**American University of Beirut**

Department of Electrical and Computer Engineering

EECE 310 – Electronics Fall 2011 – 2012

Homework 1

Due Wednesday October 5, 2011 at 9:00 am

**Problem 1. [50 points]**

An amplifier has the transfer characteristic: *vO* = 12 – 10 (*vI* – 3)2 V.

where *vO* and *vI* are in volts. This transfer characteristic applies for 3 < *vI* < *vO* + 3 V, and *vO* positive. At the limits of this region, the amplifier saturates.

a) **[15 points]** Sketch and clearly label the transfer characteristic. What are the saturation levels *L*+ and *L*– and the corresponding values of *vI*?

b) **[10 points]** Bias the amplifier to obtain a DC output voltage of 6 V. What value of input DC voltage *VI* is required?

c) **[10 points]** Calculate the value of the voltage gain (in V/V and in dB) at the bias point.

d) **[15 points]** If a sinusoidal input signal is superimposed on the DC bias voltage *VI*, that is: , find the resulting *vO*. Express *vO* as the sum of a DC component, a signal component at ** with amplitude *A*1 and another component at 2**with amplitude *A*2. The component at 2**is **undesirable** and is the result of the nonlinear transfer characteristic of the amplifier. If it is required to limit the ratio  to 1%, what is the corresponding upper limit on *Vi*?

**Problem 2. [50 points]**

An amplifier operating from +/– 12.7 V power supplies has a linear transfer characteristic except for output saturation at +/– 11 V.

a) **[12 points]** The *peak-to-peak* value of the largest sinusoidal wave that can be applied at the amplifier input without output distortion is 0.5 V. Find the amplifier voltage gain in V/V and in dB.

b) **[8 points]** What is the corresponding output power for an 32  load?

c) **[20 points]** What is the power gain, in W/W and in dB, if the input power is 10 mW? What is the current gain of the amplifier, in A/A and in dB?

d) **[10 points]** What is the amplifier efficiency (in %) if the DC current drawn from each power supply is 200 mA?