EE42/100 Spring 2006 Problem Set 9

Issued: March 16, 2006 Due: March 24, 2006

Please remember that homeworks are due at 12:00 noon Friday March 24th..
Please put your homework in the appropriate box (EE42 or EE100) in 240 Cory Hall.
Print your name(s) in upper right corner of your paper and indicate whether you're enrolled in EE42 or EE100.

1. *(Reading Assignment)* Sections 12.1-12.3 of Hambley 3rd edition.

2. **(20 points)** Noise-cancellation earphone circuit. In class you tried a pair of noise-cancellation earphones and saw the op-amp circuitry for them. The complete circuit appears below as Fig. 1 (full page for visibility). The simplified functional circuit below is Fig. 2. Calculate the gains of each of the six op-amp amplifiers in the circuit.

   Review: Each earphone has an associated microphone that picks up ambient noise. When you wear the earphones, an attenuated version of that noise reaches each ear; to cancel that noise for the left ear, for example, the left microphone input is amplified and inverted and then presented to the left ear via the left earphone. The amplitude of that canceling signal is controlled by the variable resistor labeled R14a. (The earphones in class may not have included those adjustable resistors.) An auxiliary stereo input (e.g., from your CD player) also reaches your earphones via the volume controls R23a and R23b and the summing circuits involving op-amps IC3a and IC3b.

   Examine the circuit of Fig. 1 to determine the values of the circuit elements in each amplifier sub-circuit. You may assume that the coupling capacitors such as C3 have zero impedance for frequencies in the audible range. Find the gains assuming that all the variable resistors are set for maximum signal amplitude.

3. (10 points) Hambley 3rd Ed. P10.35 Note: The battery in Fig. P10.35b should be 5 volts.

4. (10 points) Hambley 3rd Ed. P10.44.

5. (10 points) Hambley 3rd Ed. P10.46

6. (10 points) Hambley 3rd Ed. P10.48

7. (10 points) Hambley 3rd Ed. P10.53

8. (10 points) Hambley 3rd Ed. P10.55

9. (10 points) Hambley 3rd Ed. P10.61

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Fig. 1. Noise-canceling earphone circuit

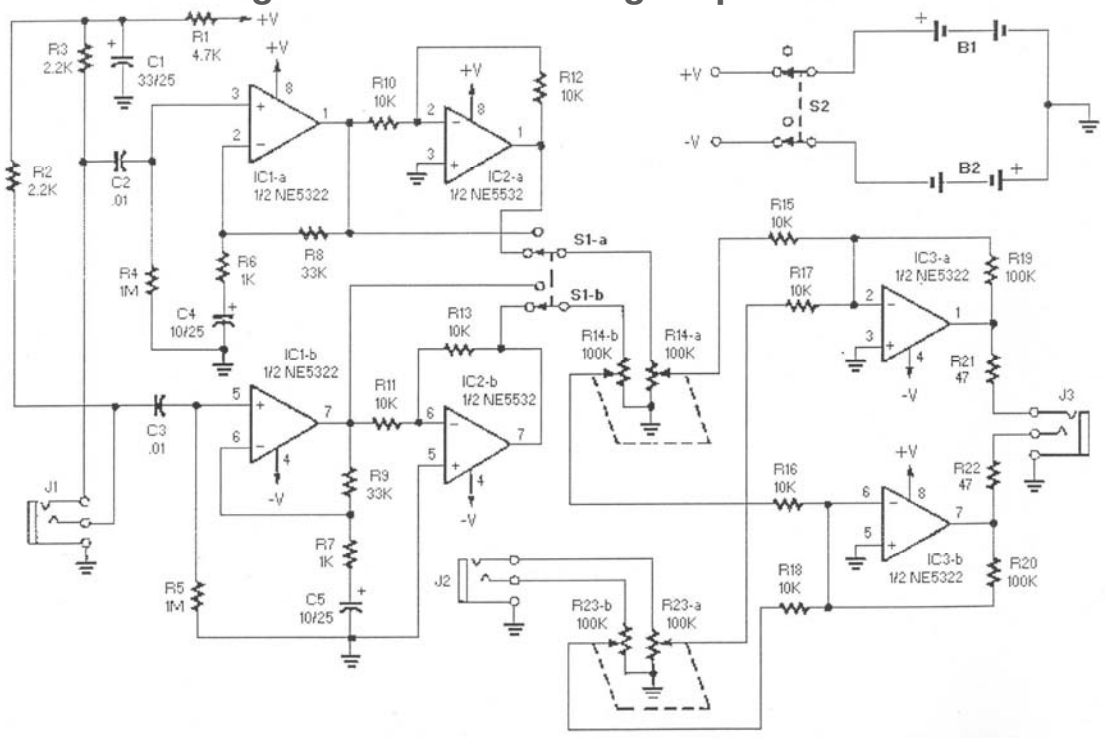

Fig. 2 Find the gains of the six amplifiers