higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

COMMUNICATION-ELECTRONICS N4

21 November 2023

This marking guideline consists of 7 pages.

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QUESTION 1

1.1 False
1.2 True
1.3 True
1.4 True
1.5 False
1.6 False
1.7 True
1.8 False
1.9 True
1.10 False

(10 × 1) **[10]**

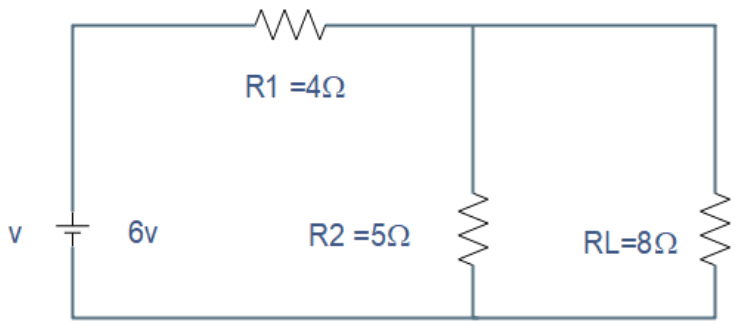
QUESTION 2

2.1 2.1.1 In any network with two or more sources of voltage, the current in the different circuits may be calculated by considering each source separately.

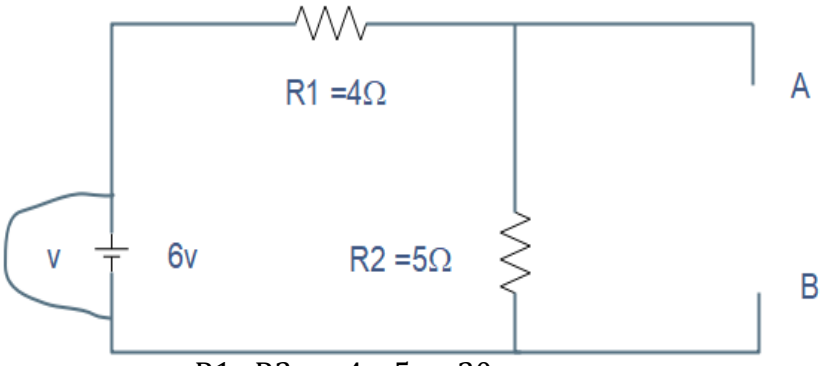
2.1.2 Any two-terminal network of impedances and generators may be replaced by a single equivalent-voltage generator and series impedance.

(2 × 2) (4)

2.2

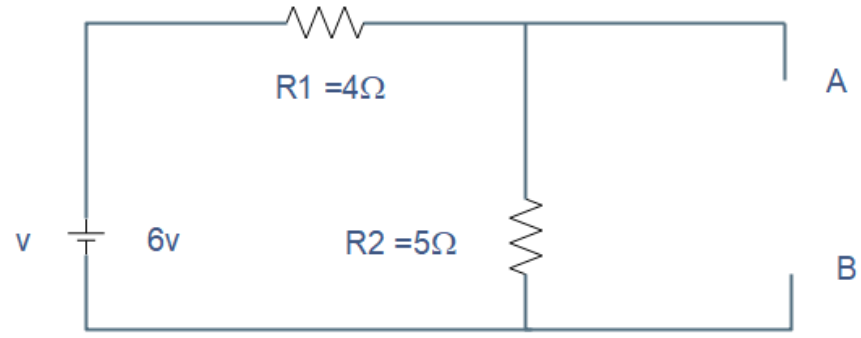


Remove R_L and short-circuit battery.



$$RAB = RTH = \frac{R1x\,R2}{R1 + R2} = \frac{4\,x\,5}{4 + 5} = \frac{20}{9} = 2{,}222\Omega\surd\surd$$

Replace battery and leave AB open.



RT = R1 + R2 = 4+5 =9Ω√

$$It = \frac{V}{Rt} = \frac{6}{9} = 0{,}667\ A\sqrt{}\sqrt{}$$

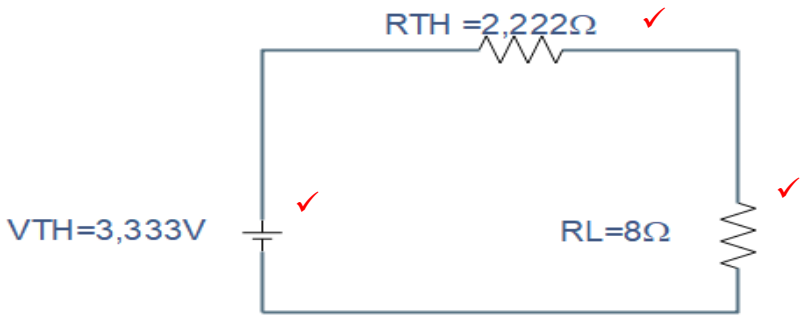
VAB =VTH = It x R2 = 0,667 x 5 =3,333V √√

Or

$$VAB = VTH = \frac{R2}{R2 + R1}\ x\ Vt$$

$$= \frac{5}{5+4}\ x\ 6 = 3{,}333A\ \sqrt{}\sqrt{}$$

Thevenin's Equivalent circuit

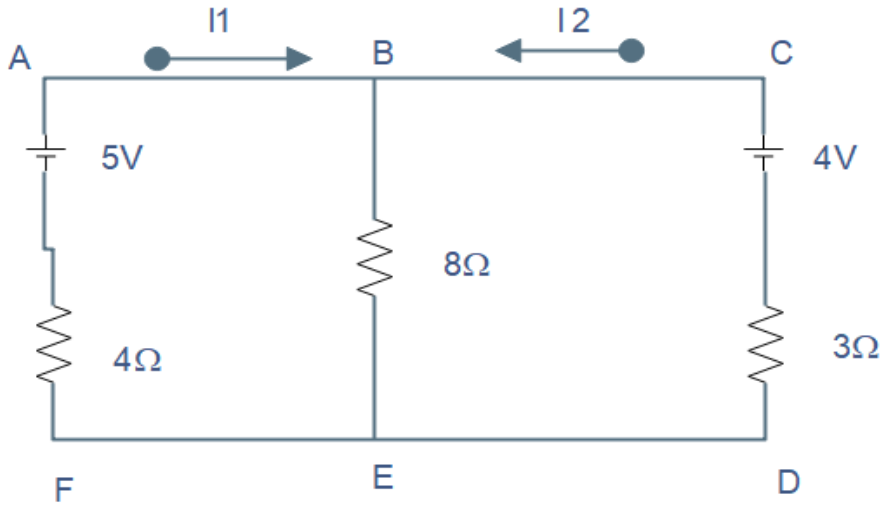


(10)
[14]

QUESTION 3

3.1

- Inductive reactance will be equal to the capacitive reactance√
- Circuit impedance will be at minimum (Z=R) √
- The current will be at maximum √
- The angle will be zero √
- VL will be equal to Vc √
- The frequency will be: $Fr = \frac{1}{2\pi\sqrt{LC}}$ √
- Power factor will be equal to 1√ (Any correct 3 × 1) (3)



Consider Loop ACDF
$5 = 4 - 3I_2 + 4I_1$
$1 = 4I_1 - 3I_2$----------(1)√

Consider Loop ABEF
$5 = 8(I_1 + I_2) + 4I1$
$5 = 8I_1 + 8I_2 + 4I_1$
$5 = 12I_1 + 8I_2$----------(2)√

(1) x 3
$3 = 12I_1 - 9I_2$----------(3)√
-
$5 = 12i_1 + 8I_2$----------(2)√
$-2 = -17I_2$

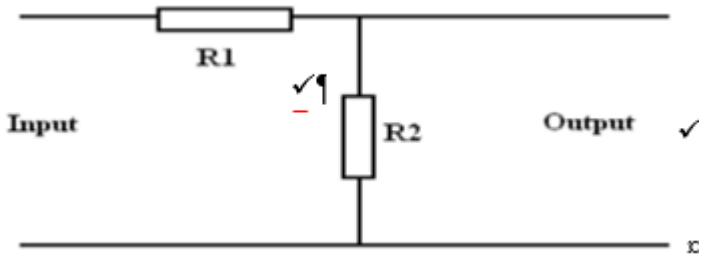
$I_2 = 0,118A$√

Sub I_2 IN (1)
$1 = 4I_1 - 3(0,118)$√
$1 = 4I_1 - 0,354$
$4I_1 = 1 + 0,354$
$4I_1 = 1,354$
$I1 = 0,339A$√ (7)

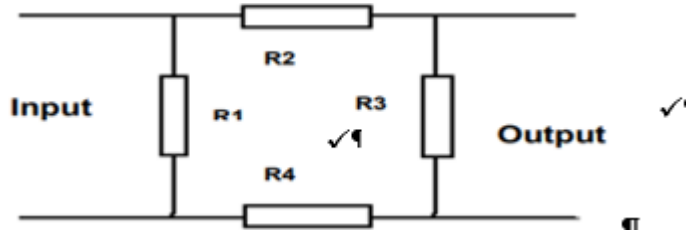
[10]

QUESTION 4

4.1 4.1.1

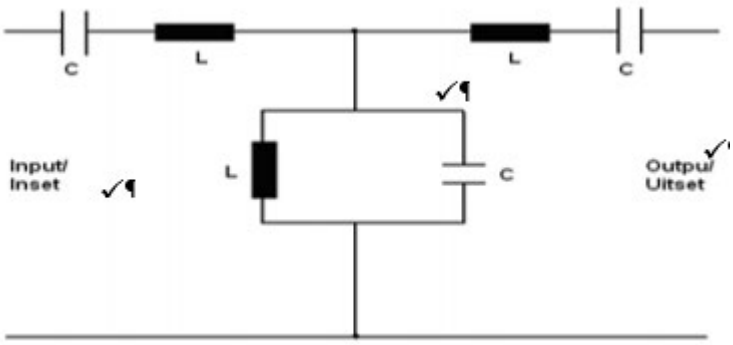


4.1.2



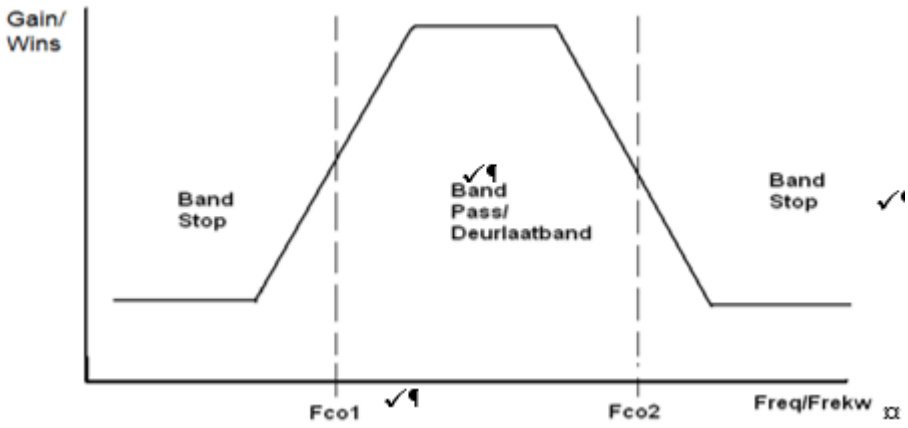
(2 × 2) (4)

4.2



(2)

4.3



(3)
[10]

QUESTION 5

5.1
- Amplitude Modulation.
- Frequency Modulation.
- Phase Modulation.
- Pulse modulation.√

(Any correct 3 × 1) (3)

5.2 5.2.1 Depth modulation is an extent of variation in the amplitude of the modulated wave.

5.2.2 Pulse Position Modulation (PPM) is an analogue modulating scheme in which the amplitude and width of the pulses are kept constant.

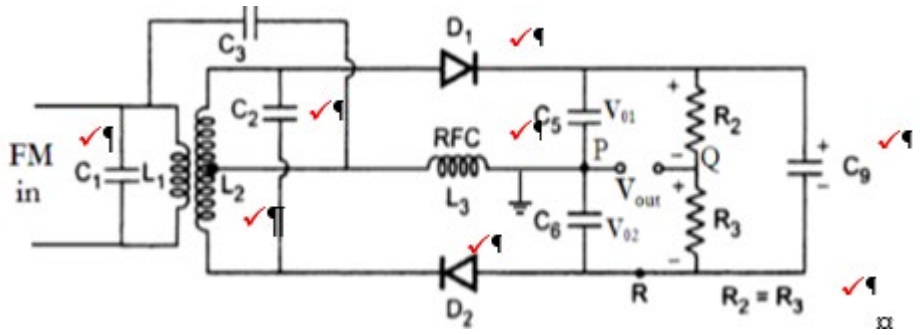
5.2.3 Pulse Amplitude Modulation (PAM) is an analogue pulse modulation scheme in which the amplitudes of a train of carrier pulses are varied according to the sample value of the message signal.

(3 × 2) (6)
[9]

QUESTION 6

6.1 Frequency distortion occurs when the detector discriminates between modulating frequencies. (2)

6.2



(8)
[10]

QUESTION 7

- Antenna: It converts electromagnetic radio waves into an electrical radio frequency current.
- RF amplifier: It matches the input impedance of the receiver to that of the antenna. It uses a tuned circuit to select the desired RF carrier signal. It also provides selectivity to the receiver.
- Mixer: It combines the incoming RF with the frequency of the local oscillator and beats the two frequencies to produce the intermediate frequency, which is the difference between the two frequencies.
- Local oscillator: It produces an RF of constant amplitude and fixed difference frequency above or below the incoming RF. Hence its frequency stability must be particularly high.
- IF amplifier: It provides the main amplification to a receiver and gives a high degree of stability to the IF signal.
- Limiter: It clips the top and bottom of the RF wave, thereby removing any interference which would otherwise give rise to amplitude variations resulting in distortion.
- Discriminator: It discriminates between the carrier and the modulating signal.
- De-emphasis network: It de-emphasises the two unequal modulating signals when the one coming from the transmitter is artificially boosted and should be corresponding at the receiver to improve noise immunity by compensation at the receiver.
- AF and power amp: It amplifies the audio signal to a value sufficient to drive a loudspeaker.
- Loudspeaker: It converts electrical audio frequency signals into mechanical sound waves. (10 × 2) **[20]**

QUESTION 8

8.1 8.1.1 Free-space propagation is when radio waves are not influenced by earth or its atmosphere.

8.1.2 Ground wave propagation is when radio waves follow the surface of the earth.

8.1.3 Ionosphere propagation is when radio waves are refracted by ionised layers in the atmosphere.

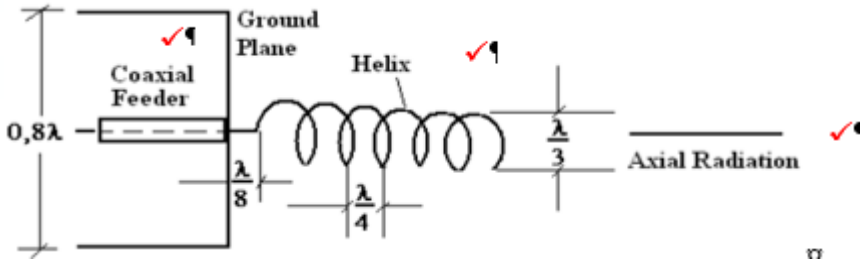
(3 × 2) (6)

8.2 $$\lambda = \frac{V}{F} = \frac{3x10^8}{60x10^6} = 5m\surd$$

$$\text{Length of half} - \text{wave dipole antenna} = \frac{5}{2} = 2.5m\surd$$

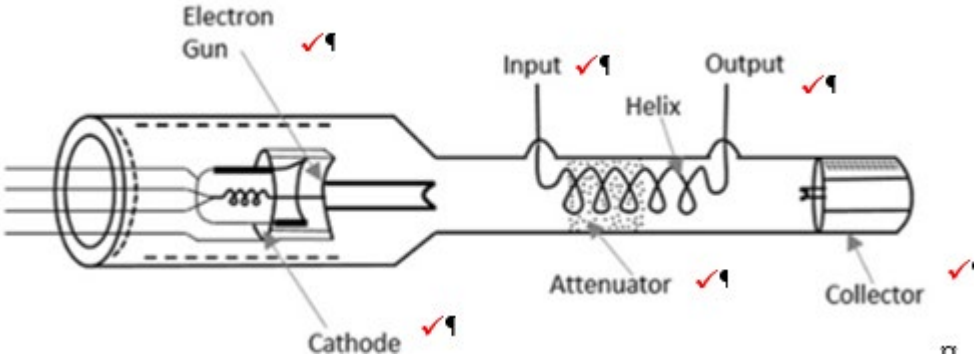
(2)

8.3



(3)

8.4



(6)
[17]

TOTAL: 100

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