higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

NOVEMBER EXAMINATION

COMMUNICATION-ELECTRONICS N4

17 NOVEMBER 2016

This marking guideline consists of 5 pages.

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QUESTION 1

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

(10 x 1) **[10]**

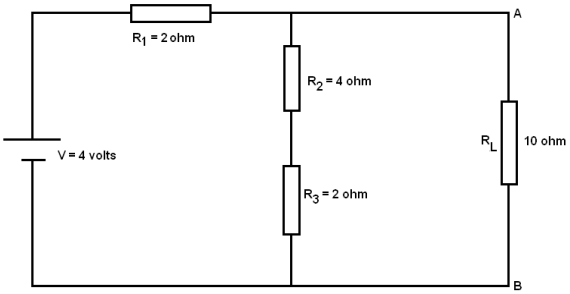
QUESTION 2

2.1 2.1.1 In any closed circuit, the algebraic sum of the products of current and resistance of each part of the circuit is equal to the resultant EMF in the circuit.

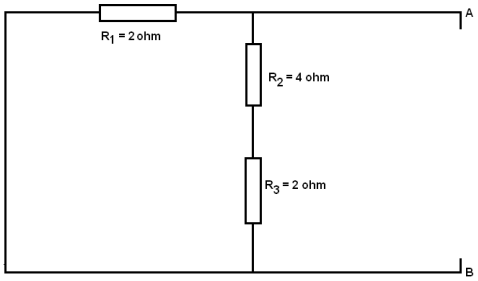
2.1.2 Any two-terminal network of impedances and generators may be replaced by a single, equivalent voltage generator and series impedance.

(2 x 2) (4)

2.2

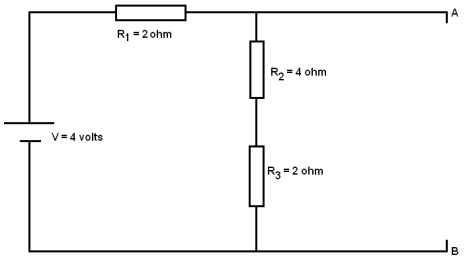


Remove load and short-circuit battery



$$R_{AB} = R_{TH} = \frac{R_1 \times (R_2 + R_3)}{R_1 + (R_2 + R_3)}$$
$$= \frac{2 \times (4 + 2)}{2 + (4 + 2)}$$
$$= 1{,}5 \text{ ohm}$$

Replace battery and leave AB open



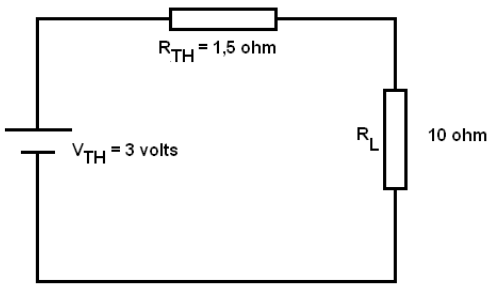
$R_T = R_1 + R_2 + R_3 = 2 + 4 + 2 = 8$ ohm

$V_{AB} = V_{TH} = I_T \times (R_2 + R_3)$

$= 4/8 \times (4 + 2)$ $\quad I_T = V/R_T = 4/8 = 0{,}5$ A

$= 3$ V

Thevenin's equivalent circuit



(6)
[10]

QUESTION 3

3.1 $F_r = 1/ (2\pi \sqrt{LC})$
$= 1/(2\pi \sqrt{(0,1 \times 250 \times 10^{-9})})$
$= 1007$ Hz

3.2 $Z_D = L/(CR)$
$= 0,1/(10 \times 250 \times 10^{-9})$
$= 40\ k\Omega$

3.3 Q-factor $= X_L/R$
$= 2\pi fL/R$
$= 2\pi \times 1\ 007 \times 250 \times 10^{-9}$
$= 63,25$

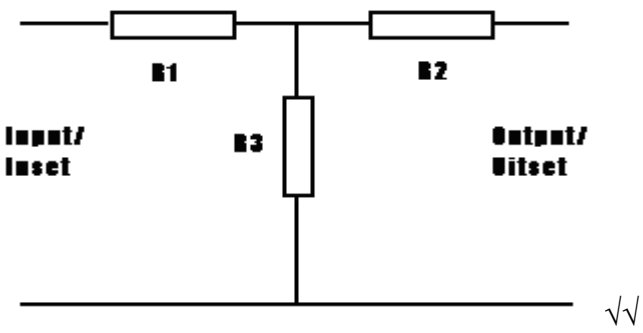
3.4 B-W $= R/2\pi L$
$= 10/2\pi \times 0,1$
$= 15,92$ Hz

3.5 Q-factor $= R^{-1}(\sqrt{L/C})$
$= 10^{-1} (\sqrt{(0,1/250 \times 10^{-9})})$
$= 63,25$

(5 x 2) **[10]**

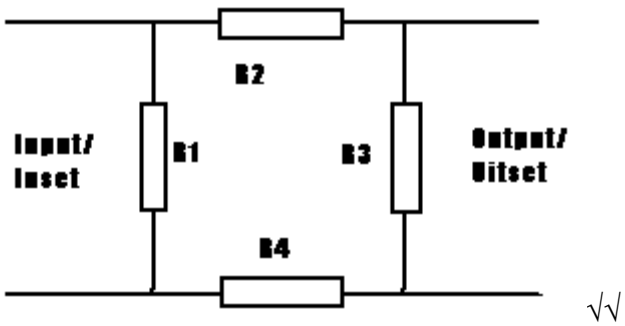
QUESTION 4

4.1 4.1.1



√√

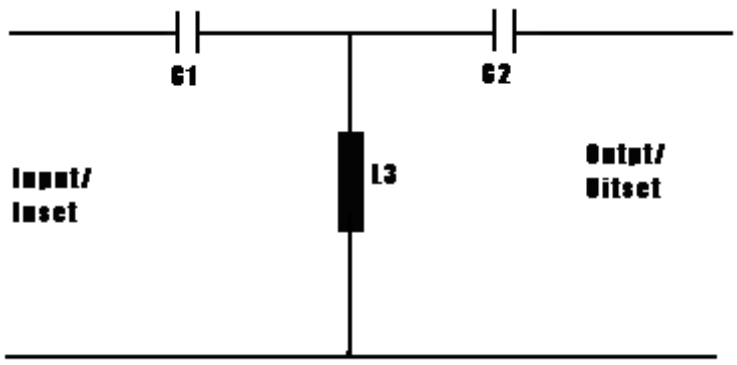
4.1.2



√√

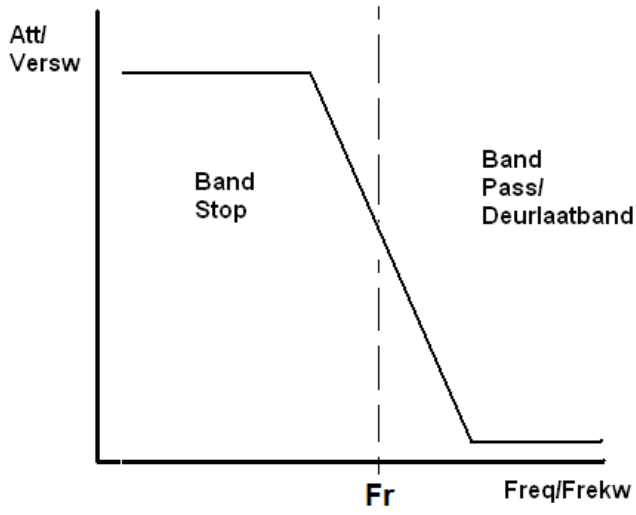
(2 x 2) (4)

4.2



√√√ (3)

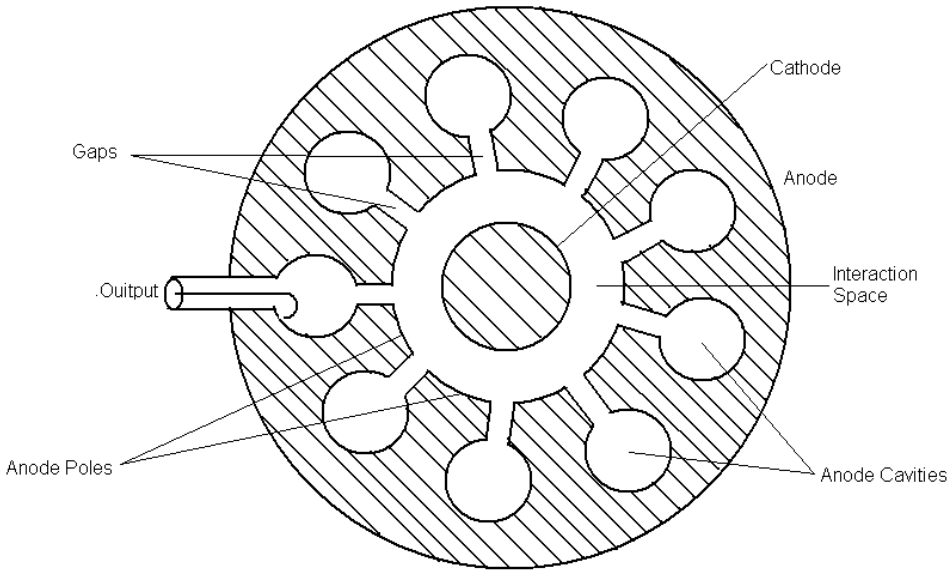
4.3



√√ (3)
[10]

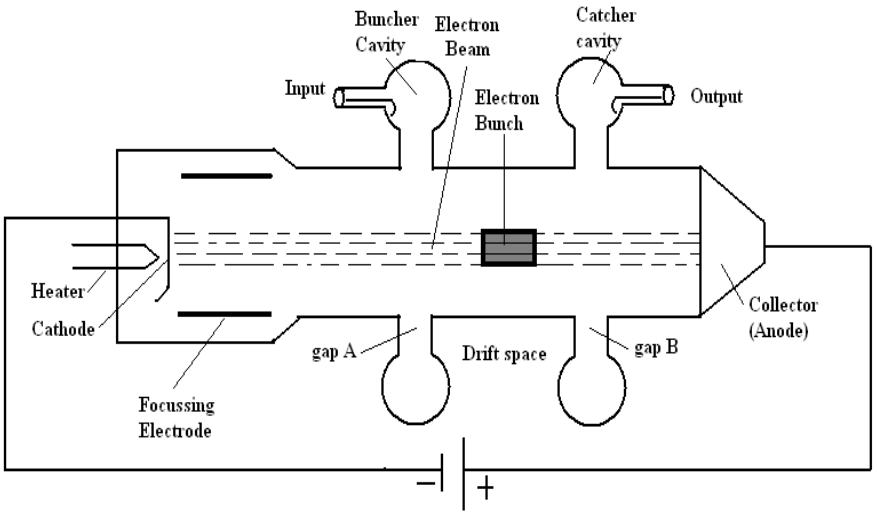
QUESTION 5

5.1



√√√√√

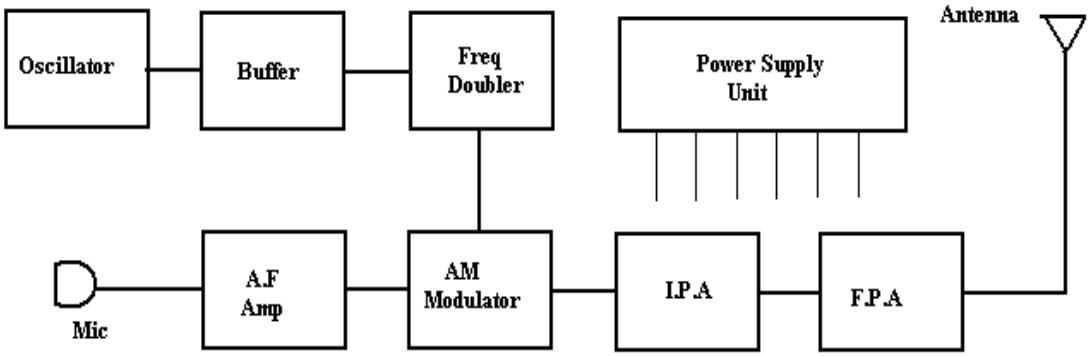
5.2



√√√√√
(2 x 5) **[10]**

QUESTION 6

6.1 **AM-transmitter**



(5)

6.2 Oscillator

- Supplies RF signal (carrier) of constant amplitude and frequency.

Buffer

- Amplifies a small amount only.
- Stabilises the oscillator output.

Frequency doubler

- Doubles frequency (tuned to 2nd harmonic).

Microphone

- Sound waves are converted to electrical currents.

Speech amplifier

- Amplifies the signal from the microphone.

Modulator

- Input: audio signal + carrier
- Output: modulated carrier wave

IPA

- Amplifies the AM signal.

PA (final)

- The modulated carrier is amplified to have sufficient energy to drive antenna circuits.

Antenna

- Converts electric currents into electromagnetic waves which are radiate into free space.

Power-supply unit

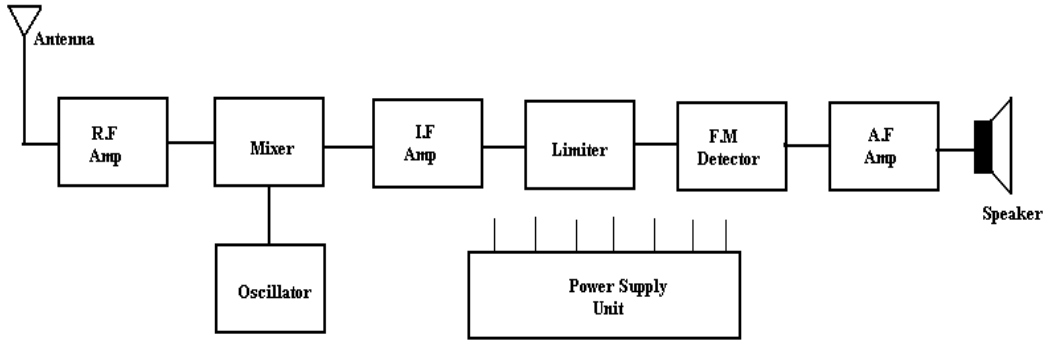
- Supplies regulated DC voltage to all stages. (10 x 1) (10)

6.3 To modulate and demodulate (2)

6.4 Half-wave detector (3)
[20]

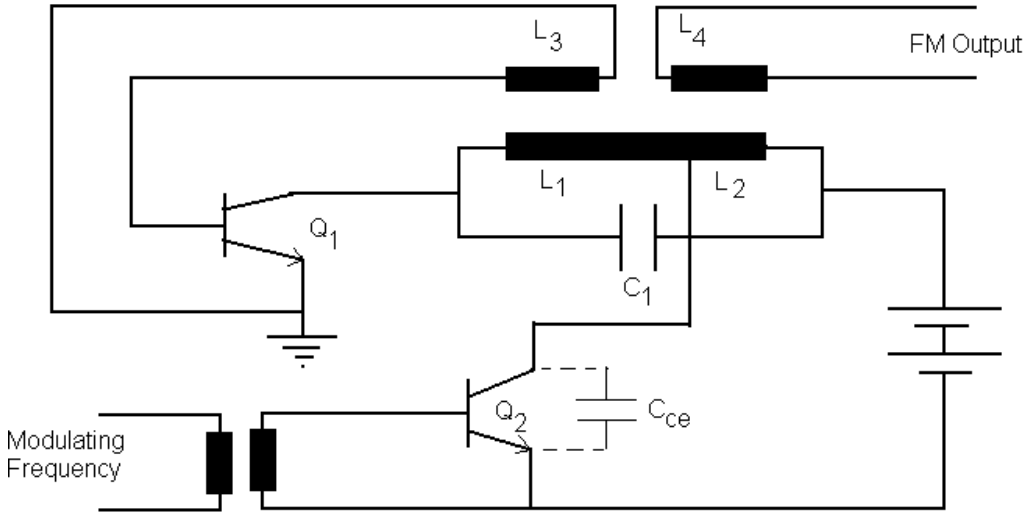
QUESTION 7

7.1 **FM-receiver**



(5)

7.2 **FM-modulator**



(5)

7.3 A process whereby the frequency of the carrier wave is made to vary in accordance with the instantaneous value of the modulating signal.√√ (2)

7.4 Modulation index - the degree of modulation in an FM system√√ (2)

7.5 The function of a limiter is to prevent amplitude variations.√ (1)
[15]

QUESTION 8

8.1 8.1.1 Beamwidth is the angular separation between the two points on the major lobe of radiation at which the power received at a distant point is one half of that received on the axis of the lobe at the same distance.

8.1.2 It refers to the direction in space of the electric field which is radiated from the antenna and is parallel to the antenna itself.

8.1.3 Refraction index -- the measure of the bending of a sky-wave as it passes from one medium to another.

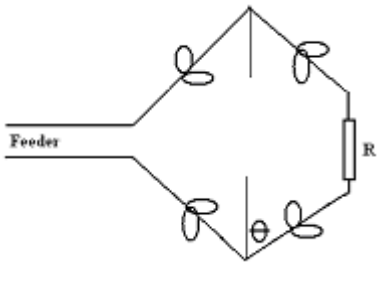
8.1.4 It is the angle between the norm and the radiated sky-wave for a given M.U.F, where the wave is first refracted back without penetration.

(4 x 2) (8)

8.2 The absence of a radio signal at a foot of a mountain is a result of a phenomenon called **skip distance.** (1)

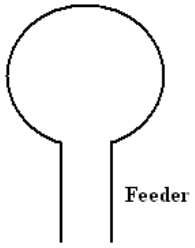
8.3
- Temperature of the sun varies causing variation in ultraviolet radiation.
- Ultraviolet radiation from the sun is the main cause of ionisation.
- Variation in ionisation of ionosphere layers has an effect on radio communication. (Any 2 x 1) (2)

8.4 8.4.1 The rhombic antenna



√√

8.4.2 The loop antenna



√√

(2 x 2) (4)
[15]

TOTAL: 100

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