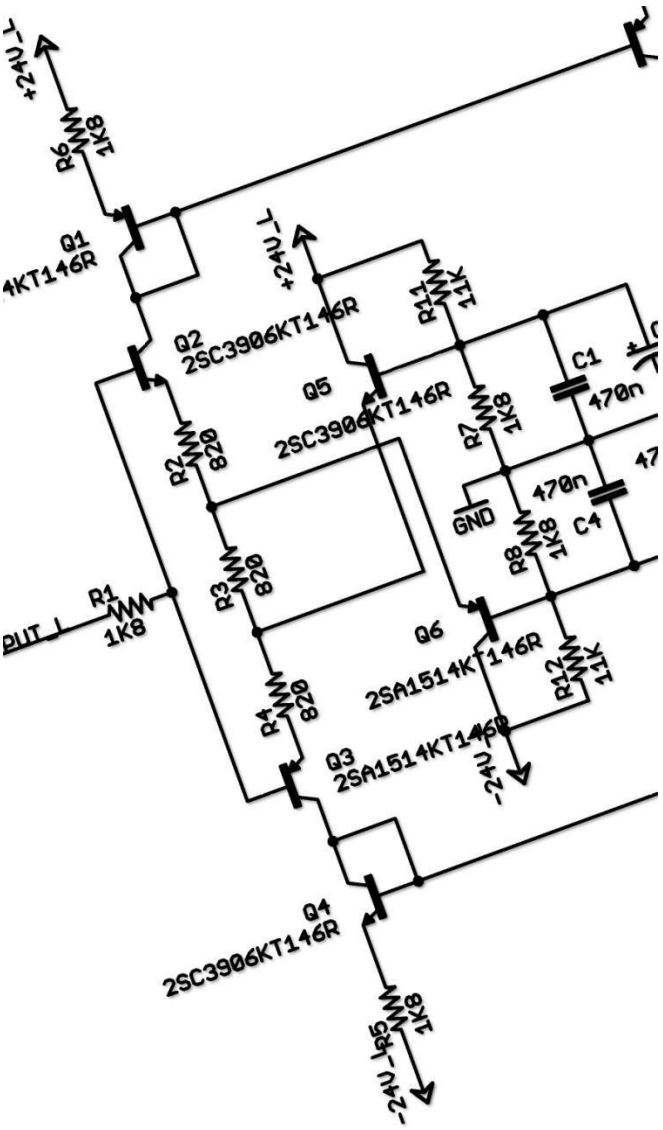
MONASH University
Engineering

ECE2131

Electrical Circuits Laboratory Notes



2022 Edition

Name:	Student ID:	Email:

Electrical and Computer Systems Engineering, Monash University

2022

10 Diode Circuits

10.1 Learning Objectives and Introduction

Diodes are a versatile electronic component that allow current to flow in only one direction. They have a huge number of applications, such as circuit protection, power rectification, voltage multiplication, logic, demodulation, clipping, and clamping. Other varieties of diode are also used as light sources, and for optical communications.

This lab is designed to provide practical experience in working with diodes, introducing you to as many of the different applications for diodes as possible. This lab is also designed to increase your exposure to applications of diodes you may not have considered. If you have time, you should try to ensure you understand as many of the circuits as possible, as many are useful for electronics design problems you may encounter later in your degree and in your career.

By the end of this lab you should:

- Apply simple diode models to predict the outputs of circuits with diodes
- Analyse, build and characterise diode circuits.

10.2 Equipment and Components

- Breadboard.
- Diode 1N4007.
- Resistor 100 Ohm, 100 kOhm.
- Capacitor 470 nF.

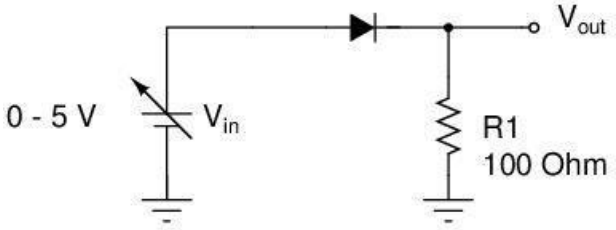
10.3 Important Notes

Pay close attention the diode I-V curve. Applying a voltage source across a diode junction will result in an exponentially increasing current, which can very easily damage the diode. You should therefore always limit the maximum current flowing through the diode, e.g. using a resistor.

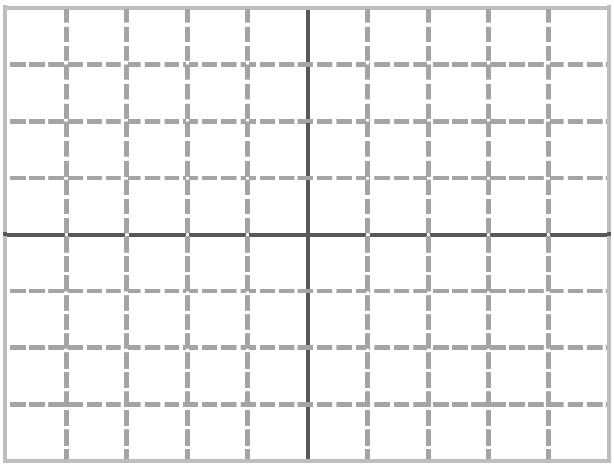
10.4 Experimental Work

10.4.1 PART A – DIODE CHARACTERISTIC

Construct the following circuit on the prototype board.



10.4.1.1 Sweep the DC supply voltage manually from 0V to 5V, recording at least 15 points. Measure the output voltage using a multimeter or oscilloscope. Plot the graph of V_{out} against V_{in}.



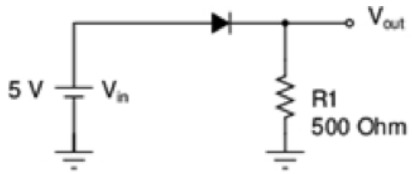
Is this as expected? How well does this match the simple diode models you have been introduced to?

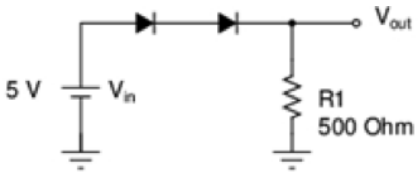
10.4.1.2 Your measurements should have demonstrated that the forward voltage drop does not change much over a large range of currents, so we can safely *assume a constant voltage drop of approximately 0.7 V* across the diode for bias circuit calculations.

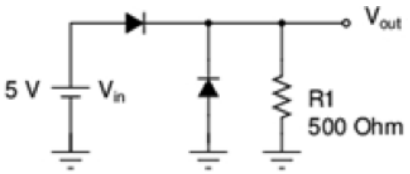
To test this, we want to achieve a diode current of 10mA in the circuit shown in figure 1. Verify your calculations from the preliminary quiz by measuring the diode current experimentally. To do this, choose the nearest resistor to the one you specified in the quiz. What current did you observe? (You may only be able to perform this in the laboratory using a multimeter to measure current)

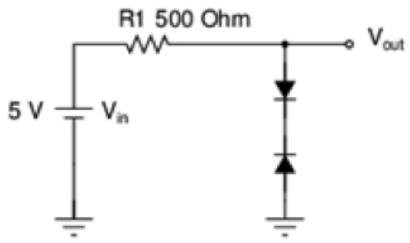
10.4.2 PART B – DIODES IN SERIES AND PARALLEL

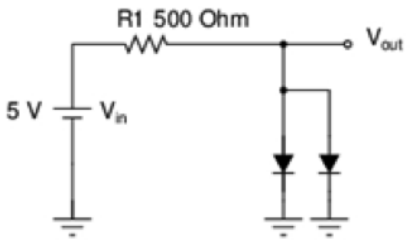
Since forward-biased diodes have a relatively constant voltage drop, various combinations are sometimes used in circuits to shift the DC level up or down by a fixed amount or for clipping and clamping purposes. Predict the output voltage and verify with measurements for each of the following circuits. Use the space below to explain your predictions or analysis, as well as write the measured output voltages.

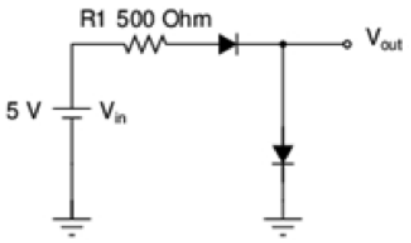


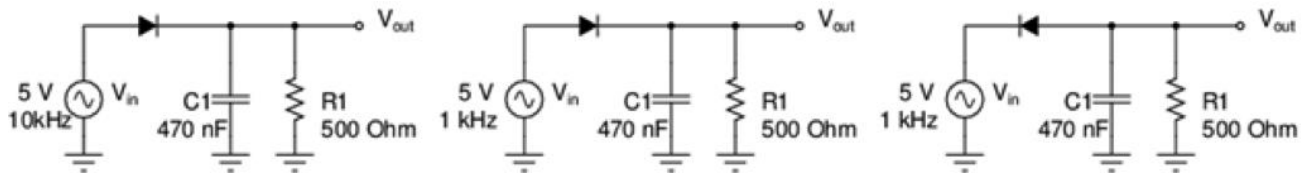





R1 500 Ohm
V_{out}
5 V
V_{in}

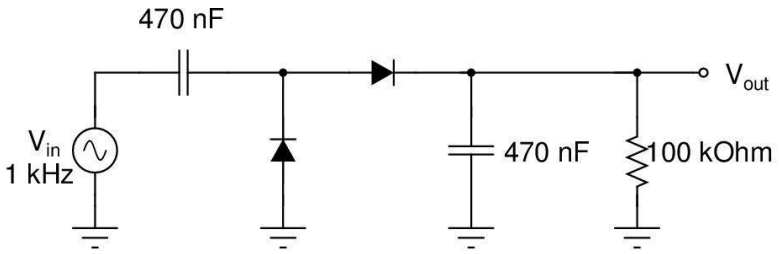

R1 500 Ohm
V_{out}
5 V
V_{in}


R1 500 Ohm
V_{out}
5 V
V_{in}


5 V
10kHz
Vin
C1
470 nF
R1
500 Ohm
Vout
5 V
1 kHz
Vin
C1
470 nF
R1
500 Ohm
Vout
5 V
1 kHz
Vin
C1
470 nF
R1
500 Ohm
Vout

10.4.3 PART C – DIODES IN VOLTAGE MULTIPLIERS

Construct the following circuit:



10.4.3.1 Analyze and measure this circuit. How is it a voltage multiplier, and what is the output voltage V_{out} in terms of V_{in}?

ASSESSMENT

Student Statement:

I have read the university's statement on cheating and plagiarism, as described in the *Student Resource Guide*. This work is original and has not previously been submitted as part of another unit/subject/course. I have taken proper care safeguarding this work and made all reasonable effort to make sure it could not be copied. I understand the consequences for engaging in plagiarism as described in *Statue 4.1 Part III – Academic Misconduct*. **I certify that I have not plagiarized the work of others or engaged in collusion when preparing this submission.**

Student signature:_____Date:____/____/____

TOTAL: _____(/7)

ASSESSOR: _____

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