

COURSE ELT3140: MOTORS**Level:** Advanced**Theme:** Robotic and Control Systems**Prerequisite:** None**Description:** Students demonstrate knowledge of electric motor operation and loading characteristics.

Parameters: AC/DC motors (single-phase AC motor and DC motors) and related resources.
Note: The student must have access to instruction from an individual with Electrical Technologist or journeyman status when students are performing practical components other than low voltage.

Supporting Courses: ELT2130 Magnetic Control Devices
 ELT3040 Generation/Transformation
 ELT2080 Control Systems 2

Curriculum and Assessment Standards

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> explain electromotive principles as applied to direct current (DC) and single-phase alternating current (AC) motors explain the operational characteristics of common DC and AC motors 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> explaining the electromotive principles of both a DC motor and an AC single-phase motor. <p><i>Assessment Tool</i> ELT3140–1: Presentation/Reports, Electric Motors</p> <p><i>Standard</i> Performance rating of 3 for each applicable task</p>	15
	<ul style="list-style-type: none"> describing the operating characteristics of: <ul style="list-style-type: none"> – DC series motor – DC shunt motor – DC compound motor – single- and/or three-phase commutator motors – single- and/or three-phase induction motor – single- and/or three-phase synchronous. <p><i>Assessment Tool</i> ELT3140–1: Presentations/Reports: Electric Motors</p> <p><i>Standard</i> Performance rating of 3 for each applicable task</p>	20

COURSE ELT3140: MOTORS (continued)

General Outcomes	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • set up selected DC and AC motors, and demonstrate their loading characteristics • demonstrate established laboratory procedures and safe work practices • create a profile of a trade or occupation within the field of electric motors • demonstrate basic competencies. 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • collecting data to graph the operating characteristics of the following motors: <ul style="list-style-type: none"> – DC compound motor – single- and three-phase commutator motors – single- and three-phase induction motor – single-phase synchronous. <p><i>Assessment Tool</i> <i>ELTLAB–2: Assessment Checklist: Laboratory Practice, Part 1</i></p> <p><i>Standard</i> <i>Performance rating of 3 for each applicable task</i></p> <ul style="list-style-type: none"> • observed performance in following: <ul style="list-style-type: none"> – established laboratory procedures – proper wiring practices – correct loading and operating procedures. <p><i>Assessment Tool</i> <i>ELTPSP: Assessment Checklist: Laboratory Procedures and Safety Practices</i></p> <p><i>Standard</i> <i>Performance rating of 3 for each applicable task</i></p> <ul style="list-style-type: none"> • completing a career profile chart related to servicing/repairing electric motors. <p><i>Assessment Tool</i> <i>ELTCPC: Assessment Guide: Career Profiles</i></p> <p><i>Standard</i> <i>Completing all sections of the profile chart</i></p> <ul style="list-style-type: none"> • observations of individual effort and interpersonal interaction during the learning process. <p><i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p>55</p> <p>5</p> <p>5</p> <p>Integrated throughout</p>

COURSE ELT3140: MOTORS (continued)

Concept	Specific Outcomes	Notes
<p>Safety/Resource Management</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • identify and follow safe wiring practices • use protection devices for all circuits • describe dangers of shaft rotation regarding: <ul style="list-style-type: none"> – vibration – long hair – clothing – jewelry. 	<p>Use of overload and overcurrent devices.</p> <p>Live voltage projects must be activated through GFI circuit breaker.</p> <p>When instructional journeyman qualifications restrict high voltage use, projects may be done in low voltages (less than 30 volts).</p>
<p>Fundamentals</p>	<ul style="list-style-type: none"> • explain and demonstrate motor principles: <ul style="list-style-type: none"> – counter EMF – inductance – conductive resistance • describe and explain characteristics of the following AC and DC motors: <ul style="list-style-type: none"> – shaded pole – split phase – capacitive start and run – three-phase – universal – single-phase synchronous – stepper – servo – permanent magnet. • describe methods of DC motor control: <ul style="list-style-type: none"> – pulse width modulations (PWM) – positional feedback/shaft encoding • explain nameplate ratings: <ul style="list-style-type: none"> – voltage – current – horsepower – efficiency – cycle – RPM – phase – frame size – enclosure. 	<p>Power small DC hobby motor with PWM circuit using 555 timer circuit Reference Industrial Electronic by Petruzella.</p>

COURSE ELT3140: MOTORS (continued)

Concept	Specific Outcomes	Notes
<p>Designing and Prototyping</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • design and construct the following motor circuits to find torque versus load and speed regulation versus load on: <ul style="list-style-type: none"> – inductive motors: <ul style="list-style-type: none"> • split phase • capacitor start • permanent split capacitor • shaded pole • three-phase – brush motors: <ul style="list-style-type: none"> • universal • flat compound DC motor – others: <ul style="list-style-type: none"> • single-phase synchronous • stepper • servo • permanent magnet. 	<p>Starting current.</p> <p>Rotation.</p> <p>Drives in electronic components.</p> <p>Small hobby motor projects, e.g., solar cars and robots.</p>
<p>Careers</p>	<ul style="list-style-type: none"> • research careers that require knowledge of electric motors. 	<p>Oil/gas industry.</p> <p>Computer processor control.</p> <p>Manufacturers—assembly line.</p> <p>Printing presses.</p> <p>Elevators.</p>