University of California

College of Engineering

Department of Electrical Engineering and Computer Science

EE 105

Spring 2016

Homework Assignment #1

Due Friday 1/29 at 5PM in EE105 dropbox

1.40

An amplifier operating from ±3-V supplies provides a 2.2-V peak sine wave across a 100-Ω load when provided with a 0.2-V peak input from which 1.0 mA peak in drawn. The average current in each supply is measured to be 20mA. Find the voltage gain, current gain, and power gain expressed as ratios and in decibels as well as the supply power, amplifier dissipation, and amplifier efficiency.

1.44

An amplifier with 40 dB of small-signal, open-circuit voltage gain, an input resistance of 1 MΩ, and an output resistance of 100 Ω, drives a load of 500 Ω. What voltage and power gains (expressed in dB) would you expect with the load connected? If the amplifier has a peak output-current limitation of 20 mA, what is the rms value of the largest sine-wave input for which an undistorted output is possible? What is the corresponding output power available?

1.48

You are given two amplifiers, A and B, to connect in cascade between a 10-mV, 100-kΩ source and a 100-Ω load. The amplifiers have voltage gain, input resistance, and output resistance as follows: for A, 100 V/V, 100 kΩ, 10 kΩ, respectively; for B, 10 V/V, 10 kΩ, 1 kΩ, respectively. Your problem is to decide how the amplifiers should be connected. To proceed, evaluate the two possible connections between source S and load L, namely, SABL and SBAL. Find the

voltage gain for each both as a ratio and in decibels. Which amplifier arrangement is best?

1.77

A voltage amplifier has the transfer function

$$A_v = \frac{1000}{\left(1 + \frac{jf}{10^5}\right)\left(1 + \frac{10^2}{jf}\right)}$$

Using the Bode plots for low-pass and high-pass STC networks (Figs. 1.23 and 1.24), sketch a Bode plot for $|A_v|$. Give approximate values for the gain magnitude at f=10 Hz, 10^2 Hz, 10^3 Hz, 10^4 Hz, 10^5 Hz, 10^6 Hz, 10^7 Hz, and 10^8 Hz. Find the bandwidth of the amplifier (defined as the frequency range over which the gain remains within 3 dB of the maximum value).