EEE1016 Electronics I:

Experiment BE1: Diode Circuits
Report Form (Part B)

(Students must submit the report immediately upon completion of the laboratory session)

Name: ___________________________ I.D.: _________________________
Student’s Signature: __________________________ Date: ____________
Major: ___________________________ Group: _____________

Part B: Experimental Results (60 marks)
(Student who is found copying experimental results and answers from other group will immediately get ZERO marks in this overall experiment evaluation.)

B4.0 Diode Test
Table B4.0: Measured $V_F$ (2 mark)

<table>
<thead>
<tr>
<th>Diode</th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
<th>D4</th>
<th>D5</th>
<th>D6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading (V)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B4.1 Half-wave Rectifier
Graph B4.1 (a): $V_I$ and $V_O$ waveforms of HW rectifier [R3 only, Procedure 3] (3 marks)

Graph B4.1 (b): $V_I$ and $V_O$ waveforms of HW rectifier [C3/R3, Procedure 4 (i)] (3 marks)
Graph B4.1 (c): $V_I$ and $V_o$ waveforms of HW rectifier [C3//R2, Procedure 4 (ii)]

(3 marks)

CH1 & CH2: 5 V/div
Time base: 20 $\mu$s/div

Graph B4.1 (d): $V_I$ and $V_o$ waveforms of HW rectifier [C2//R3, Procedure 4 (iii)]

(3 marks)

CH1 & CH2: 5 V/div
Time base: 20 $\mu$s/div

Table B4.1: Measured $V_{o,\text{max}}$ and $V_{o,\text{min}}$ of HW rectifier

(4 marks)

<table>
<thead>
<tr>
<th>Procedure</th>
<th>3</th>
<th>4 (i)</th>
<th>4 (ii)</th>
<th>4 (iii)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{o,\text{max}}$ (V)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{o,\text{min}}$ (V)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{o,r}$ (V)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{o,r} = V_{o,\text{max}} - V_{o,\text{min}}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B4.2 Full-wave Rectifier

Graph B4.2 (a): $V_I$ and $V_O$ waveforms of FW rectifier [R3 only, Procedure 3]

(3 marks)
Graph B4.2 (b): $V_I$ and $V_O$ waveforms of FW rectifier [C3//R3, Procedure 4 (i)]

(3 marks)

CH1 & CH2: 5 V/div
Time base: 20 µs/div

Graph B4.2 (c): $V_I$ and $V_O$ waveforms of FW rectifier [C3//R2, Procedure 4 (ii)]

(3 marks)

CH1 & CH2: 5 V/div
Time base: 20 µs/div

Graph B4.2 (d): $V_I$ and $V_O$ waveforms of FW rectifier [C2//R3, Procedure 4 (iii)]

(3 marks)

CH1 & CH2: 5 V/div
Time base: 20 µs/div

Table B4.2: Measured $V_{o\text{,max}}$ and $V_{o\text{,min}}$ of FW rectifier

(4 marks)

<table>
<thead>
<tr>
<th>Procedure</th>
<th>3</th>
<th>4 (i)</th>
<th>4 (ii)</th>
<th>4 (iii)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{o\text{,max}}$ (V)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{o\text{,min}}$ (V)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{o\text{,r}}$ (V)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$V_{o\text{,r}} = V_{o\text{,max}} - V_{o\text{,min}}$
B4.3 Clipping Circuits

Graph B4.3 (a): $V_I$ and $V_O$ waveforms of upper clipping circuit with $+V_{DC}$ (4 marks)

Table B4.3 (a): Measured $V_{o,\text{max}}$ and $V_{o,\text{min}}$ of upper clipping circuit with $+V_{DC}$ (2 marks)

<table>
<thead>
<tr>
<th>$V_{DC}$ (V)</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{o,\text{max}}$ (V)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{o,\text{min}}$ (V)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Graph B4.3 (b): $V_I$ and $V_O$ waveforms of lower clipping circuit with $+V_{DC}$ (4 marks)

Table B4.3 (b): Measured $V_{o,\text{max}}$ and $V_{o,\text{min}}$ of lower clipping circuit with $+V_{DC}$ (2 marks)

<table>
<thead>
<tr>
<th>$V_{DC}$ (V)</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{o,\text{max}}$ (V)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{o,\text{min}}$ (V)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Graph B4.3 (c): $V_I$ and $V_O$ waveforms of lower clipping circuit with $-V_{DC}$ (4 marks)

Table B4.3 (c): Measured $V_{o,\text{max}}$ and $V_{o,\text{min}}$ of lower clipping circuit with $-V_{DC}$ (2 marks)

<table>
<thead>
<tr>
<th>$V_{DC}$ (V)</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{o,\text{max}}$ (V)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{o,\text{min}}$ (V)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
B4.4 Clamping Circuit
Graph B4.4: $V_I$ and $V_O$ waveforms of clamping circuit ($V_{DC} = 0\,\text{V}$ and $2\,\text{V}$ cases only)

(3 marks)

Table B4.4: Measured $V_{o,\max}$ and $V_{o,\min}$ of clipping circuit

(4 marks)

<table>
<thead>
<tr>
<th>$V_{DC}$ (V)</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{o,\max}$ (V)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{o,\min}$ (V)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{o,\text{pp}}$ (V)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$V_{o,\text{pp}} = V_{o,\max} - V_{o,\min}$
ANSWER ALL QUESTIONS (20 marks)

Half-wave rectifier (6 marks)

1. For the half-wave rectifier circuit, the difference between the maximum output voltage \(V_{o,\text{max}}\) and maximum input voltage \(V_{i,\text{peak}}\) in Graph B4.1(a) is ______ V.
2. The difference between \(V_{o,\text{max}}\) and \(V_{i,\text{peak}}\) in Graph B4.1(a) is caused by ____________________________________________________.
3. The frequency of output voltage waveform \((V_o)\) of the half-wave rectifier is ________kHz.
4. The difference between the output ripple voltage \((V_{o,r})\) of Graph B4.1(b) and (c) is ______________________V.
5. The amplitude of ripple voltage \((V_{o,r})\) can be reduced by using a capacitor connected in parallel with a larger/smaller load resistance at fixed input frequency.

Full-wave rectifier (6 marks)

1. For the full-wave rectifier circuit, the difference between the maximum output voltage \(V_{o,\text{max}}\) and maximum input voltage \(V_{i,\text{peak}}\) in Graph B4.2(a) is ________V.
2. The value of \(V_{o,\text{max}}\) - \(V_{i,\text{peak}}\) of full-wave rectifier is different from that of half-wave rectifier because ____________________________________________________.
3. The frequency of output voltage waveform \((V_o)\) of the full-wave rectifier is ________kHz.
4. The difference between the output ripple voltage \((V_{o,r})\) of Graph B4.2(b) and (d) is ______________________V.
5. The amplitude of ripple voltage \((V_{o,r})\) can be reduced by using a larger/smaller capacitor connected in parallel with a load resistance at fixed input frequency.
Clipping circuit (5 marks)

1. The minimum output voltage \( (V_{o,\text{min}}) \) in Graph B4.3(a) of the upper clipping circuit is \[ \text{______________} \text{V}. \]

2. For the upper clipping circuit, the \( V_{o,\text{max}} \) is always larger than the DC supply voltage in Graph B4.3(a) because \[ \text{______________________________}. \]

3. The maximum output voltage \( (V_{o,\text{max}}) \) in Graph B4.3(c) of the lower clipping circuit is \[ \text{______________} \text{V}. \]

4. For the lower clipping circuit in section 4.3 procedure 6, the minimum output voltage \( (V_{o,\text{min}}) \) is equal to the DC bias because \[ \text{______________________________} \].

Clamping circuit (3 marks)

1. The peak-to-peak output voltage waveform \( (V_{o,\text{peak-to-peak}}) \) of clamping circuits in Graph B4.4 is \[ \text{______________} \text{V}. \]

2. The clamping circuit in section B.4.4 is a negative clamper, a positive clamper can be made by \[ \text{__________________} \text{ the diode and polarized capacitor.} \]