Name:	**Dr JBO**
Student ID Number:	**Model Answer**
Section:	01A / 01B / 02A / 02B
Lecturer:	Dr. Jamaludin Bin Omar

EEEB273 - Quiz 3 [Question Set 1]
SEMESTER 2, ACADEMIC YEAR 2012/2013
Date: 10 December 2012

Question:

Figure 1 shows a **class-A** emitter follower. The circuit parameters are $V^+ = +12$ V, $V^- = -12$ V, $R = 1$ kΩ, and $R_L = 330$ Ω. The transistor parameters are $V_{BE}(\text{on}) = 0.7$ V for all transistors, $\beta = \infty$ for Q_1, and $\beta = 50$ for Q_2 and Q_3.

(a) Find I_Q. [3 marks]

(b) For $v_O = 0$, find the power dissipated in the transistor Q_1 and the power dissipated in the current source (Q_2, Q_3, and R). [5 marks]

(c) Determine the power conversion efficiency (η) for a symmetrical sine-wave output voltage with a peak value of **6 V**. [2 marks]

Write your answer **using pen,** in 4 decimal points, with **proper Units** for the parameters.

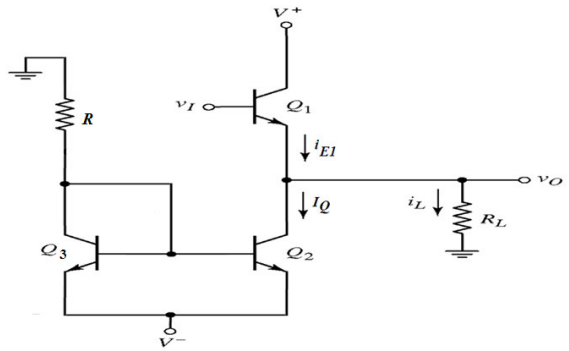

Figure 1

Answer:

(a)

$I_R = (0 - V_{BE3}(\text{on}) - V^-) / R$ = (0 – 0.7 – (-12)) / (1k) = **11.3 mA** **[1, 0.5]**

$I_Q = I_R / (1 + 2/\beta)$ = (11.3m)/(1 + 2/50) = **10.865 mA** **[1, 0.5]**

(b)

$P_{DQ1} = V_{CE1} \times I_{C1} = (V^+ - v_O) \times I_{E1} = (V^+ - v_O) \times I_Q$ **[1.5]**

= (12 - 0) x (10.865m) = **0.13038 W** **[0.5]**

$P_{DCS} = P_{DQ2} + P_{DQ3} + P_{DR}$ **[0.5]**

$P_{DQ2} = V_{CE2} \times I_{C2} = (v_O - V^-) \times I_Q$ = (0- (-12)) x (10.865m) = **0.13038 W** **[1]**

$P_{DQ3} + P_{DR} = (0 - V^-) \times I_R$ = (0- (-12)) x (11.3m) = **0.1356 W** **[1]**

P_{DCS} = 0.13038 + 0.1356 = **0.26598 W** **[0.5]**

(c)

Average power to load, $P^*_L = V^2_p / (2 R_L)$ = (6 x 6)/(2 x 330) = **0.05454 W** **[0.5]**

Average power supplied, $P^*_S = P_{DQ1} + P_{DCS}$ = 0.13038 + 0.26598 = **0.39636 W** **[0.5]**

$\eta = (P^*_L / P^*_S) \times 100\%$ = (0.05454 / 0.39636) x 100% = **13.76 %** **[1]**

Name:	**Dr JBO**
Student ID Number:	**Model Answer**
Section:	01A / 01B / 02A / 02B
Lecturer:	Dr. Jamaludin Bin Omar

EEEB273 - Quiz 3 [Question Set 2]
SEMESTER 2, ACADEMIC YEAR 2012/2013
Date: 10 December 2012

Question:

Figure 1 shows a **class-A** emitter follower. The circuit parameters are $V^+ = +14$ V, $V^- = -14$ V, $R = 1$ kΩ, and $R_L = 330$ Ω. The transistor parameters are $V_{BE}(\text{on}) = 0.7$ V for all transistors, $\beta = \infty$ for Q_1, and $\beta = 50$ for Q_2 and Q_3.

(a) Find I_Q. [3 marks]

(b) For $v_O = 0$, find the power dissipated in the transistor Q_1 and the power dissipated in the current source (Q_2, Q_3, and R). [5 marks]

(c) Determine the power conversion efficiency (η) for a symmetrical sine-wave output voltage with a peak value of **6 V**. [2 marks]

Write your answer **using pen,** in 4 decimal points, with **proper Units** for the parameters.

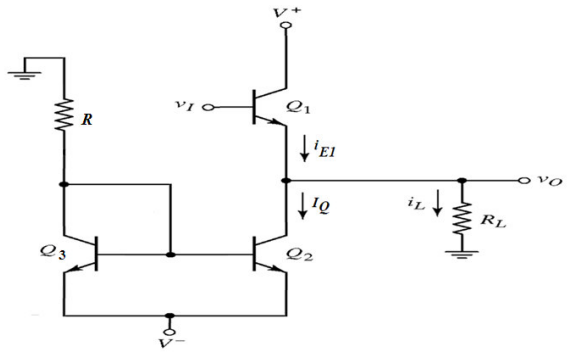

Figure 1

Answer:

(a)

$I_R = (0 - V_{BE3}(\text{on}) - V^-) / R$ = (0 – 0.7 – (-14)) / (1k) = **13.3 mA** **[1, 0.5]**

$I_Q = I_R / (1 + 2/\beta)$ = (13.3m)/(1 + 2/50) = **12.788 mA** **[1, 0.5]**

(b)

$P_{DQ1} = V_{CE1} \times I_{C1} = (V^+ - v_O) \times I_{E1} = (V^+ - v_O) \times I_Q$ **[1.5]**

= (14 - 0) x (12.788m) = **0.17903 W** **[0.5]**

$P_{DCS} = P_{DQ2} + P_{DQ3} + P_{DR}$ **[0.5]**

$P_{DQ2} = V_{CE2} \times I_{C2} = (v_O - V^-) \times I_Q$ = (0- (-14)) x (12.788m) = **0.17903 W** **[1]**

$P_{DQ3} + P_{DR} = (0 - V^-) \times I_R$ = (0- (-14)) x (13.3m) = **0.1862 W** **[1]**

P_{DCS} = 0.17903 + 0.1862 = **0.36523 W** **[0.5]**

(c)

Average power to load, $P^*_L = V^2_p / (2 R_L)$ = (6 x 6)/(2 x 330) = **0.05454 W** **[0.5]**

Average power supplied, $P^*_S = P_{DQ1} + P_{DCS}$ = 0.17903 + 0. 36523 = **0.54426 W** **[0.5]**

$\eta = (P^*_L / P^*_S) \times 100\%$ = (0.05454 / 0.54426) x 100% = **10.02 %** **[1]**

Name:	**Dr JBO**
Student ID Number:	**Model Answer**
Section:	01A / 01B / 02A / 02B
Lecturer:	Dr. Jamaludin Bin Omar

EEEB273 - Quiz 3 [Question Set 3]
SEMESTER 2, ACADEMIC YEAR 2012/2013
Date: 10 December 2012

Question:

Figure 1 shows a **class-A** emitter follower. The circuit parameters are $V^+ = +12$ V, $V^- = -12$ V, $R = 1.2$ kΩ, and $R_L = 330$ Ω. The transistor parameters are $V_{BE}(\text{on}) = 0.7$ V for all transistors, $\beta = \infty$ for Q_1, and $\beta = 50$ for Q_2 and Q_3.

(a) Find I_Q. [3 marks]

(b) For $v_O = 0$, find the power dissipated in the transistor Q_1 and the power dissipated in the current source (Q_2, Q_3, and R). [5 marks]

(c) Determine the power conversion efficiency (η) for a symmetrical sine-wave output voltage with a peak value of **6 V**. [2 marks]

Write your answer **using pen,** in 4 decimal points, with **proper Units** for the parameters.

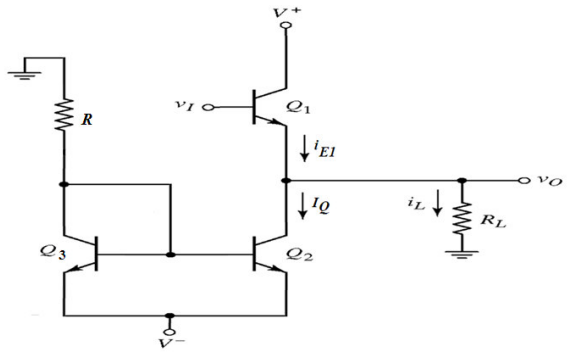

Figure 1

Answer:

(a)

$I_R = (0 - V_{BE3}(\text{on}) - V^-) / R$ = (0 – 0.7 – (-12)) / (1.2k) = **9.4167 mA** **[1, 0.5]**

$I_Q = I_R / (1 + 2/\beta)$ = (9.4167m)/(1 + 2/50) = **9.0544 mA** **[1, 0.5]**

(b)

$P_{DQ1} = V_{CE1} \times I_{C1} = (V^+ - v_O) \times I_{E1} = (V^+ - v_O) \times I_Q$ **[1.5]**

= (12 - 0) x (9.0544m) = **0.10865 W** **[0.5]**

$P_{DCS} = P_{DQ2} + P_{DQ3} + P_{DR}$ **[0.5]**

$P_{DQ2} = V_{CE2} \times I_{C2} = (v_O - V^-) \times I_Q$ = (0- (-12)) x (9.0544m) = **0.10865 W** **[1]**

$P_{DQ3} + P_{DR} = (0 - V^-) \times I_R$ = (0- (-12)) x (9.4167m) = **0.1130 W** **[1]**

P_{DCS} = 0.10865 + 0.1130 = **0.22165 W** **[0.5]**

(c)

Average power to load, $P^*_L = V^2_p / (2 R_L)$ = (6 x 6)/(2 x 330) = **0.05454 W** **[0.5]**

Average power supplied, $P^*_S = P_{DQ1} + P_{DCS}$ = 0.10865 + 0.22165 = **0.3303 W** **[0.5]**

$\eta = (P^*_L / P^*_S) \times 100\%$ = (0.05454 / 0.3303) x 100% = **16.51 %** **[1]**

Name:	**Dr JBO**
Student ID Number:	**Model Answer**
Section:	01A / 01B / 02A / 02B
Lecturer:	Dr. Jamaludin Bin Omar

EEEB273 - Quiz 3 [Question Set 4]
SEMESTER 2, ACADEMIC YEAR 2012/2013
Date: 10 December 2012

Question:

Figure 1 shows a **class-A** emitter follower. The circuit parameters are $V^+ = +14$ V, $V^- = -14$ V, $R = 1.2$ kΩ, and $R_L = 330$ Ω. The transistor parameters are $V_{BE}(\text{on}) = 0.7$ V for all transistors, $\beta = \infty$ for Q_1, and $\beta = 50$ for Q_2 and Q_3.

(a) Find I_Q. [3 marks]

(b) For $v_O = 0$, find the power dissipated in the transistor Q_1 and the power dissipated in the current source (Q_2, Q_3, and R). [5 marks]

(c) Determine the power conversion efficiency (η) for a symmetrical sine-wave output voltage with a peak value of **6 V**. [2 marks]

Write your answer **using pen,** in 4 decimal points, with **proper Units** for the parameters.

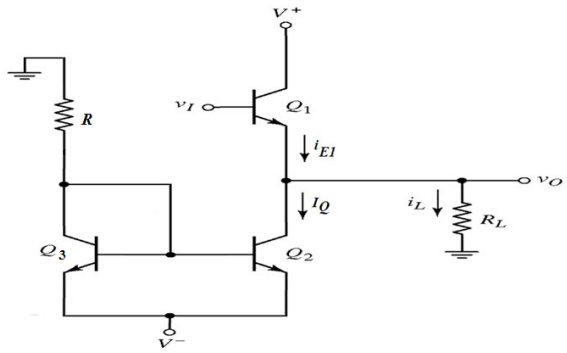

Figure 1

Answer:

(a)

$I_R = (0 - V_{BE3}(\text{on}) - V^-) / R$ = (0 – 0.7 – (-14)) / (1.2k) = **11.083 mA** [1, 0.5]
$I_Q = I_R / (1 + 2/\beta)$ = (11.083m)/(1 + 2/50) = **10.657 mA** [1, 0.5]

(b)

$P_{DQ1} = V_{CE1} \times I_{C1} = (V^+ - v_O) \times I_{E1} = (V^+ - v_O) \times I_Q$ [1.5]
= (14 - 0) x (10.657m) = **0.14919 W** [0.5]
$P_{DCS} = P_{DQ2} + P_{DQ3} + P_{DR}$ [0.5]
$P_{DQ2} = V_{CE2} \times I_{C2} = (v_O - V^-) \times I_Q$ = (0- (-14)) x (10.657m) = **0.14919 W** [1]
$P_{DQ3} + P_{DR} = (0 - V^-) \times I_R$ = (0- (-14)) x (11.083m) = **0.15516 W** [1]
P_{DCS} = 0.14919 + 0.15516 = **0.30435 W** [0.5]

(c)

Average power to load, $P^*_L = V^2_p / (2 R_L)$ = (6 x 6)/(2 x 330) = **0.05454 W** [0.5]
Average power supplied, $P^*_S = P_{DQ1} + P_{DCS}$ = 0.14919 + 0.30435 = **0.45354 W** [0.5]
$\eta = (P^*_L / P^*_S) \times 100\%$ = (0.05454 / 0.45354) x 100% = **12.02 %** [1]