higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

NOVEMBER EXAMINATION

INDUSTRIAL ELECTRONICS N3

18 NOVEMBER 2016

This marking guideline consists of 7 pages.

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QUESTION 1

1.1
1.1.1 True
1.1.2 True
1.1.3 True
1.1.4 True
1.1.5 False
1.1.6 True
1.1.7 False

(7 × 1) (7)

1.2
1.2.1 C
1.2.2 A
1.2.3 C
1.2.4 B
1.2.5 B
1.2.6 C
1.2.7 C

(7 × 1) (7)
[14]

QUESTION 2

2.1 2.1.1 Loop ABCDA

$RsI_2 + R_1I_1 = 10$

$20I_2 + 25I_1 = 10$✓

$25I_1 + 20I_2 = 10$ ----------(1)✓ (2)

2.1.2 Loop AFEDA

$Rs(I_1 - I_2) + R_1I_1 = 10$

$30I_1 - 30I_2 + 25\ I_1 = 10$✓

$55I_1 - 30I_2 = 10$ ----------(2)✓ (2)

2.1.3 (1) x -55 : $-1\ 375I_1 - 1\ 100I_2 = -550$

(2) x 25 : $1\ 375I_1 - 750I_2 = 250$

$-1\ 850I_2 = -300$✓

$I_2 = 300/1\ 850$

$I_2 = 0{,}162$ A✓

(2)

Substitute I_2 in Equation 1

$25I1 + 20(0{,}162) = 10$

$25I_1 = 10 - 3{,}24$✓

$I_1 = 6{,}76/25$

$I_1 = 0{,}27$ A✓ (2)

2.2 $X_L = 2\pi fL$
$= 2 \times \pi \times 50 \times 32 \times 10^{-3}$
$= 10{,}053\ \Omega$✓

$Z_{RL} = \sqrt{R^2 + X_L^2}$

$= \sqrt{12^2 + 10{,}053^2}$ ✓

$= 15{,}564\ \Omega$✓

$\cos \Theta_L = R/Z_{RL}$
$\Theta_L = \cos^{-1}(12/15{,}564)$
$= 39{,}952°$✓

$I_{RL} = V/Z_{RL}$
$= 240/15{,}654$
$= 15{,}332\ A$✓

$I_C = I_{RL} \sin\Theta$
$= 15{,}332 \times 0{,}642$✓
$= 9{,}845\ A$✓

$X_C = V/I_C$
$= 240/9{,}845$
$= 24{,}378\ \Omega$✓

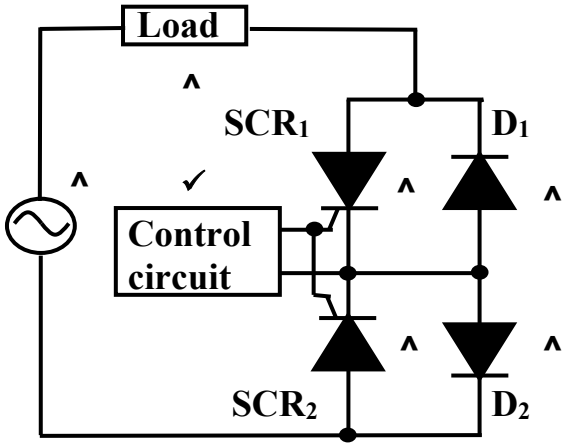
$C = 1/2\pi fXc$
$= 1/(2\pi x\ 50 \times 24{,}378)$ ✓
$= 130{,}573\ \mu F$✓ (10)
[18]

QUESTION 3

3.1 3.1.1 Cycle control
3.1.2 Cyclotronic control
3.1.3 Phase control
3.1.4 Static control

(4 × 1) (4)

3.2



(ONE mark for diagram and THREE marks for correctness) (4)

3.3 3.3.1 (a) piezo-electric effect (b) subjected to a force (2)

3.3.2 (a) 180° (b) high (c) high (3)

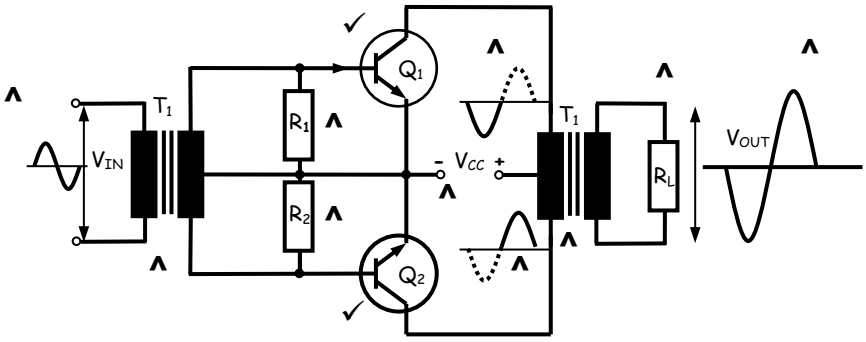
3.3.3 (a) resistor (b) diode (2)

3.3.4 (a) dual-beam (b) dual-trace (2)

3.3.5 MOSFET (1)
[18]

QUESTION 4

4.1



(7)

4.2 4.2.1 In class A amplifiers the bias point corresponds to the midpoint of the active region✓ of the characteristic curve and is selected so that the current flows during the whole of the input cycle.✓

4.2.2 In class B amplifiers the bias point corresponds to the cut-off region✓ of the characteristic curve and the current flows only during the positive half cycles of the signal voltage.✓

(2 × 2) (4)

4.3 4.3.1 C
4.3.2 A
4.3.3 B

(3 × 1) (3)

4.4
- Seven-segment
- Dot Mix
- Bar-graph displays

(Any 2 × 1) (2)

4.5 4.5.1 capacitor
4.5.2 reverse

(2 × 1) (2)

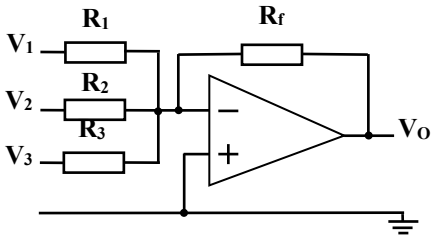
[18]

QUESTION 5

5.1
- Low output impedance
- High input impedance
- High voltage gain
- Wide band width

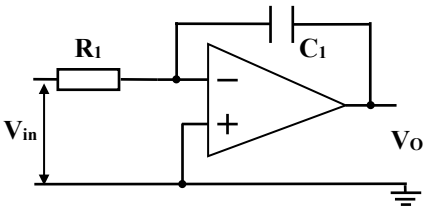
(4 × 1) (4)

5.2 5.2.1



R1, R2, R3 and Rf = 1✓
Correct connections = 1✓
Correctness = 1✓

5.2.2

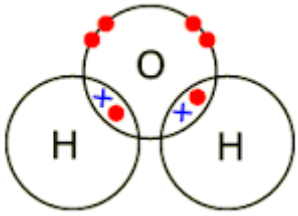


R1 and C1 =1✓
Correct connections✓
Correctness✓

(2 × 3) (6)

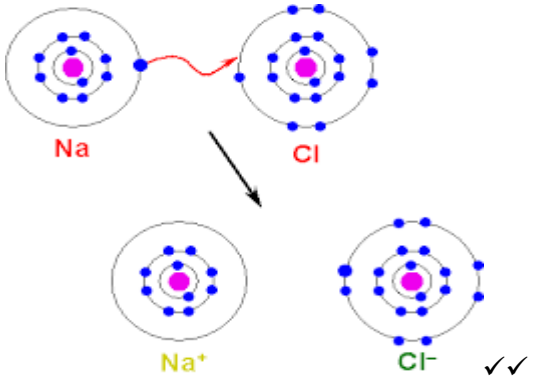
5.3 Fermi level is a convenient way of showing the relative distribution of charge carriers in different materials. (2)

5.4 5.4.1 Covalent bond



✓✓

5.4.2 Ionic bond



✓✓

(2 × 2) (4)

5.5 V_F – static forward voltage.✓ This is the maximum voltage level necessary to produce the desired forward-current level.✓ (2)

[18]

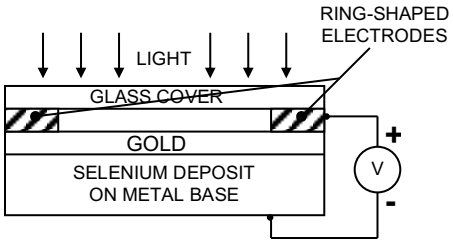
QUESTION 6

6.1 6.1.1 Capacitive pressure transducer (1)

6.1.2 The distance between the plates is varied by the externally applied force or pressure which causes change in capacitance. (2)

6.1.3
- Displacement
- Pressure
- Force (Any 1 × 1) (1)

6.2 6.2.1



Drawing = 2 marks
Labels = 2 marks (4)

6.2.2 A voltage is generated in a semiconductor junction device✓ when the incident light activates the cell.✓ (2)

6.3 6.3.1 Deflection plates position the CRT spot anywhere on the screen✓ by simultaneous application of appropriate vertical and horizontal voltage inputs.✓ (2)

6.3.2 The delay line delays the arrival✓ of the input waveform at the vertical deflection plates until the trigger and time-base circuits have had a chance to start the sweep of the beam.✓ (2)
[14]

TOTAL: 100

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