

Section 10 Test

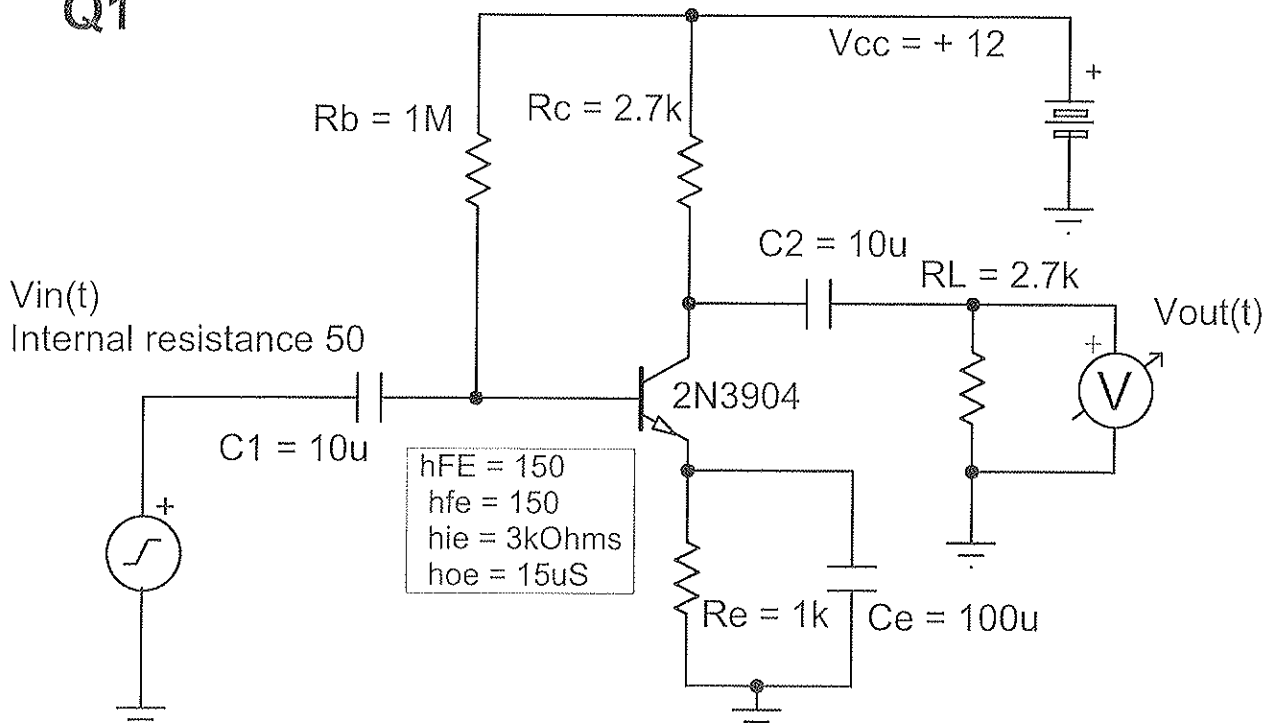
27 March 2008

Student Name:

Student ID:

Just fill in the answers in the spaces provided; no working is required.

Q1

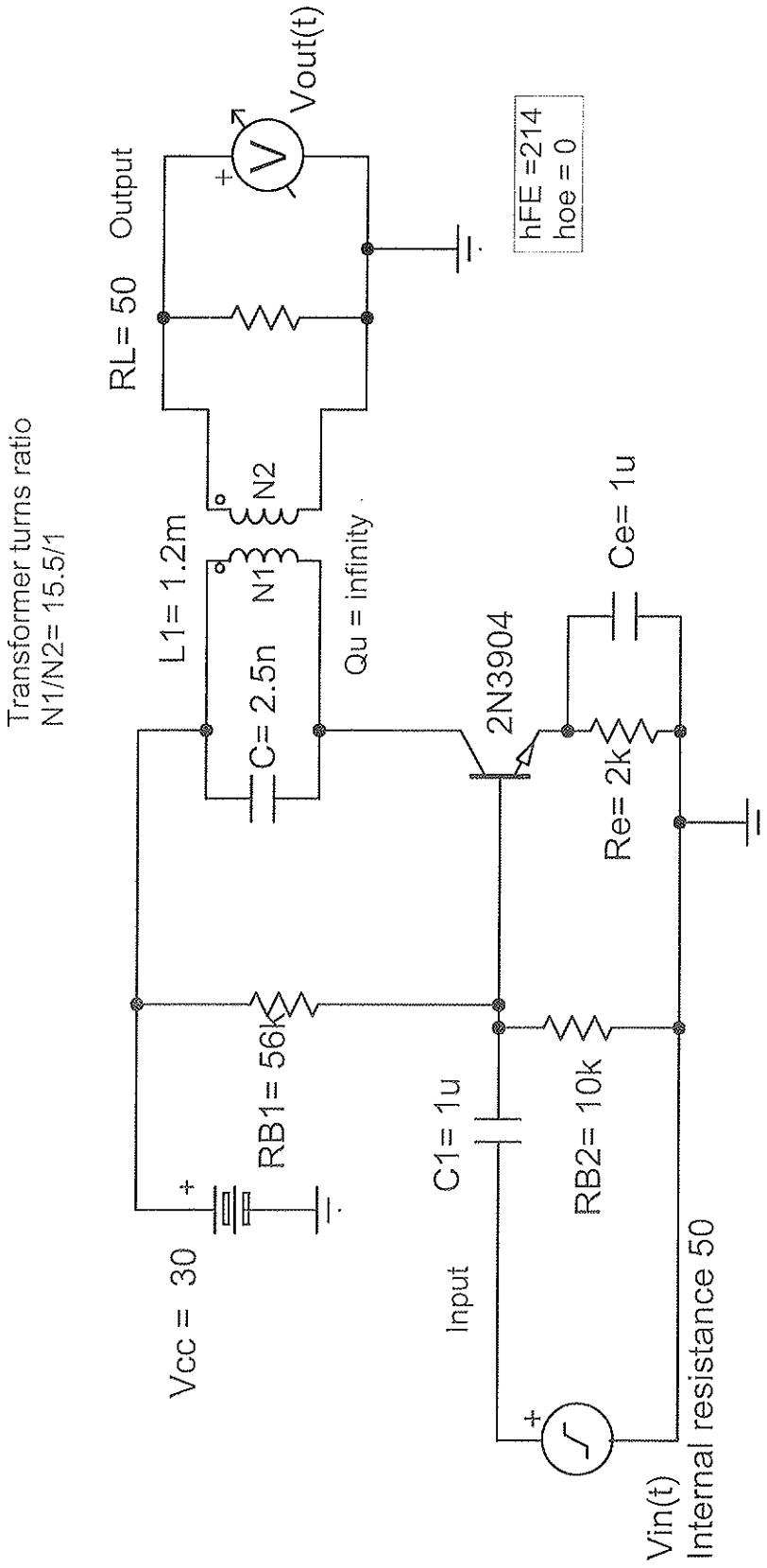


For the circuit shown find:

- | | | |
|---|-------|---------|
| (a) The DC bias base current $I_b =$ | 9.8 | μA |
| (b) The DC bias collector current $I_c =$ | 1.47 | mA |
| (c) The DC bias base voltage $V_b =$ | 2.1 | V |
| (d) The DC bias emitter voltage $V_e =$ | 1.47 | V |
| (e) The DC bias collector voltage $V_c =$ | 8.0 | V |
| (f) The BJT emitter resistor $r_e =$ | 17.7 | ohms |
| (g) The mid-band small signal gain as a ratio = | -74.6 | |
| (h) The mid-band small signal gain in dB = | 38 | dB |
| (i) The mid-band input resistance $R_{in} =$ | 2.99k | ohms |
| (j) The low -3dB cutoff frequency caused by $C_e =$ | 90 | Hz |

Marks out of 20

Q2



For the circuit shown find:

- The Theven equivalent voltage of V_{cc} with $RB1$ and $RB2$ =
- The Thevenin equivalent resistance of $RB1$ and $RB2$ =
- The DC bias base current I_b =
- The DC bias collector current I_c =
- The BJT emitter resistor r_e =
- The resonant frequency f_0 =
- The total load resistance as seen by the collector RL' =
- The small signal ac gain =
- The loaded Q of the output circuit QL =
- The bandwidth BW =

$4.5V$
 $8.48k\Omega$
 $3.7\mu A$
 $1.8mA$
 13.6Ω
 $100kHz$
 12Ω
 350Ω
 15.5
 $6.3kHz$

Marks of 20

①

ENEL434 Test - Model answer
(with some explanations).

Q 1

$$(a) \quad 12 - I_B \times 1000 \times 10^3 - 0.7 - 150 \times 10^3 I_B = 0$$

$$\therefore I_B = 11.3 / 1150 \times 10^3 = 9.83 \mu A$$

$$(b) \quad I_C = 150 \times 9.83 \times 10^{-6} = 1.474 \text{ mA}$$

$$(c) \quad V_E = I_E R_E = \underbrace{(1.474 \times 10^{-3} + 9.83 \times 10^{-6})}_{I_E} \times 10^3 = 1.48 V$$

$$(d) \quad V_B = 1.48 V + 0.7 V = 2.18 V$$

$$(e) \quad V_C = 12 - 2.7 \times 10^3 \times \frac{1.474 \times 10^{-3}}{I_C} = 8.02 V$$

$$(f) \quad r_e = 0.026 / I_C = 17.57 \Omega$$

$$(g) \quad R'_C = R_C \parallel R_L \parallel 1/h_{oe}$$

$$= 1.35 \times 10^3 \parallel 66.67 \times 10^3$$

$$= 1.32 \text{ k}\Omega$$

$$\therefore A_{vss} = -1.32 \times 10^3 / 17.57 = -75$$

$$(h) \quad G_{mi} = 37.5 \text{ dB}$$

$$(i) \quad R_{ii} = 1 \times 10^6 \parallel 3 \times 10^3 = 2.99 \text{ k}\Omega$$

$$R_o = 1 \times 10^6 \parallel 150 \times 17.57 = 2.63 \text{ k}\Omega$$

$$(j) \quad R_{discharge} = R_E \parallel \left(r_e + \frac{R_B \parallel R_{gen}}{h_{fe}} \right) = 17.59 \Omega$$

$$\therefore f = \frac{1}{2\pi R_{discharge} C} = 90 \text{ Hz}$$

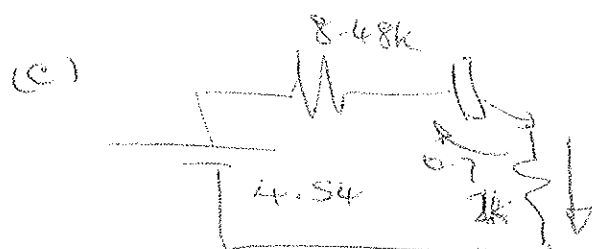
EWEL 434 Test Model answers

2

Q2.

(a) $V_{TH} = 30 \times 10 / 66 = 4.54V$

(b) $R_{TH} = 10k // 56k = 8.48k\Omega$



$$4.54 - I_B \times 8.48 \times 10^3 - 0.7 - I_B \times 214 \times 2 \times 10^3 = 0$$

$$\therefore I_B = 8.8 \mu A$$

(d) $I_E = 1.88 \mu A$

(e) $r_e = 13.8 \Omega$

(f) $f_0 = \frac{1}{2\pi} \frac{1}{r_e} = 100 kHz$

(g) $R_L' = 12k\Omega \quad (n^2 R_L)$

(h) $\frac{V_L(t)}{V_{in}(t)} = \frac{-12 \times 10^3}{13.8} = -870 \quad \left[\frac{V_o(t)}{V_{in}(t)} = \frac{870}{15.5} = -56 \right]$

$$g_{m1} = 35 dB$$

(i) $Q_L = R_L' / X_L = 12k / 754 = 15.9$

$$\therefore BW = f_0 / Q_L = 6.28 kHz$$