Solution

Semester: Summer 2025
Course Code: CSE251
Electronic Devices and Circuits
Section: 07
Faculty: TAV

Set **A**

Extra → 2 copies
Present – 22
Absent – 3
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Assessment: Quiz 1
Duration: 25 minutes
Date: July 9, 2025
Full Marks: 20

- No washroom breaks. Phones must be turned off. Using/carrying any notes during the exam is not allowed.
- At the end of the exam, both the **answer script** and the **question paper** must be returned to the invigilator.
- All the questions are compulsory. Marks allotted for each question are mentioned beside each question.
- Symbols have their usual meanings.

■ Question 1 of 2

[CO2] [8 marks]

(a) [2.5 marks] Show the alternative representation (i.e. line representation/diagram) of the circuit in Figure-1.

(b) [1.5 marks] Analyze the circuit in an alternative representation from part-(a), and calculate V_x.

(c) [2.5 marks] Analyze the circuit in an alternative representation from part-(a) & the waveform of Vin in Figure-2, and draw the waveform of the output voltage on Figure-2. Label the graph properly.

(d)[1.5 marks] Draw the VTC of this comparator(V_o vs V_{in})

Rubric:

(a) Ground taken → 1
V_{sat}^+, V_{sat}^- taken → 1
V_{in}, +15 shown → 0.5

(b) Using VDR → 1
Correct ans → 0.5

(c) Correct Transition → 1+2
& Voltage Label → 0.5

(d) Zero Crossing shape – 0.5
Label – 0.5

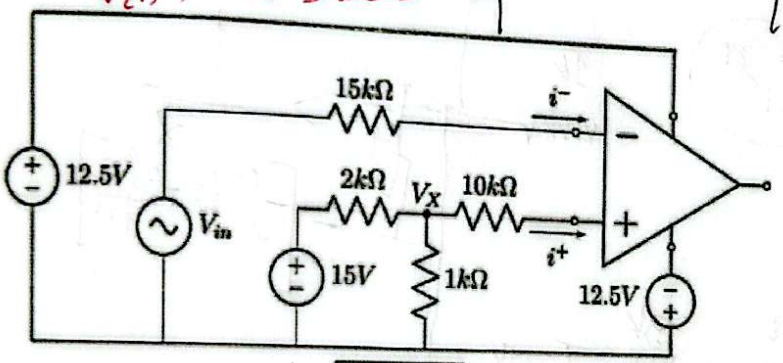


Figure-1

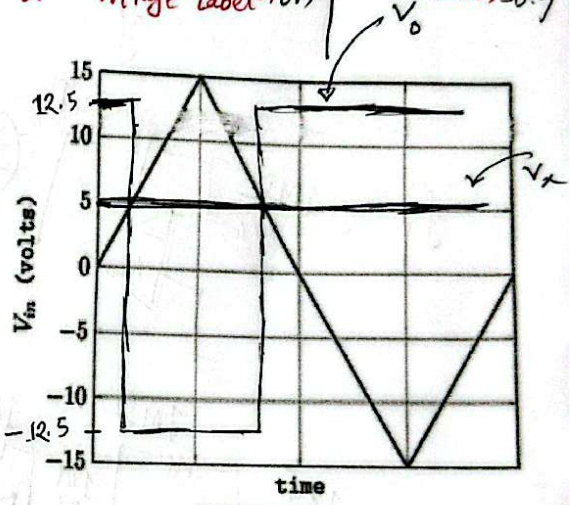
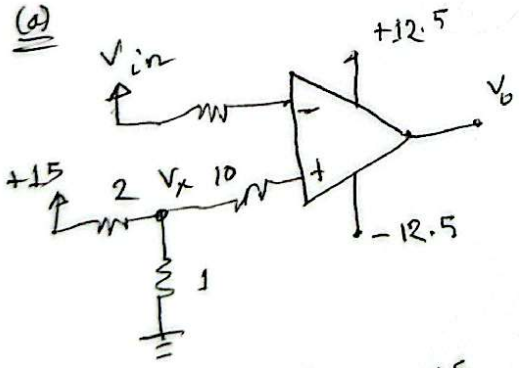


Figure-2

(a)



(b) $V_x = \frac{1}{1+2} \times 15$

$= 5V$

(c) $V_- = V_{in}$

$V_+ = V_x = 5V$

V_{in} range: $-15 \rightarrow +15$

(d) Open loop,

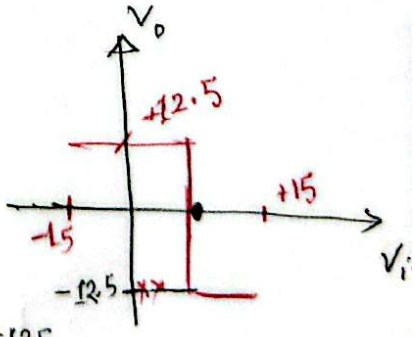
$V_o = A(V_+ - V_-)$

If $V_o = 0$, $V_+ = V_- = 5V$

If $V_- < V_+ \Rightarrow V_{in} < 5$

$V_o = V_{sat}^+ = 12.5$

If $V_- > V_+ \Rightarrow V_{in} > 5 \rightarrow V_o = V_{sat}^- = -12.5$



2(a)

Summer has (-) in formula, so taking one (-) voluntarily

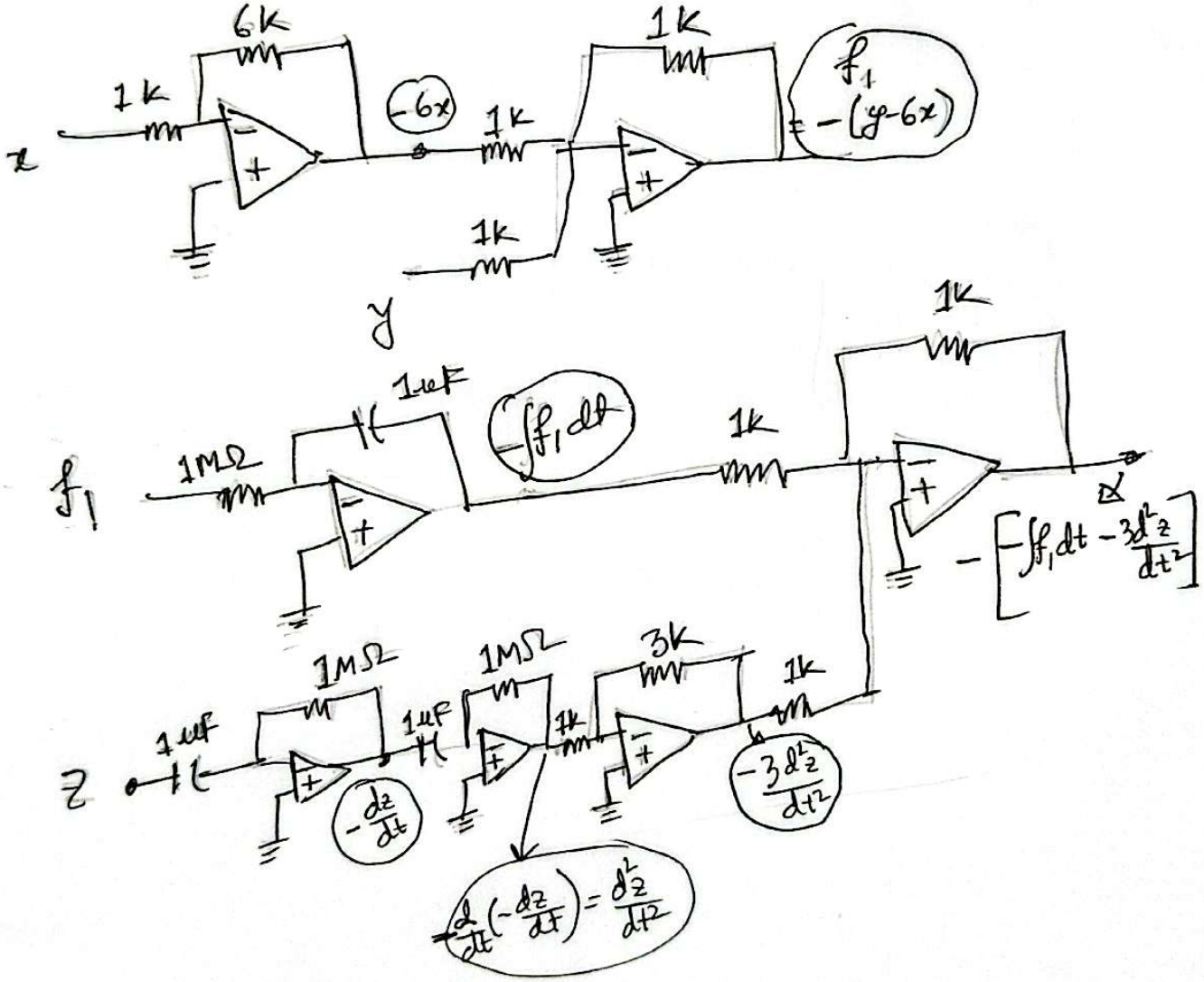
$$f = -\left[-\int (6x-y)\,dt - 3\frac{d^2z}{dt^2}\right]$$

Integration formula has (-)

$$-\int (6x-y)\,dt$$

$$-\int \left[-(y-6x)\right] dt$$

summer formula has (-)



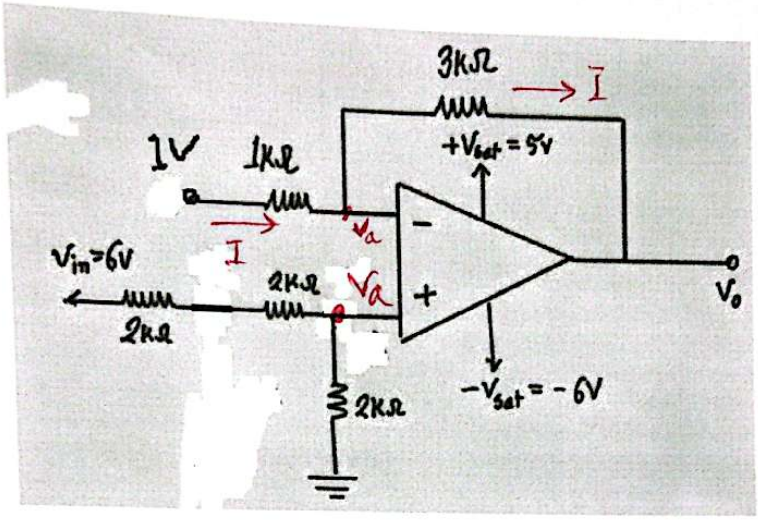
■ **Question 2 of 2**

(a) **[CO3+CO2] [7+5 marks]**

$$f = \int (6x - y)\, dt + 3\frac{d^2}{dt^2} z$$

2 differentiator → 2×1
1 integrator → 1
2 Adder → 2×1
Integration of the components → 2

(b) Find the value of V_o



$$V_a = \frac{2}{2+2+2} \times 6$$

$$= 2V$$

$$V_+ = V_- = 2V \quad [\text{Virtual Short}]$$

$$I = \frac{1 - V_a}{1} = \frac{V_a - V_o}{3}$$

$$\Rightarrow \frac{1-2}{1} = \frac{2-V_o}{3}$$

$$\Rightarrow -3 = 2 - V_o$$

$$\Rightarrow V_o = 5V$$

Rubric:

VDR for V_a → 1
Virtual short ($V_+ = V_-$) → 1.5
Equal current through 1kΩ & 3kΩ → 1.5
V_o value → 1