

Brac University

Semester: Spring 2025

Course Code: CSE251

Electronic Devices and Circuits

Section: 01-30

Set
02

Assessment: Midterm Exam

Duration: 1 hour 30 minutes

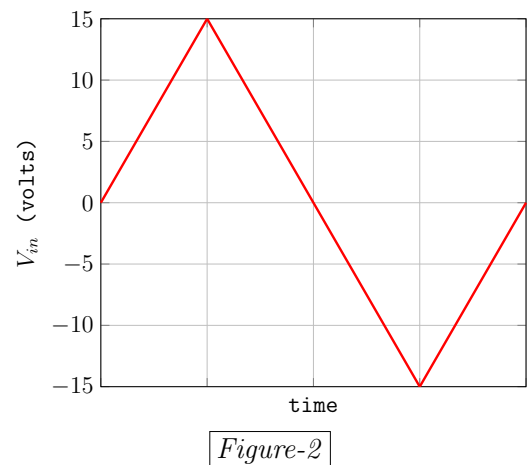
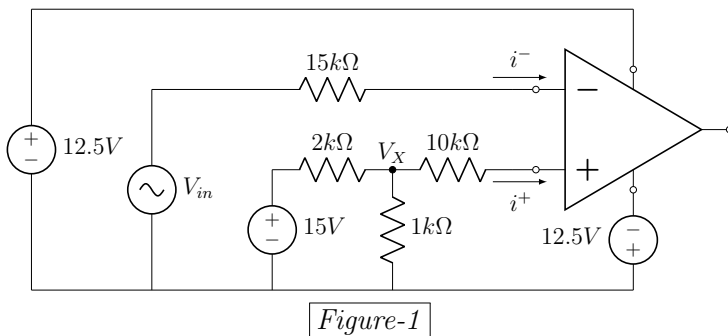
Date: 18 March, 2025

Full Marks: 30

===== Section-A : Answer 2 of 3 questions =====

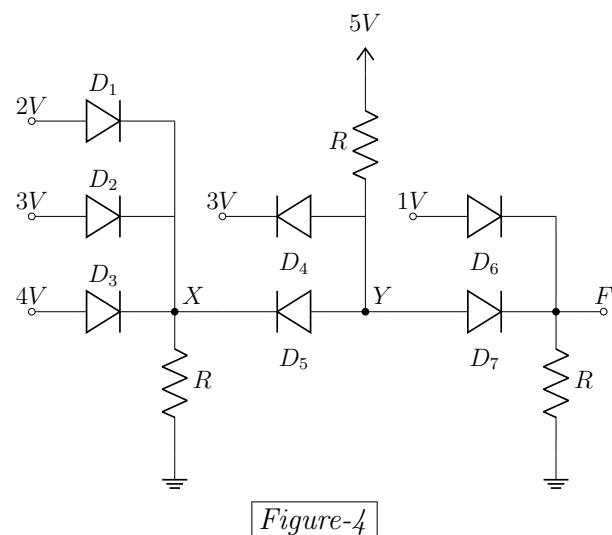
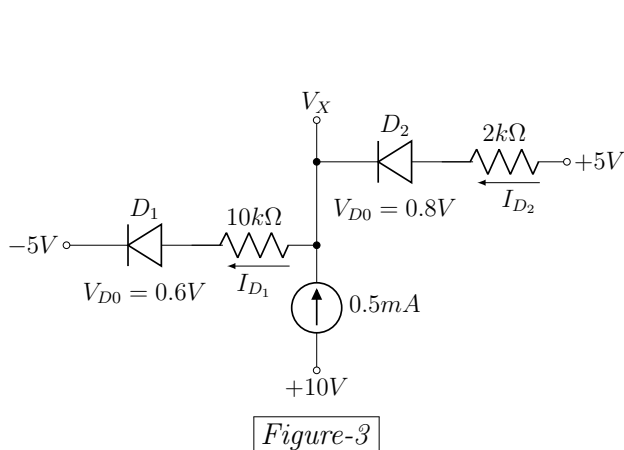
■ Question 1 [CO2] [7.5 marks]

- [2.5 marks] Show the alternative representation (i.e. line representation/diagram) of the circuit in Figure-1.
- [1 mark] State the values of i^+ and i^- of the circuit shown in Figure-1.
- [1.5 marks] Analyze the circuit in an alternative representation from part-(a), and calculate V_X .
- [2.5 marks] Analyze the circuit in an alternative representation from part-(a) & the waveform of V_{in} in Figure-2, and draw the waveform of the output voltage on Figure-2. Label the graph properly.



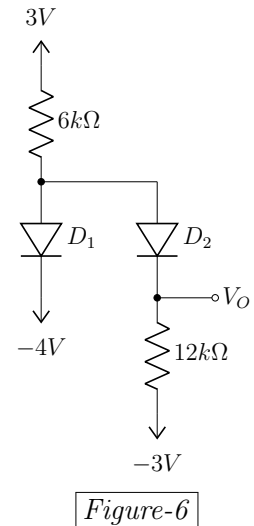
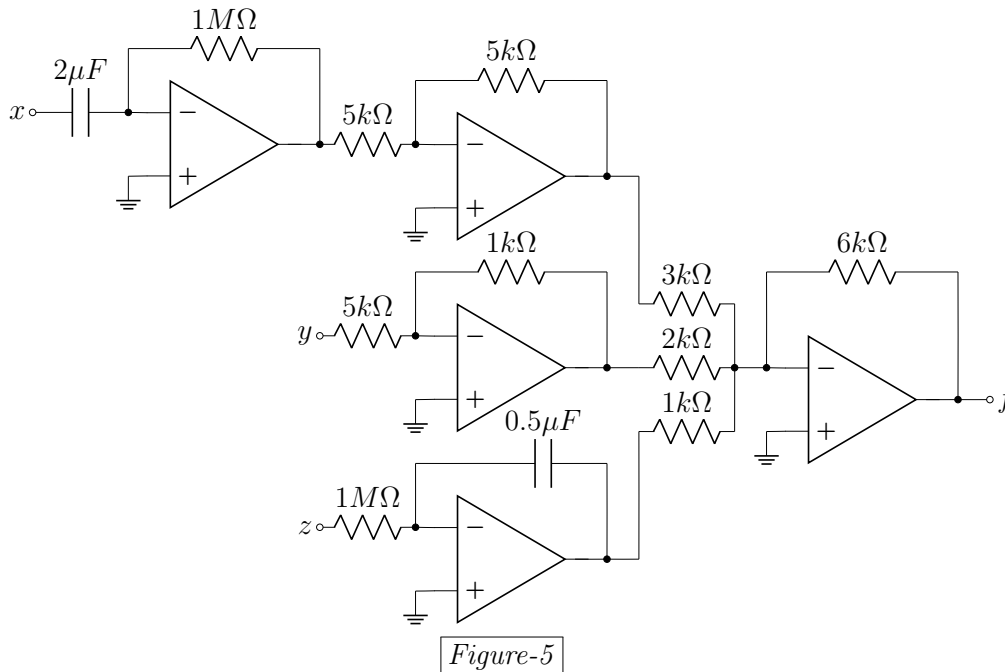
■ Question 2 [CO2] [7.5 marks]

- [4 marks] Analyze the circuit in Figure-3, and calculate I_{D1} , & I_{D2} using the method of assumed states. You must validate your assumptions.
- [1.5 marks] Analyze the circuit in Figure-4, and calculate V_X , V_Y , & V_F . Assume, all the diodes are ideal.
- [2 marks] The parameters of an inverting amplifier are: $R_1 = 10k\Omega$, R_2 or, $R_f = 30k\Omega$, $V_{Sat}^+ = 15V$, and $V_{Sat}^- = -15V$. It is fed a 12V (pk-pk) sine wave. Draw the output voltage waveform with proper labels.



■ Question 3 [CO2] [7.5 marks]

- (a) [2 marks] **Analyze** the circuit in *Figure-5*, and **determine** the expression of the function, f where x , y and z are the input of the circuit.
- (b) [4 marks] **Analyze** the circuit in *Figure-6*, and **calculate** I_{D1} , I_{D2} , & V_O using the method of assumed states. You must **validate** your assumptions. Here, $V_{D0} = 0.7V$.
- (c) [1.5 marks] **Draw** the Voltage Transfer Characteristics (VTC) of a non-inverting amplifier with Gain = 1.5, $V_{Sat}^+ = 8V$, and $V_{Sat}^- = -8V$. **Label** the graph properly.



===== Section-B : Answer all questions =====

■ Question 4 [CO1] [5 marks]

- (a) [1 mark] **State** the relation between the input and output voltages of an ideal op-amp.
- (b) [2 marks] What is a linear amplifier? **Explain** the reason for the saturation of the output voltage of an amplifier briefly.
- (c) [2 marks] **Draw** the I-V characteristics graph of the CVD+R model of a diode. **Label** the graph properly.

===== Section-C : Answer 2 of 3 questions =====

■ Question 5 [CO3] [5 marks]

- (a) [3 marks] **Analyze** the graph in *Figure-7*, and **design** a circuit that implements the relationship between the voltage waveforms, $V_{input} = 5\sin(t)$ and V_{output} . **Assume** any value if necessary.
- (b) [2 marks] **Design** the circuits with the boolean inputs A, B, C, D using Ideal Diodes to implement the following boolean logic functions:
 (i) $f = A.B.C+D$ (ii) $f = (A+B+C).D$

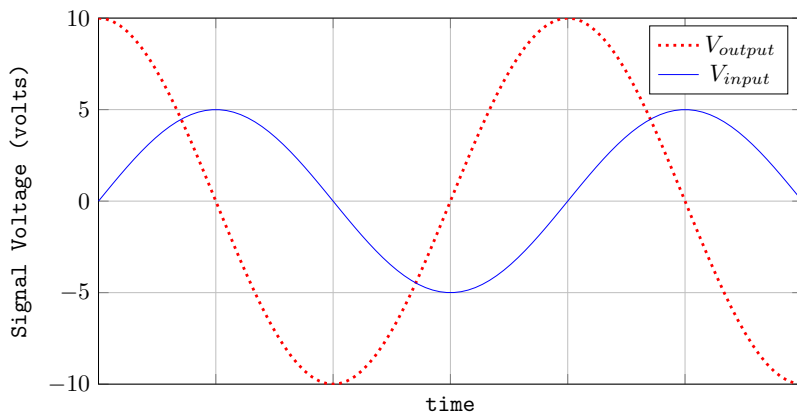


Figure-7

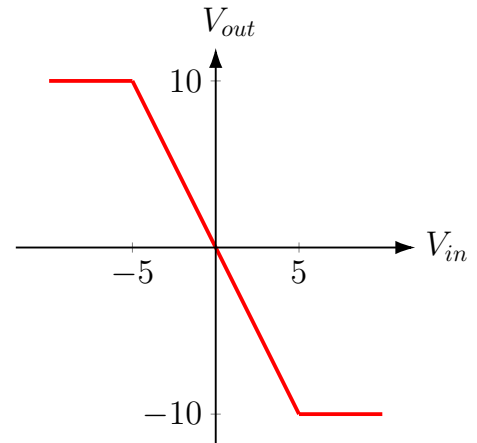


Figure-8

■ Question 6 [CO3] [5 marks]

- (a) [2 marks] **Analyze** the graph in *Figure-8*, and **design** a circuit that implements the relationship between V_{in} and V_{out} . **Assume** any value if necessary.
- (b) [3 marks] **Design** a device to implement the following function, f where x , y , and z are the input of the device. **Assume** any value if necessary.

$$f = 5 \int (x + y) dt - 3 \frac{d}{dt}(z)$$

■ Question 7 [CO3] [5 marks]

- (a) [4 marks] The Voltage Transfer Characteristics (VTC) of an ideal NOT gate can be represented by the graph in *Figure-9*. **Analyze** the graph in *Figure-9*, and **design** a circuit using an op-amp comparator that can work as an ideal NOT gate. **Assume** any value if necessary.
- (b) [1 mark] **Design** a circuits with the boolean inputs A, B using Ideal Diodes to implement the boolean logic function, $f = \overline{A}.\overline{B} + A.B$

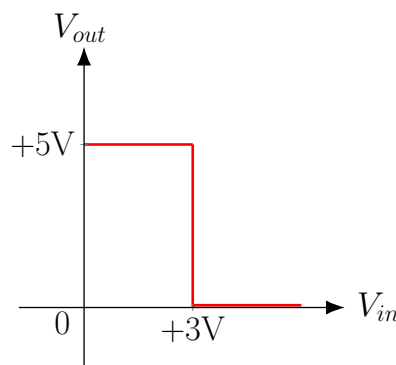


Figure-9