

ECEN321: Analogue Electronics

Assignment 1: Power Amplifiers - Submission

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Question 1

- I. *An audio amplifier operates in the frequency range of..*
 - a. **20Hz to 20kHz**
- II. *For maximum peak-to-peak output voltage, the Q point should be..*
 - c. **At the centre of the dc load line**
- III. *An amplifier has two load lines because..*
 - d. **All of the above**
- IV. *Push-pull is almost always used with..*
 - b. **Class B**
- V. *Class C amplifiers are almost always..*
 - c. **Tuned RF amplifiers**
- VI. *The input signal of a class C amplifier..*
 - c. **Produces brief pulses of collector current**
- VII. *If $RC=100\ \Omega$ and $RL=180\Omega$, the ac load resistance equals..*
 - 100 Ω**
- VIII. *In a class A amplifier, the collector current flows for..*
 - d. **The entire cycle**
- IX. *With class A, the output signal should be..*
 - a. **Unclassified**
- X. *A small quiescent current is necessary with a class AB push-pull amplifier to avoid..*
 - a. **Crossover distortion**

Question 2

- a) In the push push-pull configuration, the base-emitter junctions of the transistors have a potential of 0.7V. Thus when the input drops below this, at the **crossover** around the zero-point, the output is cut-off. This introduces a flatline distortion between positive and negative half cycles.
- b)

Question 3

$$V_{CC} = +20V \quad R_{1,2} = 1k \quad R_C = 50\Omega \quad R_E = 100\Omega \quad R_L = 50\Omega$$

i)

$$P_{i(dc)} = V_{CC} I_{CQ}$$

$$V_B = \frac{R_2}{R_1 + R_2} V_{CC} = \frac{1k}{2k} 20 = 10V$$

$$V_E = V_B - 0.7 = 9.3V$$

$$I_E = \frac{V_E}{R_E} = \frac{9.3}{100} = 93mA \approx I_{CQ}$$

$$\therefore P_{i(dc)} = 20 \times 93mA = 1.86W$$

ii)

$$P_{o(ac)} = \frac{V_{CEQ} I_{CQ}}{2}$$

$$\begin{aligned} V_{CEQ} &= V_C - V_E = (V_{CC} - I_C R_C) - V_E \\ &= (20V - 93mA \times 50\Omega) - 9.3V = 6.05V \end{aligned}$$

$$\therefore P_{o(ac)} = \frac{6.05V \times 93mA}{2} = 0.28W$$

iii)

$$\begin{aligned} \% \eta &= \frac{P_{o(ac)}}{P_{i(dc)}} \times 100 \\ &= \frac{0.28}{1.86} \times 100 = 15\% \end{aligned}$$

Question 4

i)

ii)

iii)

Question 5

$$V_{CC} = +30V \quad V_{BE} = 0.7V \quad R_1 = 300\Omega \quad R_L = 16\Omega$$

$$V_{CC} = 2R_1 I + 2V_{BE}$$

$$30V = 600\Omega \times I + 1.4V$$

$$I = \frac{30V - 1.4V}{600\Omega} = 47.67mA$$

$$R_2 = \frac{V_{BE}}{I} = \frac{0.7V}{47.67mA} = 14.67\Omega$$

Question 6