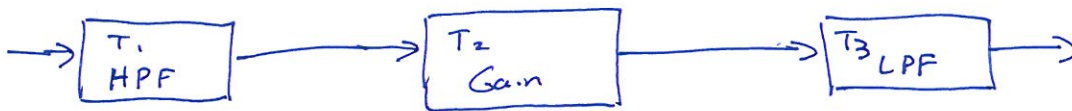## ECE 332 Quiz 5
(10 minutes)

Name: _____

1. [100 pts] **Given**: The transfer function below.

$$T(s) = \frac{\pm 50000s}{(s + 50)(s + 1000)}$$

a. [30 pts] **Find**: Rewrite $T(s)$ as a cascaded connection of 3 stages. Use two passive 1st-order filter stages and one gain stage. Clearly label each stage.
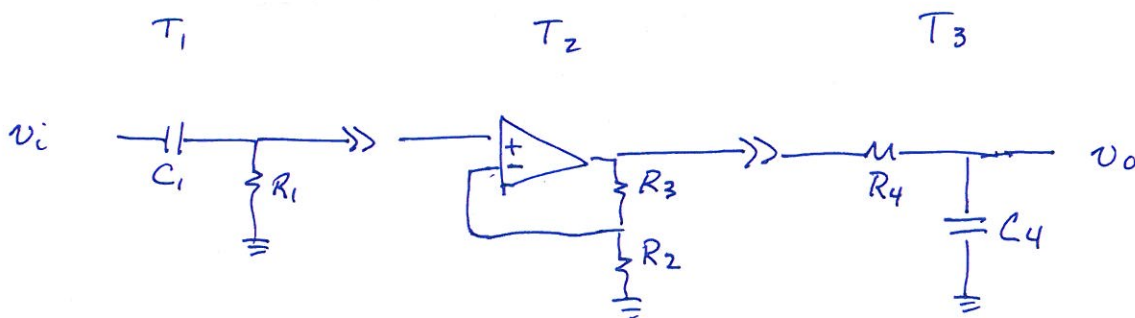

$$T_1(s) = \frac{s}{s+50} \qquad T_2(s) = 50 \qquad T_3(s) = \frac{1000}{s+1000}$$

b. [10 pts] **Find**: Based on how you cascaded $T(s)$ in part a, what filter function does it perform?

Band pass filter

c. [40 pts] **Find**: Draw a circuit below to realize $T(s)$ using only resistors, capacitors, and OP AMP(s). <u>Do not select resistor and capacitor values at this time</u>. Ensure you consider loading. Clearly label each stage according to part a.

d. [10 pts] **Find:** What are the corner frequencies of $T(s)$ i.e. the poles?

$$\omega_{c\ell} = 50 \ rad/sec \qquad\qquad s = -50$$

$$\omega_{ch} = 1000 \ rad/sec \qquad\qquad s = -1000$$

e. [10 pts] **Find**: Select appropriate values of resistors and capacitors to realize your circuit using only 1 μF capacitors.

$$\frac{1}{R_1 C_1} = 50 \qquad C_1 = 1.0 \mu F \qquad R_1 = \frac{1}{1\mu \cdot 50} = 20k\Omega$$

$$\frac{1}{R_4 C_4} = 1000 \qquad C_4 = 1.0 \mu F \qquad R_4 = \frac{1}{1\mu \cdot 1000} = \frac{1}{1m} = 1k\Omega$$

$$Gain = 1 + \frac{R_3}{R_2} = 50 \qquad Choose \quad R_2 = 1k\Omega$$

$$R_3 = 49 \, R_2 = 49k\Omega$$