**Q3)**

**b)**

diyagram, teknik çizim, plan, şematik içeren bir resim

Açıklama otomatik olarak oluşturuldu

*Figure 1. Simulink Schematic for Comparing 12-Pulse and Full Bridge Diode Rectifier*

For comparing the 12-pulse rectifier and full bridge diode rectifier, schematic as seen in Figure 1 is designed and implemented in Matlab Simulink.

metin, ekran görüntüsü, sayı, numara, yazı tipi içeren bir resim

Açıklama otomatik olarak oluşturuldu

*Figure 2. Input Voltage Sources*

In Figure 2, implemented 3-phase voltages can be seen. They are same for both systems. Then for the 12-pulse rectifier three-phase transformer is used. Input voltage connection type is Y connection, then for the first bridge rectifier, again Y connection is implemented and for the second bridge rectifier, delta connection is implemented. Then, for getting same output voltage, ratio of windings are adjusted.

metin, ekran görüntüsü, yazı tipi, sayı, numara içeren bir resim

Açıklama otomatik olarak oluşturuldu

*Figure 3. Windings Adjustments*

Average output voltages for both systems are same. Both are around 540 V. From the expectations, losses on the 12-pulse rectifier higher than 6-pulse rectifier. Expected average output voltage 540 V from the equation = 540 V. However, because of the losses output voltages are 537 V and 535 V.

ekran görüntüsü, çizgi, öykü gelişim çizgisi; kumpas; grafiğini çıkarma, metin içeren bir resim

Açıklama otomatik olarak oluşturuldu

*Figure 4. Output Voltage Waveforms of 12-Pulse and 6-Pulse Rectifiers*

Resulted output voltage waveforms can be seen in Figure 4. From this graph, we can say that ripple of 6-pulse rectifier higher than 12-pulse rectifier. So, stability of the 12-pulse rectifier is better. In addition, we can see that, frequency of the pulse in 12-pulse rectifier twice of the 6-pulse rectifier. Their average output voltages are same.

ekran görüntüsü, metin, ekran, görüntüleme, dikdörtgen içeren bir resim

Açıklama otomatik olarak oluşturuldu

*Figure 5. Output Current Waveforms of 12-Pulse and 6-Pulse Rectifiers*

After that current waveforms are printed. Then, THD of both topologies are found.

metin, çizgi, diyagram, öykü gelişim çizgisi; kumpas; grafiğini çıkarma içeren bir resim

Açıklama otomatik olarak oluşturuldu

*Figure 6. Signal with FFT Window of 12-Pulse Rectifier*

metin, ekran görüntüsü, öykü gelişim çizgisi; kumpas; grafiğini çıkarma, sayı, numara içeren bir resim

Açıklama otomatik olarak oluşturuldu

*Figure 7. FFT of 12-Pulse Rectifier for Selected Signal*

metin, çizgi, öykü gelişim çizgisi; kumpas; grafiğini çıkarma, diyagram içeren bir resim

Açıklama otomatik olarak oluşturuldu

*Figure 8. Signal with FFT Window of 6-Pulse Rectifier*

metin, ekran görüntüsü, öykü gelişim çizgisi; kumpas; grafiğini çıkarma, sayı, numara içeren bir resim

Açıklama otomatik olarak oluşturuldu

*Figure 9. FFT of 6-Pulse Rectifier for Selected Signal*

Here, as seen in the Figure’s 6-9, THD analysis of the output currents can be seen. Ripple of the 6-pulse rectifier bigger than 12-pulse rectifier. For THD analysis, magnitudes of harmonics nearly same for both topologies. When we examine for the higher time intervals, THD of the 12-pulse rectifier is much lower than 6-pulse rectifier. So, 12-pulse rectifier has smaller harmonic distortion.

12-pulse rectifier requires additional transformers, phase-shifting circuit, and interphase reactors, so these make it more complex and expensive. Moreover, it requires more space due to the additional transformers and components. They are usually used for high-power applications.