

Q 3.a.

The topology which indicated at Figure 1 is named as Twelve Pulse Rectifier. The circuit mainly takes 3 phase voltage input and rectifies it to 12 pulse DC signal over one period with the help of two 6 phase bridge rectifiers. The purpose of using one primary and two secondary transformers is obtaining 30° phase shifted voltage output at secondary side. Therefore, 5th and 7th harmonics will be eliminated and THD will be reduced.

The other CCT topologies which can be used for similar purpose are Half-wave 12-pulse rectifier (single-way) and 12-pulse bridge rectifier (parallel connection) which can be seen from Figure 2 and Figure 3. Unlike other topologies, at Half-wave 12-pulse rectifier we connect 12 phases via interconnection transformers. In series connection rectifier we provide centre point for earthing purposes. As a final note we can say that because of their special transformer needs 12 pulse rectifiers are very expensive devices.

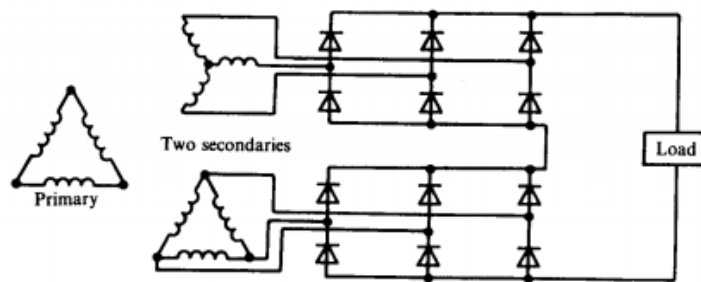


Figure 1: Twelve Pulse Rectifier (Series Connection)

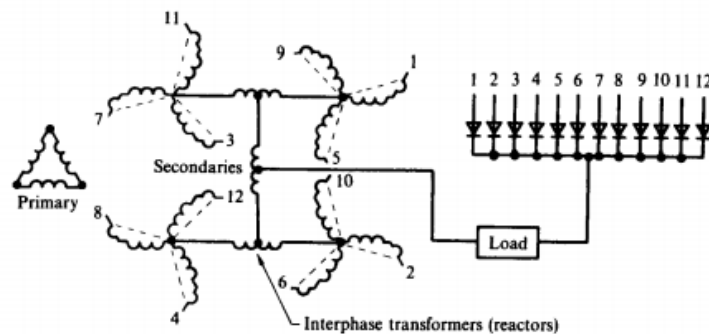


Figure2: Half-wave 12-pulse rectifier (single-way)

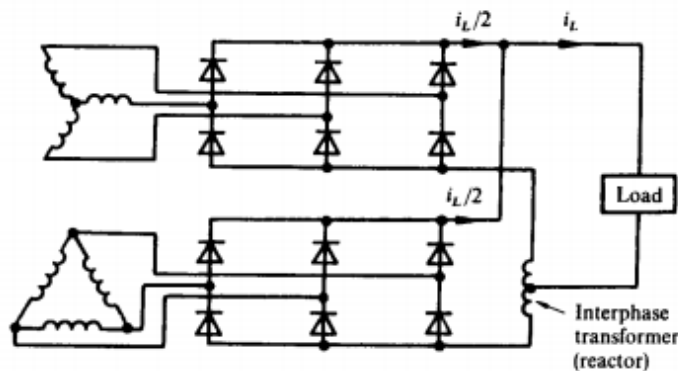


Figure3: 12-pulse bridge rectifier (parallel connection)

Q 3.b.

We have simulated both Twelve Pulse Rectifier (can be seen from Figure) and Full Bridge Rectifier for same average output voltage values. The simulation results indicated at Figures 5 and 6. According to the findings, we observed that the ripple voltage decreased for 12 Pulse Rectifier. Because our load is purely resistive the same situation is valid for output load currents. In addition, we can say that the cost of twelve pulse rectifier construction will be more expensive because of delta-delta-wye connected transformers. The maximum output voltage and current -and hence RMS values- is higher for Full Bridge Rectifier.

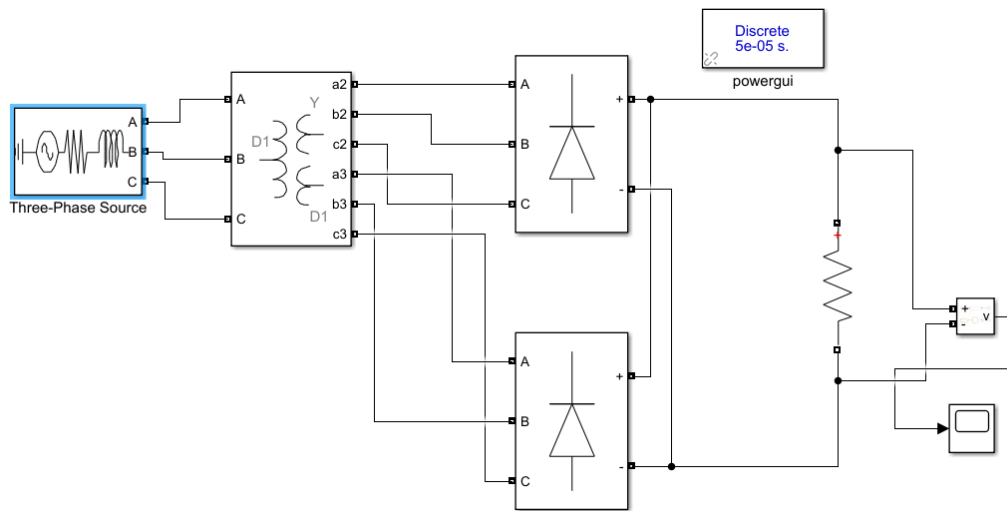


Figure 4: Twelve Pulse Rectifier (Series Connection) Simulink Schematic

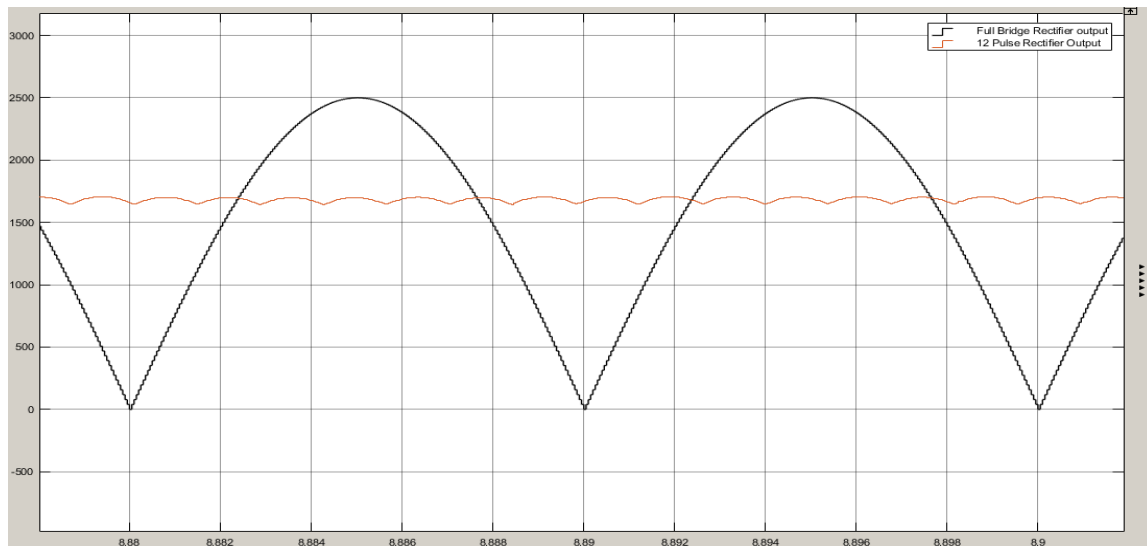


Figure 5: Twelve Pulse Rectifier vs Full Bridge Rectifier Output Voltage Waveforms

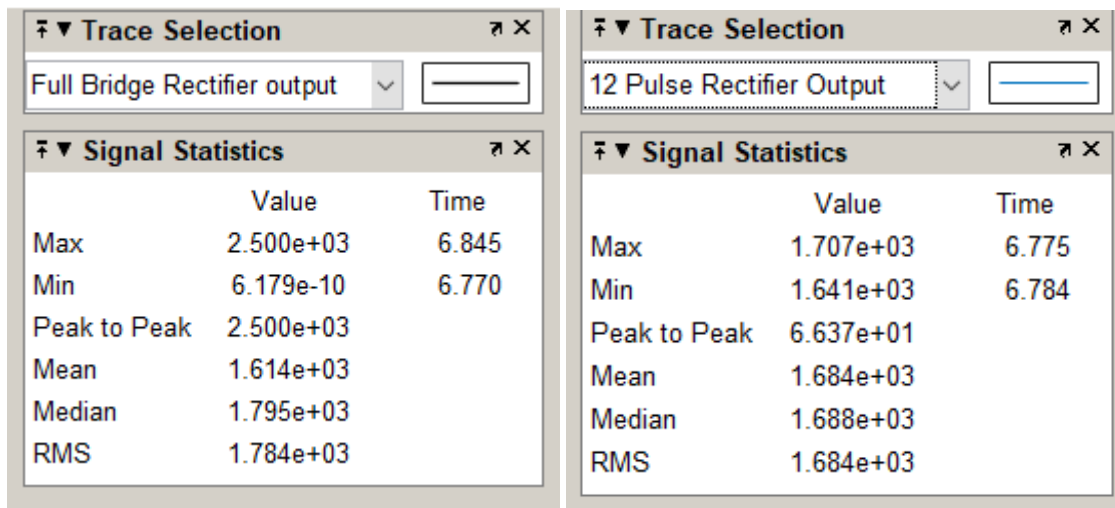


Figure 6: Twelve Pulse Rectifier vs Full Bridge Rectifier Output Voltage Waveforms' numeric examinations