

## Experiment 3

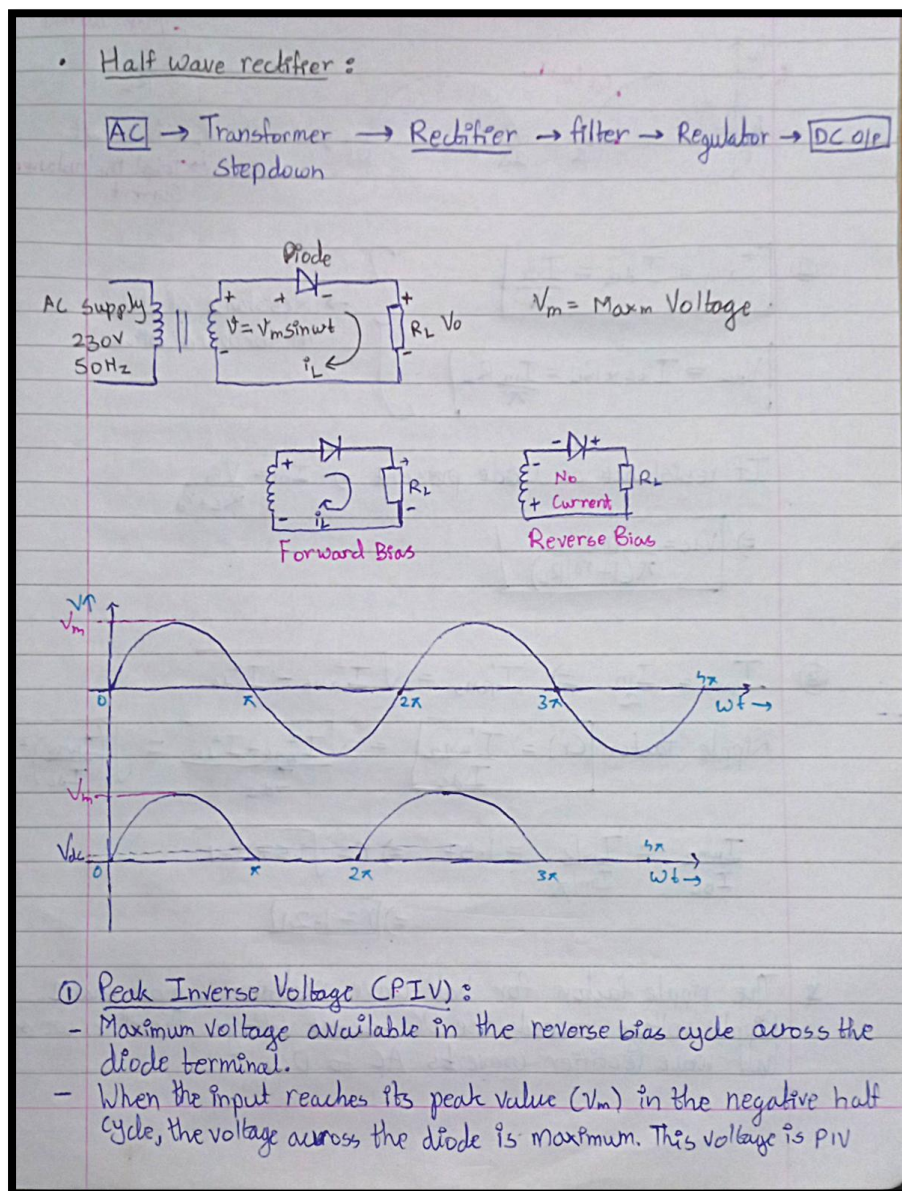
### Aim:

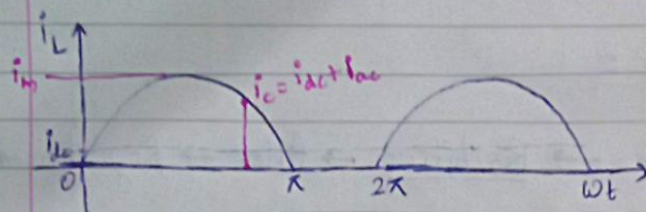
Working and simulation of Half Wave Rectifier and Full Wave Rectifier.

### Tools and Apparatus:

LTSpice, Capacitor, Resistor, Diodes, Voltage Source

### Theory and Design:





Max current  
 $i_m = \frac{V_m}{R_L}$

$i_L = i_m \sin \omega t$   
 ↳ Total instantaneous current

②  $I_{avg} = I_{dc} = \frac{I_m}{\pi}$

$V_{dc} = I_{dc} \times R_L = \frac{I_m R_L}{\pi}$

→ Resistance of diode in forward bias

If resistance of diode present  $\Rightarrow I_m = \frac{V_m}{R_L + r_d}$

$\Rightarrow V_{dc} = \frac{V_m}{\pi(1 + r_d/R_L)}$

③  $I_{RMS} = \frac{I_m}{2} \Rightarrow I'_{RMS} = \sqrt{I_{RMS}^2 - I_{dc}^2}$

Ripple factor  $(r) = \frac{I'_{RMS}}{I_{dc}} = \frac{\sqrt{I_{RMS}^2 - I_{dc}^2}}{I_{dc}} = \sqrt{\left(\frac{I_{RMS}}{I_{dc}}\right)^2 - 1}$

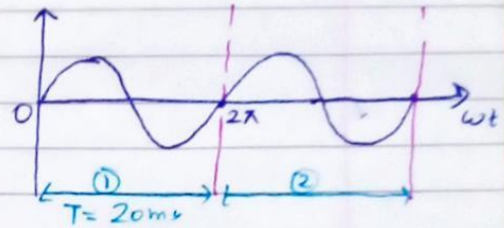
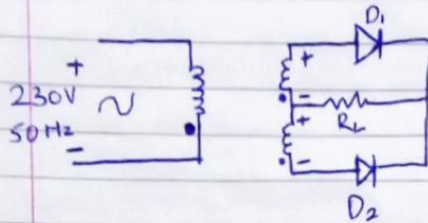
$\frac{I_{RMS}}{I_{dc}} = \frac{I_m/2}{I_m/\pi} = 1.57 \Rightarrow r = \sqrt{(1.57)^2 - 1}$

$\Rightarrow r = 1.21$

\* The ripple factor for half-wave rectifier is more than 1. Ripple voltage exceeds the DC current voltage. Therefore, we say half-wave rectifier converts AC to DC.

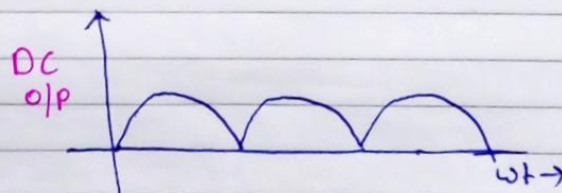
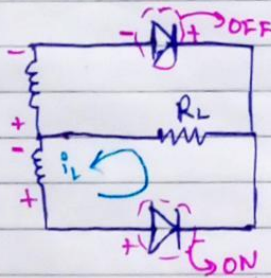
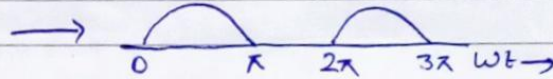
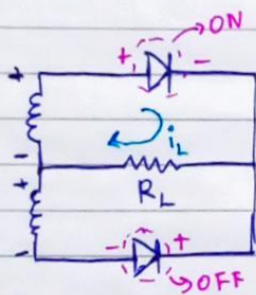
- Full Wave Rectifier:

- ① Center tapped:



$$f = 50 \text{ Hz}$$

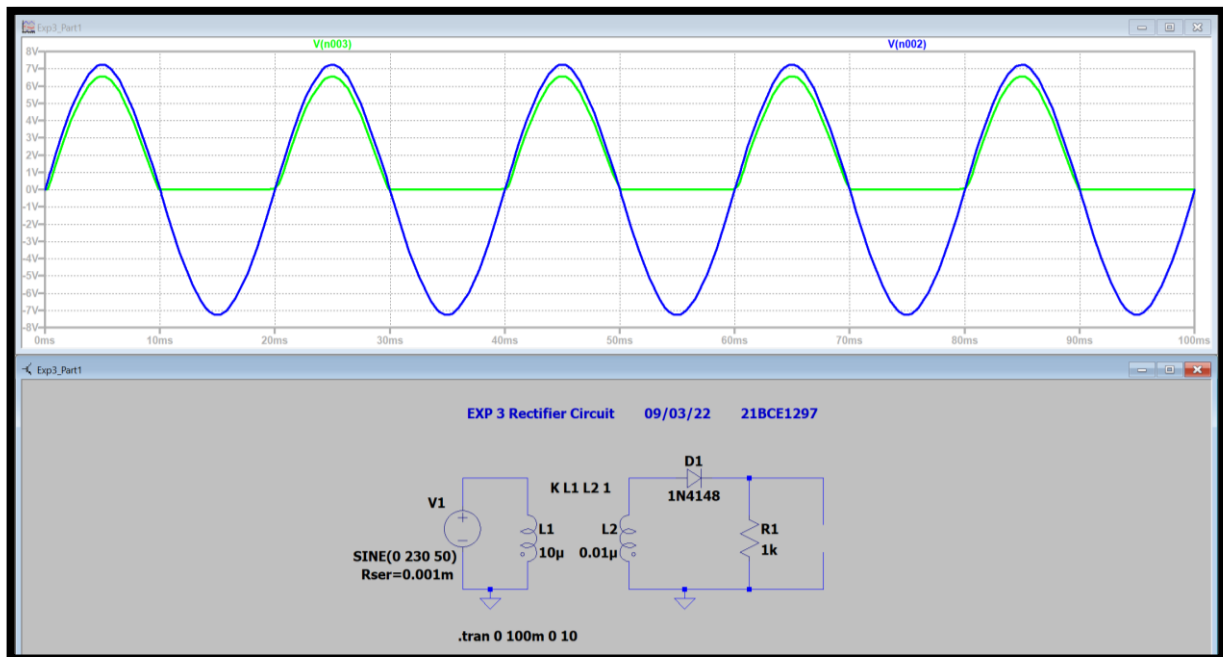
$$T = 1/f = 1/50 = 20 \text{ ms}$$





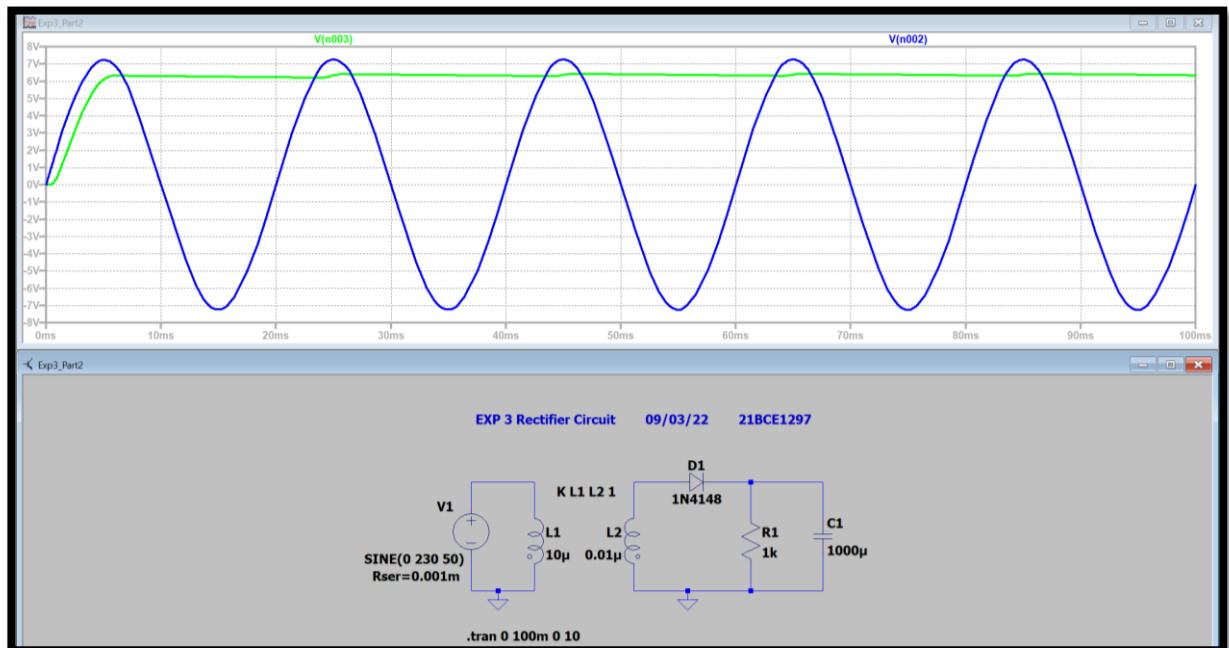
## Simulation Results:

### 1) Half Wave Rectifier without capacitor

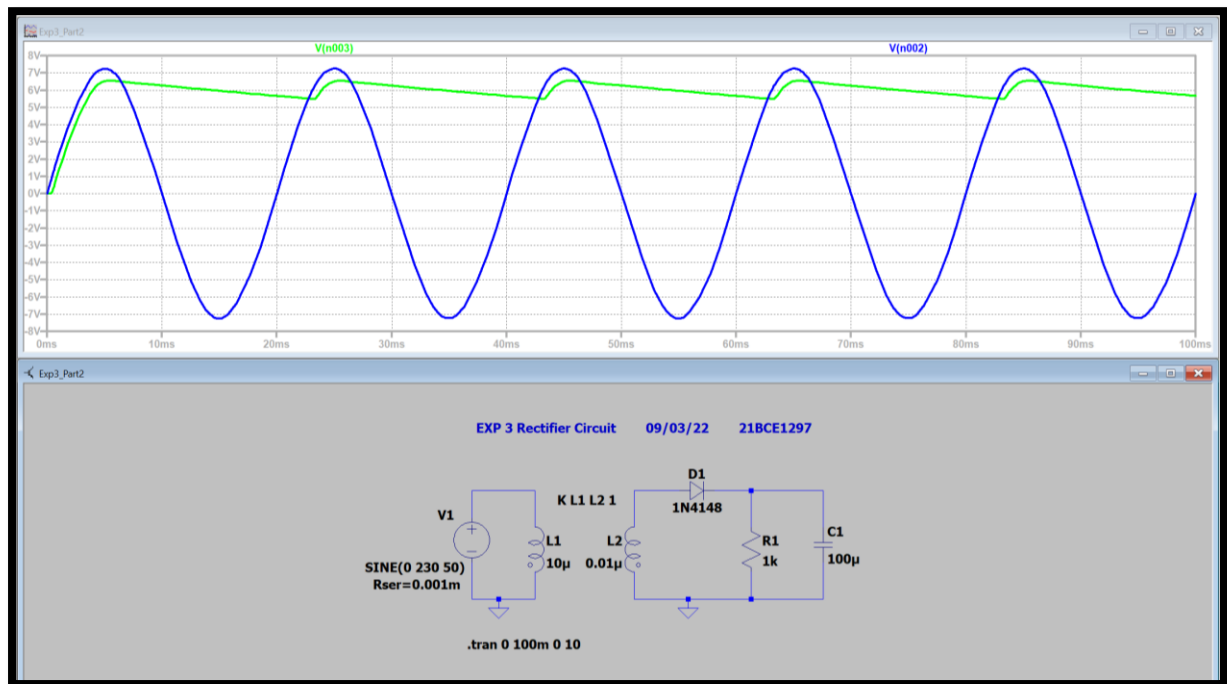


### 2) Half Wave Rectifier

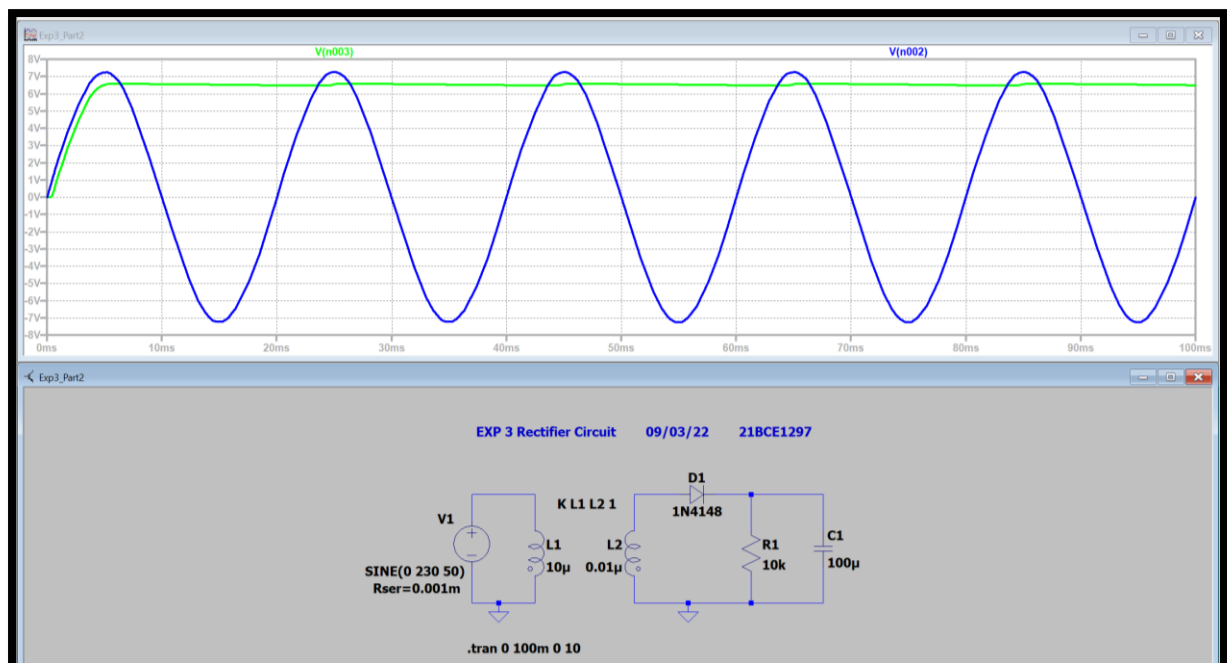
a)  $R = 1k\ \Omega$ ,  $C = 1000\mu$



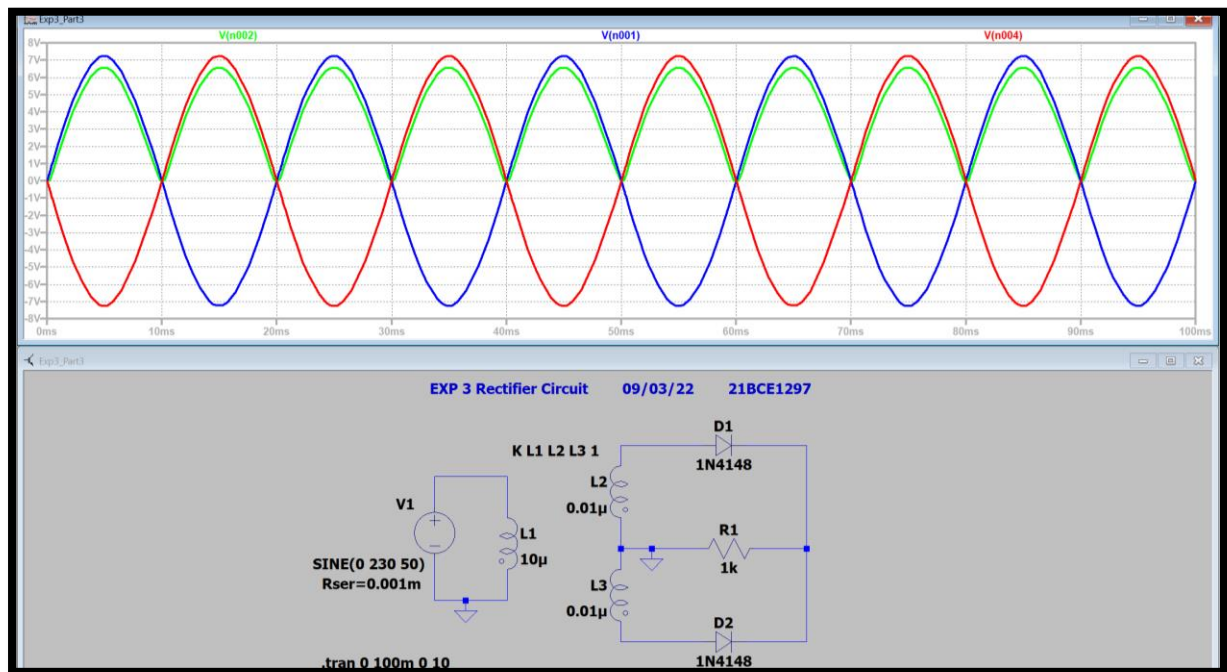
b)  $R = 1\text{ k}\Omega$ ,  $C = 100\mu$



c)  $R = 10\text{ k}\Omega$ ,  $C = 100\mu$



### 3) Full Wave Center Tapped Rectifier



### Conclusion:

1. Cutting Voltage for Half Wave Rectifier =  $7.25 - 6.58 = 0.67 \text{ V}$
2. Cutting Voltage for Full Wave Rectifier =  $7.23 - 6.55 = 0.68 \text{ V}$

### Inferences:

1. Rectifiers are used to convert AC voltage to DC Voltage
2. Transformers are used for stepping down AC voltage
3. While stimulation connect diode in proper direction
4. Changing R and C values in half wave rectifier affects the DC output wave form
5. Difference between voltages gives cutting voltage which is approximately 0.7 for silicon diodes.