Al Mustaqbal University College

STUDENT NAME:	
TUTOR NAME:	**Dr. Ameer Al-khaykan**
PROGRAMME:	
SUBJECT:	**Analog Electronics**
COURSEWORK TITLE:	**The Zener Diode**

Issue Date:	Due Date:	Feedback Date:	Extension Date:

PERFORMANCE CRITERIA:

TARGETED LEARNING OUTCOMES

4. Solve problems involving basic analogue and digital electronic circuits using numerical skills appropriate to an engineer.

5. Identify and safely use standard laboratory equipment to extract data, then apply in the solution of an electronic or electrical engineering problem;

6. Adopt a logical approach to the solution of engineering problems.

Important Information – Please Read Before Completing Your Work

All students should submit their work by the date specified using the procedures specified in the Student Handbook. An assessment that has been handed in after this deadline will be marked initially as if it had been handed in on time, but the Board of Examiners will normally apply a lateness penalty.

Your attention is drawn to the Section on Academic Misconduct in the Student's Handbook.

All work will be considered as individual unless collaboration is specifically requested, in which case this should be explicitly acknowledged by the student within their submitted material.

Any queries that you may have on the requirements of this assessment should be e-mailed to **ameer.alkhaykan@mustaqbal-college.edu.iq**
No queries will be answered after respective submission dates.
You must ensure you retain a copy of your completed work prior to submission.

MARKING CRITERIA

COURSEWORK WILL BE MARKED ACCORDING TO THE FOLLOWING UNIVERSITY CRITERIA.

90-100%: a range of marks consistent with a first where the work is exceptional in all areas;

80-89%: a range of marks consistent with a first where the work is exceptional in most areas.

70-79%: a range of marks consistent with a first. Work which shows excellent content, organisation and presentation, reasoning and originality; evidence of independent reading and thinking and a clear and authoritative grasp of theoretical positions; ability to sustain an argument, to think analytically and/or critically and to synthesise material effectively.

60-69%: a range of marks consistent with an upper second. Well-organised and lucid coverage of the main points in an answer; intelligent interpretation and confident use of evidence, examples and references; clear evidence of critical judgement in selecting, ordering and analysing content; demonstrates some ability to synthesise material and to construct responses, which reveal insight and may offer some originality.

50-59%: a range of marks consistent with lower second; shows a grasp of the main issues and uses relevant materials in a generally business-like approach, restricted evidence of additional reading; possible unevenness in structure of answers and failure to understand the more subtle points: some critical analysis and a modest degree of insight should be present.

40-49%: a range of marks which is consistent with third class; demonstrates limited understanding with no enrichment of the basic course material presented in classes; superficial lines of argument and muddled presentation; little or no attempt to relate issues to a broader framework; lower end of the range equates to a minimum falls short in one or more areas.
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35-39%: achieves many of the learning outcomes required for a mark of 40% but falls short in one or more areas.

30-34%: a fail; may achieve some learning outcomes but falls short in most areas; shows considerable lack of understanding of basic course material and little evidence of research.

0-29%: a fail; basic factual errors of considerable magnitude showing little understanding of basic course material; falls substantially short of the learning outcomes for compensation.

Note:

- While constructing circuits all connects should be made with the power supply in the off position.
- Check power and ground connections (and other connections) **before** switch on the power.
- Make sure that the power and the ground are properly connected to all IC's before switch on the power.
- **DO NOT** strip wire ends longer than 1/4" and jam long bare ends into the breadboard holes. This will cause shorts and ruin the board.
- **DO NOT** short (connect) the power supply outputs together, i.e., do not allow the exposed wires to touch each other. This will cause permanent damage to the power supply.
- **DO NOT** connect the power supply to the breadboard with reverse polarity. This will cause the permanent chip damage.

- **DO NOT** connect an output of any gate to the output of another gate, to a switch, to power (+5V), or to ground. These situations will cause excessive currents and result in the permanent damage to the chip or chips involved.

5.1Object:

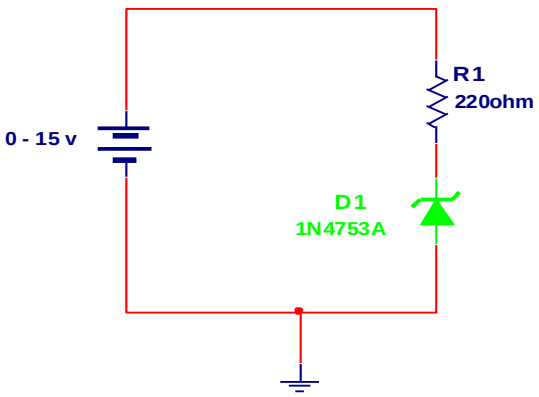
1. To determine and graph the volt-ampere characteristic of a Zener diode.
2. To use the Zener diode in particular circuits.
3. To show the various operation regions of the zener diode.=

5.2 Theory:

A zener diode is a special type of diode where the diode has been optimized for operation in the reverse or avalanche region. This is completely the opposite of normal diodes or rectifiers where every effort is made to keep the diode from breaking down in the reverse direction.

The breakdown voltage can be well controlled and yields a device which exhibits a constant breakdown voltage over a wide range of currents. There is a series resistor to limit the avalanche current and the zener finds great use as a voltage regulator. In the forward direction, the zener diode acts as a normal forward biased diode. The zener diode circuit is shown in figure (1) and the characteristics of zener diode shown in figure (2).

These types of diodes are operating in the breakdown region that the normal diodes cannot pass it without damaged. These diodes have a very important used in the regulation voltage circuits, which give a specific voltage and determine it in a specific value.



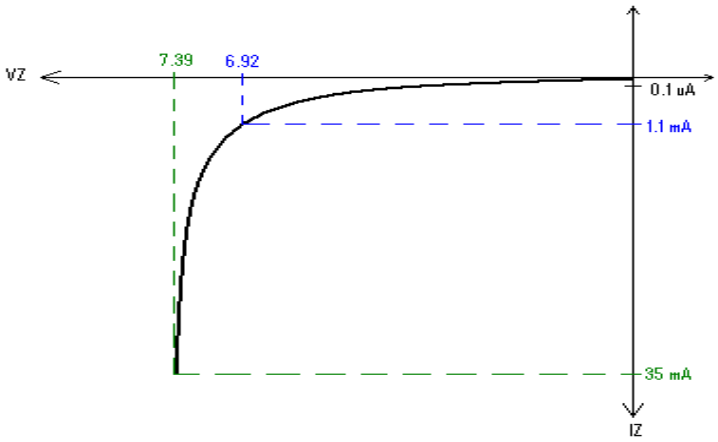


Figure (1) The Zener diode circuit **Figure (2): The characteristics of zener diode**

The shadow region represent the knee voltage which is = 6.92v

As we see from figure (2) that the current take a specific value = 0.1 μA, this value represent the saturation current and this value still = 0.1 μA until the break down voltage which is = 6.92v, and we can see the very increasing range of the current after this voltage while the voltage about to equal that value that take the constant shape.

5.3 Equipment:

1. 220 ohm resistor.
2. 1N4753A: 6.2 volt zener diode.
3. Voltmeter.
4. Oscilloscope.
5. 0-15 dc power supply

5.4 Procedure

1. Connect the following circuit as shown in figure(1)
2. Make the DC voltage variable from 0 to 15 and record the zener voltage and zener current at each state in table (1).
3. From the results obtained in table (1), sketch the characteristic curve (I-V) of the Zener diode.

Table (1) (The DC voltages applied to the Zener diode circuit)

Source value	Zener voltage (v)	Zener current (A)
1		
3		
5		
7		
9		
10		
12		
13		
15		

5.5 Discussion

1. Compare between the normal and zener diodes.
2. What is the application of the zener diode?
3. From the values obtained in table (1), compute the AC resistance of the zener diode.

5.6 Review Questions

1. From your data, the zener voltage for the zener diode used in this experiment is approximately
   (a) 0.3V (b) 0.7V (c) 6V (d) 10V

2. For which portion of the diode curve does the zener diode look like an open circuit?
   a) Diode voltages less than the zener voltage.

   b) Diode voltages greater than the zener voltage.

3. For the circuit of figure (1), if the input voltage is less than 6V, the output voltage is
   (a) 0V (b) 6V (c) the same as the input

   (d) 1/2 of the input voltage

4. If the load resistor of figure (1) is disconnected, the current through the zener diode is approximately
   (a) 0mA (b) 10mA (c) 20mA (d) 40mA

5. The power dissipated by the zener diode for the circuit of figure (1) is greatest when
   a) The zener diode is shorted

   b) The load resistor is removed

   c) The load resistor is shorted

   d) The input voltage is increased