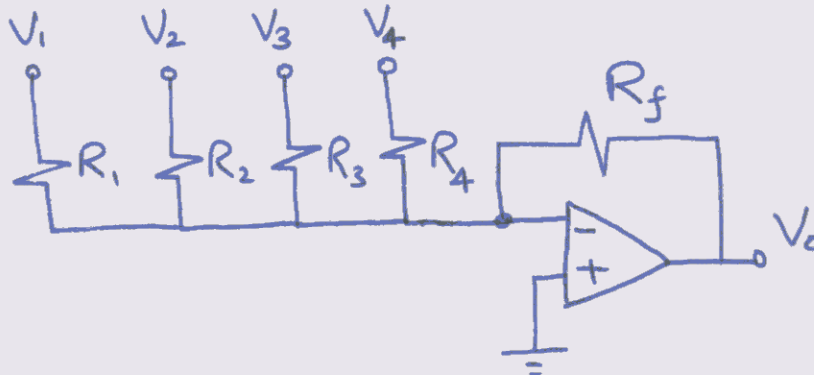


**Homework # 1**  
**EE201 (032)**  
**Instructor: Noman Ali Tasadduq**

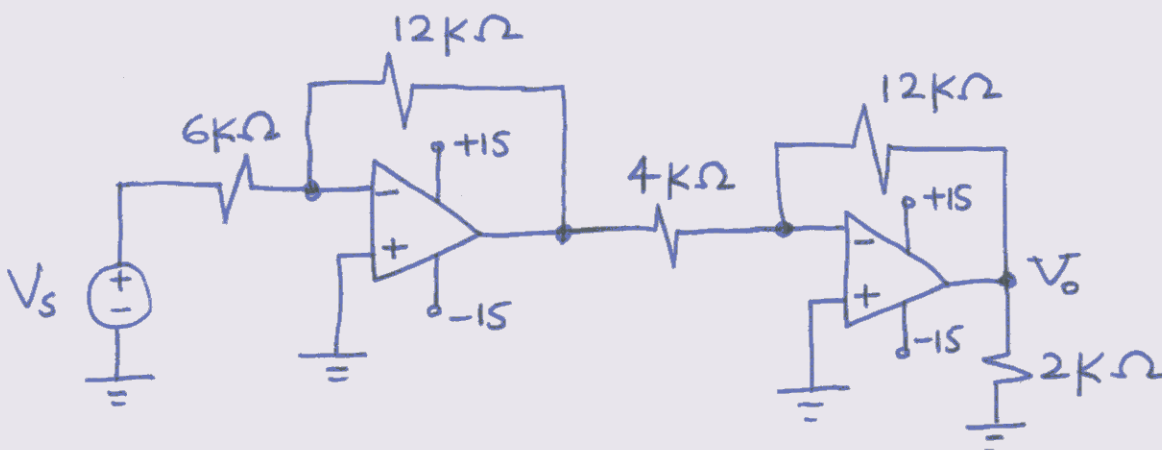
- Q1. In the op amp circuit shown in the figure below,
- find an expression for the output voltage 'Vo'
  - Let  $R_f=10k\Omega$ ,  $R_1=10k\Omega$ ,  $R_2=20k\Omega$ ,  $R_3=40k\Omega$  and  $R_4=80k\Omega$ . Inputs  $V_1$  to  $V_4$  could have only two values, either 0 or 1 (binary input). If  $V_1$  is the most significant bit (MSB) and  $V_4$  is the least significant bit (LSB) draw a table with three columns, with the first column showing the binary input [ $V_1V_2V_3V_4$ ], the second column showing the decimal equivalent value and the third column showing the value of output voltage ( $V_o$ ) from equation of part (a). Obtain the output voltage for all the combination of binary inputs [0000],[0001],[0010],.....,[1111]
  - Can you guess from the table of part (b) what is the function performed by this op amp circuit.

(Notice that the resistor values are  $R_4=2R_3=4R_2=8R_1$ . This is called binary weighted ladder.)



- Q2. Your laboratory has available a large number of  $10\mu\text{F}$  capacitors rated at 300V. To design a circuit you need a  $40\mu\text{F}$  capacitor rated at 600V. How many  $10\mu\text{F}$  capacitors rated at 300V are needed from the laboratory and how would you connect them to get a  $40\mu\text{F}$  capacitor rated at 600V. Show the connection of capacitors clearly.

- Q3. Find  $V_o$ , if  $V_s=12\text{mV}$ .



- Q4. A 10V dc voltage is applied to an op amp integrator with  $R=50k\Omega$ ,  $C=100mF$  at  $t=0$ . How long will it take for the op amp to saturate (non linear region) if the supply voltages are  $\pm 12V$ ? Assume that the initial capacitor voltage was zero.
- Q5. The gap in the circuit will arc over whenever the voltage across the gap reaches 36kV (36000V). The initial current in the inductor is zero. The value of  $\beta$  is adjusted so that the Thevenin resistance seen by the inductor becomes  $(-3k\Omega)$ .
- (a) What is the value of  $\beta$ ?
- (b) How many microseconds after the switch has been closed will the gap arc over?

[What is Arcing: When electricity flows through the air from one pole of an electric circuit to another, or jumps from its source to ground without flowing through a desired circuit, it is said to arc. This phenomenon is often accompanied by visible flashes of light and a crackling noise. Lightning and static electricity shocks are well-known examples of arcing. In electrical generation, arcing is usually undesirable because an arc sends all electricity to ground without putting it to a practical use. However, deliberately-created high-intensity arcs of electricity have many practical applications ranging from welding to high-intensity lighting.]

