UVA WELLASSA UNIVERSITY OF SRI LANKA

Department of Computer Science and Technology

End Semester Examination - Semester -1 – 2008/2009

CST308-2 Microelectronics

ENG301-2 Digital and Analogue Electronics

Time Allowed: Two Hours | Answer 4 Questions Only

1.

(a) What are the characteristics of an ideal operational amplifier?

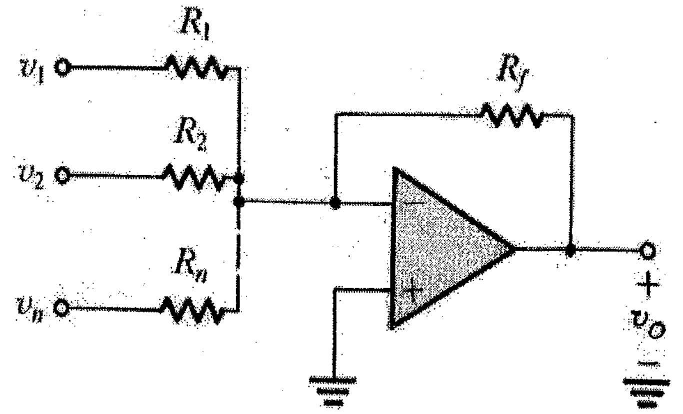
(b) Draw basic schematic diagrams of both inverting and non inverting amplifiers.

(c) By taking above characteristics in part (a) into consideration derive expressions for closed loop gain (G) of both inverting and non inverting amplifiers presented in part (b)

(d) Show that if the open loop gain A is finite, the closed loop gain of an inverting amplifier is

$$G = \frac{(R2/R1)}{1+(1+R2/R1)/A}$$

2. The following is a circuit diagram of a practically used electronics circuit.



(a) Identify above circuit, its practical application and describe the functionality. (derive an equation for its output in terms of inputs and component values)

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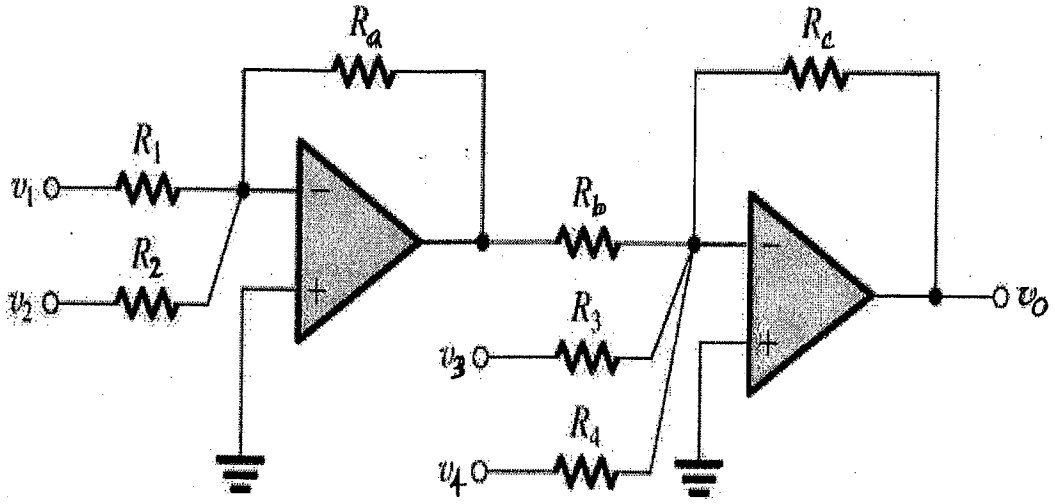


(b) Similarly derive an equation for output for above circuit.

(c) For the circuit in above part (b) suggest appropriate values for each resistor such that all inputs will be amplified by the same magnitude

3. A stereo (two channel) sound source is converted in to digital PCM-WAV format using sampling at a frequency of 48000Hz and with a sample size of 16bit.

(a) If this data is stored as an uncompressed WAV file what's the file size of a 1hour long recording?

(b) This wave file is converted into Dolby Digital AC3 format having a bit rate of 192Kbps. What's the compression ration and what's the file size of 1hour long recording?

(c) What's the most suitable Analog to Digital Converter (ADC) type to do above conversion? Justify your answer.

(d) In modern DVD players two types of digital audio outputs exists called SPDIF and Optical out. What are the advantages over these digital outputs over conventional analog audio outputs.

(e) Draw a functional block diagram of a Digital Audio Amplifier capable of amplifying 6channel DTS (digital Theater Systems) encoded optical audio input. Briefly describe the function of each block.

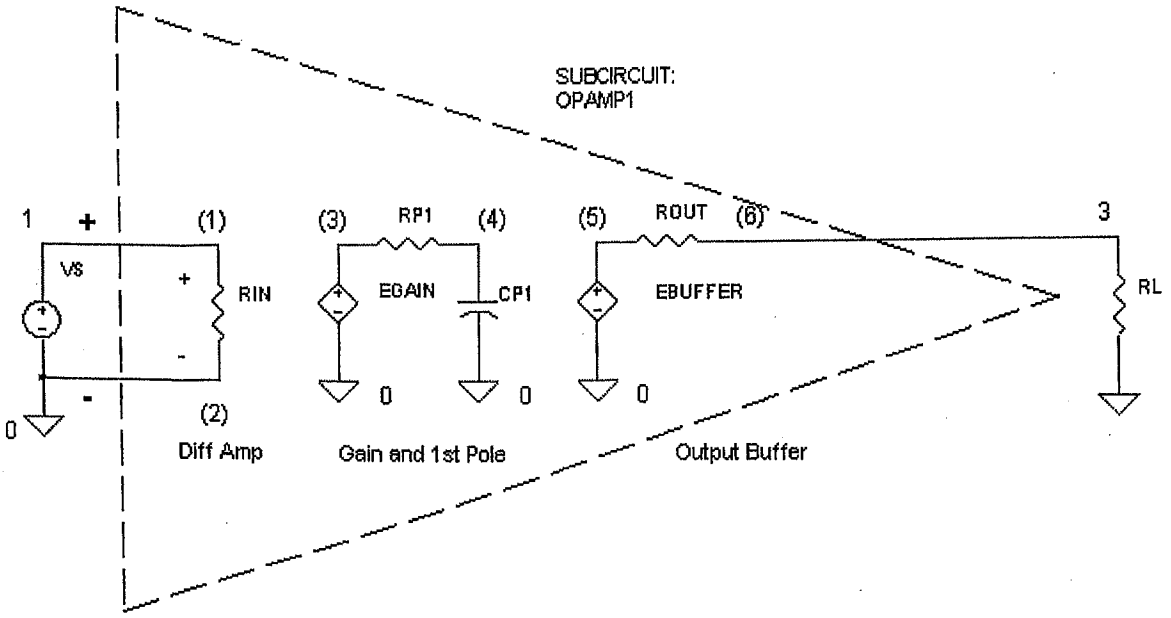
4. In a public address system, a dynamic microphone having a 300Ohms output impedance is connected to a pre-amplifier having an input impedance of 400Ohms and an output impedance equals to 50Ohms. The pre-amplifier is connected to a power amplifier having an input impedance of 1KOhms and an output impedance of 0.05Ohms. The power amp output is fed to 10 speaker boxes rated 4Ohms, 20W each. The power amplifier is operated by a single supply voltage supply of 30Volts. Typical output voltage of a dynamic microphone is 20mV. The pre-amplifier has a voltage gain of 40dB.

   (a) What's the maximum RMS power without distortion that can be generated by the power amplifier assuming the linear output voltage of the amplifier lies in (2V to 28V) range. (also assume speaker boxes are connected in parallel)

   (b) If we increase the power supply voltage of the power amp to 50Volts, at what gain should the power amp be operated in order to protect speakers.

   (c) At 50Volts supply what's the Peak Music Power Output of the amplifier?

5. The following circuit diagram is used to construct a basic op-amp model to be used in SPICE simulations.



   (a) Write down the role of each component inside OPAMP1 sub-circuit. (Components surrounded by the dotted triangle)

   (b) Implement OPAMP1 sub-circuit using SPICE directives.

   (c) Draw a schematic diagram of a voltage follower circuit and implement it as a SPICE netlist using the OPAMP1 sub-circuit above.

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