



2023/24 ANNUAL TEACHING PLANS: ELECTRICAL TECHNOLOGY (ELECTRONICS): GRADE 11 (TERM 1)

TERM 1	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7	WEEK 8	WEEK 9	WEEK 10	WEEK 11
CAPS TOPIC	Occupational health and safety	Tools and measuring instruments	Waveforms	Waveforms	Waveforms	Waveforms	RLC	RLC	RLC	PAT Consolidation revision and assessment	PAT Consolidation revision and assessment
CONCEPTS, SKILLS AND VALUES	OHS Basic introduction to regulations <ul style="list-style-type: none"> - What are regulations? - How to use regulations? - Impact of regulations on the workshop - Introduction and purpose of the regulations - General Machinery Regulation 1988 ▪ Supervision of machinery ▪ Safeguarding of machinery ▪ Operation of machinery ▪ Working on moving or electrically alive machinery ▪ Devices to start and stop machinery ▪ Reporting of incidents in connection with machinery - Electrical Machinery Regulations 1988 ▪ Safety equipment ▪ Electrical control gear ▪ Switchboards ▪ Portable electric tools ▪ Earthing ▪ Conductors Safety <ul style="list-style-type: none"> - What is ergonomics? (workplace conditions, comfort – everything has a place and everything is in its place) 	Testing equipment <ul style="list-style-type: none"> • Line tester, clamp meter & power factor meter <ul style="list-style-type: none"> ➢ External parts and their functions ➢ Principle of operation ➢ Application ➢ Care ➢ Maintenance • Function generator and oscilloscope <ul style="list-style-type: none"> ➢ External parts and their functions ➢ Principle of operation ➢ Application ➢ Care ➢ Maintenance • Calculation on the Oscilloscope <ul style="list-style-type: none"> ➢ Time ➢ Frequency ➢ Phase difference ➢ Maximum value 	Introduction to waveforms <ul style="list-style-type: none"> - Uses of waveforms - Different types of waves - Waveforms and their applications - Square wave - Saw-tooth wave - Triangular wave - Rectangular wave - Radio wave Definition, symbol & unit of: <ul style="list-style-type: none"> - The sinusoidal wave <ul style="list-style-type: none"> ➢ Instantaneous value ➢ Maximum value, minimum value ➢ Peak-to-peak value ➢ Rms value $V_{rms} = 0.707 \times V_m$ ➢ Average value over half cycle ($V_{avg} = V_{max} \times 0.637$) ➢ Time period ➢ Frequency ➢ Duty cycle ➢ Form factor ➢ Concept of phase and phase difference ➢ Harmonic frequencies (concept only) - Difference between a sound wave and an electromagnetic wave (concept only – self propagating vs medium needed) - Electromagnetic waves (concept only – combination of electrical and magnetic wave – unique characteristics) 	Pulse technique <ul style="list-style-type: none"> - Pulse polarity - Pulse time - Rise time, fall time - What is a clock pulse, leading edge, trailing edge? Calculations <ul style="list-style-type: none"> - Pulse time - Pulse frequency - Rise time - Fall time - Period and frequency - λ (wavelength) & frequency Practical: Set up and measure different waveforms generated by the function generator on the oscilloscope	Wave-shaping circuits <ul style="list-style-type: none"> - Diode using discrete components only - Clipping circuits (positive clipping only) <ul style="list-style-type: none"> ➢ Simple series ➢ Series biased ➢ Simple parallel ➢ Biased parallel 	<ul style="list-style-type: none"> - Clamping circuits (positive clamping only) - Clamping circuit – diode - Clamping circuit – Zener diode - Integrator & differentiator - No calculations ➢ Input and output waveforms on oscilloscope ➢ Construction on breadboard ➢ Measurement of output waveform Practical: Construct each type of clipping and clamping circuit on breadboard using diodes	Effect of alternating current on resistors, inductors and capacitors (RLC) <ul style="list-style-type: none"> - Components in series circuits only - All applicable calculations relevant to the theory to be completed - Emphasis will be on circuits containing ONE resistor, ONE capacitor and ONE inductor - Wave representation - Phasor diagram - Inductive reactance <ul style="list-style-type: none"> o $X_L = 2\pi fL (\Omega)$ - Capacitive reactance <ul style="list-style-type: none"> o $X_C = \frac{1}{2\pi fC} (\Omega)$ - Effect of frequency changes on X_L and X_C Practical: Show phase difference between RL and RC Practical: Start with simulation 1	<ul style="list-style-type: none"> - Impedance $Z = \sqrt{R^2 + (X_L - X_C)^2}$ - Scalar: Representation of the impedance triangle - Power $P = V \times I \cos \theta (W)$ - Power factor $\cos \theta = \frac{R}{Z}$ - Phase angle $\theta = \cos^{-1} \frac{R}{Z} (Deg)$ - Phase angle $\theta = \cos^{-1} \frac{V_R}{V_Z} (Deg)$ 	<ul style="list-style-type: none"> - Natural resonance - Effect of frequency changes on the impedance and current flow - Resonance with its characteristic curve - Q factor - Bandwidth - Frequency changes Calculations <ul style="list-style-type: none"> - Series combination circuits containing ONE resistor, ONE capacitor and ONE inductor - Phasor and wave representation - Resonance - Bandwidth - Q factor 	Simulation 1 finalised Part 1 of PAT project Circuit diagram and component list Revision: Term 1 Assignment	Simulation 1 finalised Part 1 of PAT project Circuit diagram and component list Assignment

TERM 1	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7	WEEK 8	WEEK 9	WEEK 10	WEEK 11
	Personal safety <ul style="list-style-type: none"> - Protective gear for machinery - Personal protection equipment - Eye protection - Coveralls, overalls - Hearing protection Practical: Use personal protection equipment (during practical sessions) he, she obtains quotations for PAT projects and submit to SMT Principal approves procurement of PAT projects resources Teacher ensures that PAT project is procured		<ul style="list-style-type: none"> - Speed of radio waves - Frequency and wavelength Demonstration: Function generator and the oscilloscope used to measure and display waveforms								
RESOURCES (OTHER THAN TEXTBOOK) TO ENHANCE LEARNING	Educational videos and IT-related resources										
INFORMAL ASSESSMENT, REMEDIATION	Classwork, case studies, worksheets, homework, theory and practical, etc.										
SBA (FORMAL ASSESSMENT)	PAT simulation 1 completed 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.										Assignment

2023/24 ANNUAL TEACHING PLANS: ELECTRICAL TECHNOLOGY (ELECTRONICS): GRADE 11 (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
CAPS TOPIC	Semiconductor devices	Semiconductor devices	Semiconductor devices	Semiconductor devices	Semiconductor devices	Semiconductor devices	Semiconductor devices	Semiconductor devices	PAT consolidation and revision	PAT consolidation and revision	PAT consolidation assessment
CONCEPTS, SKILLS AND VALUES	Introduction to semiconductor devices <ul style="list-style-type: none"> - Component data - Where to source data on all types of electronic components - How to read a data sheet - Pin configuration - Typical operating values - Working temperature - Equivalent components - Packages (dual in line, TO 92, basic packages) - Through-hole components vs surface mount devices 	Semiconductors <ul style="list-style-type: none"> - Electron flow vs conventional flow - Semiconductors & solid state - Silicon vs Germanium - Doping - P&N material - Majority carriers, minority carriers PN diode <ul style="list-style-type: none"> - Construction of a PN diode - Depletion layers - Biasing – forward and reverse - Characteristics curve & symbol - Calculation of diode load line 	Zener diode <ul style="list-style-type: none"> - Construction - Principle of operation - Forward biasing - Reverse biasing - Avalanche breakthrough vs controlled breakthrough - Zener as a voltage regulator - Characteristics curve & symbol - Zener calculations Practical: Determine the value of the series resistor for a Zener diode	The NPN transistor <ul style="list-style-type: none"> - Construction - Principle of operation - Purpose of biasing & thermal runaway - Forward biasing - Reverse biasing - Base curve - Emitter output curve - Regions of operations (saturation, active and off) - The transistor DC load line - Transistor power related to the load line (V_{cc} and V_{ce}) - Influence of the DC load line on the characteristics of the transistor - Symbol 	Application of transistors <ul style="list-style-type: none"> - Transistor as a switch - Transistor as an amplifier - Transistor gains - Current & voltage gain Practical: Determine the DC Load line of the transistor Practical: Build a circuit using the transistor as a switch	The PNP transistor <ul style="list-style-type: none"> - Construction - Principle of operation - Relation to NPN - Symbol - Application – simple circuits only Practical: Build a circuit using the transistor as a switch	Thyristor - SCR <ul style="list-style-type: none"> - Construction - Principle of operation - Purpose of biasing - Symbol - Characteristics curve - Application (relaxation oscillator, phase control, switch mode application, DC-DC converter (buck, boost)) - Circuit diagram 	Practical: Construct a relaxation oscillator and show waveform on oscilloscope Practical: Construct a light dimmer circuit	Simulation 2 finalised Design and make: Part 2 PAT project Revision: Term 2	Revision: Term 2 Design and make: Part 2 PAT project Controlled test	Design and make: Part 2 PAT project Controlled test
RESOURCES (OTHER THAN TEXTBOOK) TO ENHANCE LEARNING	Educational videos and IT-related resources										
INFORMAL ASSESSMENT, REMEDIATION	Classwork, case studies, worksheets, homework, theory and practical, etc.										
SBA (FORMAL ASSESSMENT)	PAT Simulation 2 completed 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.										Controlled test

2023/24 ANNUAL TEACHING PLANS: ELECTRICAL TECHNOLOGY (ELECTRONICS): GRADE 11 (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
CAPS TOPIC	Semiconductor devices	Semiconductors	Power supplies	Power supplies	Power supplies	Amplifiers	Amplifiers	Amplifiers	PAT consolidation and revision	PAT consolidation revision and assessment	PAT consolidation and assessment
CONCEPTS, SKILLS AND VALUES	TRIAC <ul style="list-style-type: none"> - Construction - Principle of operation - Purpose of biasing - Symbol - Characteristics curve - Application (relaxation oscillator, phase control, switch mode application, DC-DC converter (buck, boost)) - Circuit diagram - Practical: Construct a light dimmer circuit 	DIAC <ul style="list-style-type: none"> - Construction - Principle of operation - Purpose of biasing - Symbol - Characteristics curve - Application (relaxation oscillator, phase control, switch mode application, DC-DC converter (buck, boost)) - Circuit diagram application 	DC Power supplies <ul style="list-style-type: none"> - Concept of transformation - Rectification (half wave and full wave) <ul style="list-style-type: none"> ➤ Waveforms ➤ Circuit construction (practical) ➤ Representation of waves on oscilloscope 	Filtering (ripple factor, C, LC) and waveforms <ul style="list-style-type: none"> - Block diagram - Circuit diagram and construction of a filter on breadboard - Representation of waves on oscilloscope - Ripple factor 	Voltage regulation (Series & shunt regulation using Zener diode and transistor) <ul style="list-style-type: none"> - Circuit diagram - Waveforms - Measurement with multimeter - Zener calculations of the series resistor Practical: Connect a series regulator circuit on the breadboard Practical: Connect a shunt regulator circuit on the breadboard	Introduction to amplifiers <ul style="list-style-type: none"> - Definition of an amplifier - Types of amplifiers (Class A, B, AB and C) using transistors - Principle of operation of a transistor amplifier - Connection - Characteristics - Circuit diagrams Input and output signals of: <ul style="list-style-type: none"> - Common base (no biasing) - Common collector (no biasing) - Common emitter (with different types of biasing) 	Biasing of transistor amplifiers <ul style="list-style-type: none"> - Types of biasing applied to the common emitter amplifier <ul style="list-style-type: none"> ➤ Fixed base biasing - Simple circuit diagram - Advantages & disadvantages ➤ Collector feedback biasing - Basic circuit diagram - Advantages & disadvantages 	<ul style="list-style-type: none"> - Voltage divider biasing <ul style="list-style-type: none"> ➤ Circuit diagram ➤ Function of components in the circuit ➤ Advantages & disadvantages Calculation of: <ul style="list-style-type: none"> - Transistor DC load line (common emitter amplifier with fixed current biasing) - Reference to regions of operation as well as V_{cc} and V_{ce} - The interpretation of a load line in conjunction with an AC signal (active region) to determine the values of the base and collector current, using emitter output curve to derive amplification classes. - Influence of DC biasing on the load line and Q point 	Simulation 3 finalised Design and make: Part 2 PAT project Building an enclosure and installing circuit into it Revision: Term 3	Design and make: Part 2 PAT project Building an enclosure and installing circuit into it Revision: Term 3 Controlled test	Design and make: Part 2 PAT project Building an enclosure and installing circuit into it Revision: Term 3 Controlled test
RESOURCES (OTHER THAN TEXTBOOK) TO ENHANCE LEARNING	Educational videos and IT-related resources										
INFORMAL ASSESSMENT, REMEDIATION	Classwork, case studies, worksheets, homework, theory and practical, etc.										
SBA (FORMAL ASSESSMENT)	PAT simulation 3 completed 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.									Term test	

2023/24 ANNUAL TEACHING PLANS: ELECTRICAL TECHNOLOGY: ELECTRONICS: GRADE 11 (TERM 4)

TERM 4	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7	WEEK 8	WEEK 9	WEEK 10
CAPS TOPIC	Amplifiers	Amplifiers	Sensors and transducers	Sensors and transducers	Communication systems	PAT consolidation and revision	PAT consolidation and revision	Examination	Examination	Examination
CONCEPTS, SKILLS AND VALUES	Feedback in amplifiers <ul style="list-style-type: none"> - What is feedback? (applications & purpose) - Negative feedback (basic introduction only – block diagram) ➤ Advantages and disadvantages ➤ Reasons for using negative feedback ➤ Applications of negative feedback - Positive feedback ➤ Advantages and disadvantages ➤ Reasons for using positive feedback ➤ Applications of negative feedback 	The common emitter amplifier <ul style="list-style-type: none"> - Input waveform - Output waveform - Breadboard construction - Representation of waves on oscilloscope Practical: Class A audio amplifier construction, testing & measurements	Introduction to sensors and transducers <ul style="list-style-type: none"> - Definition of sensors and transducers - Piezo Electric Effect - Wheatstone bridge principles of resistance measurement Practical: Connect a microphone to an amplifier and the output to an oscilloscope and display on a screen	Functional operation of sensors and transducers: <ul style="list-style-type: none"> - Sound <ul style="list-style-type: none"> ➤ Dynamic microphone ➤ Electret microphone - Light <ul style="list-style-type: none"> ➤ The LDR ➤ Photodiode ➤ Phototransistor ➤ Opto-coupler - Temperature <ul style="list-style-type: none"> ➤ The thermistor ➤ Thermocouple – working principle and special conditions for use. (not a linear resistive output – to be used with lookup table) 	Transmitters and receivers <ul style="list-style-type: none"> - Basic principle of operation - What is modulation? - Waveforms - Block diagrams - Principle of operation - Types of modulation & related devices <ul style="list-style-type: none"> ➤ Continuous wave modulation (CW) ➤ CW (Morse Code) transmitter ➤ Regenerative receiver ➤ Amplitude modulation (AM) ➤ The AM transmitter ➤ The AM receiver 	Finalising PAT portfolio and project for moderation Revision: Term 1 & 2	Finalising PAT portfolio and project for moderation Revision: Term 3 & 4			
RESOURCES (OTHER THAN TEXTBOOK) TO ENHANCE LEARNING	Educational videos and IT-related resources									
INFORMAL ASSESSMENT, REMEDIATION	Classwork, case studies, worksheets, homework, theory and practical, etc.									
SBA (FORMAL ASSESSMENT)	Final examination									