



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

RADIO THEORY N3

5 AUGUST 2019

This marking guideline consists of 6 pages.

QUESTION 1

1.1 From the oscilloscope 1 cycle = $2 \times 0,5 \mu\text{s}$ ✓
 $= 1 \mu\text{s}$ ✓

$$\therefore f = \frac{1}{T} = \frac{1}{1 \times 10^{-6}} = 1 \text{ MHz} \checkmark$$

Receiver tuned to: $1 \text{ MHz} + 455 \text{ kHz} = 1\,455 \text{ kHz}$ OR $1,455 \text{ MHz}$ ✓

(4)

1.2 $V_{\text{max}} = 0,1 \times 4 = 1,4 \text{ V}$ ✓

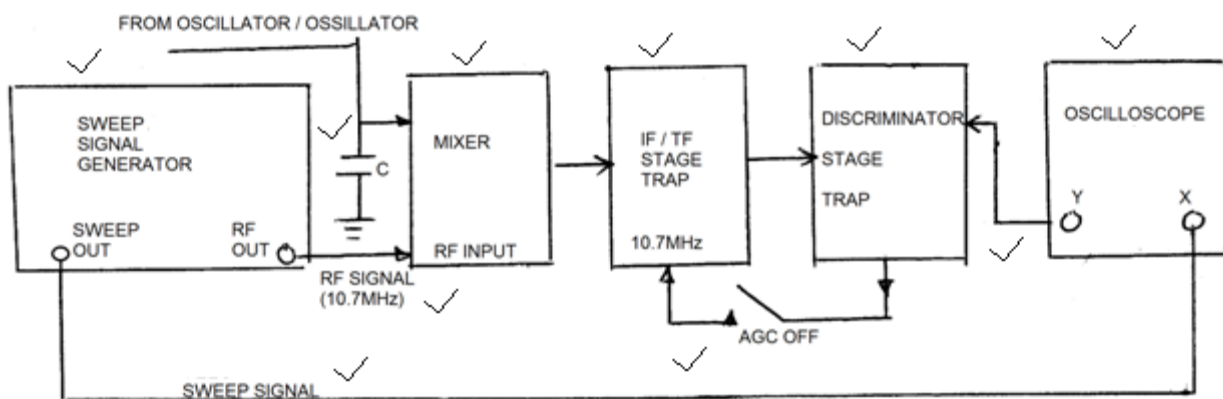
$\text{RMS} = 0,707 \times V_{\text{max}}$ ✓ $\text{average} = 0,637 \times V_{\text{max}}$

$$= 1,4 \times 0,707 \checkmark$$

$$= 1,4 \times 0,637 \checkmark$$

$$= 0,9898 \text{ V} \checkmark$$

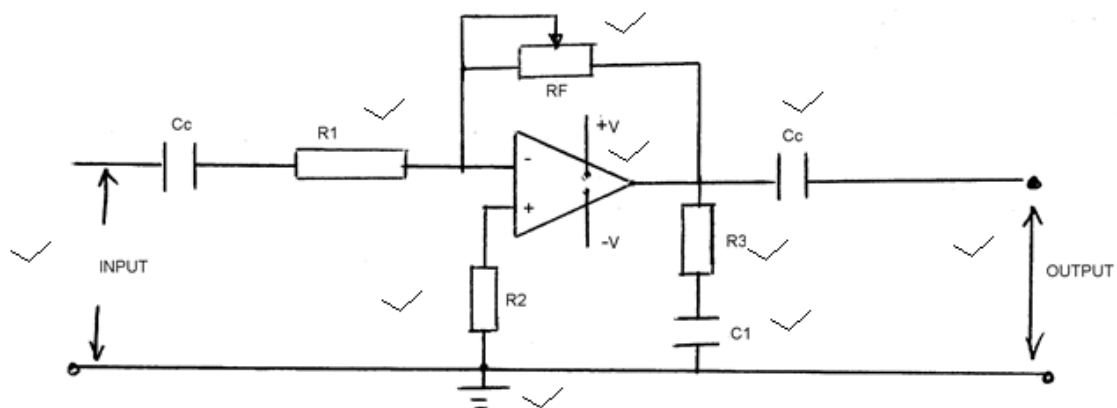
$$= 0,892 \text{ V} \checkmark$$

(6)
[10]**QUESTION 2**

[10]

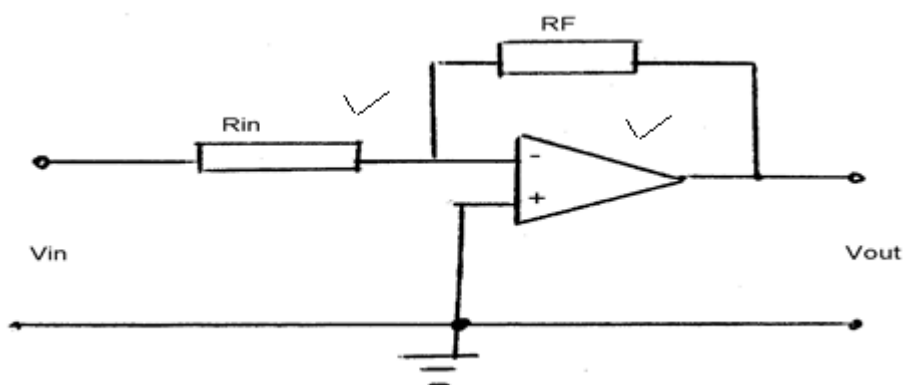
QUESTION 3

3.1



(10)

3.2



(2)

3.3

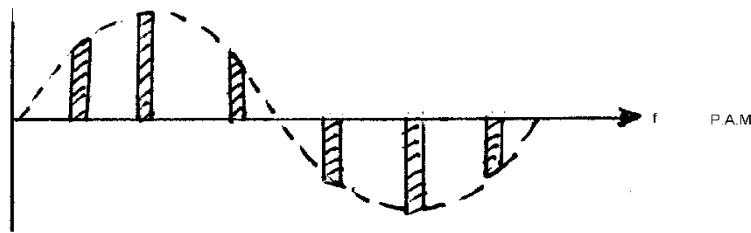
$$\begin{aligned}
 V_{out} &= \frac{-R_F}{R_{in}} \times V_{in} \checkmark \\
 &= \frac{-400}{200} \times 5 \checkmark \\
 &= -10 \text{ V} \checkmark
 \end{aligned}$$

(3)
[15]**QUESTION 4**

- 4.1 capacitor
- 4.2 Space
- 4.3 index
- 4.4 more
- 4.5 audio
- 4.6 gain
- 4.7 unidirectional
- 4.8 fast
- 4.9 detector
- 4.10 Delta
- 4.11 oscilloscope
- 4.12 bending
- 4.13 90°
- 4.14 capstan
- 4.15 local oscillator

QUESTION 5

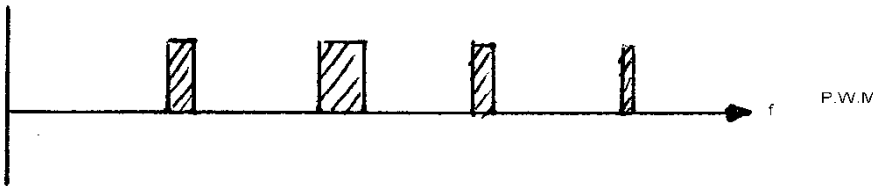
5.1



The amplitude of each sample is varied in sympathy with the signal to be transmitted.

(2)

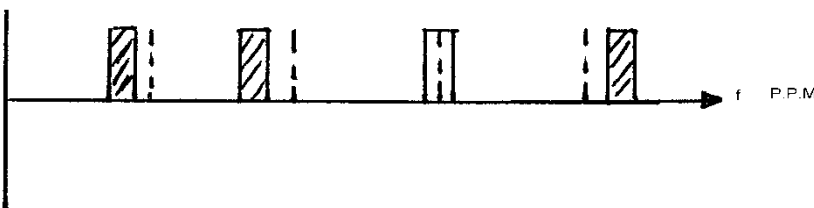
5.2



The amplitude of each sample is kept constant and the width or duration is varied about a fixed value.

(3)

5.3



The amplitude of the sample is kept constant but the position of the pulse is varied about some reference position.

(3)

[8]**QUESTION 6**

6.1

AGC is needed to automatically✓ adjust the RF and especially the IF gain✓ level so that output of the receiver is held substantially constant✓ despite changes in the amplitude✓ of the level of the input signal.

(4)

6.2

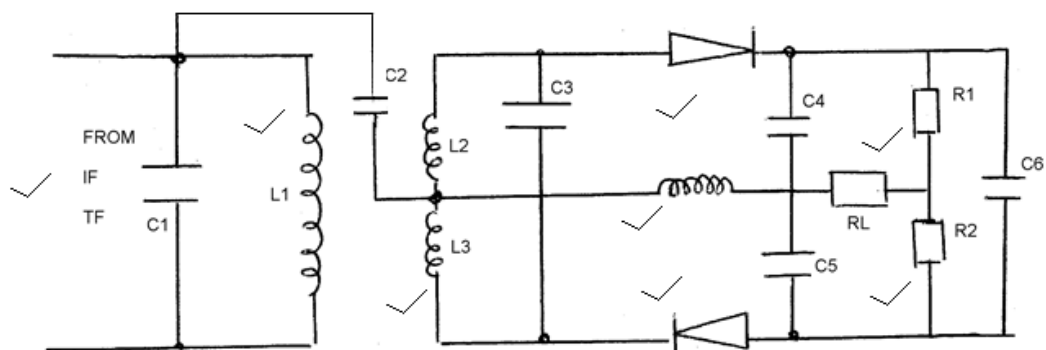
Selectivity is the ability of an amplifier to select one desired frequency from all the others and amplify it to a usable level. Sensitivity is the ability of an amplifier to pick out and amplify a specific small signal and amplify it to a usable level.

(3)

[7]

QUESTION 7

7.1



(8)

- 7.2 The purpose of the detector is to change the frequency or amplitude of the RF signal caused by modulation to proportional current✓ and to filter out the RF signal (carrier)✓ or to regain the signal (information) and eliminate (filter out) the carrier.✓ (Any 2 × 1) (2)
- 7.3 455 kHz (1)
- 7.4 IF amplifier (2)
- 7.5 Employs a limiter that eliminates noise variations on the signal (2)
- [15]**

QUESTION 8

- 8.1 This is the result of change in the refractive index✓ of the atmosphere at the boundary between the air masses of differing temperatures and humidity.✓ The more dense air at lower levels✓ and cooler, the less dense air at higher altitudes can form a duct in which radio wave can propagate for long distances.✓ The duct imparts a downward curvature to the radio wave travel.✓ (5)
- 8.2 This is caused by irregularities✓ in the atmosphere in which the refractive index differs✓ from the mean value of the surrounding areas. The scattering effect takes place by partial reflection✓ and is closely associated with temperature and humidity changes. Scattering results in a very large transmit signal loss✓ and at the receiving end it results in a continuously fluctuating signal.✓ (5)
- [10]**

QUESTION 9

- 9.1 The capstan drive uses a spindle✓ or capstan to control the length✓ of tape✓ per second and so ensures a constant drive. The capstan has a large flywheel✓ to eliminate variations✓ in speed. The tape is held against the capstan by means of a pinch wheel.✓ (6)
- 9.2 The bias signal places the audio signal in the linear area of the magnetising curve of the tapes and has the following advantages:
- Better linearity
 - Less distortion
 - Reduced tape noise (good signal to noise ratio)
 - Larger output signal swing
- (4)
[10]
- TOTAL: 100**