FSK 224 - Memo Oktober 2006.

1.1) (i)

$$V_{cc} = I_A R_A + I_B R_B + U_{BE} \quad \text{-----} \; (1)$$ ✓

Maar $I_A = I_B + I_c$ ✓ ---- (2)

en $I_c = \beta I_B$ ✓ ---- (3)

Uit (2) en (3) volg dat:

$$I_A = I_B(1+\beta) \quad \text{----} \; (4)$$

Stel in (1) dan volg:

$$V_{cc} = I_B(1+\beta)R_A + I_B R_B + U_{BE}$$

$$\Rightarrow I_B = \frac{V_{cc} - V_{BE}}{(1+\beta)R_A + R_B}$$ ✓

$$= \frac{20V - 0{,}7V}{(1+120).4{,}7k\Omega + 680k\Omega}$$

$$= \underline{15{,}46 \mu A}$$ ✓

[5]

(ii) $V_{cc} = I_A R_A + V_{CE}$ ---- (1) ✓

$$\Rightarrow V_{CE} = V_{cc} - I_A R_A$$

$$= V_{cc} - I_B(1+\beta)R_A$$

$$= \underline{11{,}208 \ V}$$ ✓ [2]

(iii) Verwyder die gelykspanning ✓ [1]

1.2

(i) $V_{CC} = I_{motor} \cdot R_{motor} + V_{CE}$ ✓

* As skakelaar S toe is, is transistor vol aan
$\Rightarrow V_{CE} = 0\,V$ ✓

$$\Rightarrow I_{motor} = \frac{V_{CC}}{R_{motor}}$$

$$= \frac{24\,V}{120\,\Omega}$$

$$= 200\,mA$$ ✓

* Vir skakel met 'n transistor wat $\beta_S = \frac{\beta}{10}$ ✓ gedefinieer.

$$\beta_S = \frac{50}{10}$$

$$= 5$$

Dus $I_B = \frac{I_C}{\beta_S}$ ✓

Waar $I_C = I_{motor}$

$$\Rightarrow I_B = \frac{200\,mA}{5}$$

$$= 40\,mA$$ ✓ →

* Waar $V_{CC} = I_B R_B + V_{BE}$ ✓

$$\Rightarrow R_B = \frac{V_{CC} - V_{BE}}{I_B}$$

$$= \frac{24\,V - 0{,}7\,V}{40\,mA}$$

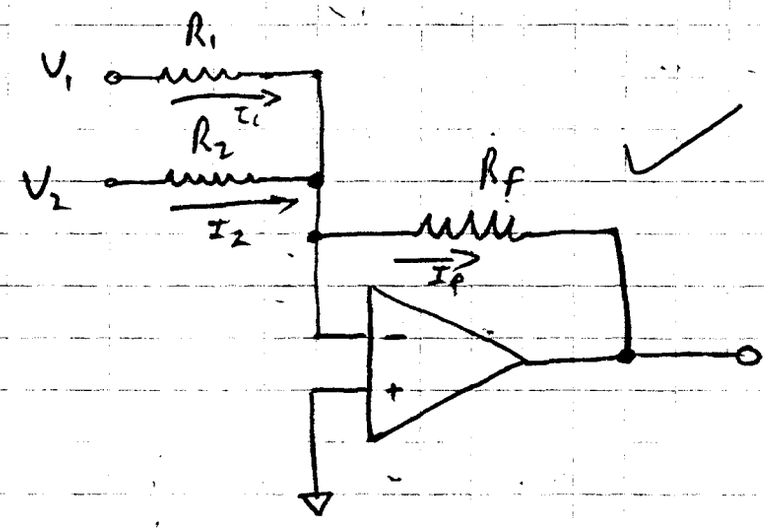
$$= 582{,}5\,\Omega$$ ✓ →

[8]

(ii) Die diode beskerm die transistor teen die hoë spanning wat ontstaan in die windings wen die motor as die stroom af geskakel word!

[2]

2.1



→ Dis is 'n terugvoer stroombaan daarom is.

$V_+ \approx V_-$ $\quad V_+ = 0V$ ← geaard verbinding

$\Rightarrow V_- = 0V.$

Nou $I_1 + I_2 = I_f$ ← gaan stroom vloei by V_- in groot ingang impedansie

Nou $I_1 = \frac{V_1 - V_-}{R_1} = \frac{V_1}{R_1}$

en $I_2 = \frac{V_2 - V_-}{R_2} = \frac{V_2}{R_2}$

en $I_f = \frac{V_- - V_o}{R_f} = \frac{-V_o}{R_f}$

Dus is $\frac{V_1}{R_1} + \frac{V_2}{R_1} = \frac{-V_o}{R_f}$

$\Rightarrow V_o = \frac{-R_f}{R}(V_1 + V_2)$ ✓

indien $R_1 = R_2 = R$

[7]

2.2

- Dit is a.g.v. stroomloos

$\Rightarrow V_+ \simeq V_-$ ✓

Nou $V_+ = \frac{4\,k\Omega}{(4\,k\Omega + 6\,k\Omega)} \times 5V$ ✓

$= 2V$

$\Rightarrow V_- = 2V$ ✓

- Die stroom deur die $3\,k\Omega$ weerstand

$I_3 = \frac{5V - V_-}{3\,k\Omega}$

$= \frac{5V - 2V}{3\,k\Omega} = 1\,mA$ ✓

- Die stroom deur die $12\,k\Omega$ weerstand is gelyk aan die stroom deur die $3\,k\Omega$.

$I_3 = I_{12}$ ✓

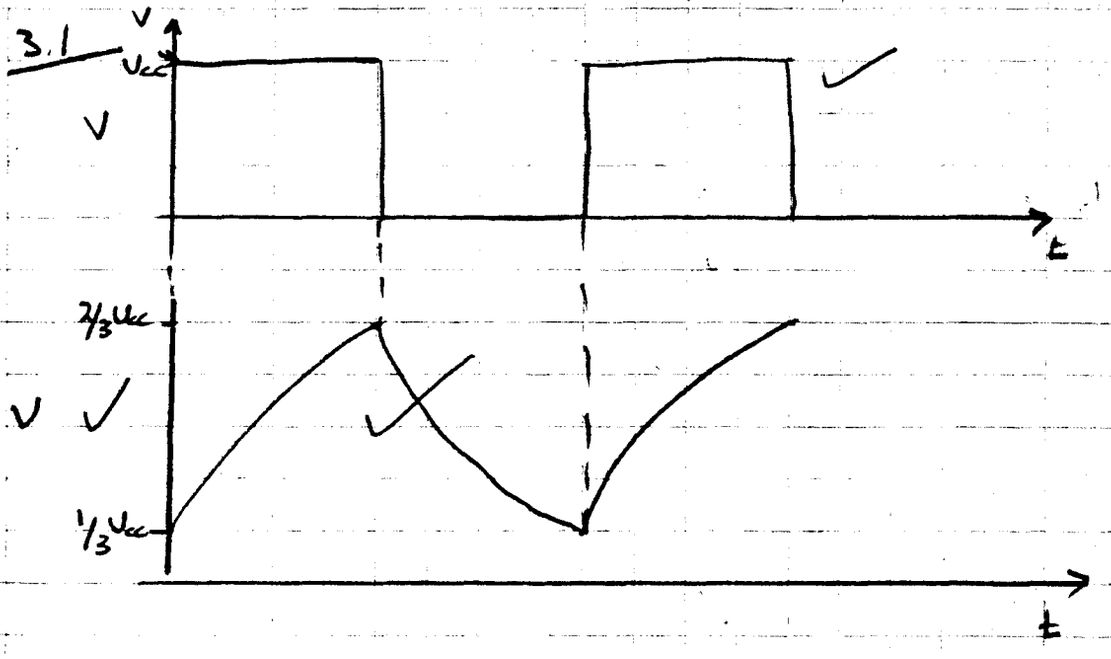
Now $I_{12} = \frac{V_- - V_o}{12\,k\Omega}$ ✓

$\Rightarrow V_o = V_- - I_{12} \times 12\,k\Omega$

$= 2V - (1mA \times 12\,k\Omega)$

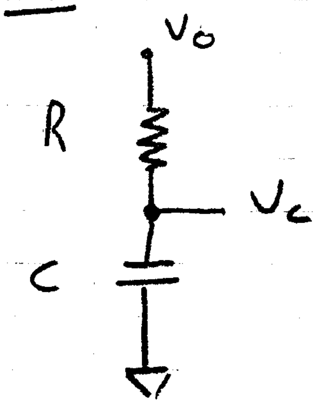
$V_o = -10V$ ✓ [1]

3.1



[3]

3.2



Nou $V_0 = Ri + V_c$

Maar $i = \frac{dq}{dt}$ ½ def.

en

$$q = CV_c \quad \text{½ def}$$

$$\frac{dq}{dt} = C\frac{dV_c}{dt} \quad ½$$

$$\Rightarrow V_0 = RC\frac{dV_c}{dt} + V_c \quad ½$$

$$\Rightarrow \frac{1}{RC}\int_{t_1}^{t_2} dt = \int_{V_1}^{V_2} \frac{dV_c}{V_0 - V_c}$$

$$\Rightarrow \left[t\right]_{t_1}^{t_2} = RC\left[-\ln(V_0 - V_c)\right]_{V_1}^{V_2}$$

Nou is die stroom ontlaai die helfte deur 2R.

$$\Rightarrow \Delta t = 2RC\ln\left[\frac{V_{cc} - \frac{1}{3}V_{cc}}{V_{cc} - \frac{2}{3}V_{cc}}\right]$$

$$= 2RC\ln(2)$$

$$= RC(1{,}386\ldots)$$

[6]

4.1

$\frac{53}{2} = 26 \rightarrow 1$

$\frac{26}{2} = 13 \rightarrow 0$

$\frac{13}{2} = 6 \rightarrow 1$

$\frac{6}{2} = 3 \rightarrow 0$

$\frac{3}{2} = 1 \rightarrow 1$

$\frac{1}{2} = 0 \rightarrow 1$ ✓

$53_{Dec} \rightarrow 110101_{Bin}$.

$AE8 = A \times 16^2 + E \times 16^1 + 8 \times 16^0$

$= 10 \times 16^2 + 14 \times 16^1 + 8 \times 16^0$

$= 2792.$ ✓

[2]

4.2.

$$F = \overline{\overline{A.A} \cdot \overline{B.B} \cdot \overline{A.A} \cdot \overline{B.B}}$$ ✓

$$= \overline{\overline{A} \cdot \overline{B} \cdot \overline{A} \cdot \overline{B}} \qquad (A.A = A)$$

$$= \overline{\overline{A+B} \cdot \overline{A+B}} \qquad \bar{A}.\bar{B} = \overline{A+B}$$

$$= \overline{(A+B) \cdot (A+B)} \qquad (\bar{\bar{A}} = A)$$

$$= \overline{(A+B)} + \overline{(A+B)} \qquad \overline{A \cdot B} = \bar{A} + \bar{B}$$

$$F = \overline{A+B} \qquad A + A = A$$

[4]

4.3

$$F = \overline{A.D + \bar{B}.C + D}$$

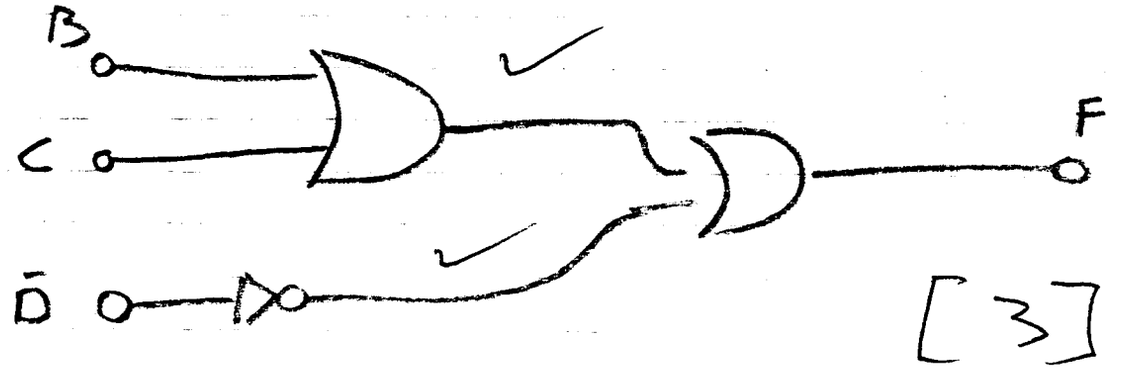
$$= \overline{D(A+1) + \bar{B}.C}$$

$$= \overline{D + \bar{B}.C}$$

$$= \bar{D} + \overline{\bar{B}.C}$$

$$= \bar{D} + \bar{\bar{B}} + \bar{C}$$

$$= \bar{D} + B + C$$ ✓



[3]