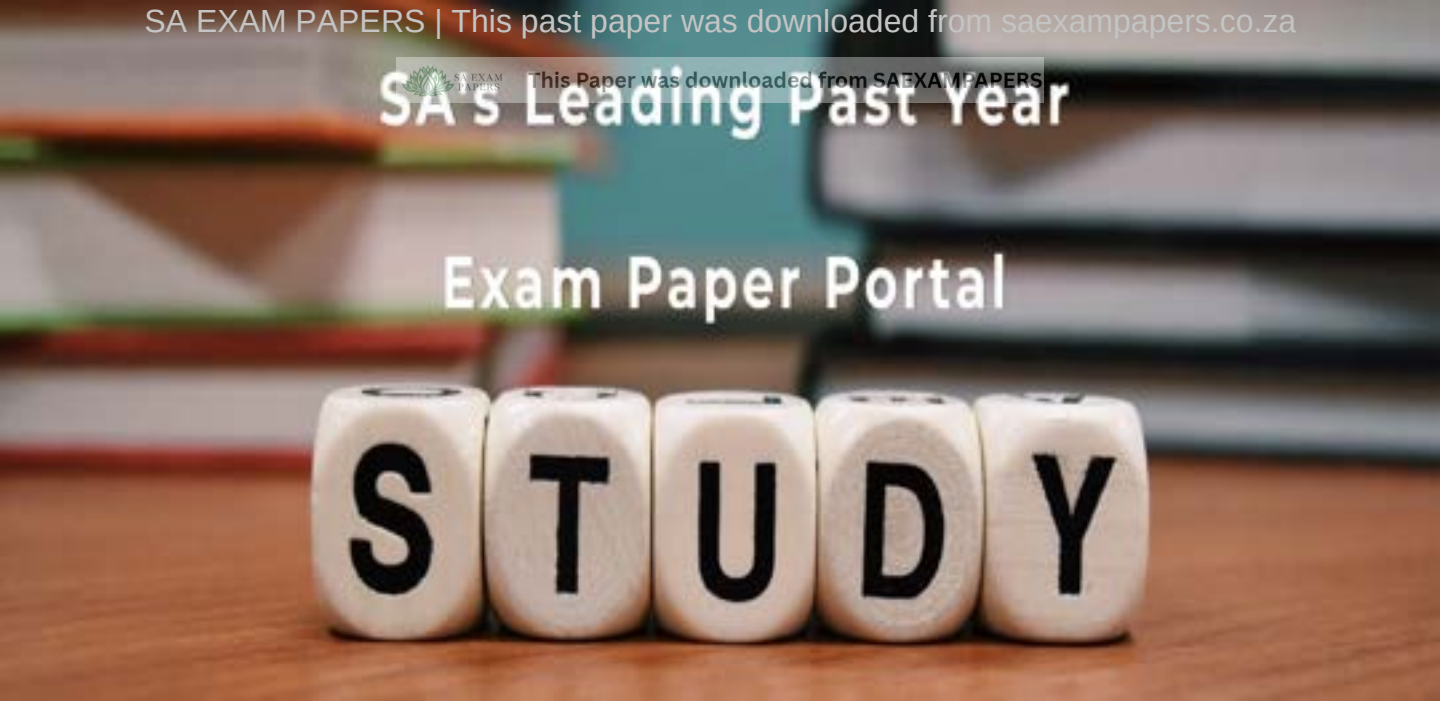


GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

JUNE EXAMINATION
GRADE 12

2026

NAME:	

DATE:	2	0	2	6	–	M	M	–	D	D

SCHOOL:	

SUBJECT:	**ELECTRICAL TECHNOLOGY: DIGITAL ELECTRONICS**

ANSWER ALL THE QUESTIONS IN THE QUESTION PAPER.

MARKER					INT. MODERATOR				DIST. MODERATOR				PROV. MODERATOR			
Question	Marks			Marker's code & initials	Marks			IM's code & initials	Marks			DM's code & initials	Marks			PM's code & initials
1																
2																
3																
4																
5																
TOTAL																

TIME: 3 hours

MARKS: 200

29 pages + a 1-page formula sheet

INSTRUCTIONS AND INFORMATION

1. This question paper consists of FIVE questions. Answer ALL the questions in the spaces provided.
2. Use the mark allocation as a guide to the length of your answers.
3. Sketches and diagrams must be large, neat and FULLY LABELLED.
4. Show ALL calculations and round-off answers correctly to TWO decimal places.
5. You may use a non-programmable calculator.
6. A FORMULAE SHEET is attached at the end of this question paper.
7. Calculations must include:

   7.1 Formulae and manipulations where needed

   7.2 Correct replacement values

   7.3 Correct answers and relevant units where applicable

8. No pages may be torn from this question paper.
9. Candidates may not retain a question or remove it from the examination room. Question papers must be returned to the invigilator at the end of the examination session.
10. Answers must be written in black/blue ink as distinctly as possible. Do NOT write in the margins.
11. Indicate the questions you have answered by drawing a circle around the relevant numbers on the front cover of the question paper where marks are to be recorded.
12. Draw a neat line through any work/rough work that must NOT be marked.
13. In the event that you use the additional space provided:

    13.1 Write down the number of the question.
    13.2 Leave a line open and rule off after your answer.

14. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A – D) for each corresponding question (1.1.1 to 1.1.15) in the blocks provided.

1.1 What are the symptoms of a third-degree burn?

A Charred skin, no pain
B Swelling
C Blisters and pain
D Redness and pain (1)

1.2 What is the main reason you should avoid contact with a person who is being electrocuted?

A To avoid getting your clothes dirty
B To avoid becoming a second victim
C To avoid getting shocked yourself
D To avoid damaging the equipment (1)

1.3 In a monostable multivibrator using 555 IC, the resistance R is 100 kΩ and capacitance C is 10 µF, what is the pulse width of the output?

A 1,1 ms
B 2,2 ms
C 1,1 s
D 2,2 s (1)

1.4 What does "DIP" stand for in the context of integrated circuits?

A Digital input programme
B Dual in-line package
C Dynamic input process
D Direct input port (1)

1.5 In an S-R flip-flop, what does the "Set" input do?

A It resets the flip-flop to 0.
B It sets the flip-flop to 1.
C It has no effect.
D It disables the flip-flop. (1)

1.6 A latch is a: [ ]

A Monostable multivibrator
B Astable multivibrator
C Bistable multivibrator
D 555 timer (1)

1.7 Hysteresis in a Schmidt trigger refers to: [ ]

A The time delay between input and output
B The difference in threshold voltages for rising and falling inputs
C The gain of the amplifier
D The output voltage swing (1)

1.8 A … output has the transistor emitter connected to the anode of the LED. [ ]

A sourcing
B draining
C distributing
D sinking (1)

1.9 Which circuit would you use to drive the timing of a security light that must be on for 15 seconds and then reset? [ ]

A Astable circuit
B Monostable circuit
C Bistable circuit
D Timer circuit (1)

1.10 Identify the circuit that can be used to drive the indicator light of a car. [ ]

A Astable circuit
B Monostable circuit
C Bistable circuit
D Timer circuit (1)

1.11 A/an … can be used to switch between the active and inactive states of an alarm system thereby arming and disarming the alarm. [ ]

A astable circuit
B monostable circuit
C bistable circuit
D timer circuit (1)

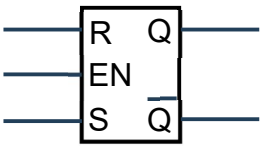
1.12 The function of a debounce circuit is to:

A Filter out mechanical vibrations to protect the electronic circuits
B Filter out noise from the previous circuit to obtain a clear signal
C Filter out vibrations in an oscillating circuit
D Filter out unwanted pulses coming out from a switch

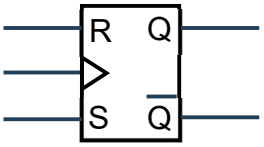
(1)

1.13 Identify the correct symbol for an active high RS-latch.

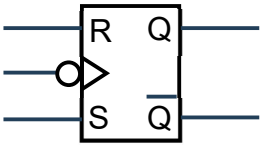
A



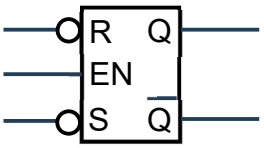
B



C



D



(1)

1.14 A JK-latch is shown in FIGURE 1.14. This JK-latch will only react on values on its inputs when the clock pulse …

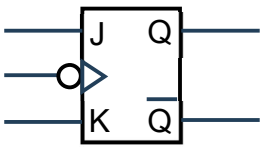


FIGURE 1.14

A is active.
B changes state from low to high.
C changes state from high to low.
D is inactive.

(1)

1.15 An up/down MO-16 counter has the ability to:

A Count up to 16_{10} and down to 1_{10} with every clock pulse
B Count up and down simultaneously to its limits
C Count up to a maximum value and then count down again to zero
D Count up or down according to the user's selection (1)

[15]

QUESTION 2: OCCUPATIONAL HEALTH AND SAFETY

2.1	Name TWO incidents that should be reported to inspectors in the workplace.	
		(2)

2.2	Explain why the location of the emergency master switch is important for safety in and around the workshop.	
		(2)

2.3	State TWO general duties of manufacturers with regard to a product that will be used in the workplace.	
		(2)

2.4	Describe how teamwork can improve work ethics.	
		(2)

2.5	Define the term *danger* with reference to the Occupational Health and Safety Act, 1993 (Act 85 of 1993).	
		(2)

[10]

QUESTION 3: SEMICONDUCTOR DEVICES

3.1 Refer to FIGURE 3.1 below and answer the questions that follow.

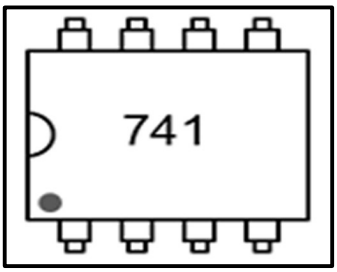


FIGURE 3.1 741 OP-AMP

3.1.1	State how you would identify pin 1 of the IC in FIGURE 3.1.	
		(1)

3.1.2	List the THREE stages into which the internal circuit of the op-amp is divided.	
		(3)

3.1.3	Describe the differences between the *inverting* and *non-inverting* inputs of the 741 op-amp.	
		(2)

3.1.4	State the typical operating voltages of the 741 op-amp.	
		(2)

3.1.5	Explain the term *closed-loop gain* in relation to the 741 op-amp.	
		(2)

3.2 Refer to FIGURE 3.2 below and answer questions that follow.

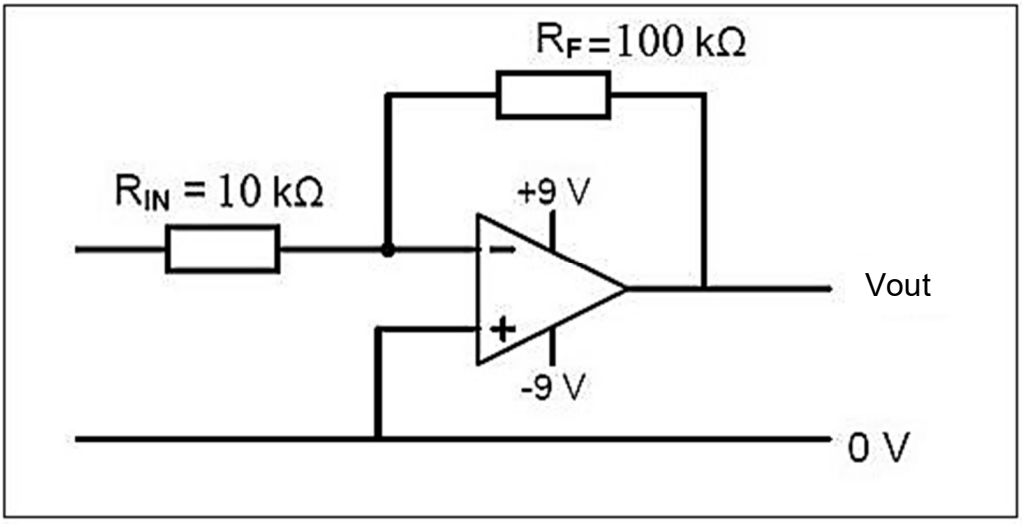


FIGURE 3.2: OPERATIONAL AMPLIFIER

3.2.1	Identify the circuit in FIGURE 3.2.	
		(1)

3.2.2	Calculate the voltage gain of the circuit in FIGURE 3.2	
		(3)

3.2.3	Name the type of feedback used in FIGURE 3.2.	
		(1)

3.3	Explain the term *common-mode rejection ratio* with reference to operational amplifier characteristics.	
		(2)

3.4	State TWO advantages of an operational amplifier.	
		(2)

3.5 FIGURE 3.5 below shows the 555 timer. Answer the questions that follow.

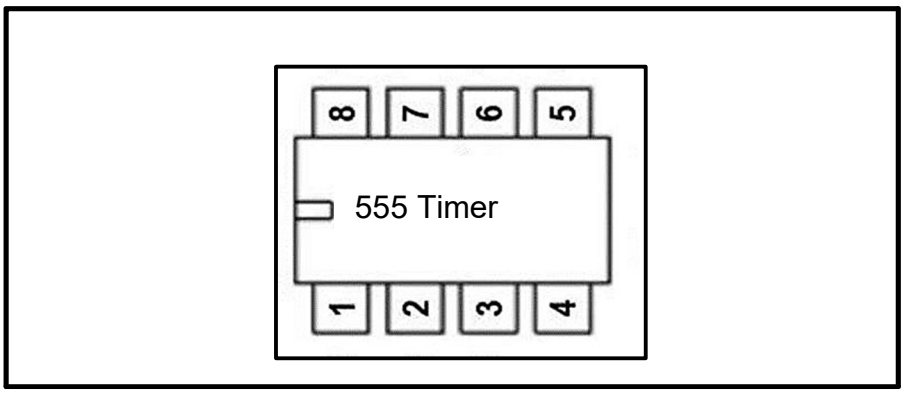


FIGURE 3.5: 555 Timer

3.5.1	Name the TWO primary building blocks of a 555 timer.	
		(2)

3.5.2	Explain the function of the output driver circuit in the 555 timer.	
		(2)

3.5.3	Explain the purpose and function of pin 7 of the 555 timer.	
		(2)

3.5.4	Briefly describe what happens when the voltage at pin 2 falls below $\frac{1}{3}$ of the supply voltage.	
		(2)

3.5.5	Name TWO applications of the 555 timer.	
		(2)

3.5.6	One of the functions of the 555 timer is to solve switch bounce. Explain switch bounce and the function of a de-bounce circuit.	
		(4)

3.6	In an astable multivibrator using 555 timer IC, if values of R1, R2 and C are 47 kΩ, 100 kΩ and 10 µF respectively, calculate the time period of the output waveform.	
		(3)

3.7 Refer to FIGURE 3.7 below and answer the questions that follow.

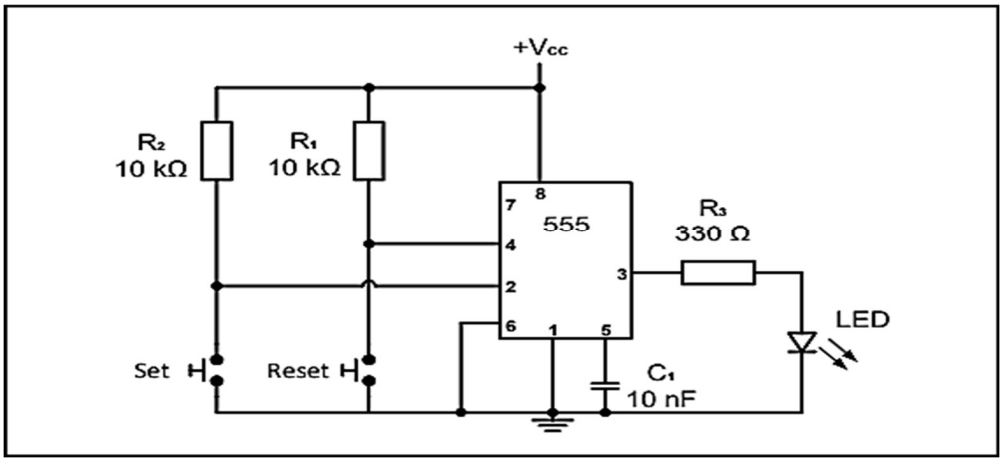


FIGURE 3.7: 555 IC BISTABLE MULTIVIBRATOR

3.7.1	State the typical operating voltages for a 555 IC.	
		(1)

3.7.2	Explain the operation of the 555 IC when connected in bistable mode.	
		(3)

[40]

QUESTION 4: SWITCHING AND CONTROL CIRCUITS

4.1 Study the circuit diagram in FIGURE 4.1 and answer the questions that follow.

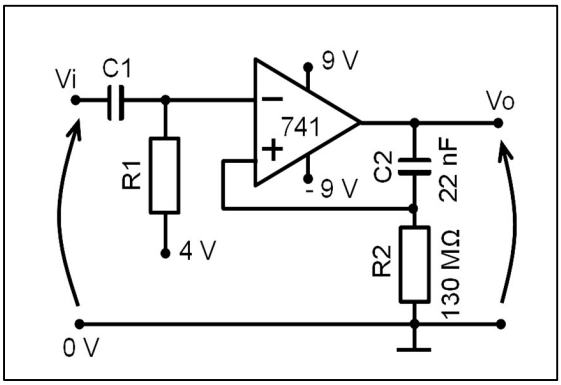


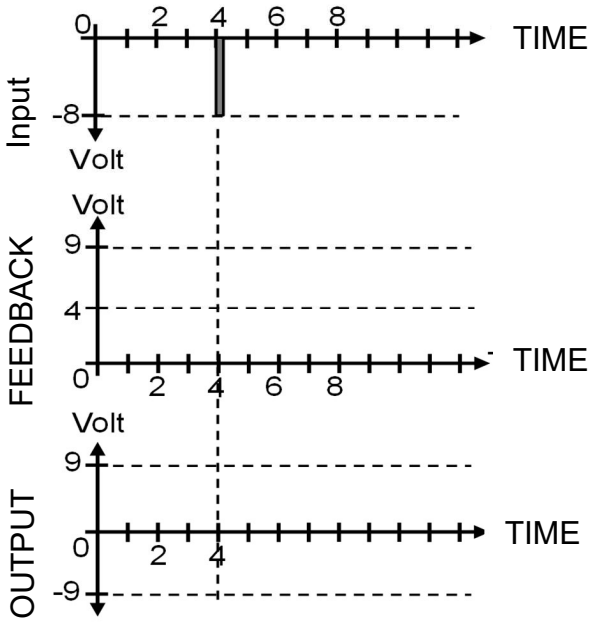
FIGURE 4.1

4.1.1	Identify the circuit in FIGURE 4.1.	
		(1)

4.1.2	Determine the stable state voltage of the circuit. Motivate your answer.	
		(2)

4.1.3	Calculate the time that the circuit would remain in its unstable state.	
		(3)

4.1.4 Complete the feedback and output wave forms for the given input of the circuit.



(4)

4.2 Study FIGURE 4.2 of the 741-operational amplifier, and answer the questions that follow.

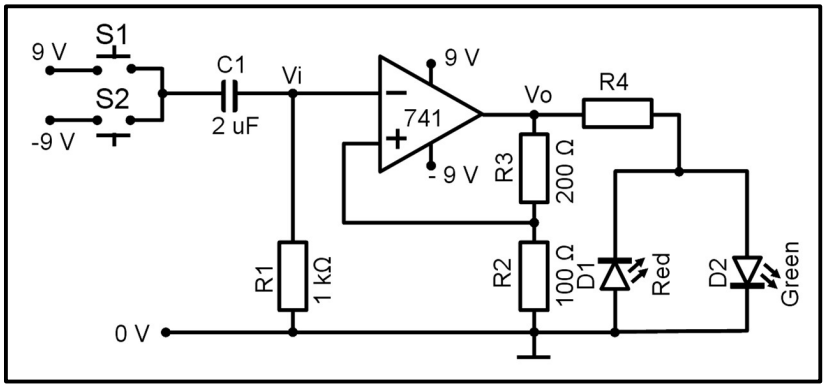


FIGURE 4.2

4.2.1	Identify the mode of operation of the circuit.	
		(1)

4.2.2	Determine the output voltage of the circuit if the green LED is on. Motivate your answer.	
		(2)

4.2.3	Explain which LED will be lit when switch S1 is pressed.	
		(2)

4.2.4	Explain why the output does not change state when the input voltage to the inverting input falls back to 0 V after the initial input pulse.	
		(4)

4.2.5	What is the combined purpose of capacitor C1 and resistor R1 in the circuit?	
		(1)

4.3 A 741-operation amplifier is used in a circuit as shown in FIGURE 4.3 below. The input waveform to the circuit is also shown. Study the circuit and waveform and answer the questions that follow.

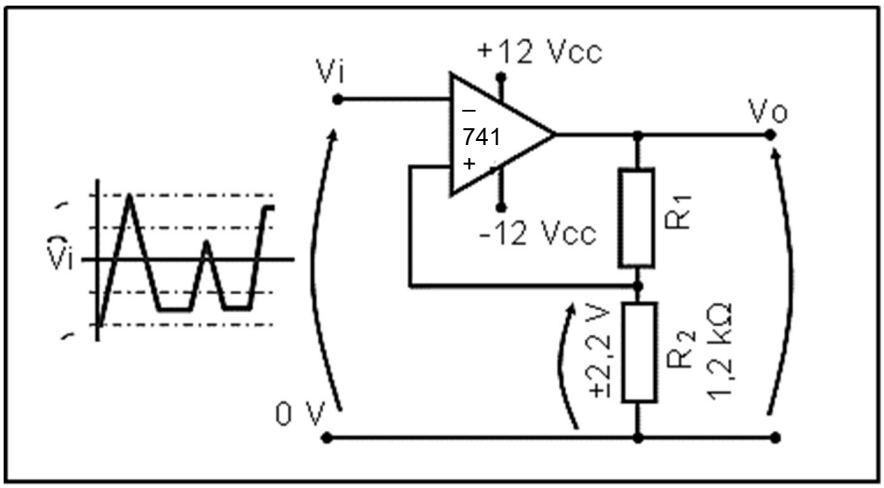
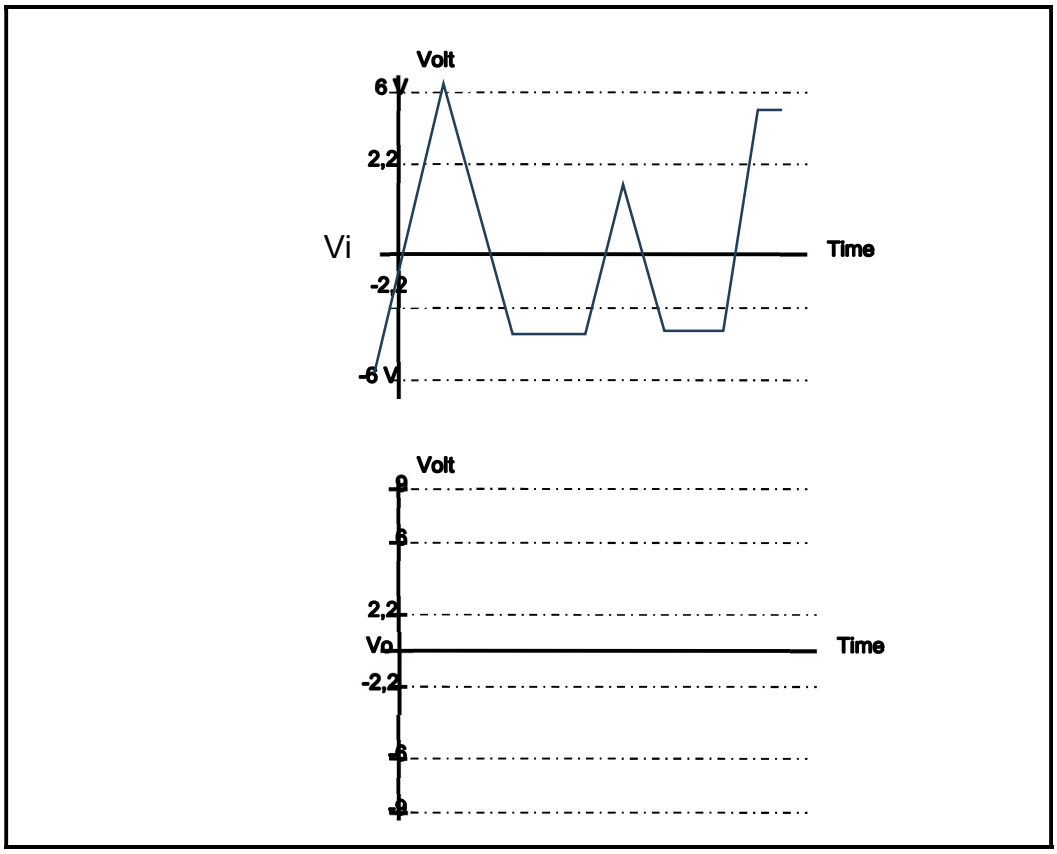


FIGURE 4.3

4.3.1	Identify the type of circuit used in FIGURE 4.3.	
		(1)

4.3.2	Explain the basic operation of the circuit.	
		(6)

4.3.3 Draw the output waveform of the circuit on the diagram below.



(3)

4.3.4	Calculate the value of resistor R1 in the circuit.	
		(3)

4.4 Draw a neatly labelled circuit diagram of a 555-timer IC used as an astable multivibrator, in the space provided below. The discharge circuit consists of a 10 kΩ resistor and a 100 uF capacitor. The other components have unknown values. The supply voltage to the circuit is 9 V.

(7)

4.5 A monostable 555-timer circuit diagram is shown in FIGURE 4.5 below. Study the circuit diagram and answer the questions that follow.

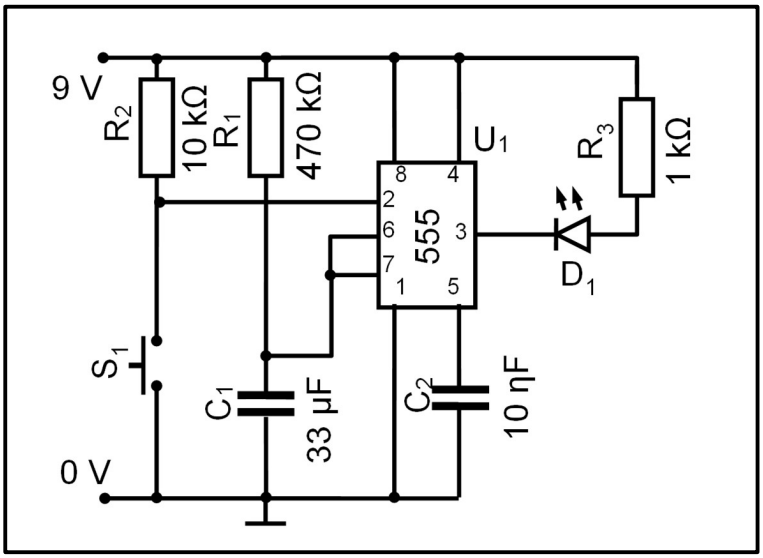


FIGURE 4.5

4.5.1	Explain the function of resistor R_2 in the circuit.	
		(2)

4.5.2	Calculate the time that the circuit would be in its unstable state.	
		(3)

4.5.3	Will the LED be lit when the circuit is in its unstable state? Motivate your answer.	
		(2)

4.5.4	Explain the reaction of the circuit after switch S_1 was pressed.	
		(5)

4.6 An operational amplifier circuit is shown in FIGURE 4.6 below. Study the circuit and answer the questions that follow.

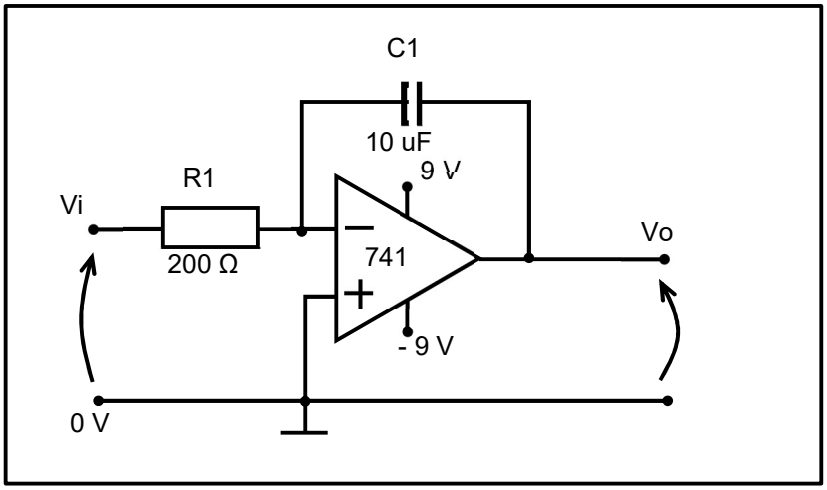


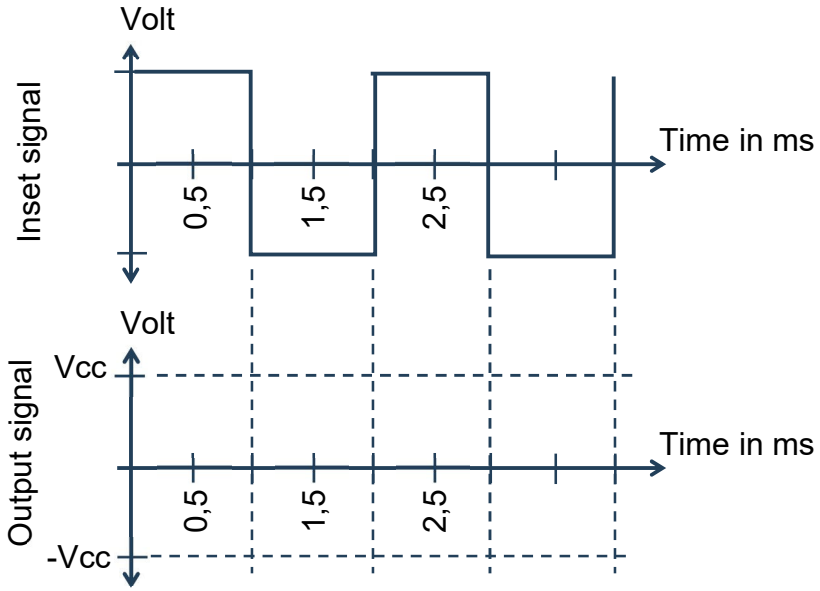
FIGURE 4.6

4.6.1	Identify the circuit shown in FIGURE 4.6.	
		(1)

4.6.2	Calculate the time constant of the circuit.	
		(3)

4.6.3	Explain how the output signal will react if the negative supply is removed from the corresponding pin, and the pin is then connected to 0 V.	
		(1)

4.6.4	The input signals to the circuit are shown on the diagram below. Draw the relevant output signals for the input signal when the RC-time constant for the circuit is 2 milliseconds on the diagram.	(3)



[60]

QUESTION 5: DIGITAL AND SEQUENTIAL DEVICES

5.1	Explain the difference between a *common anode* and a *common cathode 7-segment LED display unit.*	(4)

5.2 A decade counter 7-segment LED display driver is shown in FIGURE 5.2. Study the figure and answer the questions that follow.

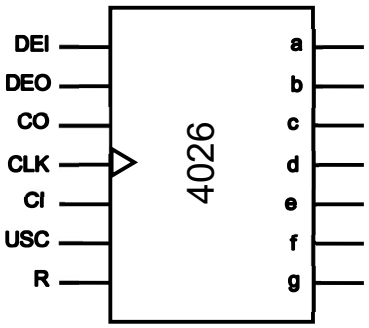


FIGURE 5.2

5.2.1	Discuss the reason for the use of the decade counter 7-segment LED display driver.	
		(3)

5.2.2	Explain the application of terminals **a** to **g** of the 4026 IC.	
		(2)

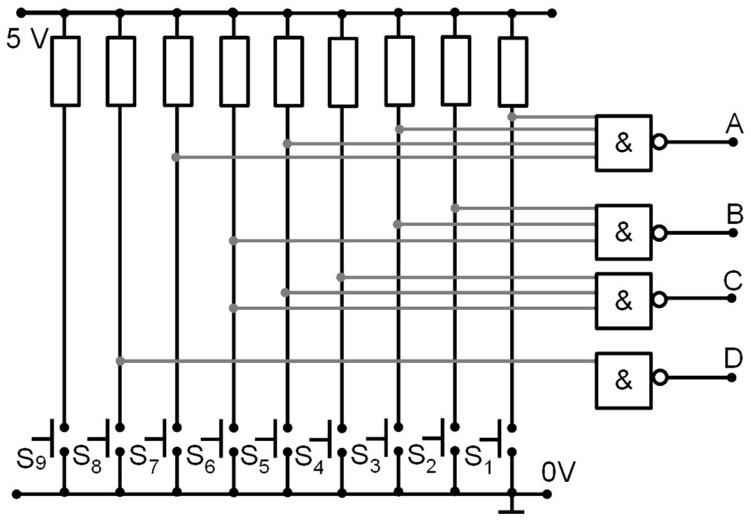
5.2.3	Explain the function and use of terminal C_O of the 4026 IC.	
		(2)

5.3	The diagram below shows a selective part of the truth table of a full adder. Complete the truth table by filling in the missing information in the shaded blocks.	

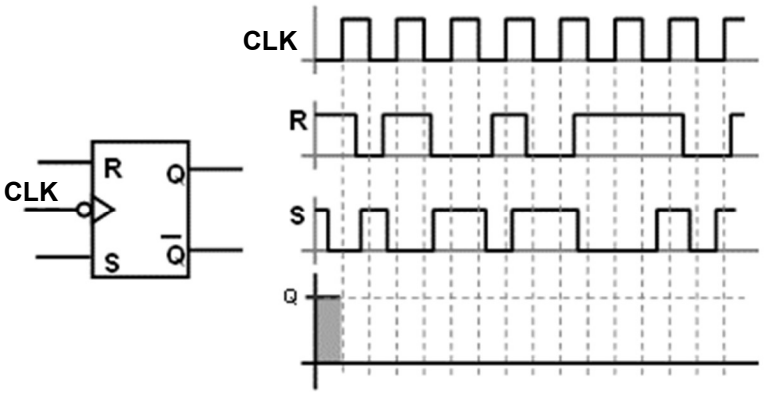
A	B	C	SUM	Co
1	1	1		
1	1	0		0
1	0	0		0
1	0	1		

(6)

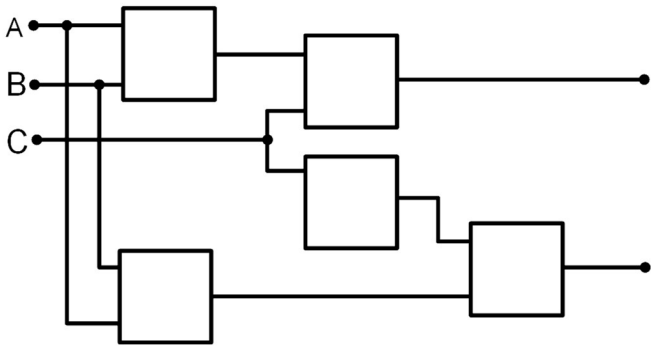
5.4	A part of a decimal to binary encoder is shown below. Study the diagram and complete the diagram by adding the missing information.	

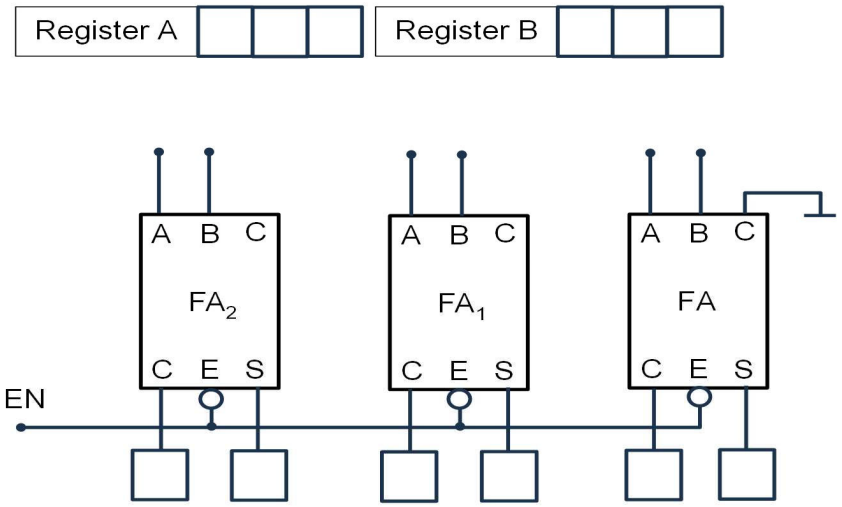


(4)

5.5	The IEC symbol of an RS-latch with a waveform is shown below. Study the wave diagram and then complete the output wave on the diagram.	
		(8)

5.6	Explain the difference between a *full adder* and a *half adder.*	
		(4)

5.7	An incomplete full adder is shown below. Study the circuit diagram and then complete it by adding the missing information.	
		(7)

5.8	An incomplete binary adder capable of adding 1_2 and 111_2 is shown below. Study the diagram and then complete the diagram by filling in the missing information in the blocks provided and completing the connections between the adders and the registers.	
		(10)

5.9 A MOD16 asynchronous ripple counter is shown below.

Study the circuit diagram and answer the questions that follow.

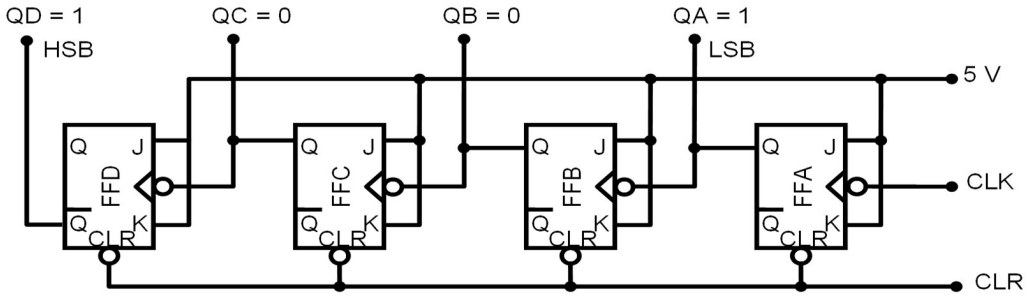
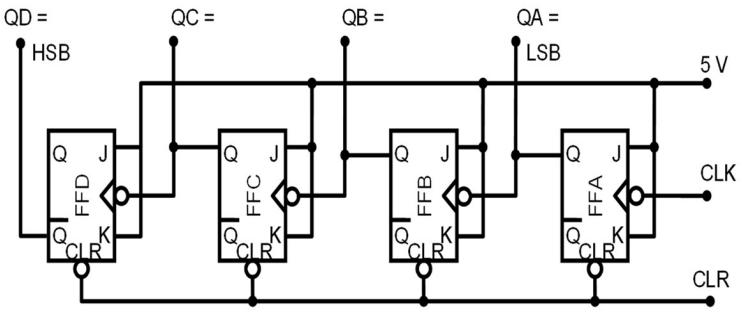
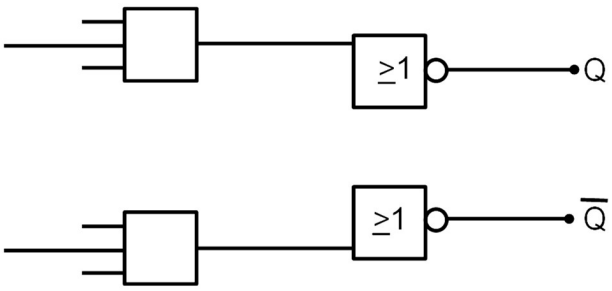


FIGURE 5.9

5.9.1	Identify the counter type in FIGURE 5.9.	
		(1)

5.9.2	Explain in chronological steps the functioning of the counter for TWO clock pulses counting from 1001_2.	
		(10)

5.9.3	Change the counter into a truncated counter that counts up to 110_2 and then resets back to 000_2. Indicate your changes on the circuit diagram shown below.  	(5)

5.10	Complete the logic gate diagram of a JK-latch shown below.	
		(8)

5.11	State ONE function of shift registers.	
		(1)

[75]

ADDITIONAL SPACE

ADDITIONAL SPACE

TOTAL: 200

END

FORMULA SHEET

SEMICONDUCTOR DEVICES

$Gain\ A_V = \frac{V_{out}}{V_{in}}$ **OR** $Gain\ A_V = -\left(\frac{R_F}{R_{in}}\right)$ **OR** $Gain\ A_V = 1 + \frac{R_F}{R_{in}}$

$V_{out} = V_{in} \times \left(-\frac{R_F}{R_{in}}\right)$

$V_{out} = V_{in} \times \left(1 + \frac{R_F}{R_{in}}\right)$

SWITCHING CIRCUITS

$V_{out} = -\left(V_1 \frac{R_F}{R_1} + V_2 \frac{R_F}{R_2} + \ldots V_N \frac{R_F}{R_N}\right)$

$Gain\ A_V = \frac{V_{out}}{V_{in}}$ **OR** $Gain\ A_V = \frac{V_{out}}{V_1 + V_2 + \ldots V_N}$

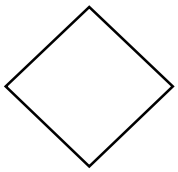
$V_{out} = -(V_1 + V_2 + \cdots V_N)$

$V_{FB} = V_{SAT} \times \frac{R_2}{R_1 + R_2}$

$V_{TRIG} = V_{out} \times \frac{R_2}{R_1 + R_2}$

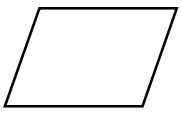
FLOW CHART SYMBOLS

Process



Decision

Terminator



Data

GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

JUNE EXAMINATION
GRADE 12

2026

ELECTRICAL TECHNOLOGY:
DIGITAL ELECTRONICS

ELECTRICAL TECHNOLOGY: Digital

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