Apprenticeship and Industry Training

Electric Motor Systems Technician

Apprenticeship Course Outline

030 (2017)

Alberta

Apprenticeship and Industry Training

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Electric Motor Systems Technician: apprenticeship course outline

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Electric Motor Systems Technician
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Course Outline

Apprenticeship

Apprenticeship is post-secondary education with a difference. Apprenticeship begins with finding an employer. Employers hire apprentices, pay their wages and provide on-the-job training and work experience. Approximately 80 per cent of an apprentice's time is spent on the job under the supervision of a certified journeyperson or qualified tradesperson. The other 20 per cent involves technical training provided at, or through, a post-secondary institution – usually a college or technical institute.

To become certified journeypersons, apprentices must learn theory and skills, and they must pass examinations. Requirements for certification—including the content and delivery of technical training—are developed and updated by the Alberta Apprenticeship and Industry Training Board on the recommendation of Electric Motor Systems Technician Provincial Apprenticeship Committee.

The graduate of the Electric Motor Systems Technician apprenticeship program is a certified journeyperson who will be able to:

- diagnose problems and dismantle electric motors, transformers, switchgear, electric welders, generators and other electrical and mechanical equipment for servicing, modification or repair
- remove and replace shafts, bearings, commutators and other components, referring to blueprints or service manuals as required
- wind and assemble various types of coils for electric motors or transformers and reinstall them, and
- balance armatures or rotors, weld and braze or solder electrical connections, and align and adjust parts to close tolerances to reassemble items.

Apprenticeship and Industry Training System

Industry-Driven

Alberta's apprenticeship and industry training system is an industry-driven system that ensures a highly skilled, internationally competitive workforce in more than 50 designated trades and occupations. This workforce supports the economic progress of Alberta and its competitive role in the global market. Industry (employers and employees) establishes training and certification standards and provides direction to the system through an industry committee network and the Alberta Apprenticeship and Industry Training Board. The Alberta government provides the legislative framework and administrative support for the apprenticeship and industry training system.

Alberta Apprenticeship and Industry Training Board

The Alberta Apprenticeship and Industry Training Board provides a leadership role in developing Alberta's highly skilled and trained workforce. The board's primary responsibility is to establish the standards and requirements for training and certification in programs under the Apprenticeship and Industry Training Act. The board also provides advice to the Minister of Advanced Education on the needs of Alberta's labour market for skilled and trained workers, and the designation of trades and occupations.

The thirteen-member board consists of a chair, eight members representing trades and four members representing other industries. There are equal numbers of employer and employee representatives.

Industry Committee Network

Alberta's apprenticeship and industry training system relies on a network of industry committees, including local and provincial apprenticeship committees in the designated trades, and occupational committees in the designated occupations. The network also includes other committees such as provisional committees that are established before the designation of a new trade or occupation comes into effect. All trade committees are composed of equal numbers of employer and employee representatives. The industry committee network is the foundation of Alberta's apprenticeship and industry training system.

Local Apprenticeship Committees (LAC)

Wherever there is activity in a trade, the board can set up a local apprenticeship committee. The board appoints equal numbers of employee and employer representatives for terms of up to three years. The committee appoints a member as presiding officer. Local apprenticeship committees:

- monitor apprenticeship programs and the progress of apprentices in their trade, at the local level
- make recommendations to their trade's provincial apprenticeship committee (PAC) about apprenticeship and certification in their trade
- promote apprenticeship programs and training and the pursuit of careers in their trade
- make recommendations to the board about the appointment of members to their trade's PAC
- help settle certain kinds of disagreements between apprentices and their employers
- carry out functions assigned by their trade's PAC or the board

Provincial Apprenticeship Committees (PAC)

The board establishes a provincial apprenticeship committee for each trade. It appoints an equal number of employer and employee representatives, and, on the PAC's recommendation, a presiding officer - each for a maximum of two terms of up to three years. Most PACs have nine members but can have as many as twenty-one. Provincial apprenticeship committees:

- Make recommendations to the board about:
    - standards and requirements for training and certification in their trade
    - courses and examinations in their trade
    - apprenticeship and certification
    - designation of trades and occupations
    - regulations and orders under the Apprenticeship and Industry Training Act
- monitor the activities of local apprenticeship committees in their trade
- determine whether training of various kinds is equivalent to training provided in an apprenticeship program in their trade
- promote apprenticeship programs and training and the pursuit of careers in their trade
- consult with other committees under the Apprenticeship and Industry Training Act about apprenticeship programs, training and certification and facilitate cooperation between different trades and occupations
- consult with organizations, associations and people who have an interest in their trade and with employers and employees in their trade
- may participate in resolving certain disagreements between employers and employees
- carry out functions assigned by the board

Electric Motor Systems Technician PAC Members at the Time of Publication

Mr. K. Christiansen	Beaumont	Presiding Officer
Mr. M. Bushnell	Edmonton	Employer
Mr. C. Ho	Edmonton	Employer
Mr. E. Jahelka	Fort McMurray	Employer
Mr. B. Kessir	Stony Plain	Employer
Mr. R. Allan	Calgary	Employee
Mr. K. Christiansen	Edmonton	Employee
Mr. M. Cox	Calgary	Employee

Alberta Government

Alberta Advanced Education works with industry, employer and employee organizations and technical training providers to:

- facilitate industry's development and maintenance of training and certification standards
- provide registration and counselling services to apprentices and employers
- coordinate technical training in collaboration with training providers
- certify apprentices and others who meet industry standards

Apprenticeship Safety

Safe working procedures and conditions, incident/injury prevention, and the preservation of health are of primary importance in apprenticeship programs in Alberta. These responsibilities are shared and require the joint efforts of government, employers, employees, apprentices and the public. Therefore, it is imperative that all parties are aware of circumstances that may lead to injury or harm.

Safe learning experiences and healthy environments can be created by controlling the variables and behaviours that may contribute to or cause an incident or injury. By practicing a safe and healthy attitude, everyone can enjoy the benefit of an incident and injury free environment.

Alberta Apprenticeship and Industry Training Board Safety Policy

The Alberta Apprenticeship and Industry Training Board fully supports safe learning and working environments and encourages the teaching of proper safety procedures both within trade specific training and in the workplace.

Trade specific safety training is an integral component of technical training, while ongoing or general non-trade specific safety training remains the responsibility of the employer and the employee as required under workplace health and safety legislation.

Workplace Responsibilities

The employer is responsible for:

- training employees and apprentices in the safe use and operation of equipment
- providing and maintaining safety equipment, protective devices and clothing
- enforcing safe working procedures
- providing safeguards for machinery, equipment and tools
- observing all accident prevention regulations

The employee and apprentice are responsible for:

- working in accordance with the safety regulations pertaining to the job environment
- working in such a way as not to endanger themselves, fellow employees or apprentices

Occupational Health and Safety

A tradesperson is often exposed to more hazards than any other person in the work force and therefore should be familiar with and apply the Occupational Health and Safety Act, Regulations and Code when dealing with personal safety and the special safety rules that apply to all daily tasks.

Occupational Health and Safety (a division of Alberta Human Services) conducts periodic inspections of workplaces to ensure that safety regulations for industry are being observed.

Additional information is available at www.humanservices.alberta.ca

Technical Training

Apprenticeship technical training is delivered by the technical institutes and colleges in the public post-secondary system throughout Alberta. The colleges and institutes are committed to delivering the technical training component of Alberta apprenticeship programs in a safe, efficient and effective manner. All training providers place a strong emphasis on safety that complements safe workplace practices towards the development of a culture of safety for all trades.

The technical institutes and colleges work with Alberta's Apprenticeship and Industry Training Board, industry committees and Alberta Advanced Education to enhance access and responsiveness to industry needs through the delivery of the technical training component of apprenticeship programs across the Province. They develop curriculum from the course outlines established by industry and provide technical training to apprentices.

The following institutions deliver Electric Motor Systems Technician apprenticeship technical training:

Southern Alberta Institute of Technology (Main Campus)

Procedures for Recommending Revisions to the Course Outline

Advanced Education has prepared this course outline in partnership with the Electric Motor Systems Technician Provincial Apprenticeship Committee.

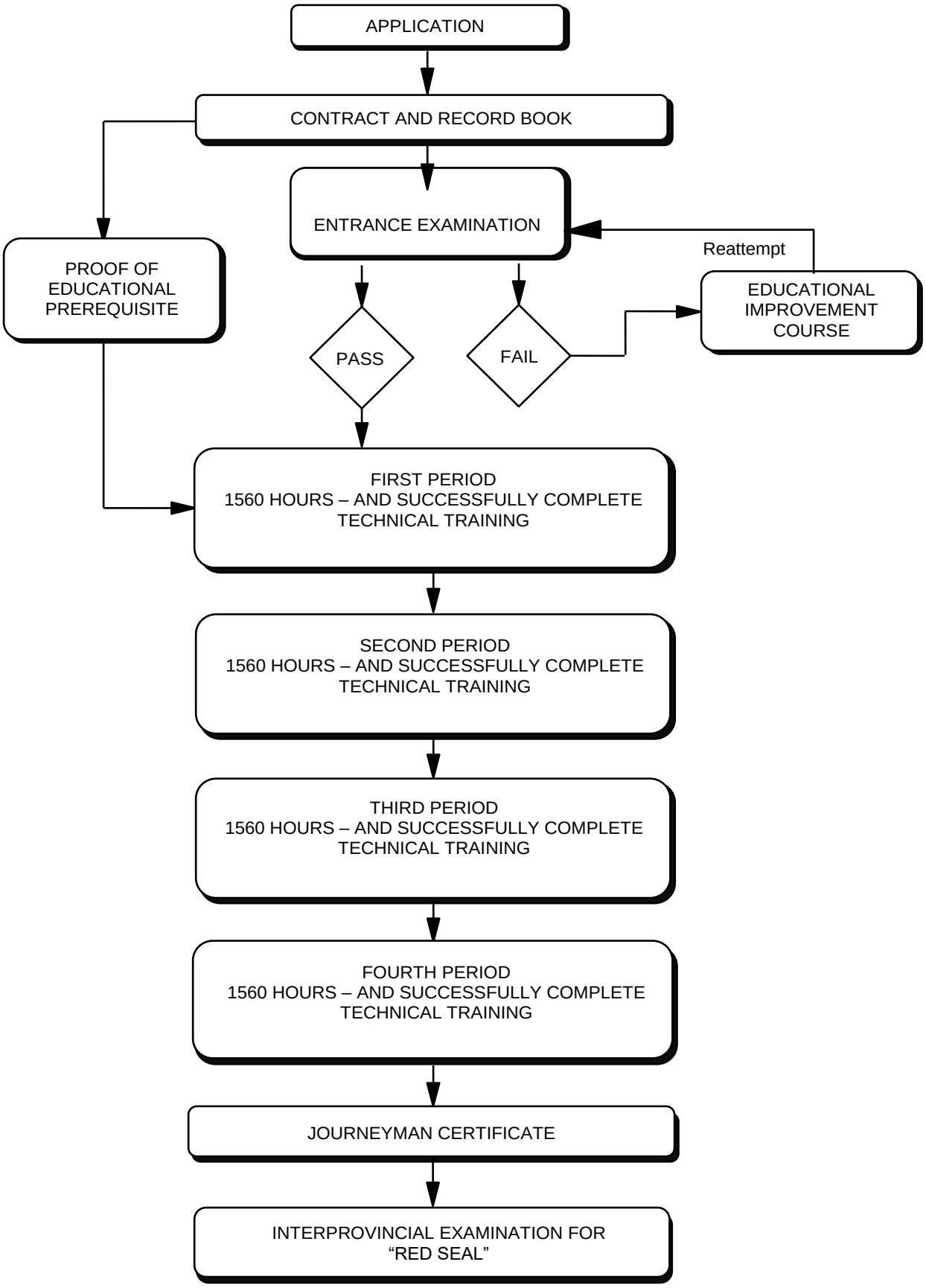
This course outline was approved on September 23, 2016 by the Alberta Apprenticeship and Industry Training Board on a recommendation from the Provincial Apprenticeship Committee. The valuable input provided by representatives of industry and the institutions that provide the technical training is acknowledged.

Any concerned individual or group in the province of Alberta may make recommendations for change by writing to:

Electric Motor Systems Technician Provincial Apprenticeship Committee
c/o Industry Programs and Standards
Apprenticeship and Industry Training
Advanced Education
10th floor, Commerce Place
10155 102 Street NW
Edmonton AB T5J 4L5

It is requested that recommendations for change refer to specific areas and state references used. Recommendations for change will be placed on the agenda for regular meetings of the Electric Motor Systems Technician Provincial Apprenticeship Committee.

Apprenticeship Route toward Certification



Electric Motor Systems Technician Training Profile

FIRST PERIOD
(8 Weeks 30 Hours per Week – Total of 240 Hours)

SECTION ONE

WORKPLACE SAFETY AND TRADE MATH

24 HOURS

A	B	C
Safety Legislation, Regulations & Industry Policy in the Trades 2 Hours	Climbing, Lifting, Rigging and Hoisting 2 Hours	Hazardous Materials & Fire Protection 2 Hours

D	E	F
Apprenticeship Training Program 2 Hours	Electrical Safety 4 Hours	Trade Math 12 Hours

SECTION TWO

ELECTRICAL THEORY

120 HOURS

A	B	C
Principles of Electricity 15 Hours	Series Circuit 10 Hours	Parallel Circuit 10 Hours

D	E	F
Series-Parallel Circuit 15 Hours	Edison Three-Wire Circuit 10 Hours	Conductors 10 Hours

G	H	I
Work, Energy and Power 15 Hours	Electrical Efficiency 10 Hours	Magnetism & Electromagnetism 20 Hours

J
Meters 5 Hours

SECTION THREE

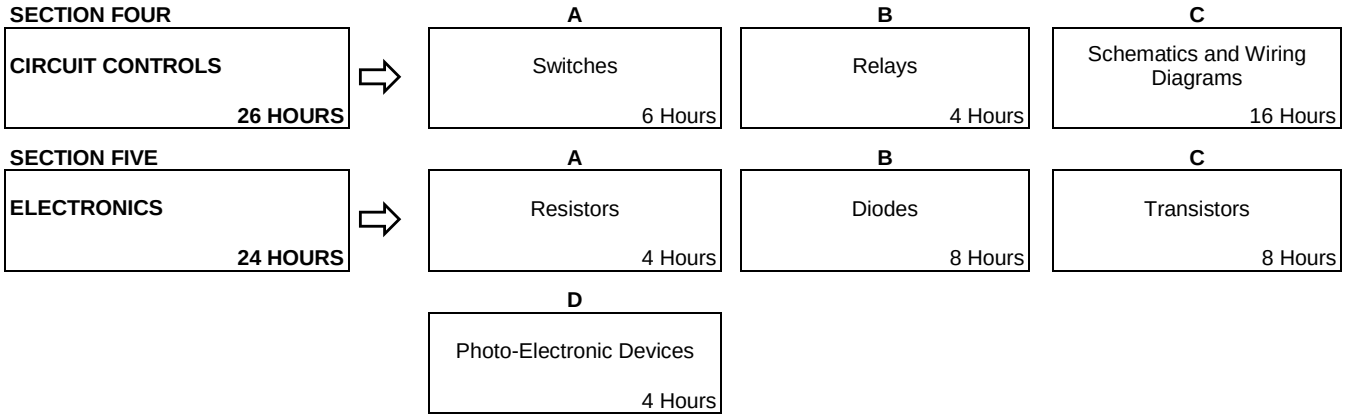
ELECTRICAL MACHINES

46 HOURS

A	B	C
Diagnostic Tools 4 Hours	Oxy-Fuel Welding and Cutting 16 Hours	Electrical Machine Removal 2 Hours

D	E	F
Electrical Machine Disassembly 6 Hours	Electrical Machine Repair 8 Hours	Electrical Machine Assembly 6 Hours

G
Electrical Machine Installation 4 Hours



SECOND PERIOD
(8 Weeks 30 Hours per Week – Total of 240 Hours)

SECTION ONE

ALTERNATING CURRENT

95 HOURS

A	**B**	**C**
Principles of Alternating Current (ac) 30 Hours	Inductance and Inductive Reactance 15 Hours	Capacitance and Capacitive Reactance 10 Hours
D	**E**	
RLC Circuits 20 Hours	Power Relationships 20 Hours	

SECTION TWO

SINGLE-PHASE MOTORS

55 HOURS

A	**B**
Single-Phase Motor Operation 30 Hours	Single-Phase Motor Winding 25 Hours

SECTION THREE

CONTROL CIRCUITS

32 HOURS

A	**B**	**C**
Relays and Magnetic Starters 9 Hours	Control Circuit Devices 4 Hours	Circuits and Connections 14 Hours
D		
Overload Protection 5 Hours		

SECTION FOUR

SINGLE-PHASE ELECTRONICS

24 HOURS

A	**B**
Single-Phase Rectifier Circuits 12 Hours	Thyristors 12 Hours

SECTION FIVE

TRANSFORMERS

34 HOURS

A	**B**	**C**
Transformer Characteristics 4 Hours	Transformer Operation 12 Hours	Transformer Maintenance 2 Hours
D		
Single-Phase Transformers 16 Hours		

THIRD PERIOD
(8 Weeks 30 Hours per Week – Total of 240 Hours)

SECTION ONE

THREE-PHASE ELECTRICAL PRINCIPLES

92 HOURS

A	B	C
Principles of Three-Phase Electricity 24 Hours	Three-Phase Transformers 8 Hours	Three-Phase Induction Motors 32 Hours

D	E
Dual Voltage Multispeed Motor Connections 12 Hours	Three-Phase Rotors 16 Hours

SECTION TWO

THREE-PHASE MOTOR WINDING

100 HOURS

A	B	C
Motor Winding Characteristics 20 Hours	Coils and Grouping 12 Hours	Motor Winding Connections 14 Hours

D	E	F
Motor Winding Redesign 8 Hours	Motor Winding 36 Hours	Phase Converters 4 Hours

G
Squirrel Cage Rotors 6 Hours

SECTION THREE

PROGRAMMABLE LOGIC CONTROLLERS (PLC)

24 HOURS

A	B
PLC Operation 12 Hours	PLC Programming 12 Hours

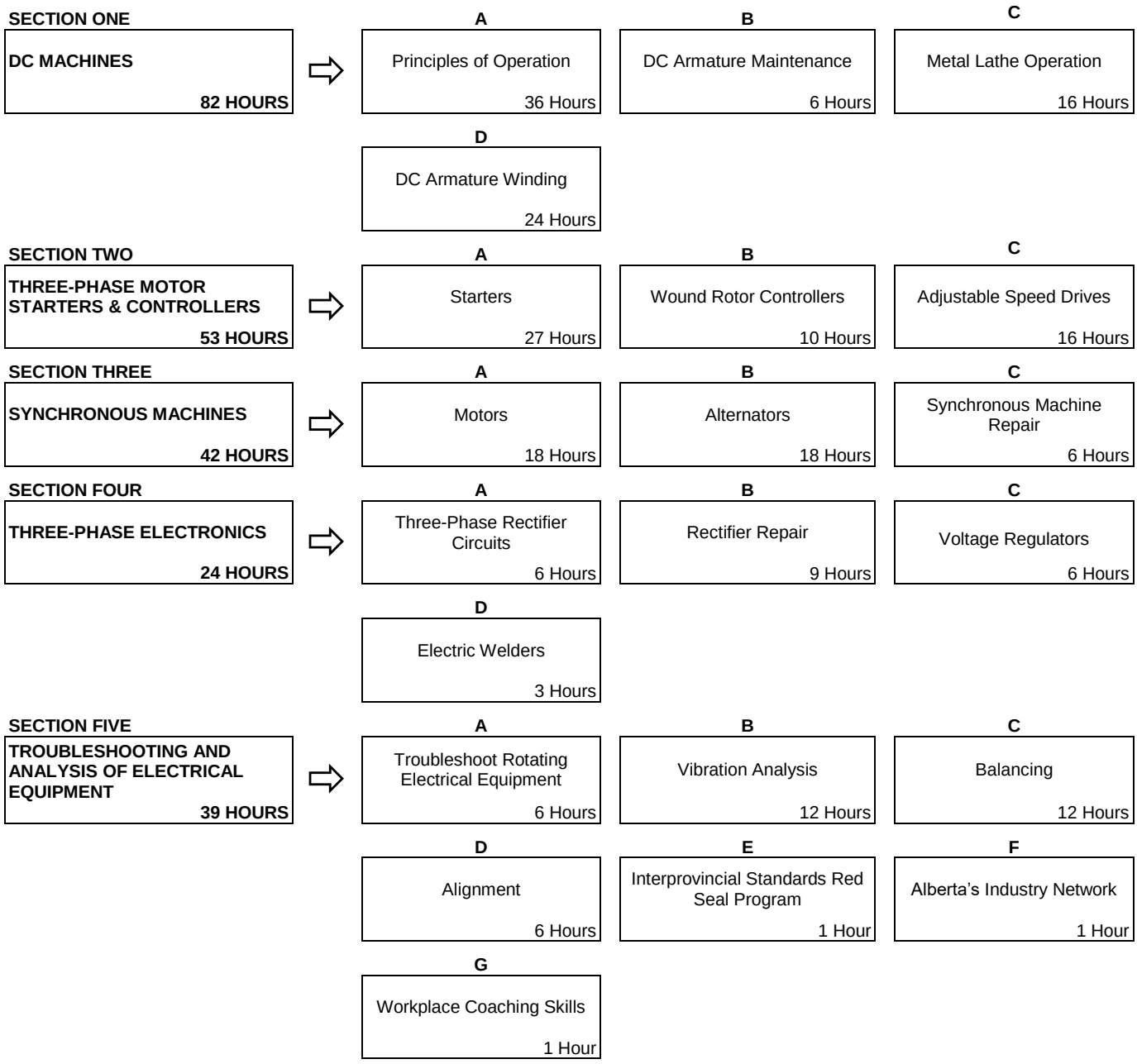
SECTION FOUR

ELECTRICAL CODE APPLICATIONS

24 HOURS

A	B
Canadian Electrical Code (CEC) Part 1 12 Hours	Hazardous Location Motors 12 Hours

FOURTH PERIOD
(8 Weeks 30 Hours per Week – Total of 240 Hours)



NOTE: The hours stated are for guidance and should be adhered to as closely as possible. However, adjustments must be made for rate of apprentice learning, statutory holidays, registration and examinations for the training establishment and Apprenticeship and Industry Training.

FIRST PERIOD TECHNICAL TRAINING
ELECTRIC MOTOR SYSTEMS TECHNICIAN TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE: .....WORKPLACE SAFETY AND TRADE MATH.....24 HOURS

A. Safety Legislation, Regulations & Industry Policy in the Trades..... 2 Hours

Outcome: ***Apply legislation, regulations and practices ensuring safe work in this trade.***

1. Demonstrate the application of the Occupational Health and Safety Act, Regulation and Code.
2. Describe the employer's and employee's role with Occupational Health and Safety (OH&S) regulations, Worksite Hazardous Materials Information Systems (WHMIS), fire regulations, Workers Compensation Board regulations and related advisory bodies and agencies.
3. Describe industry practices for hazard assessment and control procedures.
4. Describe the responsibilities of worker and employers to apply emergency procedures.
5. Describe tradesperson attitudes with respect to housekeeping, personal protective equipment and emergency procedures.
6. Describe the roles and responsibilities of employers and employees with the selection and use of personal protective equipment (PPE).
7. Maintain required PPE for tasks.
8. Use required PPE for tasks.

B. Climbing, Lifting, Rigging and Hoisting ..... 2 Hours

Outcome: ***Use industry standard practices for climbing, lifting, rigging and hoisting in this trade.***

1. Describe manual lifting procedures.
2. Describe rigging hardware and associated safety factors.
3. Select equipment for rigging loads.
4. Describe hoisting and load moving procedures.
5. Maintain personal protective equipment (PPE) for climbing, lifting and load moving equipment.
6. Use PPE for climbing, lifting and load moving equipment.

C. Hazardous Materials & Fire Protection ..... 2 Hours

Outcome: ***Apply industry standard practices for hazardous materials and fire protection in this trade.***

1. Describe roles, responsibilities, features and practices related to the Workplace Hazardous Materials Information System (WHMIS) program.
2. Describe three key elements of WHMIS.
3. Describe handling, storing and transporting procedures for hazardous material.
4. Describe venting procedures when working with hazardous materials.
5. Describe hazards, classes, procedures and equipment related to fire protection.

D. Apprenticeship Training Program ..... 2 Hours

Outcome: ***Manage an apprenticeship to earn journeyman certification.***

1. Describe the contractual responsibilities of the apprentice, employer and Alberta Apprenticeship and Industry Training.
2. Describe the purpose of the apprentice record book.
3. Describe the procedure for changing employers during an active apprenticeship.
4. Describe the purpose of the course outline.
5. Describe the procedure for progressing through an apprenticeship.
6. Describe advancement opportunities in this trade.

E. Electrical Safety ..... 4 Hours

Outcome: ***Apply safe work practices for electrical motor systems technicians.***

1. Identify the safe work practices to protect from arc flash hazards.
2. Identify and describe lockout procedures.
3. Identify the safe work practices to prevent electrical shock.
4. Apply safe work practices for electrical motor systems technicians.

F. Trade Math ..... 12 Hours

Outcome: ***Solve trade-related problems using mathematical skills.***

1. Transpose algebraic equations.
2. Explain the usage of reciprocals in electrical problems.
3. Solve right angle triangles using trigonometric functions given unknowns.
4. Solve phasor (vector) problems involving magnitude and directions.

SECTION TWO: .....ELECTRICAL THEORY .....120 HOURS

A. Principles of Electricity ..... 15 Hours

Outcome: ***Determine voltage, current and resistance in an electrical circuit.***

1. Explain the fundamental relationship between the structure of the atom and flow of electrons.
2. Describe electron theory.
3. Describe the methods used to generate ac and dc.
4. Describe the relationship between cycles, poles and frequency.
5. Describe units of measurement for electrical terms.
6. Describe the relationship of voltage, current and resistance in an electric circuit.
7. Apply Ohm’s law to circuit voltage, current and resistance.

B. Series Circuit ..... 10 Hours

Outcome: ***Analyze series circuits.***

1. Describe a series circuit.
2. Describe the applications of a series circuit.
3. Apply Ohm’s Law in a series circuit.

4. Apply Kirchhoff's Voltage and Current Laws in a series circuit.
5. Connect a series circuit.
6. Analyze a series circuit.

C. Parallel Circuit ..... 10 Hours

Outcome: Analyze parallel circuits.

1. Describe a parallel circuit.
2. Describe the applications of a parallel circuit.
3. Apply Ohm's Law in a parallel circuit.
4. Apply Kirchhoff's Voltage and Current Laws in a parallel circuit.
5. Connect a parallel circuit.
6. Analyze a parallel circuit.

D. Series-Parallel Circuit ..... 15 Hours

Outcome: Analyze series-parallel circuits.

1. Describe a series-parallel circuit.
2. Describe the applications of a series-parallel circuit.
3. Apply Ohm's Law in a series-parallel circuit.
4. Apply Kirchhoff's Voltage and Current Laws in a series-parallel circuit.
5. Connect a series-parallel circuit.
6. Analyze a series-parallel circuit.

E. Edison Three-Wire Circuit ..... 10 Hours

Outcome: Analyze Edison three-wire circuits.

1. Describe an Edison three-wire circuit.
2. Describe the applications of an Edison three-wire circuit.
3. Apply Ohm's Law in an Edison three-wire circuit.
4. Apply Kirchhoff's Voltage and Current Laws in an Edison three-wire circuit.
5. Describe balanced, unbalanced and open neutral in an Edison three-wire circuit.
6. Connect an Edison three-wire circuit.
7. Analyze an Edison three-wire circuit.

F. Conductors ..... 10 Hours

Outcome: Describe the characteristics of conductors, semiconductors and insulators.

1. Describe various attributes of wire size.
2. Describe the factors affecting resistance of conductors.
3. Describe the characteristics of conductors, semiconductors and insulators

G. Work, Energy and Power ..... 15 Hours

Outcome: ***Apply the principles of work, energy, and power to electrical systems.***

1. Describe the relationship between work, energy and power.
2. Perform electrical power calculations.
3. Perform mechanical power and work calculations.
4. Convert horsepower to watts.
5. Describe torque.
6. Perform torque calculations.

H. Electrical Efficiency ..... 10 Hours

Outcome: ***Analyze electrical efficiency of a circuit.***

1. Describe electrical efficiency.
2. Describe line drop, line loss and efficiency in electrical circuits.
3. Calculate line drop, line loss and efficiency in electrical circuits.
4. Analyze electrical efficiency.

I. Magnetism & Electromagnetism ..... 20 Hours

Outcome: ***Apply the laws of magnetism and electromagnetic induction to electrical systems.***

1. Describe the characteristics of magnetic lines of force.
2. Describe the laws of magnetic attraction and repulsion.
3. Describe the field around a current carrying conductor.
4. Describe electromagnetic induction.
5. Explain the losses that occur in an electromagnet.
6. Describe self-induction in a coil.
7. Wind, shape, and tape a coil.
8. Analyze the properties of a coil.
9. Describe the relationship between current and magnetism to explain transformer action.
10. Apply Fleming's hand rules.
11. Apply Faraday's law of induction.
12. Apply Lenz's law of induction.

J. Meters ..... 5 Hours

Outcome: ***Interpret meter readings.***

1. Describe the applications of meters.
2. Describe the precautions when using meters.
3. Calculate correct shunts or multipliers.
4. Perform measurements using meters.
5. Interpret meter readings.

SECTION THREE: ..... ELECTRICAL MACHINES .....46 HOURS

A. Diagnostic Tools ..... 4 Hours

Outcome: Perform diagnostic tests on electrical machines.

1. Describe methods of mechanical fault tracing.
2. Describe methods of electrical fault tracing.
3. Describe the measuring tools for diagnostic applications.
4. Perform diagnostic tests using the appropriate equipment.

B. Oxy-fuel Welding and Cutting ..... 16 Hours

Outcome: Perform oxy-fuel welding, cutting, and heating.

1. Describe characteristics for oxy-fuel gases and equipment.
2. Describe handling procedures for oxy-fuel gases and equipment.
3. Select oxy-fuel cutting attachments.
4. Demonstrate procedures for equipment set-up, operation and shut- down.
5. Identify causes and preventive measures for backfires, flashbacks and burn-backs.
6. Perform gas welding, cutting, and heating.

C. Electrical Machine Removal……2 Hours

Outcome: Remove electrical machines.

1. Perform visual inspections.
2. Record mounting details.
3. Record electrical details.
4. Describe securement considerations of related equipment during the repair process.
5. Remove electrical machines.

D. Electrical Machine Disassembly ..... 6 Hours

Outcome: Determine scope of work for the repair of an electrical machine.

1. Inspect end-play, run-out, and thermal expansion.
2. Check air-gap.
3. Demonstrate methods of bearing removal.
4. Inspect all machined fits.
5. Inspect for soft-foot.
6. Determine scope of work.

E. Electrical Machine Repair..... 8 Hours

Outcome: Describe corrections for mechanical faults of an electrical machine.

1. Describe corrections for out-of-tolerance end-play, run-out, and thermal expansion.
2. Describe corrections for out-of-tolerance air-gap.
3. Describe corrections for out-of-tolerance machined fits.
4. Describe corrections for soft-foot.

5. Describe corrections for harmonics produced by natural frequencies.
6. Describe types and applications of friction and anti-friction bearings.
7. Describe procedures to convert between bearing types.
8. Describe corrections for out-of-tolerance sleeve bearings.

F. Electrical Machine Assembly ..... 6 Hours

Outcome: Assemble an electrical machine.

1. Describe the installation procedures for bearings.
2. Describe lubrication requirements for bearings.
3. Describe types of gaskets and seals.
4. Describe the installation procedures for gaskets and seals
5. Assemble electrical machines.
6. Bench test electrical machines.

G. Electrical Machine Installation ..... 4 Hours

Outcome: Install electrical machines.

1. Describe mounting methods for electrical machines.
2. Calculate pulley or gear requirements.
3. Describe electrical machine alignment requirements with other equipment.
4. Install electrical machines.

SECTION FOUR: ..... CIRCUIT CONTROLS ..... 26 HOURS

A. Switches ..... 6 Hours

Outcome: Connect switches in electrical circuits.

1. Describe operating principles of switches.
2. Describe types of switches.
3. Describe components of switches.
4. Connect switches in electrical circuits.

B. Relays ..... 4 Hours

Outcome: Analyze control circuits that use relays.

1. Describe the operating principle of a relay.
2. Describe components of a relay.
3. Connect control circuits using relays.
4. Analyze control circuits using relays.

C. Schematics and Wiring Diagrams ..... 16 Hours

Outcome: Fault trace circuits using schematic and wiring diagrams.

1. Describe specific terms that refer to control circuits.
2. Identify the symbols that are commonly used in control circuits.

3. Differentiate between schematics and wiring diagrams.
4. Convert wiring diagrams to schematic representations.
5. Draw schematic and wiring diagrams for various circuits.
6. Interpret schematics and wiring diagrams.
7. Fault trace circuits using schematic and wiring diagrams.

SECTION FIVE: ..... ELECTRONICS ..... 24 HOURS

A. Resistors ..... 4 Hours

Outcome: Analyze electrical characteristics of resistors in circuits.

1. Describe methods of defining voltage and current values.
2. Describe electrical properties and ratings of resistors.
3. Analyze electrical characteristics of resistors in circuits.

B. Diodes ..... 8 Hours

Outcome: Analyze diode operation.

1. Describe operating characteristics of diodes.
2. Identify applications of diodes in simple circuits.
3. Analyze diode operation.

C. Transistors ..... 8 Hours

Outcome: Connect transistors in circuits.

1. Describe operating principles of transistors.
2. Describe applications of transistors.
3. Test transistors.
4. Connect transistors in circuits.

D. Photo-Electronic Devices ..... 4 Hours

Outcome: Connect photo-electronic devices in circuits.

1. Describe operating principles of photo-electronic devices.
2. Describe applications of photo-electronic devices.
3. Test photo-electronic devices.
4. Connect photo-electronic devices in circuits.

SECOND PERIOD TECHNICAL TRAINING
ELECTRIC MOTOR SYSTEMS TECHNICIAN TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE:..... ALTERNATING CURRENT ..... 95 HOURS

A. Principles of Alternating Current (ac).....30 Hours

Outcome: Describe ac as it applies to sine waves and phasors.

1. Describe methods used to generate ac.
2. Describe characteristics of an ac sine wave.
3. Draw phasors to represent electrical characteristics of voltage and current of an ac system.
4. Describe alternating current as it applies to sine waves and phasors.

B. Inductance and Inductive Reactance.....15 Hours

Outcome: Calculate inductance in circuits.

1. Describe construction and characteristics of inductors.
2. Describe inductance.
3. Describe effects of inductive reactance.
4. Describe the relationship between resistance and inductive reactance.
5. Describe effects of resistance with inductive reactance.
6. Demonstrate principles of inductance in a coil.
7. Calculate inductance in circuits.

C. Capacitance and Capacitive Reactance .....10 Hours

Outcome: Calculate capacitive reactance in circuits.

1. Describe construction and characteristics of capacitors.
2. Describe capacitance.
3. Describe effects of capacitive reactance.
4. Describe the relationship between resistance and capacitive reactance.
5. Describe effects of resistance with capacitive reactance.
6. Calculate capacitance in various circuits.
7. Calculate capacitive reactance in various circuits.

D. RLC Circuits .....20 Hours

Outcome: Calculate impedance in RLC circuits.

1. Solve problems involving resonance.
2. Describe impedance.
3. Describe the components of an impedance triangle.

4. Describe the relationship between resistance, inductive reactance and capacitive reactance in circuits.
5. Calculate resistance, inductive reactance and capacitive reactance in RLC circuits.
6. Calculate impedance in RLC circuits.

E. Power Relationships ..... 20 Hours

Outcome: Perform power calculations.

1. Describe power.
2. Describe apparent power.
3. Describe reactive power.
4. Describe power factor.
5. Describe phase angle.
6. Perform power calculations.

SECTION TWO: ..... SINGLE-PHASE MOTORS ..... 55 HOURS

A. Single-Phase Motor Operation ..... 30 Hours

Outcome: Perform fault tracing on single-phase motors and devices.

1. Describe characteristics and types of single-phase motors.
2. Draw connection diagrams for all types of single-phase motors.
3. Perform lead identification for all types of single-phase motors.
4. Describe types and applications of protective devices.
5. Demonstrate the installation and adjustment of centrifugal mechanisms and starting switches.
6. Demonstrate the installation of solid state, current and potential relays as starting switches for replacement of centrifugally operated switches.
7. Describe nameplate information.
8. Determine the speed of magnetic field as compared to the rotor speed.
9. Perform fault tracing on single-phase motors and devices.

B. Single-Phase Motor Winding ..... 25 Hours

Outcome: Wind a single-phase motor.

1. Demonstrate stripping.
2. Record winding data.
3. Draw radial and schematic diagrams.
4. Clean and insulate all slots.
5. Wind and replace all coils.
6. Connect and secure all coils.
7. Explain methods of dipping and baking winding.
8. Describe the temperature ratings and classes of insulation.
9. Perform final electrical testing following wind.

SECTION THREE: ……..CONTROL CIRCUITS.....32 Hours

A. Relays and Magnetic Starters .....9 Hours

Outcome: Analyze magnetic motor starters.

1. Describe the construction of relays as compared to magnetic contactors or starters.
2. Describe the operation of relays compared to magnetic contactors or starters.
3. Describe the application of relays compared to magnetic contactors.
4. Describe the operation of the components of a magnetic motor starter.
5. Perform maintenance on magnetic motor starters.
6. Differentiate between low voltage release and low voltage protection.
7. Connect a magnetic motor starter.
8. Analyze a magnetic motor starter.

B. Control Circuit Devices .....4 Hours

Outcome: Apply control devices to circuits.

1. Describe types of control circuit devices.
2. Describe the difference between momentary and maintained contact switches.
3. Draw a wiring diagram of a push button start-stop station as it applies to low voltage protection.
4. Describe types of switches used in motor control.
5. Describe the application of indicator lights.
6. Describe the application of holding and auxiliary contacts.
7. Apply control devices to circuits.

C. Circuits and Connections .....14 Hours

Outcome: Apply control and power circuits for motor starting.

1. Interpret drawings, circuit diagrams and ladder logic.
2. Demonstrate the use of control and power circuits for start-stop stations.
3. Demonstrate the use of control and power circuits for start-jog-stop stations.
4. Demonstrate the use of control and power circuits for forward–reverse-stop stations.
5. Describe applications and operations of electrical interlocking.
6. Describe the application and operation of mechanical interlocking.
7. Draw schematic and wiring diagrams of across-the-line and forward-reversing starters.

D. Overload Protection .....5 Hours

Outcome: Describe the applications of overload protection devices.

1. Describe types of overload protection devices.
2. Describe the components and operation of thermal overload relays.
3. Describe the operation of magnetic overload relays.
4. Describe the operation of electronic overload devices.

5. Describe the operation of thermal devices.
6. Describe International Electrotechnical Commission (IEC) and Electrical and Electronic Manufacturers Association of Canada (EEMAC) ratings.

SECTION FOUR: ..... SINGLE-PHASE ELECTRONICS..... 24 HOURS

A. Single-Phase Rectifier Circuits .....12 Hours

Outcome: Analyze rectifier circuits.

1. Describe the principles of operation of single-phase rectifiers.
2. Describe the electrical properties and ratings of capacitors.
3. Describe the electrical properties and ratings of inductors.
4. Describe the effects of adding filters to a rectifier circuit.
5. Analyze rectifier circuits.

B. Thyristors .....12 Hours

Outcome: Analyze thyristors in a circuit.

1. Describe the operating principles of a silicon controlled rectifier (SCR).
2. Describe applications of an SCR.
3. Describe operating principles of an SCR firing circuit.
4. Describe applications of an SCR firing circuit.
5. Describe operating principles of a Triac.
6. Describe applications of a Triac.
7. Analyze thyristors in a circuit.

SECTION FIVE: ..... TRANSFORMERS ..... 34 HOURS

A. Transformer Characteristics.....4 Hours

Outcome: Describe the characteristics of transformers.

1. Describe components of a transformer.
2. Describe types of transformers.
3. Describe applications of transformers.
4. Describe how transformers are rated and sized.
5. Describe the nameplate information of a transformer.
6. Describe the standard terminal and winding identification.
7. Describe methods of cooling transformers.

B. Transformer Operation.....12 Hours

Outcome: Solve problems involving transformer voltage, turns and current ratios.

1. Describe transformer action.
2. Describe the operation of a transformer as load is added.
3. Determine the losses of a transformer.

4. Determine the efficiency of operation.
5. Differentiate between subtractive and additive polarity.
6. Describe the function of current and potential instrument transformers.
7. Calculate wattmeter readings using instrument transformers.
8. Solve problems involving transformer voltage, turns and current ratios.

C. Transformer Maintenance ..... 2 Hours

Outcome: Maintain transformers.

1. Identify liquids used for cooling transformers.
2. Describe handling and disposal procedures of transformer coolants.
3. Describe maintenance and oil testing procedures.

D. Single-Phase Transformers ..... 16 Hours

Outcome: Describe the operation of a single-phase transformer.

1. Determine polarity.
2. Demonstrate identification of leads.
3. Demonstrate transformer connections for single-phase applications.
4. Demonstrate connections for autotransformers.
5. Describe the operation of a single-phase transformer.

THIRD PERIOD TECHNICAL TRAINING
ELECTRIC MOTOR SYSTEMS TECHNICIAN TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE:..... THREE-PHASE ELECTRICAL PRINCIPLES ..... 92 HOURS

A. Principles of Three-Phase Electricity ..... 24 Hours

Outcome: Apply electrical principles of three-phase systems.

1. Describe the generation of three-phase voltages.
2. State advantages for three-phase systems over single-phase systems.
3. Name types of three-phase connections.
4. Describe the phase relationship for the three voltages in a three-phase system.
5. Describe balanced three-phase systems.
6. Describe connections and relationships of three phase wye systems.
7. Describe connections and relationships of three phase delta systems.
8. Compare voltages and currents of three-phase wye and delta connected loads.
9. Calculate voltage, current and power in three-phase balanced and unbalanced systems.
10. Calculate power factor correction of three phase systems.
11. Measure power using a three-phase wattmeter.
12. Calculate power using the three wattmeter method.

B. Three-Phase Transformers ..... 8 Hours

Outcome: Identify faults in three-phase transformer connections.

1. Demonstrate transformer connections for three-phase applications.
2. Describe three-phase transformer operation.
3. Identify faults in three-phase transformer connections.

C. Three-Phase Induction Motors ..... 32 Hours

Outcome: Calculate currents, voltages, power, power factor and efficiency of induction motors.

1. Describe types of three phase motors.
2. Describe the function of squirrel cage induction motor components.
3. Describe methods of cooling the squirrel cage induction motor.
4. Describe nameplate information.
5. Describe operating principles of induction motors.
6. Determine the speed of a rotating magnetic field.
7. Determine rotor frequency, slip, poles and RPM relationship.
8. Describe percent speed regulation.
9. Describe factors of motor efficiency.

10. Describe effects of loading on induction motors.
11. Determine effects of reduced line voltage on an induction motor.
12. Calculate currents, voltages, power, power factor and efficiency of induction motors.

D. Dual Voltage Multispeed Motor Connections ..... 12 Hours

Outcome: Connect dual voltage and multispeed motors.

1. Draw EEMAC numbered schematic diagrams for motors.
2. Identify unmarked external motor leads for motors.
3. Describe the development of consequent poles in the stator.
4. Describe operating principles of two-speed motors.
5. Identify types of two-speed motors based upon the nameplate data.
6. Draw connection diagrams for low and high speeds of two-speed motors.

E. Three-Phase Rotors ..... 16 Hours

Outcome: Calculate torque, horsepower and speed for induction motors.

1. Describe squirrel cage and wound rotor types and designs.
2. Describe full load, starting, breakdown, and pull-up torque.
3. Describe effects of changing rotor resistance on starting torque and starting current.
4. Describe effects of changing rotor resistance on full load speed.
5. Describe torque changes throughout the load and speed range of a rotor.
6. Describe the speed control of a wound rotor motor.
7. Calculate torque, horsepower, and speed for induction motors.

SECTION TWO: ..... THREE-PHASE MOTOR WINDING ..... 100 HOURS

A. Motor Winding Characteristics ..... 20 Hours

Outcome: Record winding data.

1. Describe insulation characteristics.
2. Describe temperature classifications of insulation materials.
3. Describe classifications of magnet wire.
4. Describe classifications of lead wire.
5. Identify motor winding failures.
6. Describe core loss testing.
7. Describe stripping procedures.
8. Record winding data.

B. Coils and Grouping ..... 12 Hours

Outcome: Apply knowledge of coils and grouping when winding motors.

1. Describe winding using the lap method.
2. Describe winding using the concentric method.
3. Describe coil pitch.

4. Describe coil span.
5. Describe the effect of chord factor and distribution factor.
6. Determine pole-phase groups for odd or even grouping.
7. Describe turns per coil and slot fill.
8. Demonstrate turns per coil and slot fill.
9. Describe the construction of form-wound coils and groups.
10. Describe the construction of mush-wound coils and groups.

C. Motor Winding Connections ..... 14 Hours

Outcome: ***Apply knowledge of motor winding connections when winding motors.***

1. Draw radial, block and line connection diagrams.
2. Describe connection schematic diagrams.
3. Describe short and long jumper connection methods.
4. Explain the reversed "B" phase method of connecting.
5. Describe two, four, six and eight pole connection methods.
6. Describe series and parallel wye (dual voltage) connection methods.
7. Describe series and parallel delta (dual voltage) connection methods.
8. Describe connecting methods used to achieve multi-speed operation using single-winding consequent poles.
9. Describe connecting methods used to achieve multi-speed operation using two-windings.

D. Motor Winding Redesign ..... 8 Hours

Outcome: ***Calculate reconnection or winding changes required to change voltage, frequency or speed.***

1. Convert lap windings to concentric windings.
2. Convert concentric windings to lap windings.
3. Determine if a motor is capable of being redesigned for a change in voltage, frequency or speed.
4. Calculate reconnection or winding changes required to change voltage, frequency or speed.

E. Motor Winding ..... 36 Hours

Outcome: ***Wind a three-phase motor.***

1. Record winding data.
2. Demonstrate the required stripping procedures.
3. Identify the class of insulation required.
4. Describe methods for repairing or re-stacking laminated core.
5. Manufacture a full set of mush wound coils for a three-phase motor.
6. Install a full set of coils and required insulation.
7. Determine motor lead size.
8. Connect stator windings and attach leads.
9. Secure windings.
10. Test rewound motor.

F. Phase Converters ..... 4 Hours

Outcome: Describe the types of phase converters.

1. Describe the principle of operation and connection of phase converters.
2. Demonstrate the connection of a 12 lead motor for phase converter operation.
3. Describe the various types of phase converters.

G. Squirrel Cage Rotors ..... 6 Hours

Outcome: Diagnose squirrel cage rotor faults.

1. Determine rotor condition by full load and no load testing.
2. Describe methods of repairing rotor bars.
3. Diagnose rotor faults.

SECTION THREE: .....PROGRAMMABLE LOGIC CONTROLLERS (PLC)..... 24 HOURS

A. PLC Operation..... 12 Hours

Outcome: Troubleshoot a PLC circuit.

1. Describe the function of a PLC and components.
2. Describe programming methods used in PLC's.
3. Describe methods of addressing discrete I/O field devices.
4. Describe methods of disabling and forcing.
5. Describe functions of a holding register.
6. Describe functions of a retentive timer.
7. Describe the function of a Time Delay on Energization (T.D.E) (on delay) timer.
8. Describe the function of a Time Delay De-energization (T.D.D) (off delay) timer.
9. Troubleshoot a PLC circuit.

B. PLC Programming ..... 12 Hours

Outcome: Program PLC circuits.

1. Program a dual stop-start station.
2. Program a jogging circuit.
3. Program forward-reverse operation.
4. Program a hand-off-auto switch.
5. Program a PLC timer.
6. Program a PLC counter.

SECTION FOUR: ..... ELECTRICAL CODE APPLICATIONS ..... 24 HOURS

A. Canadian Electrical Code (CEC) Part 1……..……..12 Hours

Outcome: Interpret the CEC Part 1.

1. Explain the purpose of the CEC Part 1.
2. Identify those responsible for electrical installations.

3. Interpret the standards provided in the CEC from section 0.
4. Interpret the standards provided in the CEC from section 10.
5. Interpret the standards provided in the CEC from section 12.
6. Interpret the standards provided in the CEC from section 18.
7. Interpret the standards provided in the CEC from section 28.

B. Hazardous Location Motors .....12 Hours

Outcome: Repair explosion proof motors.

1. Identify an explosion proof motor.
2. Describe applications of hazardous location motors.
3. Describe the documentation necessary for recertification of a hazardous location motor.
4. Describe handling of hazardous location motors.
5. Demonstrate dismantling of hazardous location motors.
6. Perform flame path measurements according to CSA standards.
7. Interpret applicable sections of the CSA standards.
8. Describe stripping and winding requirements of hazardous location motors.
9. Describe the procedures to repair hazardous location motors.

FOURTH PERIOD TECHNICAL TRAINING
ELECTRIC MOTOR SYSTEMS TECHNICIAN TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE:.....DC MACHINES..... 82 HOURS

A. Principles of Operation .....36 Hours

Outcome: Troubleshoot dc machines and equipment.

1. Describe the parts of the magnetic circuit of a dc machine.
2. Describe the information found on a dc motor and generator's nameplate.
3. Describe the electrical circuit of a dc machine.
4. Describe methods of field excitation.
5. Describe voltage and speed regulation of dc machines.
6. Calculate the efficiency of a dc machine.
7. Describe how torque is produced in a dc motor.
8. Demonstrate methods of starting and speed control for dc motors.
9. Describe dynamic braking of a dc motor.
10. Demonstrate connections of various dc machines and equipment.
11. Troubleshoot dc machines and equipment.

B. DC Armature Maintenance.....6 Hours

Outcome: Maintain an armature.

1. Identify equipment fault by commutator appearance.
2. Describe testing and winding procedures of dc armatures.
3. Describe coil types and connections of dc armatures.
4. Describe armature banding methods and materials of dc armatures.
5. Describe methods of temporary repairs of dc armatures.
6. Describe brush selection.
7. Describe leading, trailing and radial brush mountings.
8. Describe the process of adjusting brush holders and seating brushes.
9. Describe commutator reconditioning.
10. Describe armature cleaning, servicing and maintenance.

C. Metal Lathe Operation .....16 Hours

Outcome: Operate a metal lathe.

1. Describe the use and maintenance of a metal lathe.
2. Describe cutting tools for material types.
3. Perform tool sharpening.
4. Select cutting speeds for different materials.

5. Perform center drilling.
6. Perform lathe chucking and dialing.

D. DC Armature Winding ..... 24 Hours

Outcome: Wind a dc armature.

1. Strip an armature.
2. Record winding data.
3. Insulate an armature.
4. Wind an armature.
5. Turn and undercut a commutator.
6. Fault test an armature.
7. Band an armature.

SECTION TWO: ..... THREE-PHASE MOTOR STARTERS AND CONTROLLERS ..... 53 HOURS

A. Starters ..... 27 Hours

Outcome: Connect motor starters.

1. Describe the effects on induction motors when started by reduced voltage means.
2. Describe the operation of manual across the line starters.
3. Describe the operation of across the line magnetic starters.
4. Describe the operation of primary resistance starters.
5. Describe the operation of part winding starters.
6. Describe the operation of wye-delta starters.
7. Describe the operation of electronic soft-starter.
8. Describe the operation of IEC and National Electrical Manufacturers Association (NEMA) overload devices.
9. Describe the principles of motor designs used in various reduced voltage starting methods.
10. Connect motor starters.

B. Wound Rotor Controllers ..... 10 Hours

Outcome: Connect multi-speed motor controllers.

1. Describe the principle of operation of controllers and resistor banks for wound rotor motors.
2. Describe the connection of controllers and resistor banks for wound rotor motors.
3. Describe the principle of operation of multi-speed motor controllers.
4. Connect multi-speed motor controllers.

C. Adjustable Speed Drive ..... 16 Hours

Outcome: Install adjustable speed drives.

1. Describe types and advantages of adjustable speed drive systems and their applications.
2. Describe the principles of operation and application of a variable frequency drives (VFD).
3. Select motors for different applications.

4. Describe motor faults associated with VFDs.
5. Connect and program adjustable speed drives.
6. Describe how harmonics are produced.
7. Describe effects of harmonics on supply side and load side voltage and current.
8. Describe types of filtering and methods of limiting harmonics.
9. Describe shaft voltages and how they affect rotating equipment.
10. Describe methods of protecting rotating equipment from harmonics and shaft voltages.

SECTION THREE: ..... SYNCHRONOUS MACHINES ..... 42 HOURS

A. Motors ..... 18 Hours

Outcome: ***Analyze a synchronous motor during operation.***

1. Describe components of a synchronous motor.
2. Describe information found on the motor's nameplate.
3. Describe applications of synchronous motors.
4. Describe operating principles of a synchronous motor.
5. Describe methods of starting synchronous motors.
6. Describe effects of load changes on synchronous motors.
7. Describe effects of field excitation changes on synchronous motors.
8. Describe operation of synchronous condensers.
9. Connect a synchronous motor.
10. Analyze a synchronous motor during operation.

B. Alternators ..... 18 Hours

Outcome: ***Analyze a synchronous alternator during operation.***

1. Describe the parts of a synchronous alternator.
2. Describe the information found on the nameplate of an alternator.
3. Describe applications of synchronous alternators.
4. Describe operating principles of synchronous alternators.
5. Describe types of field excitation.
6. Describe effects of load changes on synchronous alternators.
7. Describe paralleling and parallel operation of synchronous alternators.
8. Describe factors affecting voltage regulation.
9. Demonstrate paralleling and parallel operation of synchronous alternators.
10. Demonstrate the effects of different load types on synchronous alternator operation.
11. Analyze a synchronous alternator during operation.

C. Synchronous Machine Repair ..... 6 Hours

Outcome: Repair synchronous machines.

1. Describe common problems for synchronous motors.
2. Describe troubleshooting for synchronous motors.
3. Describe common problems for synchronous alternators.
4. Describe troubleshooting for synchronous alternators.
5. Repair excitation components.
6. Repair synchronous machines.

SECTION FOUR: ..... THREE-PHASE ELECTRONICS..... 24 HOURS

A. Three-Phase Rectifier Circuits ..... 6 Hours

Outcome: Analyze three-phase rectifier circuits.

1. Describe the principles of operation of three-phase rectifiers.
2. Describe the effects of adding filters to a three-phase rectifier circuit.
3. Analyze three-phase rectifier circuits.

B. Rectifier Repair ..... 9 Hours

Outcome: Repair rectifier components.

1. Describe applications of diodes.
2. Describe the operation of the rectifier stage of a battery charger.
3. Describe the operation of the rectifier stage of a welder.
4. Select replacement rectifier components from manufacturer's specification sheets.
5. Repair rectifier components.

C. Voltage Regulators ..... 6 Hours

Outcome: Describe the operation of an alternator voltage regulator.

1. Describe the operation of a shunt regulator.
2. Describe the operation of dc machine voltage regulators.
3. Describe the operation of an alternator voltage regulator.

D. Electric Welders ..... 3 Hours

Outcome: Troubleshoot electric welders.

1. Describe the primary components of an electric welder.
2. Describe the operating principles of a transformer type electric welder.
3. Describe the operating principles of a rotating electric welder.
4. Troubleshoot electric welders.

SECTION FIVE: .....TROUBLESHOOTING AND ANALYSIS OF ELECTRICAL EQUIPMENT..... 39 HOURS

A. Troubleshoot Rotating Electrical Equipment .....6 Hours

Outcome: Troubleshoot rotating electric equipment.

1. Describe the results of rotating electric equipment operating under low voltage condition.
2. Describe the results of rotating electric equipment operating under high voltage condition.
3. Describe the results of rotating electric equipment operating under over loaded condition.
4. Describe the results of rotating electric equipment operating under blocked ventilation condition.
5. Describe the results of rotating electric equipment operating under single phasing condition.
6. Troubleshoot rotating equipment.

B. Vibration Analysis.....12 Hours

Outcome: Describe methods of identifying machine vibration.

1. Describe vibration using the associated terminology.
2. Describe methods of measuring vibration.
3. Describe how to determine shaft rpm.
4. Describe machine signature and its importance in vibration analysis.
5. Describe causes of vibration in rotating equipment.
6. Describe vibration analysis methods.
7. Use a vibration analyzer.
8. Interpret vibration signatures.

C. Balancing.....12 Hours

Outcome: Balance rotating equipment.

1. Describe imbalance and balancing.
2. Describe the types of imbalance.
3. Describe causes of imbalance.
4. Describe imbalance correction methods and considerations.
5. Describe the single-plane vector method of balancing.
6. Describe the two-plane vector method of balancing.
7. Balance rotating equipment using a two-plane dynamic balancer.

D. Alignment .....6 Hours

Outcome: Align rotating equipment.

1. Describe causes of misalignment.
2. Describe techniques for measuring alignment.
3. Describe corrections for misalignment.
4. Align rotating equipment.

E. Interprovincial Standards Red Seal Program .....1 Hour

Outcome: Use Red Seal products to challenge an Interprovincial examination.

1. Identify Red Seal products used to develop Interprovincial examinations.
2. Use Red Seal products to prepare for an Interprovincial examination.

F. Alberta's Industry Network ..... 1 Hour

Outcome: ***Describe the role of the network of industry committees that represent trades and occupations in Alberta.***

1. Describe Alberta's Apprenticeship and Industry Training system.
2. Describe the roles and responsibilities of the Alberta Apprenticeship and Industry Training Board, the Government of Alberta and post-secondary institutions.
3. Describe the roles and responsibilities of the Provincial Apprenticeship Committees (PAC's), Local Apprenticeship Committees (LAC's) and Occupational Committees (OCs).

G. Workplace Coaching Skills ..... 1 Hour

Outcome: ***Use coaching skills when training an apprentice.***

1. Describe the process for coaching an apprentice.

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