Assignment 1

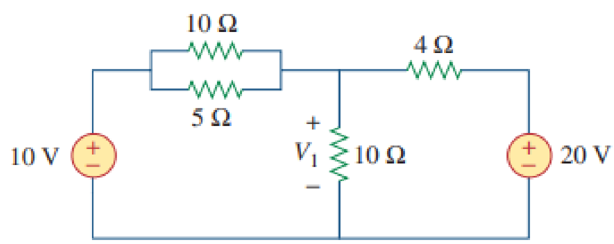
BRAC University

Semester: Fall 2022
Course No: CSE251
Course Title: Electronic Devices and Circuits

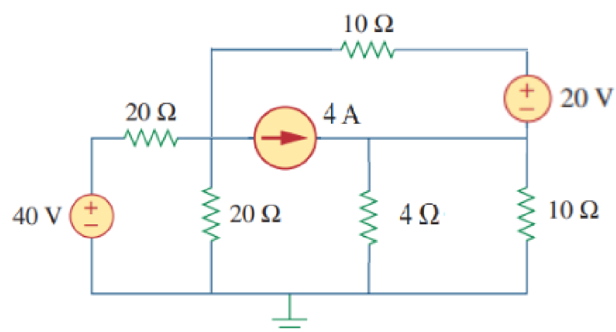
Full Marks: 100
Deadline: **16 February 2022**

---

1. Draw the alternate representations of the following circuits *[Note that the number of floating sources should be minimized in your design]*. **[5+5]**

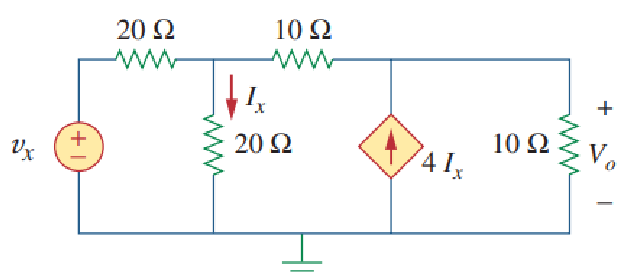


a)



b)

2. Use nodal analysis to find V_o in the following circuit: **[10]**



Here, v_x = (40+last digit of your ID) V

3. **[20+5+10+5]**

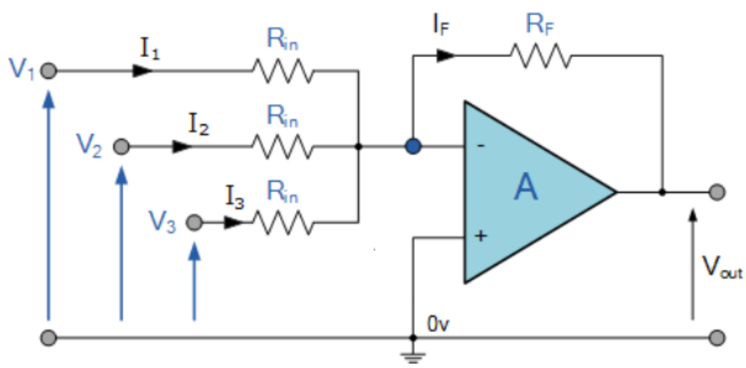
(a) **Design** a circuit using an **Op-Amp comparator** to turn ON (or OFF) the street lights automatically. For this, you have a lux sensor installed on top of the street lights (facing above) that outputs a voltage proportional to the amount of natural light, as listed below:

$v_{\text{night, 0 lux}} = 1\text{ V}$	$v_{\text{dusk, 20 lux}} = 2\text{ V}$	$v_{\text{dawn, 80 lux}} = 3\text{ V}$

The lights require 20 V and should be ON if the light goes below 20 lux (at dusk).

[Hints: you may start by building the circuit as a comparator.]

(b) **Analyze** the following circuit and **derive** the expression for the output voltage (V_{out}) in terms of the inputs. If V_1=1 V, V_2 = 2V, and V_3 = 1.5 V, and all the resistors have equal values, calculate V_{out}.

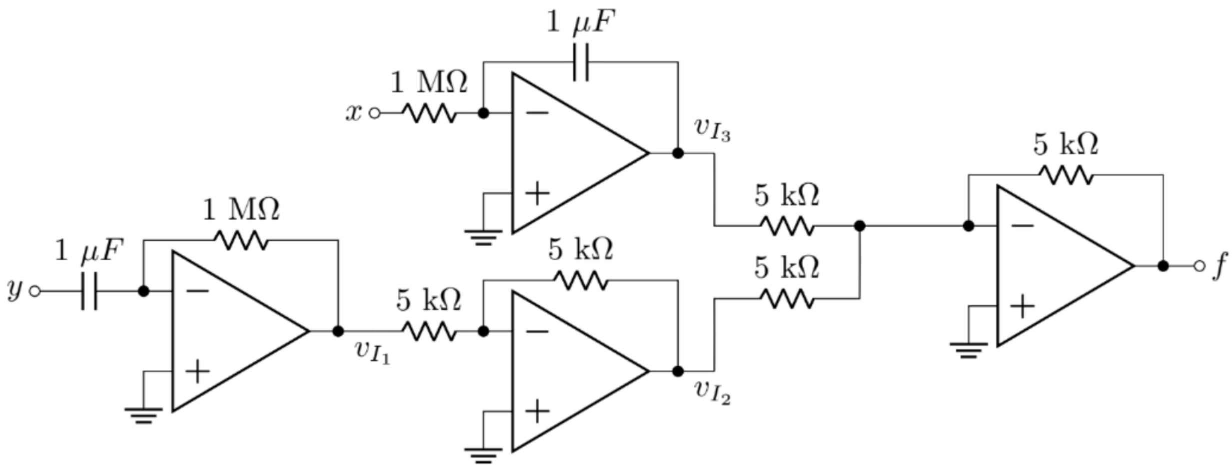


(c) **Design** a circuit using Op-Amp to implement the following expressions:

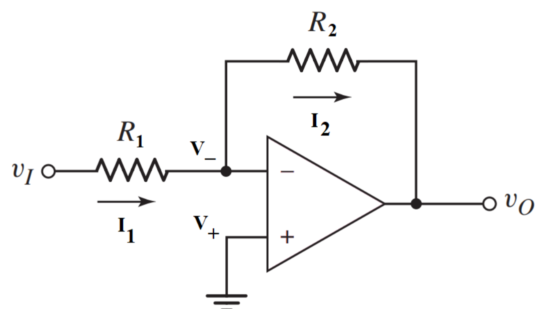
(i) $$z = \int x\,dt - 2\frac{dy}{dt} - u$$

(ii) y = 12x

(d) **Analyze** the circuit below to find f in terms of inputs x and y.



4. **[15+15]**



(a) **Design** an inverting amplifier (i.e., find the values of R_1 and R_2 of the circuit shown in Fig.) in such a way that the voltage gain is **−5**.

(b) Consider the circuit in Figure 3(b) again. Assume the input $v_i = 0.1 \sin\omega t$ (V) has a maximum current rating of 5 μA. What design changes, if any, are required for this input, if the voltage gain remains the same?

5. Consider the non-inverting schmitt trigger we discussed in class. If R_1=2 kΩ, R_2=3×2=6 kΩ, v_L= −10V, v_H=10V, v_{ref} = 2.5V, calculate the threshold voltages and draw the transfer characteristics. **[10]**