Week 7 Assignment 7

Common Base Amplifier

1. Analyze the circuit shown below. The voltage gain of the amplifier can be calculated as follows:

\[ V_{out} = V_{in} \times g_m \times r_{f} \]

where:
- \( V_{out} \) is the output voltage
- \( V_{in} \) is the input voltage
- \( g_m \) is the transconductance of the transistor
- \( r_f \) is the feedback resistor

2. The current through the base resistor \( R_b \) can be calculated as:

\[ I_{b} = \frac{V_{in} - V_{be}}{R_b} \]

where:
- \( V_{be} \) is the base-emitter voltage

3. The power dissipated in the collector resistor \( R_c \) can be calculated as:

\[ P = I_{c} \times V_{cc} \]

where:
- \( I_{c} \) is the collector current
- \( V_{cc} \) is the supply voltage

4. The output voltage swing can be calculated as:

\[ V_{out} = \pm (V_{cc} - V_{be}) \]

where:
- \( V_{be} \) is the base-emitter voltage
- \( V_{cc} \) is the supply voltage

5. The overall voltage gain of the amplifier can be calculated as:

\[ V_{out} = V_{in} \times g_m \times r_{f} \]

where:
- \( V_{out} \) is the output voltage
- \( V_{in} \) is the input voltage
- \( g_m \) is the transconductance of the transistor
- \( r_f \) is the feedback resistor

6. The input resistance of the amplifier can be calculated as:

\[ R_{in} = \frac{1}{g_m} \]

where:
- \( R_{in} \) is the input resistance
- \( g_m \) is the transconductance of the transistor

7. The output resistance of the amplifier can be calculated as:

\[ R_{out} = R_c \]

where:
- \( R_{out} \) is the output resistance
- \( R_c \) is the collector resistor

8. The power dissipated in the transistor can be calculated as:

\[ P = I_{c} \times V_{ce} \]

where:
- \( I_{c} \) is the collector current
- \( V_{ce} \) is the collector-emitter voltage

9. The input impedance of the amplifier can be calculated as:

\[ Z_{in} = R_b \]

where:
- \( Z_{in} \) is the input impedance
- \( R_b \) is the base resistor

10. The output impedance of the amplifier can be calculated as:

\[ Z_{out} = r_{f} \]

where:
- \( Z_{out} \) is the output impedance
- \( r_{f} \) is the feedback resistor

11. The bandwidth of the amplifier can be calculated as:

\[ f_{3dB} = \frac{1}{2\pi R_c C_e} \]

where:
- \( f_{3dB} \) is the bandwidth
- \( R_c \) is the collector resistor
- \( C_e \) is the collector capacitance