



Daffodil International University
Department of Electrical and Electronic Engineering, Faculty of Engineering
Mid Term Examination, Fall – 2025

Course Code: 0714- 221

Course Title: Electronics II

Section: A, B, C

Level-Term: L2-T2

Full Marks: 25

Date: Oct. 18, 2025

Teacher's Initial: SR

Time: 1.5 Hours

[Notes: Answer all the following questions]

Q1. Determine the output voltage v_o in the Op-Amp circuit of below Fig. 1.

**CO-1 05
(C3)**

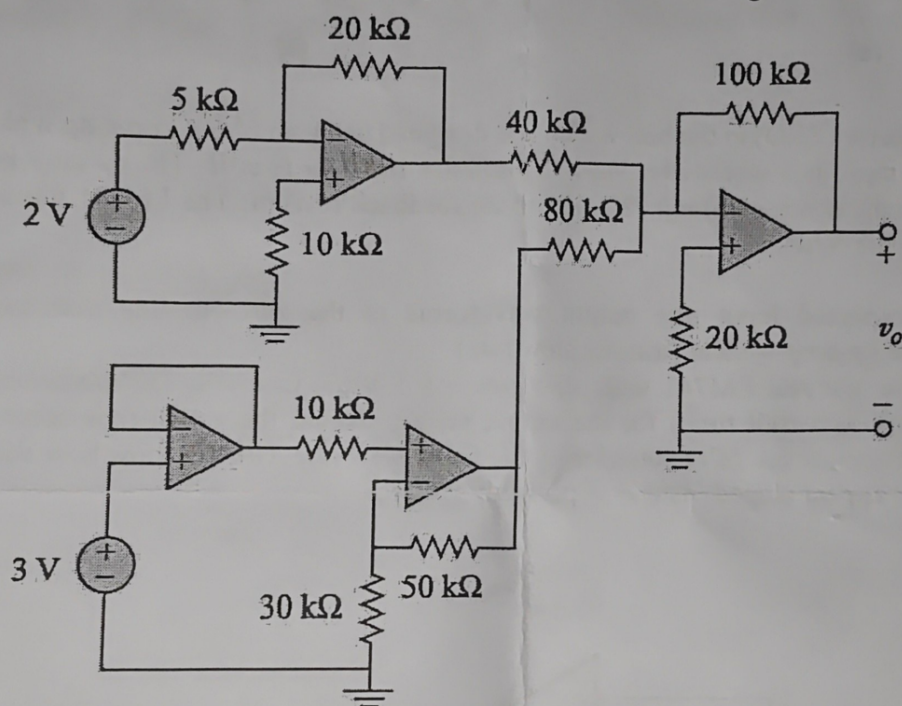


Fig. 1

Q2. Design a temperature threshold alarm using an LM741 as a comparator.

**CO-1 05
(C4)**

- A sensor provides 10 mV/°C output (0 V at 0 °C).
- The system should trigger (output goes HIGH) when the temperature exceeds 40 °C.
- The LM741 is powered from ± 12 V.
- Assume the sensor output goes to the non-inverting input.
- Use a resistor divider from the +12 V supply to generate the reference voltage.

Tasks:

1. Draw the comparator circuit with LM741.
2. Calculate the reference voltage that corresponds to 40 °C.
3. Choose suitable resistor values (≥ 10 k Ω) for the divider to generate this reference voltage.
4. Show the output condition when the temperature is:
 - o (a) 35 °C
 - o (b) 45 °C

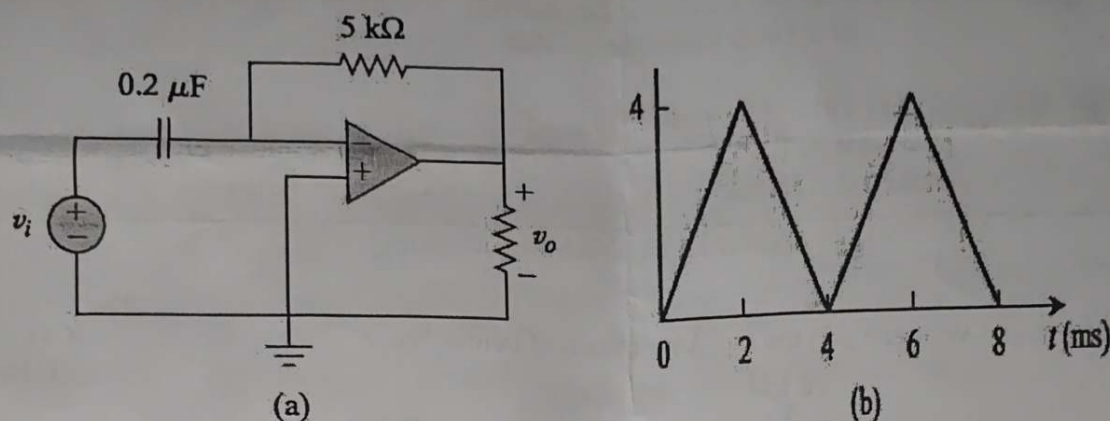
Q3 I. If an OP-Amp differential amplifier has Common-Mode Rejection Ratio (CMRR) = 80 dB and differential gain (A_d)=200, determine the common-mode gain (A_{cm}).

**CO-1 02
(C4)**

II. Design a circuit to amplify the difference between two input signal by 2. (a) Use only one op amp. (b) Use two op amps. All resistances must be ≥ 10 k Ω in your design.

03

- Q4. The waveform in Fig. (b) is applied to the input of the op amp differentiator in Fig. (a). **CO-1 05**
Calculate the output and show the output waveform. **(C3)**



- Q5. A zero-crossing detector (ZCD) in the below Fig. 2 is designed using an LM741 op-amp with $\pm 15 \text{ V}$ supply. The input is a sine wave: $V_{in} = 5 \sin(2\pi * 10 \text{ kHz} * t) \text{ volt}$. The op-amp is configured as a comparator (open-loop ZCD) with no feedback resistor. The LM741 has a typical **slew rate** of $0.5 \text{ V}/\mu\text{s}$. **CO-1 05**
(C3)

- Draw the expected input and output waveforms of the zero-crossing detector assuming the op-amp is ideal (infinite slew rate).
- Now consider the real LM741 with slew rate $= 0.5 \text{ V}/\mu\text{s}$. Calculate the minimum transition time (rise/fall time) for the output swing. Sketch the actual (non-ideal) output waveform of the ZCD considering the finite slew rate. Clearly show how the output edges appear sloped instead of perfectly vertical.

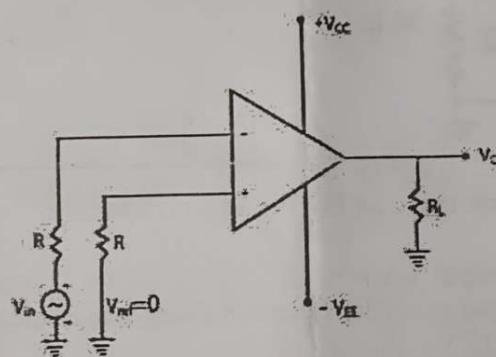


Fig. 2: zero-crossing detector (ZCD)