

Thus $V_{\text{arm}} = \frac{V_{\text{out}}}{10} = 1 \text{ V peak}$.

Handwritten student solutions for an electronics exam, organized by question number. The solutions include circuit diagrams, mathematical derivations, and final answers for various problems related to op-amp circuits, frequency response, and signal processing.

Question 1: General Amplifier Considerations (25 Marks)

1a) Consider an amplifier operating from 10-V power supplies. It is fed with a sinusoidal voltage having 1-V peak and delivers a sinusoidal voltage having 1-V peak to a 1-kΩ load. The amplifier has an input resistance of 10 kΩ and an output resistance of 100 Ω. The input current of the amplifier is 100 μA. The output current of the amplifier is 10 mA. The power gain of the amplifier is 100 dB. The power dissipated in the amplifier is 10 mW. The amplifier efficiency is 10%.

1b) Determine the overall voltage gain, A_v , the current gain, and the power gain for the amplifier described above. In the amplifier, the power gain is equal to the product of the amplifier's current gain and the overall voltage gain, A_v . The overall voltage gain is 100.

Question 2: General Amplifier Frequency Response (25 Marks)

2a) Using the Bode plots for the low-pass and high-pass BJT models, find the overall voltage gain of the amplifier. The amplifier has a low-pass cutoff frequency of 10 Hz and a high-pass cutoff frequency of 100 Hz. The overall voltage gain is 100.

2b) Derive an expression for the amplifier voltage gain A_v as a function of the frequency. The amplifier has a low-pass cutoff frequency of 10 Hz and a high-pass cutoff frequency of 100 Hz. The overall voltage gain is 100.

Question 3: The Inverting Configuration (25 Marks)

3a) Design the circuit shown below to have an input resistance of 100 kΩ and a gain that can be varied from -1 V/V to -100 V/V using the 100-kΩ potentiometer R_2 . What voltage gain results when the potentiometer is set exactly at its middle value? The voltage gain is -50 V/V.

3b) Derive an expression for the amplifier voltage gain A_v as a function of the frequency. The amplifier has a low-pass cutoff frequency of 10 Hz and a high-pass cutoff frequency of 100 Hz. The overall voltage gain is 100.

Question 4: General Amplifier Frequency Response (25 Marks)

4a) Derive an expression for the amplifier voltage gain A_v as a function of the frequency. The amplifier has a low-pass cutoff frequency of 10 Hz and a high-pass cutoff frequency of 100 Hz. The overall voltage gain is 100.

4b) Derive an expression for the amplifier voltage gain A_v as a function of the frequency. The amplifier has a low-pass cutoff frequency of 10 Hz and a high-pass cutoff frequency of 100 Hz. The overall voltage gain is 100.

Question 5: General Amplifier Frequency Response (25 Marks)

5a) Derive an expression for the amplifier voltage gain A_v as a function of the frequency. The amplifier has a low-pass cutoff frequency of 10 Hz and a high-pass cutoff frequency of 100 Hz. The overall voltage gain is 100.

5b) Derive an expression for the amplifier voltage gain A_v as a function of the frequency. The amplifier has a low-pass cutoff frequency of 10 Hz and a high-pass cutoff frequency of 100 Hz. The overall voltage gain is 100.