VICTORIA UNIVERSITY OF WELLINGTON TE HERENGA WAKA NEW ZEALAND

XMUT204 Electronic Design

Laboratory 5: BJT Applications - Questions

Due date: You need to submit a report to XMUT co-teacher; please contact him for how and when to submit it.

Answer the following questions by referring to different sections in the lab exercises:

1. For the given BJT transistor circuit as a switch:
   a. Sketch the input and output characteristics of this circuit. [10 marks]
   b. Give the logic table for the operation of your circuit. What logic function does this implement? [10 marks]
   c. Use the results from previous lab 4 exercises (e.g. transistor output curves of V_{CE} vs I_C) and plot the approximate position of the operating point for V_{in} = 0 V and V_{in} = 5 V. [10 marks]
   d. Sketch how you could use NPN transistor to construct:
      i. OR gate. [5 marks]
      ii. NOR gate. [5 marks]
      iii. AND gate. [5 marks]

2. Show the typical variations in values of β observed in the active region and show how the variation in these values of β will lead to different operating characteristics in a circuit such as in Figure 2. [15 marks]

3. For given BJT transistor circuit as an amplifier:
   a. Related to the circuit in Figure 3, use the results from previous lab exercises (transistor output curves of V_{CE} vs I_C), determine the approximate position of the DC operating point, and sketch the waveform in each case for:
      i. The undistorted sine wave output. [5 marks]
      ii. The saturation and cut-off distorted sine wave outputs. [10 marks]
   b. Calculate the voltage gain and phase shift of your CE amplifier with and without the capacitor C_e. Explain at least two effects of this capacitor. [15 marks]
   c. Explain at least two roles of the resistor combination R_{B1} and R_{B2} in the circuit. [5 marks]
   d. Explain at least two roles of the resistor R_e in this circuit. [5 marks]

Marking Schedule

Student Name : _____

Student ID : _____

No	Section	Mark	Your Mark	Remarks
	Questions			
1	For given BJT transistor circuit:			
a	Sketch the input and output characteristics of this circuit.	10		
b	Give the logic table for the operation of your circuit. What logic function does this implement?	10		
c	Use the results from previous lab exercises (transistor output curves of V_{CE} vs I_C) and plot the approximate position of the operating point for V_{in} = 0V and V_{in} = 5 V.	10		
d	Sketch how you could use npn transistor to construct:			
	i. a OR gate.	5		
	ii. a NOR gate.	5		
	iii. an AND gate.	5		
2	Show the typical variation in values of β observed in the active region and show how the variation in these values of β will lead to different operating characteristics in a circuit such as in Figure 2.	15		
3	For given BJT transistor circuits:			
a	Related to the circuit in Figure 3, use the results from previous lab exercises (transistor output curves of V_{CE} vs I_C), determine the approximate position of the DC operating point, and sketch the waveform in each case for:			
	i. The undistorted sine wave output.	5		

	ii. The saturation and cut-off distorted sine wave outputs.	10		
b	Calculate the voltage gain and phase shift of your CE amplifier with and without the capacitor C_E. Explain the effect of this capacitor.	15		
c	Explain the roles of the resistor combination R_{B1} and R_{B2} in the circuit.	5		
d	Explain the roles of the resistor R_e in this circuit.	5		
	Total	100		

Comment: