higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

RADIO THEORY N3

14 APRIL 2021

This marking guideline consists of 5 pages.

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QUESTION 1

1.1 unity
1.2 watt
1.3 decreases
1.4 dipole
1.5 SSB
1.6 flywheel
1.7 IF
1.8 centre
1.9 local oscillator
1.10 spectrum

(10 × 1) **[10]**

QUESTION 2

$$P_{IN} = \frac{E^2}{R} \quad ✓$$
$$= \frac{(50 \times 10^{-3})^2}{200} ✓$$
$$\underline{= 12{,}5\mu W} ✓$$

$$P_{OUT} = I^2 R \quad ✓$$
$$= 2^2 \times 4 ✓$$
$$\underline{= 16W} ✓$$

$$Gain = 10\log\frac{P_O}{P_{IN}} ✓$$
$$= 10\log\frac{16}{12{,}5 \times 10^{-6}} ✓✓$$
$$= 10 \times 6{,}107$$
$$\underline{= 61{,}07dB} ✓$$

[10]

QUESTION 3

Adjustment of tuned circuits in IF-stage done to obtain maximum✓ gain for given bandwidth,✓ determined by modulation✓ spectrum ensuring good selectivity,✓ sensitivity and fidelity✓

Adjustment of front-end (RF stage) and oscillator are done to maintain difference frequency✓ (IF) across entire✓ spectrum covered by tuning scale ensuring dial calibration corresponds✓ with received frequency,✓ and gain or sensitivity is kept uniform✓ across the scale **[10]**

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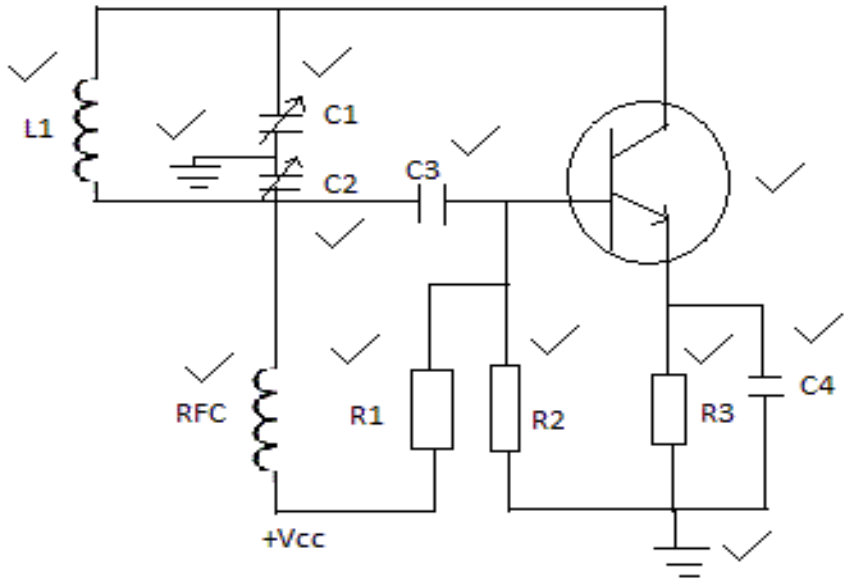
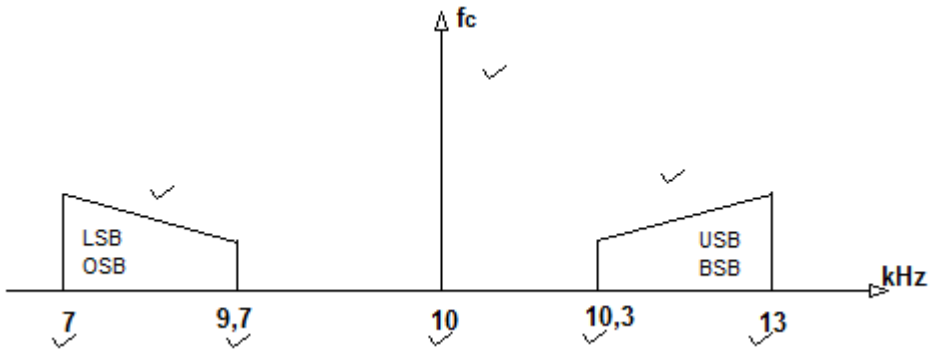
QUESTION 4

4.1



(12)

4.2



(8)
[20]

QUESTION 5

5.1	Carrier oscillator	Generates a stable low frequency to be modulated with the audio in the balanced modulator.✓✓
	Balanced modulator	Modulates oscillator frequency with audio and generates/ produces two sidebands, namely USB and LSB✓✓
	Sideband filter	Selects required sideband, rejecting other one✓✓
	Conversion/Carrier oscillator	Produces radio frequency (RF) with which sideband is modulated✓✓
	Frequency converter	Modulates the selected sideband with the carrier oscillation to produce the sideband to be transmitted.✓✓
	Linear RF amplifier	Produces transmit power at the required frequencies and rejects harmonics.✓✓

(12)

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5.2
- Pulse division
- Pulse amplitude
- Pulse width
- Pulse position
- Pulse code
- Pulse time
- AM
- FM
- PM (Any 6 × 1) (6)

5.3 Modulation process in which intelligence (binary data) is converted to tones – high audio tone for one, low audio tone for a zero – tone can be frequency or amplitude modulated. (2)
[20]

QUESTION 6

Digital data comprises of ones and zeros which can be applied to a modem and sent as FSK information to its destination. Transmission is not subject to errors since ones and zeros are transmitted as shifts in frequency, and are not affected by attenuation or amplitude variations of interference.✓✓✓✓

Analogue data does not comprise specific levels and variation in amplitude and due to transmission losses can result in severe errors.✓✓ **[6]**

QUESTION 7

7.1 Result of change in refractive index✓ of atmosphere at boundary between air masses of differing temperatures and humidities.✓ The denser air at lower levels✓ and cooler, the less dense air at higher altitudes can form a duct in which radio waves can propagate for long distances.✓ Duct imparts a downward curvature to radio wave travel.✓ (5)

7.2 Tropospheric scatter is caused by irregularities✓ in atmosphere in which refractive index differs✓ from mean value of surrounding areas. Scattering effect takes place by partial reflection✓ and is closely associated with temperature and humidity changes. Scattering results in large transmit signal loss✓ resulting in a continuously fluctuating signal at receiving end✓ (5)

7.3 Upper limit✓ of range of frequencies that will be reflected back✓ when beamed at ionosphere. Above this frequency, density✓ of ionosphere will not be enough to bend signal back to earth and it will continue into space✓ (4)
[14]

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QUESTION 8

8.1
- Pressure of pinch-roller against tape and capstan
- Deformation of pinch-roller and capstan
- Positive tension due to take-up spool
- Negative tension or drag due to unspooling and friction across head
- Unbalanced drive motor (Any 4 × 1) (4)

8.2 Wow caused by slow variation of tape speed while fast variation of tape speed causes flutter (2)

8.3 Slow recording speed results in poor frequency response. ✓ However, more information can be recorded per unit length of magnetic tape.✓ Fast recording speed results in good frequency response✓ but less information can be recorded per unit length of magnetic tape.✓ (4)

[10]

TOTAL: 100

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