TRADE: ELECTRICIAN

MODULE	CODE	OBJECTIVES	CRITERIA
INDUCTION	ID1	Recall applicable sections of the Manpower Training Act (No 56, 1981), with special reference to discipline and legal responsibilities.	Pass a questionnaire with at leas 80%.
	ID2	Recall terms and conditions of apprenticeship as Gazetted 26 July 1991.	Pass a questionnaire with at leas 80%.
	ID3	Recall applicable grievance procedures.	Pass a questionnaire with at least 80%.
	ID4	Recall applicable disciplinary procedures.	Pass a questionnaire with at least 80%.
	ID5	Recall company rules and procedures.	Pass a questionnaire with at least 80%.
	ID6	Recall quality assurance procedures.	Correct according to company standards and procedures with a minimum of five (5) questions and 100% pass.
SAFETY	SF1	Recall relevant regulations of the following Acts: (where applicable): – Occupational Health and Safety Act (Act 85, 1993) – Minerals Act and Regulations (Act 50, 1991).	Pass a questionnaire with at least 80%.
	SF2	Attend a standard industrial safety course accredited by the industry.	Obtain recognised certificate.
	SF3	Recall safety in welding and gas cutting.	All safety aspects correct according to accredited procedures.
	SF4	Attend first aid course.	Obtain a recognised certificate - 1st level.
	SF5	Identify relevant colour markings and symbolic safety signs.	Correct use of SABS 0140 and SABS 1186 publications.
HAND TOOLS	HT1	Identify measuring, checking, forming, cutting, marking and fastening tools and tooling aids.	Tools in a safe and functional working condition.

MODULE	CODE	OBJECTIVES	CRITERIA
	HT2	Use measuring, checking, forming, cutting, marking and fastening tools and tooling aids.	a) Measuring and marking tools - 1,0mm accumulative dimensional tolerance and 2° on angular tolerance. b) Checking tools - 0,5mm dimensional tolerance. c) Forming, cutting and marking tools - correct application. d) All safety aspects adhered to.
	HT3	Maintain measuring, checking, forming, cutting, marking and fastening tools and tooling aids.	Tools in a safe and functional working condition.
	HT4	Use hand tools applicable to the trade.	1. All safety aspects adhered to. 2. No tools or equipment is damaged. 3. All tools and equipment are clean after use.
WORKSHOP TOOLS	WT1	Use fixed and portable drilling machines.	1. Correct speeds and feeds to be used. 2. Holes to be within 1,0mm of centre. 3. Correct cutting compounds to be used.
	WT2	Use fixed and portable grinding machines including replacing, setting, truing and ringing of wheels.	All prescribed safety standards applied.
	WT22	Dress a grinding wheel.	Wheel must be concentric.
MATERIALS	ME1	Recall the physical properties and characteristics of metals. (With reference to ME3).	Minimum of 15 questions with at least 80% pass.
	ME3	Identify the following conducting materials with respect to conductivity, current carrying capacity and temperature: copper and aluminium.	Correct according to SABS 0142.
	ME4	Identify and use the following insulating materials with respect to resistively, temperature and hydroscopic qualities: PVC, glass fibre, resins, tapes, varnishes, epoxy compounds and PVC compounds.	Correct according to the relevant SABS codes and manufacturers specifications.

MODULE	CODE	OBJECTIVES	CRITERIA
DRAWING AND SKETCHES	DSE1	Recall symbols and abbreviations used on electrical circuits for schematic and wiring diagrams, connection schedules, cables schedules, layouts and single-line drawings.	A test of minimum 25 questions to be set with an 80% pass mark in accordance to a recognised code of practice.
	DSE2	Recall symbols and abbreviations as used on engineering drawings.	A test of minimum 25 questions to be set with an 80% pass mark.
	DSE3	Recall symbols and abbreviations pertaining to electronic circuit diagrams.	100% correct according to industry standards.
	DSE4	Interpret electrical drawings.	Explanation of drawings to be 100% functionally correct.
	DSE5	Interpret engineering drawings.	Correct according to an acceptable code of practice.
	DSE6	Interpret electronic circuit diagrams.	Explanation of drawing to be 100% functionally correct.
	DSE7	Compile material lists from electrical, engineering and electronic drawings.	Correct according to given drawing.
	DSE8	Make free hand sketches of existing circuits and installations including mechanical components.	Sketches to be legible and identifiable.
MARKING OFF	MO1	Mark off a project applicable to the trade.	1. All angles to be within ± 30 minutes. 2. All dimensions to be within ± 0,25mm.
	MT9	Mark off projects for manufacturing using all standard marking-off techniques and tools.	1. No double lines. 2. Punch hole centres 100% correct. 3. All dimensions to be within 0,25mm 4. According to specific drawings.
HAND SKILLS	HS1	Fabricate a project applicable to the trade.	1. All angles to be within ± 30 minutes. 2. All dimensions to be within ± 0,25mm. 3. Surface texture N7.

MODULE	CODE	OBJECTIVES	CRITERIA
	HS2	Sharpen chisels.	Cutting angle is correct and no mushroom on the chisel head.
	HS3	Sharpen drills.	Angles according to tables and application.
	HS4	Dress screwdrivers.	1. All safety aspects adhered to. 2. Screwdrivers to be functionally correct.
	HS5	Sharpen punches.	1. All safety aspects adhered to. 2. Correct included angles according to application.
ARC WELDING	AO1	Identify and set up AC and/or DC welding machines, Equipment including starting up and shutting down procedures.	1. Correct according to manufacturers handbook. 2. All safety aspects adhered to.
	AO2	Differentiate between arc welding consumables.	Correct to manufacturers specifications.
	AO3	Prepare material for arc welding.	1. Correct according to compound welding procedures and practises with regard to weld joint preparation, voltage, amperages, and welding consumable. 2. All safety aspects adhered to.
	AO4	Tack and arc weld work pieces incidental to the trade using manual metal arc welding techniques.	1. Correct according to company quality control procedures. 2. All safety aspects adhered to.
GAS WELDING	GW10	Identify and set up oxygen-fuel gas welding equipment including light up, adjustment of gas pressures and shut down procedures.	1. Correct according to manufacturers handbook. 2. All safety aspects adhered to. 3. Selection of correct size nozzles in relationship to material thickness.
	GW11	Differentiate gas welding consumables.	Correct according to manufacturers specifications.
	GW12	Prepare material for gas welding.	1. Correct according to company gas welding procedures with regard to joint preparation including gas welding consumable. 2. All safety aspects adhered to.

MODULE	CODE	OBJECTIVES	CRITERIA
	GW13	Gas weld work pieces incidental to the trade.	1. Correct according to company quality control procedures. 2. All safety aspects adhered to.
GAS CUTTING AND HEATING	GC1	Identify and assemble gas cutting and heating equipment, including light up and shut down procedures.	Correct method and procedure according to safety standards.
	GC2	Select nozzles and gas pressures for cutting and heating different materials of various thicknesses.	100% correct according to manufacturers charts.
	GC3	Hand cut and heat materials incidental to the trade.	Company quality standards on finish and with maximum 2mm deviation from line.
BASIC LIFTING TECHNIQUES	BG2	Recall overhead crane hand signals.	100% correct according to recognised code of practice.
	BG3	Demonstrate overhead crane hand signals.	100% correct according to recognised code of practice.
	BG4	Use the following equipment: – chain block : 2 ton max – shackles : 2 ton max – chain slings : 2,5 ton max – wire rope slings : 20mm diameter	1. Working load not to exceed equipment safe loading capacity. 2. Correct method of slinging. 3. No kinks in wire rope slings and chain slings. 4. No damage to equipment.
ELECTRICAL MEASURING INSTRUMENTS (PANEL MOUNTED)	MJ1	Select and connect the following panel meters and interpret the readings: voltmeter, ammeter, energy meter (KWH).	1. Meters selected and connected. 2. Gives correct reading on meter.
ELECTRICAL TESTING INSTRUMENTS (PORTABLE)	ET1	Identify and use the following instruments for safety and fault finding as used for electrical systems up to 750 volts: voltage tester, multimeter, insulation tester, oscilloscope, earth leakage polarity tester, phase rotation tester and signal generator.	1. Correct test instruments selected for the application. 2. evaluation of test readings. 3. All safety rules to be applied.

MODULE	CODE	OBJECTIVES	CRITERIA
SOFT SOLDER	SS1	Prepare and solder the following: – Hard copper – Soft copper	Joint to be electrically and mechanically sound.
	SS2	Solder electronic components onto a printed circuit board.	1. No dry joints. 2. No damage to components, tracks or printed circuit boards. 3. No solder bridges. 4. Solder height not to exceed 1mm.
FAULT FINDING	FA2	Fault find on the following: control panels, distribution boards, contactors, relays, insulators, fuse holders and motor control gear.	1. All safety aspects are adhered to. 2. Correct test instruments is used. 3. Specifications as per drawing is adhered to. 4. All assemblies are correct. 5. All faults are corrected.
	FA6	Fault find on the following equipment: – Control panels – Distribution boards – Contactors and relays – Insulators – Fuse and holders The following AC heavy current motor control equipment and the practical application of fault finding techniques: – Open circuit – Short circuits – Under voltage relay faults – Retaining faults – Single phase faults – Mechanical faults – Specific faults applicable to panels and the diagnosis of the specific fault symptoms of each panel as a result of its purpose and composition.	1. All safety aspects must be adhered. 2. Current testing instruments must be used. 3. Specifications as per drawings must be adhered to. 4. All mountings must be correct. 5. All faults must be permanently safe and neatly repaired.

MODULE	CODE	OBJECTIVES	CRITERIA
CONDUCTORS	CO1	Recall the current carrying capacity of conductors according to length and cross-sectional area.	Correct according to SABS 0142.
	CO2	Join conductors by the following methods: – crimping – soldering	1. Correct size ferrule to be used. 2. Correct crimping tool to be used. 3. Joint correct according to SABS 0142.
	CO3	Insulate conductors.	Correct according to SABS 0142.
CABLES	CA1	Make off and join multi and single core, standard PVC armoured cable up to 16mm² 4 core, (1200 volt insulation).	1. Glands, ferrules and lugs used to be correct according to manufacturers specification. 2. Joint to be electrically and mechanically sound and according to manufacturer's specifications.
	CA2	Identify ratings of cables by current, voltage and temperature.	Correct according to SABS 0142.
	CA3	Recall methods of storing cables.	Correct according to SABS 0142.
	CA4	Terminate PVC cables (up to 1200 volts insulation) for entry into cable end box using mechanical and compression methods.	Correct according to SABS 0142.
	CA5	Identify XLPE cables.	100% correct.
ELECTRICAL EQUIPMENT	EE1	Maintain repair and test the following equipment: control panels, distribution boards, contactors, relays, switch-gear, circuit breakers, timers, isolators, fuse holders, motor control gear, electrical machines, protective devices and lighting systems.	1. All safety aspects adhered to. 2. All other standards according to company maintenance manuals.

MODULE	CODE	OBJECTIVES	CRITERIA
WIRING	WI1	Design and wire the following with reference to the applicable drawings: panels, starters, motors, motor control gear, electrical distribution systems, protective systems, lighting systems including discharge and fluorescent lamps.	1. All safety standards to be adhere to. 2. All circuits function according to specifications. 3. Wiring correct according to SABS 0142.
INSTALLATIONS	IN1	Mount, wire and connect the following: – switch boards – distribution boards – motor control gear – isolators – electrical equipment	1. Safety standards to be adhered to. 2. All circuits function according to specifications. 3. Wiring correct according to SABS 0142.
	IN2	Introduction to wire-ways including the following: – racks – trunking – flexible conduit	Correct according to SABS 0142.
AC MACHINES	AC9	Design and wire control and main circuit to which the following single phase machines can be connected: (take into consideration protection and safety equipment that must be used) – Capacitor start motor - forward and reverse – Capacitor start, capacitor run motor - forward and reverse.	1. Phase rotations 100% correct. 2. Correct according to SABS 0142.
	AC10	Design and wire the following control and main circuit to which 3 phase squirrel cage induction motor can be connected: (take into consideration protection and safety equipment that must be used) – Direct on line forward and reverse – Automatic Star-Delta – Auto transformer – Constant torque motor (2 speed)	1. Phase rotations 100% correct. 2. Correct according to SABS 0142.

MODULE	CODE	OBJECTIVES	CRITERIA
	AC11	Design and wire the following control and main circuit to which a three phase slip ring induction motor can be connected i.e. – Hand and automatic controlled resistance starter or current limiting starters (take into consideration protection and safety equipment that must be used).	1. Phase rotations 100% correct. 2. Correct according to SABS 0142.
	AC16	Connect three phase and three single phase transformers in various combinations to obtain various voltages.	1. Phase rotations 100% correct. 2. Correct according to SABS 0142.
	AC17	Before commissioning test the following AC machines electrically and mechanically: – Capacitor start motor – Capacitor start capacitor run motor – 3 phase squirrel cage induction motor – 3 phase slip ring motor – Transformers – Auto-transformers	1. Correct according to SABS 0142 test procedures. 2. All connections electrically and mechanically sound.
	AC18	After commissioning fault find the following AC machines: – Capacitor start motor – Capacitor start capacitor run motor – 3 phase squirrel cage induction motor – 3 phase slip ring motor – Transformers – Auto-transformers.	1. All faults must be repaired permanently and to manufacturers specifications. 2. All faults must be repaired according to SABS 0142 specifications. 3. The observation of fault symptoms on AC panels and the diagnosis thereof as a result of their purpose and composition.
DC MACHINES	DC1	Connect, test and fault find the following DC machines: – series motor – shunt motor – compound motor	1. Rotation 100% correct. 2. Correct according to SABS 0142. 3. All connections electrically and mechanically sound.

MODULE	CODE	OBJECTIVES	CRITERIA
ELECTRONICS	EL1	Identify the following electronic components: – Resistors - wire wound up to 10 watts - carbon and metal oxides (1 watt) – Capacitors - electrolytic and ceramic – Diodes – Transistors – Thyristors	100% correct to manufacturers specifications.
	EL2	Construct, solder and fault find the following electronic circuits: bi-stable multi vibrator, A stable multi vibrator, mono-stable multi vibrator, elementary SCR speed control.	All circuits to operate functionally correct.
	EL3	Use a dual- trace oscilloscope up to 20 MHZ to identify: – Wave forms (DC & AC) – Average values – Peak values – Frequencies – RMS values	1. 100% correct. 2. All readings to be within 5% of true values.
	EL5	Programme and use P. L. C. systems.	According to company requirements and manufactures specifications.
THEORETICAL TRAINING		A four subject pass is required to attempt the trade test. Mathematics and the relevant trade theory subject is compulsory . A further two relevant subjects must be chosen by the employer, college and apprentice in order to obtain the four subjects required for the trade test.	
	TT1	Mathematics N1 Relevant trade theory N1 Plus two relevant subjects N1	Obtain a four subject certificate.

MODULE	CODE	OBJECTIVES	CRITERIA
	TT2	Mathematics N2 Relevant trade theory N2 Plus two relevant subjects N2 "Should the apprentice have a qualification higher than that prescribed in the schedule, it must be ensured that the subjects are relevant to the trade in question, before a trade test date will be allocated."	Obtain a four subject certificate.
ON THE JOB EXPERIENCE AND INDEPENDENT WORK	EX1	On the job experience and independent work should cover at least 80% of all practical modules to ensure as wide as possible field of experience and must take place under supervisory control.	All work done to be recorded with respect to performance levels.