

## **EE561: Power Electronics Laboratory**

### **Experiment 6: Three-phase Rectifiers**

**Objective:** The objective of this experiment is to study the operation of Three-phase uncontrolled and controlled rectifiers using MATLAB/SIMULINK.

**Parameters:**

Parameter	Value
Input voltage	400 V, 50 Hz, Three-phase
Source Inductance	10 mH
Load Parameters	20 $\Omega$ in series with 20 mH Inductance

**Procedure**

1. Simulate a Three-phase uncontrolled rectifier (with six diodes) with no source inductance. Take the snapshots for source voltages, source currents, load voltage, and load current. Note down the average value, peak-peak ripple in load voltage and load current.
2. Repeat step 2 with source inductance. Observe the change in load voltage and source current waveforms. Note down the commutation angle 'u' and match with the theoretical value.
3. Simulate a Three-phase controlled rectifier (with six Thyristors) with no source inductance. Consider four values of Firing angles:  $\alpha = 30$  deg,  $\alpha = 60$  deg,  $\alpha = 120$  deg, and  $\alpha = 150$  deg. Take the snapshots for source voltages, source currents, load voltage, and load current. Note down the average value, peak-peak ripple in load voltage and load current.
4. Repeat step 2 with source inductance. Observe the change in load voltage and source current waveforms. Note down the commutation angle 'u' and match with the theoretical value.

**Report**

Prepare the report with the results obtained for each case and your observations. Report should also contain snapshot of the simulated circuit, Snapshot of the simulation configuration parameters

**Note:** (1) In Simulink, the circuit has to be simulated using a fixed time-step solver  
(2) To find the commutation angle 'u', the following expression can be used:

$$\cos(\alpha + u) = \cos \alpha - \frac{2\omega L_s I_o}{400\sqrt{2}}$$

$I_o$  is average load current;  $L_s$  is source inductance;  $\omega$  is source voltage frequency;