2. research common processes and methods of hazard identification, assessment and control specific to the pathway or series of courses**
 - 2.1 research and identify common job site hazard identification processes
 - 2.2 research and identify common methods for assessment and control of hazards
 - 2.3 explain and demonstrate appropriate health and safety effective practices
 - 2.4 demonstrate a proactive personal commitment toward improvement of workplace health and safety including concern for others and following instructions, rules and guidelines
- 3. apply the appropriate fabrication techniques, including proper soldering and component assembly procedures, to construct and test a simple electronic circuit**
 - 3.1 construct and analyze a simple control circuit
 - 3.2 use various breadboarding techniques to be able to understand methods used; e.g., nail and board sector and spring clip, wire wrap, point-to-point and solderless breadboard
 - 3.3 identify components
 - 3.4 measure voltage and continuity to appraise condition of circuit using appropriate instrumentation; e.g., simple alarm, simple automobile circuit, multimeter (digital and analog)

- 4. apply the appropriate fabrication techniques to construct and test an electromagnetic device**
 - 4.1 define AC/DC voltage and polarity
 - 4.2 use proper solder and soldering techniques to gain an understanding of their value
 - 4.3 analyze several magnetic devices to formulate an understanding of their function; e.g., speakers, electromagnetic crane, tape heads, moving magnetic pick-ups, relays, magnetic strip, levitation trains, magnetic device in hard drive
- 5. identify and assemble common electrical/electronic cables and connectors used in power, audio and video connections**
 - 5.1 install specialty connectors and cables to acquire knowledge and skills
 - 5.2 demonstrate an understanding of specialty cables that link systems with special functions including fibre optics, coaxial and telephone
- 6. demonstrate established laboratory procedures and safe work practices**
 - 6.1 demonstrate safe home/laboratory procedures with respect to electrical hazards and use of solder and flux
 - 6.2 identify and explain the importance of electrical protection devices
- 7. demonstrate basic competencies**
 - 7.1 demonstrate fundamental skills to:
 - 7.1.1 communicate
 - 7.1.2 manage information
 - 7.1.3 use numbers
 - 7.1.4 think and solve problems
 - 7.2 demonstrate personal management skills to:
 - 7.2.1 demonstrate positive attitudes and behaviours
 - 7.2.2 be responsible
 - 7.2.3 be adaptable
 - 7.2.4 learn continuously
 - 7.2.5 work safely
 - 7.3 demonstrate teamwork skills to:
 - 7.3.1 work with others
 - 7.3.2 participate in projects and tasks
- 8. make personal connections to the cluster content and processes to inform possible pathway choices**
 - 8.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences
 - 8.2 create a connection between a personal inventory and occupational choices

COURSE ELT1030: CONVERSION & DISTRIBUTION

Level: Introductory

Prerequisite: None

Description: Students experiment and work with principles of electrical energy conversion and distribution.

Parameters: Access to basic hand tools, a multimeter and related resources.

Outcomes: The student will:

- 1. identify and describe methods of converting nonrenewable and renewable sources of energy into electricity**
 - 1.1 build and/or operate one energy conversion system that produces electricity using chemical, light, heat and/or mechanical energy forms
- 2. construct an electrical distribution system**
 - 2.1 describe electrical power distribution systems from source to consumer
 - 2.2 wire common lighting and communication circuits
 - 2.2.1 breadboarding (low voltage)
 - 2.2.2 switches, lights, plugs, bells, buzzers, etc.
 - 2.3 test circuits for continuity and function
- 3. demonstrate how mechanical, chemical, light and heat energy can be converted into electrical energy**
 - 3.1 identify and describe how energy is converted into electricity in a:
 - 3.1.1 wet/dry cell
 - 3.1.2 photovoltaic cell
 - 3.1.3 thermocouple
 - 3.1.4 generator/alternator
 - 3.1.5 piezoelectric crystal
- 4. determine the cost efficiency, practicality and environmental impact of producing electricity from various sources of energy**
 - 4.1 research issues related to electrical generation, transmission and distribution systems including:
 - 4.1.1 cost efficiencies
 - 4.1.2 environmental impact of fossil fuel, hydro-electric and nuclear power plants
 - 4.1.3 conventional (fossil fuel) versus nonconventional (tidal, solar, wind) sources
 - 4.2 report on issues related to energy efficiency and conservation
 - 4.3 identify specific applications of energy conversion used in personal life
- 5. demonstrate established laboratory procedures and safe work practices**
 - 5.1 identify and follow safety procedures in a home/laboratory
- 6. demonstrate basic competencies**
 - 6.1 demonstrate fundamental skills to:
 - 6.1.1 communicate
 - 6.1.2 manage information
 - 6.1.3 use numbers
 - 6.1.4 think and solve problems

- 6.2 demonstrate personal management skills to:
 - 6.2.1 demonstrate positive attitudes and behaviours
 - 6.2.2 be responsible
 - 6.2.3 be adaptable
 - 6.2.4 learn continuously
 - 6.2.5 work safely
- 6.3 demonstrate teamwork skills to:
 - 6.3.1 work with others
 - 6.3.2 participate in projects and tasks
- 7. make personal connections to the cluster content and processes to inform possible pathway choices**
 - 7.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences
 - 7.2 create a connection between a personal inventory and occupational choices

COURSE ELT1050: ELECTRONIC POWER SUPPLY 1

Level: Introductory

Prerequisite: ELT1010: Electro-assembly 1

Description: Students construct different types of alternating and direct current power supplies and demonstrate their application in electrical/electronic systems.

Parameters: Access to basic hand tools, a multimeter and related resources. Direct teacher supervision for line voltage connections.

Outcomes: The student will:

- 1. identify and describe various types of alternating and direct current power supplies**
 - 1.1 distinguish and describe voltage, current and power ratings on a power supply
 - 1.2 describe AC/DC power supplies
 - 1.3 distinguish between the following various power supplies:
 - 1.3.1 transformers
 - 1.3.2 inverters
 - 1.3.3 converters
 - 1.3.4 eliminators
 - 1.3.5 battery
 - 1.3.6 solar
 - 1.3.7 voltage doubler/tripler
 - 1.4 appraise the merits and deficiencies of half-wave bridge, full-wave bridge and centre-tap rectifiers
 - 1.5 identify stages of a power supply in transformer, rectifier, filter and regulator
- 2. construct a simple power supply**
 - 2.1 construct simple power supplies, using perforated circuit boards
- 3. test a regulated, filtered power supply for output characteristics**
 - 3.1 measure power supply output using a multimeter
- 4. demonstrate established laboratory procedures and safe work practices**
 - 4.1 demonstrate a positive attitude of personal safety
 - 4.2 identify, locate and use proper personal protective equipment
- 5. demonstrate basic competencies**
 - 5.1 demonstrate fundamental skills to:
 - 5.1.1 communicate
 - 5.1.2 manage information
 - 5.1.3 use numbers
 - 5.1.4 think and solve problems
 - 5.2 demonstrate personal management skills to:
 - 5.2.1 demonstrate positive attitudes and behaviours
 - 5.2.2 be responsible
 - 5.2.3 be adaptable
 - 5.2.4 learn continuously
 - 5.2.5 work safely

- 5.3 demonstrate teamwork skills to:
 - 5.3.1 work with others
 - 5.3.2 participate in projects and tasks
- 6. make personal connections to the cluster content and processes to inform possible pathway choices**
 - 6.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences
 - 6.2 create a connection between a personal inventory and occupational choices

COURSE ELT1080: CONTROL SYSTEMS 1

Level: Introductory

Prerequisite: ELT1010: Electro-assembly 1

Description: Students construct process control systems, demonstrate their basic operation and demonstrate procedures for testing them.

Parameters: Access to digital/analog multimeters, pressure devices and related resources.

Outcomes: The student will:

- 1. identify how control systems are used in residential and commercial applications**
 - 1.1 draw and explain a process control system using block diagrams depicting each functional component and the flow of signals through the systems
- 2. identify basic process control systems and explain how they function**
 - 2.1 explain the difference between open-loop and closed-loop control systems
- 3. construct basic process control circuits, using passive devices**
 - 3.1 construct a basic process control system using passive devices including:
 - 3.1.1 thermistor
 - 3.1.2 pressure sensor
 - 3.1.3 proximity switch
 - 3.1.4 light control resistor
 - 3.1.5 float switch
 - 3.1.6 reed switch
 - 3.1.7 photocell
 - 3.2 explain process control terms including:
 - 3.2.1 precision
 - 3.2.2 standard
 - 3.2.3 calibration
 - 3.2.4 accuracy
 - 3.2.5 sensor
 - 3.2.6 transducers
 - 3.2.7 distortion
 - 3.2.8 transients
 - 3.2.9 sampling
 - 3.2.10 interrupt
 - 3.2.11 frequency
 - 3.3 demonstrate knowledge in measuring voltage, current and resistance in any control system using analog and digital instruments
 - 3.4 explain how to test process control circuit(s), voltage, current, continuity, opens and shorts
- 4. demonstrate established laboratory procedures and safe work practices**
 - 4.1 demonstrate safe and correct procedures in measuring voltage, current and resistance using digital and analog meters

5. demonstrate basic competencies

5.1 demonstrate fundamental skills to:

- 5.1.1 communicate
- 5.1.2 manage information
- 5.1.3 use numbers
- 5.1.4 think and solve problems

5.2 demonstrate personal management skills to:

- 5.2.1 demonstrate positive attitudes and behaviours
- 5.2.2 be responsible
- 5.2.3 be adaptable
- 5.2.4 learn continuously
- 5.2.5 work safely

5.3 demonstrate teamwork skills to:

- 5.3.1 work with others
- 5.3.2 participate in projects and tasks

6. make personal connections to the cluster content and processes to inform possible pathway choices

- 6.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences
- 6.2 create a connection between a personal inventory and occupational choices

COURSE ELT1090: ANALOG COMMUNICATION 1

Level: Introductory

Prerequisite: ELT1010: Electro-assembly 1

Description: Students install and demonstrate the fundamentals of various consumer audio integrated systems.

Parameters: Access to consumer audio or automobile systems, multimeters and related resources.

Outcomes: The student will:

1. distinguish the difference between terms and specifications used in analog audio systems

- 1.1 define audio terms and specifications; e.g., wattage, peak value, sine waves, distortion, impedance matching
- 1.2 identify various subsystems of an audio system including:
 - 1.2.1 amplifier
 - 1.2.2 preamplifier
 - 1.2.3 equalizer
 - 1.2.4 speakers
 - 1.2.5 compact disc player
 - 1.2.6 tape
 - 1.2.7 crossover
- 1.3 identify major components of an amplifier through the use of a block diagram, identifying power supply, preamplifier and amplifier

2. install a functional audio system according to a given set of specifications

- 2.1 follow correct wiring procedures
- 2.2 read and interpret an audio system flow connection chart
- 2.3 install a complete audio system
- 2.4 lay out and connect the wiring for an audio system
- 2.5 explain and demonstrate how to test an audio device for intended function
- 2.6 construct a simple audio device; e.g., amplifier, crossover network, fader, equalizer, distribution network, mixers or light organ

3. service and maintain a consumer audio system

- 3.1 explain and demonstrate how to troubleshoot an audio system
- 3.2 maintain an audio system by identifying and correcting problems

4. demonstrate established laboratory procedures and safe work practices

- 4.1 identify causes of high current and high heat in systems

5. demonstrate basic competencies

- 5.1 demonstrate fundamental skills to:
 - 5.1.1 communicate
 - 5.1.2 manage information
 - 5.1.3 use numbers
 - 5.1.4 think and solve problems

- 5.2 demonstrate personal management skills to:
 - 5.2.1 demonstrate positive attitudes and behaviours
 - 5.2.2 be responsible
 - 5.2.3 be adaptable
 - 5.2.4 learn continuously
 - 5.2.5 work safely
- 5.3 demonstrate teamwork skills to:
 - 5.3.1 work with others
 - 5.3.2 participate in projects and tasks
- 6. make personal connections to the cluster content and processes to inform possible pathway choices**
 - 6.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences
 - 6.2 create a connection between a personal inventory and occupational choices

COURSE ELT1110: SECURITY SYSTEMS 1

Level: Introductory

Prerequisite: ELT1010: Electro-assembly 1

Description: Students install and demonstrate the fundamentals of sensors, control units and warning devices used in security systems.

Parameters: Access to specialized equipment.

Outcomes: The student will:

- 1. identify and compare different electronic systems used to secure people, property and information**
 - 1.1 distinguish between different types of security systems; e.g., monitored, stand-alone, closed-circuit, automobile, personal
 - 1.2 distinguish between various security devices; e.g., computer systems, hardwire, remote frequency systems
- 2. describe and compare hardwired sensors**
 - 2.1 demonstrate how to inspect various sensors; e.g., contact closure, motion, thermal, moisture detectors
 - 2.2 demonstrate how to inspect various warning devices; e.g., dialler, siren, lights
- 3. install and test a security system, evaluate circuit performance and identify possible maintenance requirements**
 - 3.1 explain and demonstrate how to install a security system
 - 3.2 demonstrate how to test and validate circuit performance using voltmeter or continuity tester
 - 3.3 explain/maintain various security systems
- 4. demonstrate established laboratory procedures and safe work practices**
 - 4.1 demonstrate appropriate attitudes of personal safety
 - 4.2 identify ethical points of view in using personal security systems
- 5. demonstrate basic competencies**
 - 5.1 demonstrate fundamental skills to:
 - 5.1.1 communicate
 - 5.1.2 manage information
 - 5.1.3 use numbers
 - 5.1.4 think and solve problems
 - 5.2 demonstrate personal management skills to:
 - 5.2.1 demonstrate positive attitudes and behaviours
 - 5.2.2 be responsible
 - 5.2.3 be adaptable
 - 5.2.4 learn continuously
 - 5.2.5 work safely
 - 5.3 demonstrate teamwork skills to:
 - 5.3.1 work with others
 - 5.3.2 participate in projects and tasks

6. make personal connections to the cluster content and processes to inform possible pathway choices

- 6.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences
- 6.2 create a connection between a personal inventory and occupational choices

COURSE ELT1130: ROBOTICS 1

Level: Introductory

Prerequisite: None

Description: Students apply the fundamentals of robotics systems and basic robotics functions.

Parameters: No specialized equipment or facilities.

Outcomes: The student will:

- 1. describe the evolution and applications of robotics systems**
 - 1.1 distinguish between various robotics geometric systems
 - 1.2 distinguish between subsystems and their applications
- 2. identify and classify programmable robotics systems and subsystems**
 - 2.1 demonstrate an understanding of AC/DC motor controls to include switching motor states
 - 2.2 identify problem/task for robotics systems
- 3. identify and describe various alternative types of power sources**
 - 3.1 prototype a direct control robotics unit to illustrate the:
 - 3.1.1 use of computer-aided design
 - 3.1.2 hydraulic, pneumatic and electromechanical interfacing
 - 3.1.3 cumulative serial and parallel operations
 - 3.2 demonstrate operation of a robot through its predetermined set of functions
- 4. demonstrate basic competencies**
 - 4.1 demonstrate fundamental skills to:
 - 4.1.1 communicate
 - 4.1.2 manage information
 - 4.1.3 use numbers
 - 4.1.4 think and solve problems
 - 4.2 demonstrate personal management skills to:
 - 4.2.1 demonstrate positive attitudes and behaviours
 - 4.2.2 be responsible
 - 4.2.3 be adaptable
 - 4.2.4 learn continuously
 - 4.2.5 work safely
 - 4.3 demonstrate teamwork skills to:
 - 4.3.1 work with others
 - 4.3.2 participate in projects and tasks
- 5. make personal connections to the cluster content and processes to inform possible pathway choices**
 - 5.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences
 - 5.2 create a connection between a personal inventory and occupational choices

COURSE ELT1140: ROBOTICS APPLICATIONS

Level: Introductory

Prerequisite: ELT1010: Electro-assembly 1

Description: Students apply the fundamentals of robotics systems and basic robotics functions.

Parameters: Access to a programmable robotics system.

Outcomes: The student will:

- 1. describe the evolution and applications of programmable robotics systems**
 - 1.1 research the evolution and trends of programmable robotics systems
 - 1.2 distinguish between various programmable robotics designs
 - 1.3 explore areas where programmable robotics systems are used including outer space, medicine, manufacturing and military
- 2. identify and classify programmable robotics systems and subsystems**
 - 2.1 distinguish between subsystems and their applications
 - 2.2 identify and distinguish between teach pendant and software programming
- 3. identify and describe various alternative types of power sources**
 - 3.1 identify and describe the following power sources:
 - 3.1.1 electrochemical
 - 3.1.2 pneumatic
 - 3.1.3 solar (traditional and fuel cell)
 - 3.1.4 wind
 - 3.1.5 hydraulic
 - 3.1.6 biological
 - 3.1.7 electromagnetic
- 4. build and program a programmable robotics system**
 - 4.1 identify program download strategies including:
 - 4.1.1 teach pendant
 - 4.1.2 hardwire
 - 4.1.3 wireless
- 5. design and build a direct control robotics system**
 - 5.1 prototype a robot by:
 - 5.1.1 identifying a problem/task for a robotics system
 - 5.1.2 constructing using an engineered system
 - 5.1.3 performing serial and/or parallel operations
 - 5.1.4 demonstrating operation of a robot through its predetermined set of functions
 - 5.2 demonstrate an understanding of DC motor controls to include:
 - 5.2.1 switching motor states using a program
- 6. demonstrate established laboratory procedures and safe work practices**
 - 6.1 follow laboratory safety procedures
 - 6.2 adhere to safe equipment practices and personal protection

7. demonstrate basic competencies

- 7.1 demonstrate fundamental skills to:
 - 7.1.1 communicate
 - 7.1.2 manage information
 - 7.1.3 use numbers
 - 7.1.4 think and solve problems
- 7.2 demonstrate personal management skills to:
 - 7.2.1 demonstrate positive attitudes and behaviours
 - 7.2.2 be responsible
 - 7.2.3 be adaptable
 - 7.2.4 learn continuously
 - 7.2.5 work safely
- 7.3 demonstrate teamwork skills to:
 - 7.3.1 work with others
 - 7.3.2 participate in projects and tasks

8. make personal connections to the cluster content and processes to inform possible pathway choices

- 8.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences
- 8.2 create a connection between a personal inventory and occupational choices

COURSE ELT1910: ELT PROJECT A

Level: Introductory

Prerequisite: None

Description: Students develop project design and management skills to extend and enhance competencies and skills in other CTS courses through contexts that are personally relevant.

Parameters: Introductory project courses must connect with a minimum of two CTS courses, one of which must be at the introductory level and be in the same occupational area as the project course. The other CTS course(s) can be either at the same level or at the intermediate level from any occupational area.

Project courses cannot be connected to other project courses or practicum courses.

All projects and/or performances, whether teacher- or student-led, must include a course outline or student proposal.

Outcomes:

The teacher/student will:

- 1. identify the connection between this project course and two or more CTS courses**
 - 1.1 identify the outcome(s) from each identified CTS course that support the project and/or performance deliverables
 - 1.2 explain how these outcomes are being connected to the project and/or performance deliverables
- 2. propose the project and/or performance**
 - 2.1 identify the project and/or performance by:
 - 2.1.1 preparing a plan
 - 2.1.2 clarifying the purposes
 - 2.1.3 defining the deliverables
 - 2.1.4 specifying time lines
 - 2.1.5 explaining terminology, tools and processes
 - 2.1.6 defining resources; e.g., materials, costs, staffing
 - 2.2 identify and comply with all related health and safety standards
 - 2.3 define assessment standards (indicators for success)
 - 2.4 present the proposal and obtain necessary approvals

The student will:

- 3. meet goals as defined within the plan**
 - 3.1 complete the project and/or performance as outlined
 - 3.2 monitor the project and/or performance and make necessary adjustments
 - 3.3 present the project and/or performance, indicating the:
 - 3.3.1 outcomes attained
 - 3.3.2 relationship of outcomes to goals originally set

- 3.4 evaluate the project and/or performance, indicating the:
 - 3.4.1 processes and strategies used
 - 3.4.2 recommendations on how the project and/or performance could have been improved
- 4. demonstrate basic competencies**
 - 4.1 demonstrate fundamental skills to:
 - 4.1.1 communicate
 - 4.1.2 manage information
 - 4.1.3 use numbers
 - 4.1.4 think and solve problems
 - 4.2 demonstrate personal management skills to:
 - 4.2.1 demonstrate positive attitudes and behaviours
 - 4.2.2 be responsible
 - 4.2.3 be adaptable
 - 4.2.4 learn continuously
 - 4.2.5 work safely
 - 4.3 demonstrate teamwork skills to:
 - 4.3.1 work with others
 - 4.3.2 participate in projects and tasks
- 5. make personal connections to the cluster content and processes to inform possible pathway choices**
 - 5.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences
 - 5.2 create a connection between a personal inventory and occupational choices