

**2023/24 ANNUAL TEACHING PLANS: ELECTRICAL TECHNOLOGY (POWER SYSTEMS): GRADE 12 (TERM 1)**

TERM 1	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7	WEEK 8	WEEK 9	WEEK 10
<b>CAPS TOPICS</b>	Safety (Generic)	RLC	RLC	RLC	3-Phase AC Generation	3-Phase AC Generation	3-Phase AC Generation	3-Phase AC Generation	PAT consolidation, revision and assignment	
<b>TOPICS/ CONCEPTS, SKILLS AND VALUES</b>	First Aid HIV/Aids awareness OHS act Machine specific safety measures	Effect of alternating current on R, L and C components in series and parallel single phase circuits	<ul style="list-style-type: none"> <li>Inductive reactance <math>X = 2\pi fL</math></li> <li>Capacitive reactance impedance</li> <li>Power</li> <li>Phase angle</li> <li>Power factor</li> <li>Phasor and wave representation</li> <li>Resonance</li> <li>Q factor &amp; bandwidth</li> </ul>	<b>Calculations</b> <ul style="list-style-type: none"> <li>Series and parallel combination circuits containing ONE resistor, ONE capacitor and ONE inductor</li> <li>Frequency changes</li> <li>Phasor and wave representation</li> <li>Resonance</li> <li>Phasor diagram</li> </ul>	<b>Principles of three phase AC generation</b> <ul style="list-style-type: none"> <li>Distribution networks – Outline generation network to distribution network</li> <li>Advantages and disadvantages of single vs. three phase systems, etc.</li> </ul>	Three phase systems (3φ) <ul style="list-style-type: none"> <li>Star</li> <li>Delta</li> <li>Delta vs. star</li> <li>Schematic</li> <li>Diagrammatic representations of three phase systems, etc.</li> </ul>	<b>Power in three phase (3φ) systems and calculations</b> <ul style="list-style-type: none"> <li>Active power</li> <li>Reactive power</li> <li>Apparent power</li> </ul>	<b>Introduction to Star and Delta calculations</b> <ul style="list-style-type: none"> <li>Line voltage and current</li> <li>Phase voltage and current</li> <li>Losses, etc.</li> </ul> <b>Application of meters in three phase (3φ)</b> <ul style="list-style-type: none"> <li>Wattmeter, etc.</li> </ul>		
<b>REQUISITE PRE-KNOWLEDGE</b>	First Aid/HIV/RLC series single phase Understanding the basics operating principles of resistors, capacitors and inductors									
<b>RESOURCES (OTHER THAN TEXTBOOK) TO ENHANCE LEARNING</b>	OHS act – safety signs in workshop First aid training manuals	You Tube video clips and related IT resources Old question papers	You Tube video clips and related IT resources Old question papers	You Tube video clips and related IT resources Old question papers	You Tube video clips and related IT resources Old question papers	You Tube video clips and related IT resources Old question papers	RLC “spook box” simulation	You Tube video clips and related IT resources Old question papers	You Tube video clips and related IT resources Old question papers	You Tube video clips and related IT resources Old question papers
<b>ASSESSMENT</b>	<b>INFORMAL ASSESSMENT: REMEDIATION</b>	Class work/case studies/worksheets/homework/ (theory and practical work)								
	<b>SBA (FORMAL)</b>	<b>PAT simulation 1 and 2 completed and assignment</b> Safe work practices are types of administrative controls that include procedures for safe and proper work used to reduce the duration, frequency, or intensity of exposure to a hazard. The section on tools and equipment must be infused when doing all PAT simulations.								

2023/24 ANNUAL TEACHING PLANS: ELECTRICAL TECHNOLOGY (POWER SYSTEMS): GRADE 12 (TERM 2)

TERM 2	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7	WEEK 8	WEEK 9	WEEK 10	WEEK 11
<b>CAPS TOPICS</b>	Three-phase transformers	Three-phase transformers	Three-phase transformers	Three-phase motors & starters	Three-phase motors & starters	Three-phase motors & starters	Three-phase motors & starters	Three-phase motors & starters	Three-phase motors & starters	PAT consolidation and revision	Term 2 assessments
<b>TOPICS/CONCEPTS, SKILLS AND VALUES</b>	<p><b>Introduction to three phase (3φ) transformers</b></p> <ul style="list-style-type: none"> <li>Principle of operation and connections of three phase transformers</li> <li>Concept and understanding of losses</li> <li>Three phase transformers compared to single phase transformers (delta/star, star/delta, delta/delta, star/star)</li> <li>Construction of transformers</li> <li>Application of transformers</li> <li>Cooling</li> <li>Safety Protection</li> </ul>	<p><b>Calculations (Balanced loads only)</b></p> <ul style="list-style-type: none"> <li>Ratio</li> <li>Line and phase current, voltage and power</li> <li>Power factor</li> <li>Power</li> <li>Load including losses and efficiency</li> </ul>	<p><b>Practical:</b> Wiring of single-phase transformers to three phase: star/star; star/delta; delta/star; delta/delta</p> <p><b>Practical:</b> Testing transformers</p> <p><b>PAT Simulation 2 completed</b></p>	<p><b>Introduction to three-phase (3φ) motors</b></p> <ul style="list-style-type: none"> <li>Three phase squirrel cage induction motor</li> <li>Principle of operation</li> <li>Construction</li> <li>Advantages</li> <li>Applications</li> <li>Calculations on slip, power and efficiency</li> <li>Characteristic curve of speed vs. torque</li> </ul> <p><b>Synchronous speed</b></p> <ul style="list-style-type: none"> <li>What is synchronous speed?</li> <li>Relation of synchronous speed to generated power</li> </ul>	<p><b>Electrical and mechanical aspects of three phase (3φ) motors</b></p> <ul style="list-style-type: none"> <li>Fault-finding/troubleshooting</li> <li>Motor testing</li> <li>Commissioning</li> <li>The process involved in preparing the motor and starter to be used by the operator</li> </ul> <p><b>Practical:</b> Conduct troubleshooting on a faulty motor and rectify the problem</p> <p><b>Practical:</b> Conduct a motor test on a motor</p> <p><b>Practical:</b> Commission a new motor with a starter</p> <p><b>3φ Direct on line starter with overload</b></p> <ul style="list-style-type: none"> <li>Function of components on diagrams</li> <li>Principle of operation</li> <li>Diagram</li> <li>Wiring on a panel</li> <li>Calculation of the overload value and setting of the overload</li> </ul> <p><b>Practical:</b> Connect a DoL starter to a motor, set the overload</p> <p>Start &amp; stop the motor</p>	<p><b>3φ Forward and reverse starter with overload</b></p> <ul style="list-style-type: none"> <li>Function of components on diagrams</li> <li>Principle of operation</li> <li>Diagram</li> <li>Wiring on a panel &amp; calculation of the overload value and setting of the overload</li> </ul> <p><b>Practical:</b> Connect a 3φ forward and reverse starter to a three-phase motor. Set the overload. Start &amp; stop</p>	<p><b>3φ Sequence motor control starter with overload (Without timer)</b></p> <ul style="list-style-type: none"> <li>Function of components on diagrams</li> <li>Principle of operation</li> <li>Diagram</li> <li>Wiring on a panel</li> </ul> <p><b>Practical:</b> Connect a 3φ sequence motor starter to a squirrel cage motor. Set the overload. Start &amp; stop</p>	<p><b>3φ Sequence motor control starter with overload (With timer)</b></p> <ul style="list-style-type: none"> <li>Function of components on diagrams</li> <li>Principle of operation</li> <li>Diagram</li> <li>Wiring on a panel</li> </ul> <p><b>Practical:</b> Connect a sequence motor starter. Set the overload and timer. Start &amp; stop, overload and timer. Start &amp; stop</p>	<p><b>3φ Automatic star delta starter with overload</b></p> <ul style="list-style-type: none"> <li>Function of components on diagrams</li> <li>Principle of operation</li> <li>Diagram</li> <li>Wiring on a panel (practical) &amp; calculation of the overload value and setting of the overload</li> </ul> <p><b>Practical:</b> Connect a Star Delta starter to a squirrel cage motor. Set the overload and timer: Start &amp; Stop</p>		
<b>REQUISITE PRE-KNOWLEDGE</b>	Introduction to single-phase transformers. Introduction to magnetism	Introduction to single-phase transformers. Introduction to magnetism	Introduction to single-phase transformers. Introduction to magnetism	Introduction to single-phase motors and starters	Introduction to single-phase motors and starters						
<b>RESOURCES (OTHER THAN TEXTBOOK) TO ENHANCE LEARNING</b>	Video clips, laptop and a data projector	Chalkboard/whiteboard	Practical transformers Video clips, laptop and a data projector	Video clips, laptop and a data projector A workshop with necessary equipment	Practical transformers Video clips, laptop and a data projector A workshop with necessary equipment						
<b>ASSESSMENT</b>	<b>INFORMAL ASSESSMENT: REMEDIATION</b>	Class work/case studies/worksheets/homework/ (theory and practical work)									
	<b>SBA (FORMAL)</b>	<p><b>PAT simulation and Mid-Year Examination</b></p> <p>Safe work practices are types of administrative controls that include procedures for safe and proper work used to reduce the duration, frequency, or intensity of exposure to a hazard.</p> <p>The section on tools and equipment must be infused when doing all PAT simulations.</p>									

**2023/24 ANNUAL TEACHING PLANS: ELECTRICAL TECHNOLOGY (POWER SYSTEMS): GRADE 12 (TERM 3)**

TERM 3	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7	WEEK 8	WEEK 9	WEEK 10	WEEK 11
<b>CAPS TOPICS</b>	Programmable logic controllers	Programmable logic controllers	Programmable logic controllers	Programmable logic controllers	Programmable logic controllers	Revision	Prep exams PAT Mod.	Prep exams PAT Mod.	Prep exams PAT Mod.	Prep exams PAT Mod.	Prep exams PAT Mod.
<b>TOPICS/CONCEPTS, SKILLS AND VALUES</b>	<b>Introduction to the Programmable Logic Control Device</b> <ul style="list-style-type: none"> <li>History of the PLC (revision of Grade 11)</li> <li>Hard wiring vs. soft wiring (revision)</li> <li>The programmed scan cycle of a PLC (Input, process, output) (Revision)</li> <li>Safety and PLC devices (Revision)</li> </ul> <b>PAT:</b> HOD checks to see that 100% of PAT files and project are completed and assessed	<b>PLC software and devices</b> <p>Difference between analogue and digital</p> <p>Logic gates and truth tables of AND, OR, NAND, NOT, NOR inputs to a PLC (digital)</p> <ul style="list-style-type: none"> <li>Switches as input devices (N/O and N/C)</li> <li>Using sensors as input devices</li> </ul> <p>No theory of operation, only application of:</p> <ul style="list-style-type: none"> <li>Proximity</li> <li>Temperature</li> <li>Light</li> <li>Level</li> <li>Overload</li> </ul> <p>Outputs on a PLC (Transistor / Relay)</p>	<ul style="list-style-type: none"> <li>Contactors/ relays</li> <li>Timers (on delay/ off delay)</li> <li>Latching concepts (interlocking/ retaining circuits)</li> <li>Markers/ flags (memory elements)</li> <li>Conversion of hard-wired schematics (control circuits) to ladder logic and labelling of symbols (motor starters only)</li> <li>Applications of PLCs: The PLC as a motor starter (revision)</li> </ul>	<b>The variable speed drive as a programmable motor controller (Concepts only)</b> <ul style="list-style-type: none"> <li>Basic principle of operation</li> <li>Introduction to VSD</li> <li>Methods of speed control (mechanical/ hydraulic/ electrical)</li> <li>Basic block diagram (rectifier/ regulator/ inverter)</li> <li>Analog to digital conversion &amp; digital control</li> <li>Types of motors used with a VSD</li> <li>Regenerative braking</li> </ul>	<b>The variable speed drive as a programmable motor controller</b> <ul style="list-style-type: none"> <li>Basic applications of VSD (fans/ pumping systems/ heating/ ventilation/ air conditioning systems)</li> <li>Start-up and run profiles (with applications) (programming – optional)</li> </ul>						
<b>REQUISITE PRE-KNOWLEDGE</b>	Control devices using hard wiring	Logic gates and sensors	Introduction to PLC Motor starters	Motor control	Motor control						
<b>RESOURCES TO ENHANCE LEARNING</b>	Video clips, laptop and a data projector	Video clips, laptop and a data projector	Video clips, laptop and a data projector PLC trainer and necessary contactors	Motor control VSD Types of motors used with VSD Video clips, laptop and a data projector							
<b>ASSESSMENT</b>	<b>INFORMAL ASSESSMENT: REMEDIATION</b>	Class work/case studies/worksheets/homework/ (theory and practical work)									
	<b>SBA (FORMAL)</b>	<b>PAT project and Preparatory examination</b> Safe work practices are types of administrative controls that include procedures for safe and proper work used to reduce the duration, frequency, or intensity of exposure to a hazard. The section on tools and equipment must be infused when doing all PAT simulations.									

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TERM 4		WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7	WEEK 8	WEEK 9	WEEK 10
<b>CAPS TOPICS</b>		Revision PAT consolidation and SBA moderation	Programmable logic controllers SBA moderation	Revision SBA moderation	Revision	NCS exams	NCS exams	NSC exams	NSC exams	NSC exams	NSC exams
<b>TOPICS/CONCEPTS, SKILLS AND VALUES</b>		<p><b>Practical:</b> Problem solving using PLC applications: Sequence motor control starter with overload and timer Do practical revision of hard-wired starter before doing PLC Starter.</p> <p><b>Practical:</b> Problem solving using PLC applications: the Star Delta Starter Do practical revision of hard-wired starter before doing PLC Starter</p> <p><b>Practical:</b> Problem solving using PLC applications: The forward reverse three phase starter Do practical revision of hard-wired starter before doing PLC starter</p>									
<b>REQUISITE PRE-KNOWLEDGE</b>		PLC applications: Sequence motor control starter with overload and timer PLC applications: The star delta starter PLC applications: The forward reverse									
<b>RESOURCES (OTHER THAN TEXTBOOK) TO ENHANCE LEARNING</b>		Video clips, laptop and a data projector PLC trainer and necessary contactors	Video clips, laptop and a data projector PLC trainer and necessary contactors	Video clips, laptop and a data projector							
<b>ASSESSMENT</b>	<b>INFORMAL ASSESSMENT: REMEDIATION</b>	Class work/case studies/worksheets/homework/ (theory and practical work)									
	<b>SBA (FORMAL)</b>	<b>Final Examination</b>									