

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)**  
**ORGANISATION OF ISLAMIC COOPERATION (OIC)**  
**DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING**

Semester Final Examination  
 Course No.: EEE 4381  
 Course Title: Basic Electronics and Semiconductor Physics

Winter Semester, A. Y. 2022-2023  
 Time: 3 Hours  
 Full Marks: 150

There are 6 (six) questions. Answer all 6 (six) questions. The symbols have their usual meanings. Programmable calculators are not allowed. Marks of each question and corresponding COs and POs are written in the brackets.

1. a) Sketch the pin configuration of LM741. Describe the properties of an ideal Op-Amp. LM741 is a special type of Op-Amp – explain this statement. 13  
(CO1, PO1)
- b) Sketch the characteristic curve of an Op-Amp with proper labeling. Explain loading effect. Sketch an amplifier which will prevent this loading effect. 12  
(CO1, PO1)
2. a) Design an Op-Amp circuit with inputs  $v_1$  and  $v_2$  such that  $v_o = -7v_1 + 5v_2$ . 10  
(CO2, PO2)
- b) If  $v_1 = 7V$  and  $v_2 = 3.1V$ , find  $v_o$  in the op-amp circuit of figure 2(b). 10  
(CO2, PO2)

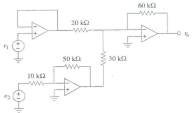


Figure: 2(b)

- c) Find  $i_o$  in the Op-Amp circuit of figure 2(c). 5  
(CO2, PO2)

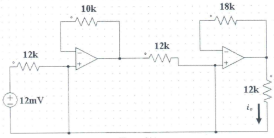


Figure: 2(c)

3. a) Sketch the circuit diagram of a noninverting zero crossing detector and show the input and output graph with proper labelling. Assume, input signal is 10 V peak to peak sinusoidal AC. Explain the working principle of a noninverting zero crossing detector.
- b) Sketch the output waveshape for the following figure 3(b):

12  
(CO1,  
PO1)

7  
(CO2,  
PO2)

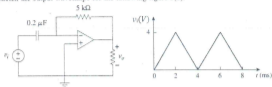


Figure: 3(b)

- c) Sketch the circuit diagram for the following figure of 3(c). In X axis each division is 1ms and in Y axis each division is 5V.

6  
(CO2,  
PO2)

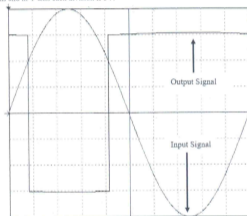


Figure: 3(c)

4. a) Discuss the differences between Bipolar Junction Transistor and Field Effect Transistor.
- b) Explain the working principle of a n-channel JFET with proper circuit diagram. Sketch the characteristic curve of a n-channel JFET with proper labelling and show its symbol.
- c) Sketch the transfer curve of a n-channel JFET defined by  $I_{DSS} = 12 \text{ mA}$  and  $V_p = -6V$ . Use Shorthand Method.

8  
(CO1,  
PO1)

12  
(CO1,  
PO1)

5  
(CO2,  
PO2)

5. a) A truth table is given below. Here A, B, C are the input variables and X, Y are the output variables. From this truth table formulate the Boolean expression for both X and Y. Sketch this Boolean expression using logic gates.

A	B	C	X	Y
0	0	0	0	0
0	0	1	0	1
0	1	0	1	1
0	1	1	1	0
1	0	0	0	0
1	0	1	1	1
1	1	0	0	0
1	1	1	1	0

- b) Design a 4-bit to 2-bit encoder and 2-bit to 4-bit decoder using digital logic gates. Formulate the truth tables. Derive the expressions and implement them using logic gates.

6. a) Determine  $I_C$ ,  $V_{CE}$  and  $V_C$  for the following circuits of Fig: 6 (a).  $\beta=400$  for both Bipolar Junction Transistors. Here  $V_{CC} = 15V$ .

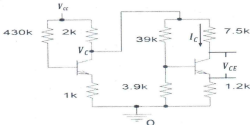


Figure: 6 (a)

- b) Determine the value of  $N_1$  and  $N_2$  for the Fig. 6(b) where input is 220V (rms) AC and the dc output voltage is 15V.

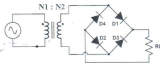


Figure: 6 (b)

- c) Sketch  $V_O$  for the following circuits of Fig: 6 (c). Assume the diode is an ideal diode. Show necessary steps.

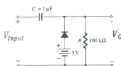
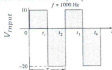


Figure: 6 (c)