Assignment 3

BRAC University

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

Full Marks: 100
Deadline: **1 December 2022**

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1. 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:

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

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}.
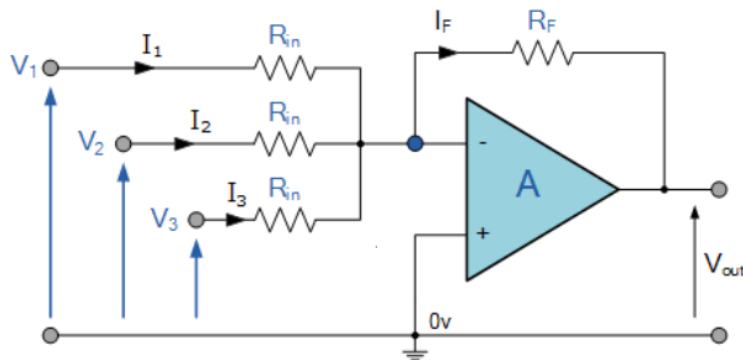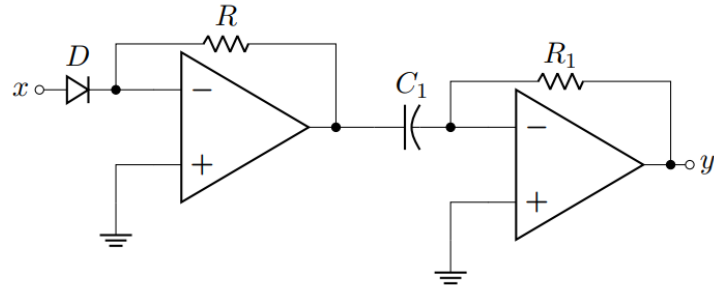

(c) **Design** a circuit using Op-Amp to implement the following expressions:

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

(ii) y = 12x

(d) **Analyze** the circuit below to find y as a function of x. For the diode, $I_SR = 1$ & $V_T = 1$.

[30+10+10x2+10]

2. Implement using MOSFETs: [10x3]

(a) f = (A + B)C

(b) f = $(\overline{AB+CD})$

(c) f = AB+A+CD (with and without simplifying the logic)