REQUIRED SKILLS AND KNOWLEDGE – UEENEEG108A		
KS01-EG108A Electrical circuit and equipment faults and fault finding techniques Using 360 Trainer		
Topic and Description	**NIDA Lesson**	**CARD #**
T1 Troubleshooting concepts encompassing: • need to understand the correct operation of a circuit or equipment, switching and control circuit arrangements. • common faults with circuits and equipment including operator faults, incorrect connections, open-circuits, short-circuits, device faults (mechanical), supply faults. • typical faults symptoms and their causes: operation of circuit protective device, appliance does not operate, single phase motor does not develop enough torque to drive the load, three phase motor does not develop enough torque to drive the load, motor overload trips • factors to consider in clarifying the nature of a fault: initial fault report, confirmation of symptoms of the fault, comparison of symptoms with normal operation • effect to cause reasoning — assumptions of possible causes • methods for testing assumptions: visual inspection, component isolation, test equipment, sectional testing, split-half tests • repairing the fault and the steps needed to ensure fault doesn't re-occur • dealing with intermittent faults (typical causes of intermittent faults are vibration, shock, changes in temperature and electromagnetic interference). • final testing and re commissioning	**Introduction to Systems** 7211-112-130 Systems Familiarization . . . . . ▪ Define a system. ▪ Define structure, interconnectivity, and behavior. ▪ Define input, process, and output. ▪ Define feedback and system control. ▪ Identify types of feedback and system control. ▪ Define interface. ▪ Apply a systems thinking approach. ▪ Set up a system. ▪ Follow setup instructions. ▪ Initialize, align, and operate a system. ▪ Perform a system E-Stop. ▪ Perform a system restart. ▪ Perform a system shutdown. 7211-112-160 Systems Safety ▪ Define a hazard. ▪ Identify a hazard as physical, chemical, ergonomic, radiation, psychological, or biological. ▪ Perform a safety risk assessment. ▪ Apply the hierarchy of risk controls. ▪ Select the correct fire extinguisher to put out a class A, B, C, D, and combination fires. ▪ Read emergency evacuation route diagrams. ▪ Practice standard safety rules while working around and with electricity. ▪ Correlate OSHA safety code colors used in manufacturing to situations and devices. ▪ Read material safety data sheets (MSDS). ▪ Implement the 5-point eye safety checklist. ▪ Recognize the hazards of confined spaces. 7211-112-190 Multimeter Familiarization	ST101, ST102, ST103, ST104, ST105, ST106

	▪ Define a digital multimeter's purpose. ▪ Identify quantities measured with a digital multimeter. ▪ Identify the sections of a digital multimeter. ▪ List the IEC Measurement Categories. ▪ List safe measurement techniques. ▪ Set up a DMM to measure DC and AC voltages. ▪ Measure and read DC and AC voltages. ▪ Apply safe voltage measurement techniques. ▪ Set up a DMM to measure DC current. ▪ Measure and read DC current. ▪ Apply safe current measurement techniques. ▪ Set up a DMM to measure resistance. ▪ Measure and read resistance. ▪ Set up a DMM to measure continuity. ▪ Measure and read continuity. ▪ Apply safe resistance and continuity measurement techniques. 7211-112-220 Oscilloscope Familiarization . . . . . . ▪ Define the purpose of an oscilloscope. ▪ Identify quantities measured with an oscilloscope. ▪ Identify the sections of an oscilloscope. ▪ Set up an oscilloscope. ▪ Zero a trace. ▪ Perform probe compensation. ▪ Use an oscilloscope to measure waveforms for determining DC voltage,AC voltage (Vpk and Vpp), and period. ▪ Calculate frequency, Vrms, phase, and pulse width using an oscilloscope. ▪ Define and measure duty cycle. **System Testing and Troubleshooting** 7211-116-160 System Maintenance and Diagnostics . . . . . . ▪ Recognize typical preventive, scheduled, and unscheduled maintenance routines. ▪ Describe general inspection techniques for systems maintenance. ▪ Recognize system unscheduled maintenance routines. ▪ Describe when unscheduled maintenance is necessary. ▪ Set up and initialize a system following a given procedure.	ST101, ST102, ST103, ST104, ST105, ST106 ST101, ST102, ST103, ST104, ST105, ST106 ST101, ST102, ST103, ST104, ST105,

	▪ Perform a system operational check. ▪ Show proper use of measurement devices. ▪ Examine basic systems fault isolation procedures. ▪ Demonstrate the ability to diagnose a defective subsystem using fault isolation procedures. 7211-116-190 System Malfunctions and Troubleshooting . . . . ▪ Examine the systems troubleshooting process. ▪ Set up and initialize a system following a given procedure. ▪ Validate system operation using sensors, displays, and monitoring devices. ▪ Verify symptoms of subsystem malfunctions. ▪ Use a digital multimeter and oscilloscope to take measurements. ▪ Troubleshoot malfunctioning subsystems in a system.	ST106 ST101, ST102, ST103, ST104, ST105, ST106

T2 Troubleshooting water heater and appliance circuits/equipment encompassing: • circuit diagrams of common single phase and three phase hot water systems • single phase and three phase element resistance values (determined from measurement and calculation from power and voltage ratings) • testing single and three phase elements for correct insulation resistance and continuity • element replacement techniques • operation of thermostats, thermal cut-outs and pressure relief valves, flow switches and checking sacrificial anodes • locating faults in common single and three phase hot water systems • repairing faulty water heating systems		
T3 Troubleshooting electrical appliance circuits/equipment encompassing: • circuit diagrams of common single phase and three phase appliances • methods to determine the cause of an RCD operation • identification of appliances that is causing an RCD to trip • testing single and three phase appliances for correct insulation resistance and continuity • operation of appliances controls • locating faults in common single and three phase appliances • repairing faulty appliances		5

T4 Troubleshooting lighting circuits encompassing: • circuit and wiring diagrams of common lighting circuits including single light controlled by a single switch, multiple lights controlled by a single switch, two and three way switching using the loop at the light method and the loop at the switch method. • causes of wiring faults from supplied symptoms and circuit and/or wiring diagrams • causes of faults in ELV lighting devices, include transformer (iron core or electronic), voltage drop, heat, over-voltage, poor connections, incompatible dimmers • diagrams of a basic fluorescent light circuit including lamp, ballast and starter • locating faults in fluorescent light circuits • operation of a range of lighting control including passive infra-red (PIR), dimmers, photo electric or day-light switches and time clocks • locating faults in lighting control circuits	.	5
T5 Troubleshooting single phase motor and control circuits encompassing: • circuit diagrams of split phase, capacitor start, capacitor start capacitor run, universal and shaded pole single phase motors • causes of single phase motor faults from supplied symptoms and circuit diagrams • causes of electrical faults in single phase motors, include open and partially open circuit winding, short and partially short circuit winding, open circuit rotor, burnt out winding, coil shorted to frame.		

• reasons for a thermal overload trip and how often they are to be reset before investigating a cause • internal mechanical faults and their consequences, include bearings, fans, bent shaft, locked rotor, blocked air vents, centrifugal switches, environmental factors • faults on driven loads and couplings and their consequences, include slipping belts, poorly aligned coupling (shims), vibration, loads bearing failing, load stalling. • locating faults in single phase motors and their controls		
T6 Troubleshooting three phase induction motor encompassing: • circuit diagrams of three phase induction motors • causes of three phase motor faults from supplied symptoms and circuit diagrams • causes of electrical faults in three phase motors, include open and partially open circuit phase winding, short and partially short circuit phase winding, open circuit rotor, burnt out phase winding, coil shorted to frame. • reasons for a thermal overload trip and how often they are to be reset before investigating a cause • internal mechanical faults and their consequences, include bearings, fans, bent shaft, locked rotor, blocked air vents, environmental factors. • faults on driven loads and couplings and their consequences, include slipping belts, poorly aligned coupling (shims), vibration, loads bearing failing, load stalling. locating faults in three phase induction motors and their controls		
T7 Troubleshooting electrical installations encompassing:		

• circuit diagrams, wiring diagrams, cable schedules and specifications of electrical installations • causes of electrical installation faults from supplied symptoms and circuit diagrams include open and partially open circuit wiring, short and partially short circuit wiring, low insulation resistance, incorrect polarity, transposition of conductors, RCD tripping. • locating faults in electrical installations repairing faulty electrical installation circuits components and wiring.		