IDAHO ELECTRICAL APPRENTICESHIP YEAR 2 PROGRAM STANDARDS

CONTENT STANDARD 1.0: ELECTRICAL MATHEMATICS

Performance Standard 1.1: Basic Trigonometry

1.1.1   Define a right triangle.

1.1.2   Use the Pythagorean theorem to solve problems concerning right triangles.

1.1.3   Solve problems using sines, cosines, and tangents.

CONTENT STANDARD 2.0: ALTERNATING CURRENT

Performance Standard 2.1: Circuits

2.1.1   Discuss the difference between AC and DC.

2.1.2   Compute instantaneous values of voltage and current for a sine wave.

2.1.3   Compute peak, RMS, and average values of voltage and current.

2.1.4   Define the phase relationship of voltage and current in a pure resistive circuit.

2.1.5   Identify half-wave and full-wave rectifiers.

Performance Standard 2.2: Inductance in AC Circuits

2.2.1   Define the properties of inductance in an AC circuit.

2.2.2   Define inductive reactance.

2.2.3   Calculate the values of inductive reactance and inductance.

2.2.4   Define the relationship of voltage and current in a pure inductive circuit.

2.2.5   Calculate values for inductors connected in series and parallel.

2.2.6   Define reactive power.

2.2.7   Define the Q of a coil.

Performance Standard 2.3: Resistive-Inductive Series Circuits

2.3.1   Define the relationship of resistance and inductance in an AC circuit.

2.3.2   Define power factor.

2.3.3   Calculate the values of voltage, current, apparent power, true power, reactive power, impedance, resistance, inductive reactance, and power factor in an RL series circuit.

2.3.4   Calculate the phase angle for current and voltage in an RL circuit.

Performance Standard 2.4: Resistive-Inductive Parallel Circuits

2.4.1   Define the operation of a parallel circuit containing resistance and inductance.

2.4.2   Calculate the values of voltage, current, apparent power, true power, reactive power, impedance, resistance, inductive reactance, and power factor in an RL parallel circuit.

2.4.3   Calculate the phase angle for current and voltage in an RL parallel circuit.

Performance Standard 2.5: Capacitors

2.5.1   List three factors that determine the capacitance of a capacitor.

2.5.2   Discuss the electrostatic charge.

2.5.3   State the difference between polarized and non-polarized capacitors.

2.5.4   Calculate the values for series and parallel connections of capacitors.

Performance Standard 2.6: Capacitance in AC Circuits

2.6.1   Understand how capacitors function in an AC circuit.

2.6.2	Define capacitive reactance.
2.6.3	Calculate the value of capacitive reactance in an AC circuit.
2.6.4	Calculate the value of capacitance in an AC circuit.
2.6.5	Identify the relationship of voltage and resistance in an AC circuit.
2.6.6	Calculate the phase angle for current and voltage in an AC circuit.

Performance Standard 2.7: Resistive-Capacitive Series Circuits

2.7.1	Identify the relationship of resistance and capacitance in an AC series circuit.
2.7.2	Calculate the values of voltage, current, apparent power, true power, reactive power, impedance, resistance, inductive reactance, and power factor in an RC series circuit.
2.7.3	Calculate the phase angle for current and voltage in an RC series circuit.

Performance Standard 2.8: Resistive-Capacitive Parallel Circuits

2.8.1	Define the operation of a parallel circuit containing resistance and capacitance.
2.8.2	Calculate the values of voltage, current, apparent power, true power, reactive power, impedance, resistance, inductive reactance, power factor, and phase angle in an RC parallel circuit.

Performance Standard 2.9: Resistive-Inductive-Capacitive Parallel Circuits

2.9.1	Identify the characteristics of AC circuits that contain resistance, inductance, and capacitance connected in parallel.
2.9.2	Calculate the values of voltage, current, apparent power, true power, reactive power, impedance, resistance, inductive reactance, power factor, and phase angle in an RLC parallel circuit.

Performance Standards 2.10: Three-Phase Circuits

2.10.1	Identify the difference between single-phase and three-phase voltages.
2.10.2	Identify a three-phase delta or wye connection.
2.10.3	Calculate the voltage and current values for wye and delta circuits.

Performance Standards 2.11: Single-Phase Transformers

2.11.1	Understand the different types of transformers and how they work.
2.11.2	Calculate the values of voltage, current, and turns for a single-phase transformer.
2.11.3	Understand the polarity markings.

Performance Standard 2.12: Three-Phase Transformers

2.12.1	Identify the proper connections for three single-phase transformers to form a three-phase bank.
2.12.2	Calculate voltage and current for three-phase transformer connections.
2.12.3	Identify the proper connections for two single phase transformers to form a three-phase open-delta connection.
2.12.4	Calculate the values of voltage and current for a three-phase transformer used to supply both three-phase and single-phase loads.
2.12.5	Define harmonics.
2.12.6	Understand harmonic problems and their solution.

CONTENT STANDARD 3.0: MOTORS

Performance Standard 3.1: Three-Phase Motors

3.1.1	Understand the basic operating principals of a three-phase motor.
3.1.2	Define a rotating magnetic field.
3.1.3	Define the operating principals of a squirrel-cage motor.
3.1.4	Identify the correct connections for dual voltage motors.
3.1.5	Define the procedure for reversing a three-phase motor.

Performance Standard 3.2: Single-Phase Motors

3.2.1	Define the operation of various motor types.
3.2.2	Define the basic operation of a split-phase motor.
3.2.3	Understand the purpose of a start winding and how it works.
3.2.4	Understand the purpose of a centrifugal switch.
3.2.5	Recognize the types of starting relays.

Performance Standard 3.3: Motor Load Calculations as per NEC

3.3.1	Determine the full load current of any motor according to the NEC.
3.3.2	Understand the information given on a motor nameplate and its application.
3.3.3	Calculate the branch circuit wire size for any motor.
3.3.4	Determine the appropriate circuit protection for any motor.
3.3.5	Calculate overloads.
3.3.6	Understand the difference between overload protection and short-circuit/ground-fault protection.
3.3.7	Calculate a feeder for any set of motors.
3.3.8	Calculate the feeder overcurrent device.

CONTENT STANDARD 4.0: NEC COMPLIANCE

Performance Standard 4.1: Box Fill and Junction Box Sizing

4.1.1	Calculate box fill for any size wire and combination of devices.
4.1.2	Calculate pull and junction boxes.

Performance Standard 4.2: Conductor Ampacity Correction Factors

4.2.1	Calculate correction factors for temperature.
4.2.2	Calculate correction factors for raceway fill.
4.2.3	Calculate correction factors for continuous loads.
4.2.4	Calculate correction factors for any combination of the above.
4.2.5	Use Table 310.15(B)(16) and similar tables.
4.2.6	Apply NEC Chapter 9 notes for derate in nipples.

Performance Standard 4.3: Raceway Fill

4.3.1	Use NEC tables to calculate raceway fill using any combination of wire and cable sizes.
4.3.2	Use Annex C tables.
4.3.3	Calculate conduit nipple fill.

Performance Standard 4.4: Grounding and Bonding

4.4.1	Define objectionable current.
4.4.2	Identify a main bonding jumper.
4.4.3	Calculate the grounding electrode conductor.
4.4.4	Identify proper installations of grounding electrode systems.
4.4.5	Understand the purpose of bonding.
4.4.6	Calculate equipment grounding conductors.
4.4.7	Use Article 250 to properly ground and bond any system.
4.4.8	Use the NEC to answer any grounding question.