Name: _____

Student No: _____

Electrical and Computer Engineering Department
University of Puerto Rico - Mayaguez, P.R.
Electronics II - Spring 2000 - Final Exam - Prof. Manuel Toledo

There are 8 problems in this exam, adding up to a total of 140 points - 100 for the exam and 40 bonus points. You can use your class notes and book while solving the exam - but do not share them with anyone. BE CLEAR AND WELL ORGANIZED OR LOOSE POINTS

1. Find the maximum value of the feedback network β allowed for stability in an amplifier with gain function given by

$$A_v(s) = \frac{1000}{(\frac{s}{2\pi f_b} + 1)^3}$$

Assume that $f_b = 100$ kHz. (10 points)

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2. For the amplifier described in problem 1, find the gain and phase margins for $\beta = 0.002$. (15 points)

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3. Sketch the gain and phase bode plots for tha amplifier in problem 1. (5 points)

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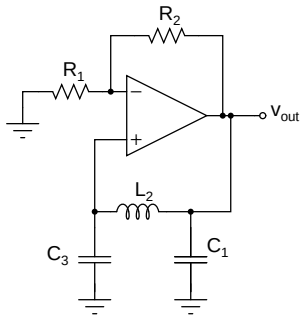
4. The circuit shown below aims at building a Colpitts oscillator using an opamp instead of a discrete transistor amplifier. Show that the circuit will not oscillate if the opamp is ideal. (10 points)



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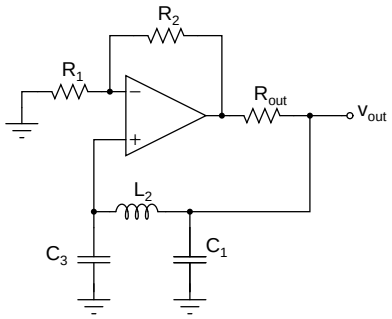
5. The circuit shown below aims at building a Colpitts oscillator using an opamp instead of a discrete transistor amplifier. Derive an expression for the frequency of oscillation in terms of R_{out}, C_1, L_2 and C_3. Assume that the opamp is ideal. (25 points)



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6. Design a Butterworth filter with a dc gain magnitude of 10, and gain magnitudes of 8.9 and 0.5 at 3.5kHz and 35 kHz, respectively. (25 points)

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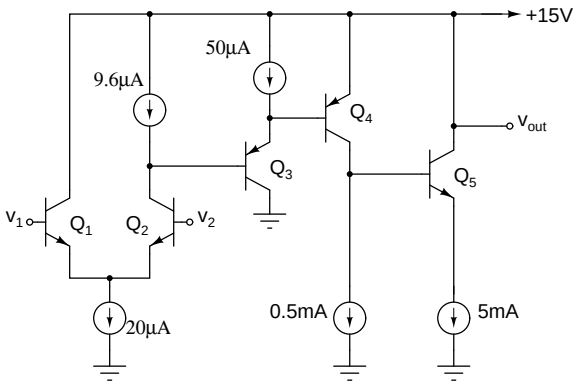
7. The figure below shows a simplified diagram for an integrated-circuit amplifier. Assume $\beta_{NPN} = 200$ and $\beta_{PNP} = 50$.

   (a) Identify the inverting and non-inverting inputs. Justify your answer. (5 points)

   (b) Find the voltage in the base of Q_3 if $v_1 = 5mV$. (15 points)



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8. (a) Design a class-B amplifier for 10W output across a 100 Ohm load. (5 points)
   (b) Find the efficiency of the amplifier if the output voltage is a 20 volt peak sine wave. (10 points)
   (c) Find the efficiency of the amplifier if the output voltage is a 20 volt peak symetric square wave. (15 points)