2023/24 ANNUAL TEACHING PLANS: ELECTRICAL TECHNOLOGY: DIGITAL ELECTRONICS: GRADE 12 (TERM 1)

basic education
Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

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 TOPICS	**Occupational health and safety**	**Semiconductor devices**	**Semiconductor devices**	**Switching circuits**	**Switching circuits**	**Switching circuits**	**Switching circuits**	**Switching circuits**	**Switching circuits**	PAT consolidation, **revision and assessment**	PAT consolidation, **revision and assessment**
TOPICS, CONCEPTS, SKILLS AND VALUES	**OHS ACT** - Definitions - Purpose of the act - General duties of employers to their employees - General duties of employers and self-employed persons to persons other than their employees - General duties of manufacturers and others regarding articles and substances for use at work - Duty to inform - General duties of employees at work - Duty not to interfere with, damage or misuse things - Functions of health and safety representatives - Report to inspector regarding certain incidents - Victimization forbidden - Offences, penalties and special orders of court **Safety revision** - Unsafe actions - Unsafe conditions - Dangerous practices - Risk analysis - Human rights in the workplace - Work ethics - Revision of emergency procedures (Grade 10) **Practical:** Use personal protection equipment (during practical sessions) **Practical**: Clean the workshop (weekly activity throughout the year) **Chemical safety** (printed circuit board manufacturing) - Revision of Grade 10 & PCB methods and safety done as part of PAT **Practical**: Etch a PCB (part of PAT completion during the year)	**Introducing of integrated circuits** Integrated circuits – the 741 Op-Am - Basic construction, symbol, functional operation - Typical operating voltages - Characteristics of an ideal Op-Amp & application as an amplifier - Gain: open loop and closed loop gain - Application as an inverting amplifier - Application as a non-inverting amplifier **Calculations** - Inverting amplifier o $Vout = Vin(-\frac{Rf}{Rin})$ - Non-inverting amplifier o $Vout = Vin(-\frac{Rf}{Rin}+1)$ - gain o $Av = Rf, Rin$ **Practical**: Build a non-inverting amplifier on a breadboard using a 741 Op-Amp Use a function generator and oscilloscope to show input and output waveforms	- Integrated circuits – the 555 timer - Basic construction, symbol, functional operation - Characteristic curves & typical operating voltages - Application as a timer **Practical**: Build a clock pulse generator using a 555 timer IC on a breadboard and display the output on an oscilloscope	**Principle of operation of switching circuits using operational amplifiers and timers** **Multivibrators** - Bistable multivibrator circuit diagram and operation - Measurement of input and output waveforms **Practical:** Construct a bistable multivibrator on a breadboard using a 741 Op-Amp, 555 timer with LEDs	- Mono-stable multivibrator circuit diagram and operation measurement of input and output waveforms **Practical:** Construct a mono-stable amplifier on a breadboard using a 741 Op-Amp, 555 timer and LEDs	- Astable multivibrator circuit diagram and operation measurement of input and output waveform **Practical:** Construct an astable amplifier on a breadboard using a 741 Op-Amp, 555 timer and show output using LEDs and the oscilloscope	Schmidt Trigger circuit diagram and operation display the input waveform in relation to the output waveform on the oscilloscope **Practical:** Construct a Schmidt Trigger on a breadboard using a 741 Op-Amp Calculations: $Vout = Vin\ x\ Gain$ $Vout = Vin1\ x(\frac{Rf}{Rin2})+ Vin1\ x(\frac{Rf}{Rin2})+...VinN\ x\ (\frac{Rf}{RinN})$	Comparator and summing amplifier circuit diagram and operation display the input waveform in relation to the output waveform on the oscilloscope Measurement of input and output waveforms **Practical:** Construct a comparator on a breadboard using a 741 Op-Amp **Practical:** Construct a summing amplifier on a breadboard using a 741 Op-Amp	Differentiator and integrator - Circuit diagram and operation - Display the input waveform in relation to the output waveform on the oscilloscope - Influence of time constant on the output waveform **Practical:** Construct a differentiator on a breadboard using a 741 Op-Amp **Practical:** Construct an integrator on a breadboard using a 741 Op-Amp	**Assignment** **PAT simulation 1**	**Assignment** **PAT simulation 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
REQUISITE PRE-KNOWLEDGE		Introduction of the OHS Act, electrical machinery regulations	Introduction to semiconductor and solid-state devices	Introduction to semiconductor and solid-state devices	Electronic components and how they work	Electronic components and how they work	Electronic components and how they work	Electronic components and how they work	Electronic components and how they work	Electronic components and how they work	Electronic components and how they work	Electronic components and how they work
RESOURCES (OTHER THAN TEXTBOOK) **TO ENHANCE LEARNING**		OHS act - safety signs in workshop First aid training manuals	741 Op-Amp, breadboard, function generator etc	Educational videos and IT-related resources Old question papers	Educational videos and IT-related resources Old question papers	Educational videos and IT-related resources Old question papers 741 Op-Amp and 555 IC simulations	Educational videos and IT-related resources Old question papers 741 Op-Amp and 555 IC simulations	Educational videos and IT-related resources Old question papers	Educational videos and IT-related resources Old question papers	Educational videos and IT-related resources Old question papers741 Op-Amp and 555 IC simulations	Educational videos and IT-related resources Old question papers	Educational videos and IT-related resources Old question papers
ASSESSMENT	**INFORMAL ASSESSMENT:** REMEDIATION	Class work, case studies, worksheets, homework (theory and practical work)										
	SBA (FORMAL)	**PAT simulation 1 completed** **Assignment** The legislation governing workplaces in relation to COVID-19 is the Occupational Health and Safety Act, Act 85 of 1993, as amended, read with the Hazardous Biological Agents Regulations. Section 8 (1) of the Occupational Health and Safety (OHS) Act, Act 85 of 1993. 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. Examples of safe work practices for SARS-CoV-2 include requiring regular hand washing or using of alcohol-based hand rubs. Learners and teachers should always wash hands when they are visibly soiled and after removing any PPE. Keep safe distances and wear a mask at all times.										

2023/24 ANNUAL TEACHING PLANS: ELECTRICAL TECHNOLOGY: DIGITAL ELECTRONICS: 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
CAPS TOPICS	**Digital and sequential devices**	**Digital and sequential devices**	**Digital and sequential devices**	**Assessment**	**Digital and sequential devices**	**Digital and sequential devices**	**Digital and sequential devices**	**Digital and sequential devices**	**PAT consolidation and revision**	**PAT consolidation and assessment**	**PAT consolidation and assessment**
TOPICS, CONCEPTS, SKILLS AND VALUES	Decoders and encoders 7-segment displays & decoder, driver LCD, LED displays & drivers	**Practical:** Connect a 7-segment display to a 4-bit BCD 7 segment display driver	**Elementary principles of combination circuits without memory elements** Functional principles, circuit diagram and use of: • Half Adder • Full Adder • Bit Parallel Binary Adder **Practical:** Connect a binary adder using a 4008B CMOS IC to add two four-bit binary number	**Simulation 2**	Elementary principles of memory elements - Application of logic gates as the building blocks for memory elements - RS and the clocked RS latch - Logic gate composition - Block diagram symbol - Operation - JK Flip Flop and Clocked JK latch - Logic gate composition - Block diagram Symbol - Operation - D Flip Flop and clocked D latch - Logic gate composition - Block diagram Symbol - Operation **Practical:** connect a 4013B CMOS IC to form an astable multivibrator using a clock pulse from a function generator	Elementary principles of counters - Ripple counters - Synchronous counters - Asynchronous counters - Up, down counters - Self-stopping counters	Application of counters: Counters as frequency dividers Application of counters: Decade counter Application of counters: Binary-coded decimal counter **Practical:** Connect a 4017B Johnson counter with a 555 timer to form a counter that will light up 6 LEDs in sequence	Elementary principles of registers Shift registers – serial load shift register (serial input, serial output) SISO Serial input – parallel output SIPO shift registers – Parallel load shift register Parallel input – serial output PISO parallel input – parallel output PIPO **Practical:** Connect a 4015 B CMOS IC to form SISO shift register			
REQUISITE PRE-KNOWLEDGE	Operation of basic gates, digital displays etc	Operation of basic gates, digital displays etc	Basic combination circuits		Basic combination circuits	Counters	Counters	Counters			
RESOURCES (OTHER THAN TEXTBOOK) **TO ENHANCE LEARNING**	Lesson plan, PowerPoint presentation, textbook	Equipment, tools, consumables	Lesson plan, PowerPoint presentation, textbook Equipment, tools, consumables	Equipment, tools, consumables	Lesson plan, PowerPoint presentation, textbook Equipment, tools, consumables	Lesson plan, PowerPoint presentation, textbook	Lesson plan, PowerPoint presentation, textbook Equipment, tools, consumables.	Lesson plan, PowerPoint presentation, textbook Equipment, tools, consumables			
ASSESSMENT	**INFORMAL ASSESSMENT:** REMEDIATION	Class work, case studies, worksheets, homework (theory and practical work)									
	SBA (FORMAL)	**PAT Simulation** **Mid-year Examination** The legislation governing workplaces in relation to COVID-19 is the Occupational Health and Safety Act, Act 85 of 1993, as amended, read with the Hazardous Biological Agents Regulations. Section 8 (1) of the Occupational Health and Safety (OHS) Act, Act 85 of 1993. 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. Examples of safe work practices for SARS-CoV-2 include requiring regular hand washing or using of alcohol-based hand rubs. Learners and teachers should always wash hands when they are visibly soiled and after removing any PPE. Keep safe distances and wear a mask at all times. See the document on the workshop safety measures.									

2023/24 ANNUAL TEACHING PLANS: ELECTRICAL TECHNOLOGY: DIGITAL ELECTRONICS: 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
CAPS TOPICS	**Microcontrollers**	**Microcontrollers**	**Microcontrollers**	**Microcontrollers**	**Microcontrollers**	**Microcontrollers**	**Microcontrollers**	PAT consolidation and **revision**	**Prep exams**	**Prep exams**	**Prep exams**
TOPICS, CONCEPTS, SKILLS AND VALUES	**Introduction to microcontrollers** - History of microcontrollers - Uses of microcontrollers **Hardware of microcontrollers** - Block diagram of a microcontroller - Basic function & concepts of microcontrollers - What is a microcontroller? - Difference between a microcontroller and a microprocessor - A digital IC that can be programmed to control a process - Discreet logic vs integrated logic devices **Parts of a microcontroller – concepts only** - CPU with registers - Memory - Input, output pins - Timers - Analogue to digital converters	**Communication in a microcontroller** - What is meant with communication in a microcontroller - Serial vs parallel communication - Asynchronous vs synchronous communication - Communication peripherals Serial Communication Interface (SCI) or Universal Asynchronous Receiver Transmitter (UART) Serial Peripheral Interface (SPI) Inter-integrated Bus (I2C) • Communication protocols ➢ RS-232 ➢ RS-485	**Software of Microcontrollers** - Definition of an algorithm - Definition of a program - Relationship between algorithms and flowcharts - Instruction set, flow diagram - Definition of a flow diagram - Flow diagram symbols in PICAXE - Instructions and conventions	- Data flow lines - Legal vs illegal data flows - Conditional statement (IF statement) - LOOPING (REPETITION) - Definition of debugging	**Software of microcontrollers** **PICAXE** - Using PICAXE programming software	Using Logicator or similar flowchart software to program PICAXE using the following functions: - Input, outputs - Analogue to digital conversion - Timers - Counters - Tutorials - Simulating before programming - Debugging a program	**Software of Microcontrollers** **PICAXE** - Interface cable (USB or RS232) - Programming the PICAXE - Uploading and downloading programs from the PICAXE microcontroller				
REQUISITE PRE-KNOWLEDGE	Basic electricity	Basic communication in a microcontroller	Basic communication in a microcontroller	Writing a PICAXE programme	Programming PICAXE and simulating the programme						
RESOURCES (OTHER THAN TEXTBOOK) **TO ENHANCE LEARNING**	Lesson plan, PowerPoint presentation, textbook and video clips	Lesson plan, PowerPoint presentation, textbook and video clips	Lesson plan, PowerPoint presentation, textbook and video clips	Lesson plan, PowerPoint presentation, textbook and video clips	Lesson plan, PowerPoint presentation, textbook and video clips						
ASSESSMENT	**INFORMAL ASSESSMENT:** REMEDIATION	Class work, case studies, worksheets, homework (theory and practical work)									
	SBA (FORMAL)	**Preparatory Examination** **PAT project** The legislation governing workplaces in relation to COVID-19 is the Occupational Health and Safety Act, Act 85 of 1993, as amended, read with the Hazardous Biological Agents Regulations. Section 8 (1) of the Occupational Health and Safety (OHS) Act, Act 85 of 1993. 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. Examples of safe work practices for SARS-CoV-2 include requiring regular hand washing or using of alcohol-based hand rubs. Learners and teachers should always wash hands when they are visibly soiled and after removing any PPE. Keep safe distances and wear a mask at all times. See the document on the workshop safety measures.									

2023/24 ANNUAL TEACHING PLANS: ELECTRICAL TECHNOLOGY (DIGITAL ELECTRONICS): GRADE 12 (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 TOPICS		**Microcontrollers**	**Microcontrollers**	**Microcontrollers**	**Microcontrollers**	**Revision**	**NSC exams**	**NSC exams**	**NSC exams**	**NSC exams**	**NSC exams**
TOPICS, CONCEPTS, SKILLS AND VALUES		• **Practical:** Use a flow diagram to simulate a flashing LED and then program PICAXE to run as a flashing LED Add input to start and stop flashing Connect an oscilloscope to the output of the PICAXE	**Practical:** Use a flow diagram to simulate a Schmidt Trigger then program PICAXE to run the program Use a potentiometer on the input to adjust the threshold and switch the output accordingly Connect an oscilloscope to show the input and output voltages	**Practical:** Use a flow diagram to simulate a Pulse Width Modulator (PWM) then program PICAXE to run the program Control an RC servo motor using the PICAXE as a PWM module Connect an oscilloscope to show the input and output voltages	**Practical:** Develop a solution of your own design						
REQUISITE PRE-KNOWLEDGE		Programming PicAXE and simulating the programme	Programming PicAXE and simulating the programme	Programming PicAXE and simulating the programme							
RESOURCES (OTHER THAN TEXTBOOK) **TO ENHANCE LEARNING**		Lesson plan, PowerPoint presentation, textbook	Lesson plan, PowerPoint presentation, textbook	Equipment, tools, consumables							
ASSESSMENT	**INFORMAL ASSESSMENT:** REMEDIATION	Class work, case studies, worksheets, homework (theory and practical work)									
	SBA (FORMAL)	**Final Examination**									