

National Revised ATP: Term 1 Grade 12 Electrical Technology: Digital Electronics 2021

TERM 1 (45days)	1: 27-29 Jan (3)	2: 01-05 Feb (5)	3: 08-12 Feb (5)	4: 15-19 Feb (5)	5: 22-26 Feb (5)	6: 1-5 March (5)	7: 8- 12 March (5)	8: 15-19 Mar (5)	9: 23-26 Mar (4)	10: - 29-31 Mar (3)
CAPS Topics	Occupational Health and Safety	Semiconductor Devices	Semiconductor Devices	Switching Circuits	Switching Circuits	Switching Circuits	Switching Circuits	Switching Circuits	Switching Circuits	Remediate and /revision
Topics /Concepts, Skills and Values	<p>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 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</p>	<p>Introducing of Integrated Circuits •Integrated circuits – the 741 Op-Amp 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</p> <p>Calculations - Inverting Amplifier o $V_{out} = Vin(-\frac{R_f}{R_{in}})$ Non-inverting Amplifier o $V_{out} = Vin(-\frac{R_f}{R_{in}} + 1)$ o Gain o $Av = Rf / Rin$</p> <p>Practical: Build a non-inverting</p>	<ul style="list-style-type: none"> Integrated circuits – the 555 Timer <p>Basic construction, symbol, functional operation Characteristic curves & typical operating voltages Application as a timer</p> <p>Practical: Build a clock pulse generator using a 555 Timer IC on a breadboard and display the output on an oscilloscope</p>	<p>Principle of Operation of Switching Circuits using Operational Amplifiers and Timers - 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</p>	<p>- 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</p>	<p>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</p> <p>Comparator and Summing Amplifier Circuit diagram and operation Display the input waveform in relation to the output waveform on the Oscilloscope</p>	<p>- 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: $V_{out} = Vin \times Gain$ $V_{out} = Vin1 \times (\frac{R_f}{R_{in2}}) + Vin1 \times (\frac{R_f}{R_{in2}}) + \dots VinN \times (\frac{R_f}{R_{inN}})$</p>	<p>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</p>	<p>Differentiator and Integrator o Circuit diagram and operation o Display the input waveform in relation to the output waveform on the Oscilloscope o Influence of time constant on the output waveform</p> <p>Practical: Construct a differentiator on a breadboard using a 741 Op-Amp Practical: Construct an integrator on a breadboard using a 741 Op-Amp</p>	<p>- PAT Simulation 1 & 2 completed Assignment</p>

	<p>Victimization forbidden Offences, penalties and special orders of court</p> <p>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)</p>	<p>amplifier on a breadboard using a 741 Op-Amp. Use a Function Generator and Oscilloscope to show input and output waveforms</p>								
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	completion during the year									
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
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 papers. 741 Op Amp and 555 IC simulations	Educational videos and IT related resources. Old question papers.
Assessment		Class work/case studies/worksheets/homework/ (theory and practical work)								
		PAT simulation 1 and 2 completed Assignment <p>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,</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. 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.</p>								

National Revised ATP: Term 2 Grade 12 Electrical Technology: Digital Electronics 2021

TERM 2 (51days)	1: 13-16 Apr (4)	2: 1 9-23 Apr (5)	3: 26-30 Apr (4)	4: 03-07 May (5)	5: 10-14 May (5)	6: 17-21 May (5)	7: 24-28May (5)	8: 31 May -4 June (5)	9: 07-11 June (5)	10-11: 14-25 June (9 days)
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 Revision PAT Simulation	
Topics /Concepts, Skills and Values	Decoders and Encoders • Seven 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 3	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)	<p>PAT Simulation Practical simulation</p> <p>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.</p>									

National Revised ATP: Term 3 Grade 12 Electrical Technology: Digital Electronics 2021

TERM 3 (52 days)	1: 13-16 Jul (4)	2: 19-23 Jul (5)	3: 26-30 Jul (5)	4: 02-06 Aug (5)	5: 10-13 Aug (4)	6: 16-20 Aug (5)	7: 23-27 Aug (5)	8: 30 Aug- 3 Sep (5)	9: 06-10 Sept (5)	10 13-17Sept (9)	11 20-23Sept (9)
CAPS Topics	Microcontrollers	Microcontrollers	Microcontrollers	Microcontrollers			Microcontrollers	Revision	PAT consolidation	Prep Exams	Prep Exams
Topics /Concepts, Skills and Values	<p>Introduction to Microcontrollers</p> <ul style="list-style-type: none"> History of microcontrollers Uses of microcontrollers <p>Hardware of Microcontrollers</p> <ul style="list-style-type: none"> 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 Discrete Logic vs. Integrated Logic devices <p>Parts of a Microcontroller – Concepts only</p>	<p>Communication in a Microcontroller</p> <ul style="list-style-type: none"> What is meant with communication in a microcontroller <p>Serial vs. parallel communication</p> <p>Asynchronous vs. synchronous communication</p> <ul style="list-style-type: none"> Communication Peripherals <p>Serial Communication Interface (SCI) or Universal Asynchronous Receiver Transmitter (UART)</p> <p>Serial Peripheral Interface (SPI)</p> <p>Inter-integrated Bus (I2C)</p> <ul style="list-style-type: none"> Communication protocols <ul style="list-style-type: none"> ➤ RS-232 ➤ RS-485 	<p>Software of Microcontrollers</p> <ul style="list-style-type: none"> Definition of an algorithm Definition of a program Relationship between algorithms and flowcharts Instruction set / Flow diagram Definition of a Flow diagram Data flow diagram symbols in PICAXE Instructions and conventions 	<ul style="list-style-type: none"> Data flow lines Legal vs. illegal data flows Conditional statement (IF statement) Looping (Repetition) Definition of debugging 	<p>Software of Microcontrollers PICAXE</p> <ul style="list-style-type: none"> Using PicAXE programming software 	<p>Using Logicator or similar flowchart software to program PICAXE using the following functions:</p> <p>Input / Outputs</p> <p>Analogue to digital conversion</p> <p>Timers</p> <p>Counters</p> <p>Tutorials</p> <p>Simulating before programming</p> <p>Debugging a program</p>	<p>Software of Microcontrollers PICAXE</p> <ul style="list-style-type: none"> Interface Cable (USB or RS232) Programming the PICAXE <p>Uploading and downloading programs from the PICAXE microcontroller</p>				

	<ul style="list-style-type: none"> • CPU with registers • Memory • Input / Output pins • Timers • Analog to digital converters 										
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)	<p>Prep Examination</p> <p>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, -</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. 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.</p> <p>See the document on the workshop safety measures.</p>									

National Revised ATP: Term 4 Grade 12 Electrical Technology: Digital Electronics 2021

TERM 4 (47 days)		1: 05-08 Oct (4)	2: 11-15 Oct (5)	3: 18-22 Oct (5)	4: 25-29 Oct (5)	5: 01-05 Nov (5)	6: 08-12 November (5)	7: 15-19 Nov (5)	8: 22-26 Nov (5)	9: 29 Nov – 3 Dec (5)	10- 06-08 Dec (3)
CAPS Topics		Microcontrollers	Microcontrollers	Microcontrollers	Microcontrollers	PAT consolidation and Moderation Revision	NCS Exams	NSC Exams	NSC Exams	NSC Exams	NSC Exams
Topics /Concepts, Skills and Values		<ul style="list-style-type: none"> 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)								NSC Exams		