 Province of the

EASTERN CAPE

EDUCATION

**DIRECTORATE SENIOR CURRICULUM MANAGEMENT (SEN-FET)**

**HOME SCHOOLING SELF-STUDY WORKSHEET ANSWER SHEET**

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| **SUBJECT** | ELECTRONICS | **GRADE** | 12 | **DATE** | JUNE 2020 |
| **TOPIC** | SWITCHING CIRCUITS | **TERM 1****REVISION** | (Please tick) | **TERM 2 CONTENT** | (√ ) |

**ANSWERS TO QUESTIONS**

**1.1 THREE types of multivibrators.**

* Monostable multivibrator

• Bi-stable multivibrator

• Astable multivibrator

1.2.1 Bi-stable multivibrator

**1.2.2 Bi-stable multivibrator Circuit diagram operation.**

* This op amp operates as a comparator. 
* Any difference between its two input causes its output to go into either positive saturation (+VSAT) or negative saturation (-VSAT). 
* The non-inverting input is fed by a fraction of the output voltage fed-back from the voltage divider pair of R2 and R3. 
* If the output voltage is high (+VSAT) then the non-inverting terminal voltage will be a smaller positive voltage and if the output is low (-VSAT) the non-inverting input terminal voltage will be a smaller negative voltage.

**1.3 Two applications of a Mono-stable multivibrator**

• De-bouncing

• Varying the time period

**1.4 Schmitt trigger circuit diagram.**

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**1.5** **Four applications of a Schmitt trigger**

* It is widely used in the first stages of many radio receivers, especially in digital applications where it is used to clean up a signal which has been distorted of which has had some noise added during its transmission through the air. 
* In digital circuitry noise is often introduced into a system via switch bounce which can cause a number of unwanted voltage spikes to appear during the switching-on period. 
* Varying input waveforms, for example a sine wave can be changed into a square or rectangular wave. 
* A signal can be successfully recovered using a Schmitt trigger even after having suffered severe distortion as the circuit will only sense a single level change, so eliminating all other noise spikes.

**1.6 Draw a fully labelled circuit diagram of a monostable multivibrator.**

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**1.7 Sketch a fully labelled circuit diagram for a 555 IC Astable multivibrator circuit also showing input and output waveforms.**

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**1.8** **Summing amplifier diagram and calculation of the circuit output voltage.**

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**Circuit output voltage**

$V\_{out}= -(V\_{1}\frac{R\_{F}}{R\_{1}}+V\_{2}\frac{R\_{F}}{R\_{2}}+V\_{3}\frac{R\_{F}}{R\_{3}})$

$V\_{out}= -(100 mV×\frac{100 kΩ}{20 kΩ}+200 mV×\frac{100 kΩ}{10 kΩ}+300 mV×\frac{100 kΩ}{50 kΩ})$

$V\_{out}= -3,1 V$

1.9 Given the circuit diagram below:

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**1.9.1 TWO full cycles of the input and output waveforms for the circuit above, if a sinusoidal waveform was added to its supply.**

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1.10 Passive RC differentiator

1.10.1 The output wave form.

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**1.11 Operation of an integrator.**

* The op-amp’s inputs draw zero current so any input current is passed through to the feedback circuit. 
* The op-amp’s two inputs are viewed as both possessing the same voltage at all times,  if the lower input is connected to ground, this introduces the virtual earth concept. 
* When a constant current is fed to a capacitor, it will charge at a constant fixed rate rather than exponential.

**1.12 A circuit diagram of an op-amp integrator.**

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**1.13 A 555 Astable multivibrator.**

1.13.1 Charging time.

$Changing time=0, 693 (R\_{1}+R\_{2})×C$

 $=0, 693(470×10^{3}+5×10^{3})×1×10^{-6}$

$ =0, 33 sec$

1.13.2 Discharging time.

$Discharging time=0, 693 × R\_{1}×C$

 $=0, 693×5×10^{3}×1×10^{-6}$

 $=3, 47milli seconds$

1.13.3 Time to complete one cycle.

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| $T= t\_{1}+t\_{2}$ $= 0, 33+ 3, 47×10^{-3}$ $=0, 33 sec$ |

1.13.4 Frequency of oscillation.

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| $f= \frac{1}{T}= \frac{1, 44}{(R\_{1}- 2R\_{2})×C}$ $ =$ $\frac{1, 44}{(470×10^{3}×+2×5×10^{3})×1×10^{-6}}$ $ = 3Hz$ |
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