BRAC University Dept. of Computer Science and Engineering		Assessment: Assignment 2 **Due: 11:59 PM 18 February 2024** Full Marks: 40
Semester: Spring 2024 Course Code: CSE251 Section: **10/11** Course Name: Electronic Devices and Circuits		**Name:** _____ **Student ID:** _____

- ✓ Write down your student ID on the **top right corner of each of the pages**.
- ✓ Clearly write the solutions, along with the questions, on white paper with black ink (no need to use color pen, don't use pencils).
- ✓ Use **CamScanner**, or **Adobe Scan**, or **Microsoft Office Lens**, or any other software to scan the pages and make a **single PDF file**.
- ✓ After creating the PDF, make sure that **(a)** there are no pages missing, **(b)** all of the pages are legible, **(c)** your student ID on each page are visible.
- ✓ Please note, **collaboration ≠ copying**. You are allowed to discuss the questions and clear confusion you might have, but you have to write your solutions independently and be able to explain your answers during a random viva.
- ✓ **[Very Important]** Rename the PDF in the following format: **"A2_StudentID_FullNameWithoutSpace.pdf"**. For example, if my student ID is 12345678 and my name is Shadman Shahid, the filename should be **"A2_12345678_ShadmanShahid.pdf"**.
- ✓ **Submission Link:** **https://forms.gle/t3jitDhcubjZVhJs6**

[CO3] Question 1: 20 Marks

a) Design circuits using **op-amp** that can implement the following functions, where x, y, z indicate input voltages and f indicates the output voltage: **6**

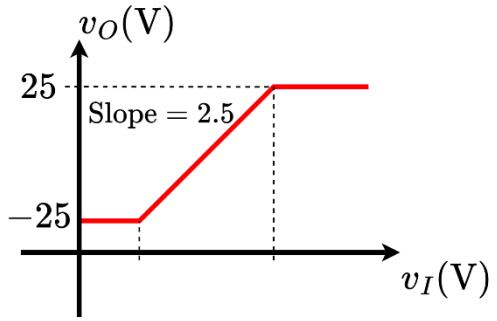
i. $f = 3x + 7y$

ii. $f = -3\int x\,dt + 7y + 5\frac{dy}{dt}$

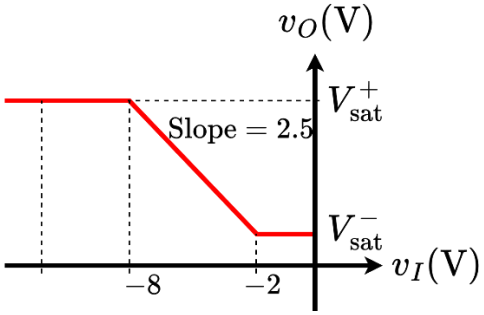
iii. $f = 4x - 7y + 8z$

b) Design circuits using **op-amp** to implement the following Voltage transfer characteristics graphs. Clearly show the saturation voltages and any necessary parameters to fully characterize the device. **8**

i.



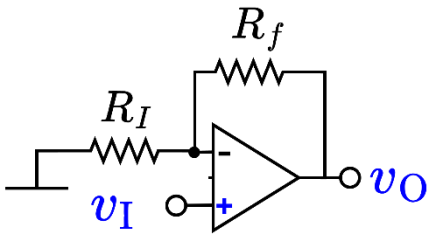
ii.



c) **Design** the circuit below such that the closed loop voltage gain is $A_{CL} = 18$. The maximum current **in any resistor** is to be limited to $15\ \mu A$ with the input voltage in the range $-30 \le v_I \le 30\ mV$. **6**

i. What are the values of R_I and R_f ?

ii. What is the range of output voltage v_o?



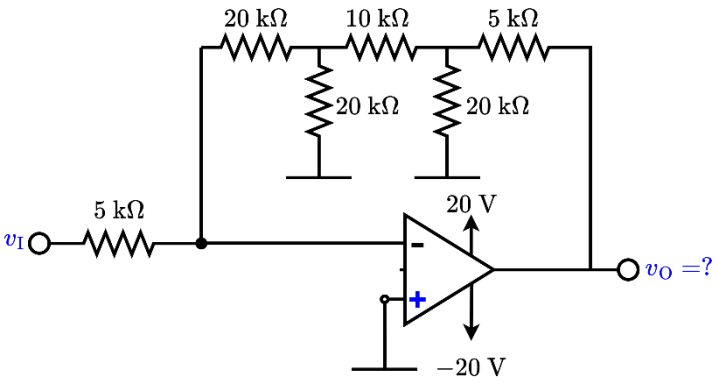
Question 2: 20 Marks

a) Find v_O for the following values of v_I: [CO2] 9

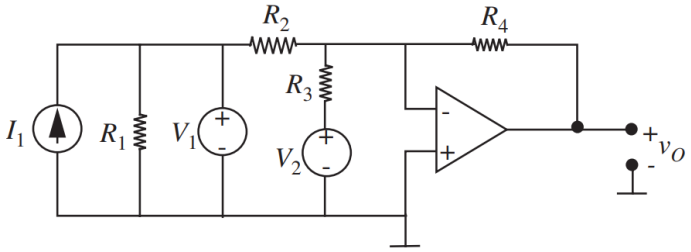
i. 0.5 V

ii. −2 V

iii. −8 V



b) Calculate v_O in terms of I_1, V_1 and V_2 in the adjacent figure. You may assume the operational amplifier has ideal characteristics. [CO2] 3



c) Write the node equations for the v_a and the v_- nodes, and enough more independent relations to specify v_O in terms of v_i. Do not solve. [CO2] 8