Assignment Problems

1. Find the best values of *q*, *s*, and *r* for 12-pulse converter configuration.
2. If a 6-pulse bridge rectifier is operating from 220 kV voltage supply through the transformer. Find the output voltage of rectifier when the firing (delay) angle is (a) 0^0 (b) 15^0 and (c) 90^0. Assume there is no source reactance.
3. If the delay angle and commutation angle of 6-pulse bridge converter is 15^0 and 10^0 respectively, find the secondary voltage of a transformer when the DC output voltage of converter is 500 kV.
4. In a HVDC link the DC current is 1 kA and the rectifier end DC voltage is 500 kV. Find the commutation reactance if the rectifier AC voltage is 400 kV. Delay angle is 15^0.
5. A 6-pulse bridge inverter is fed from 500 kV DC voltage. Find the AC voltage output of the inverter if delay angle is 160^0 and commutation angle is 5^0.
6. Draw the DC output voltage waveform of a bridge converter for
   a. ヘ = 15^0 and u = 15^0
   b. ヘ = 120^0 and u = 15^0
   c. ヘ = 35^0 and u = 60^0.
   d. ヘ = 145^0 and u = 65^0
7. Also show the voltage across valve-1 for a complete cycle with conduction sequence.

$$I_d = \frac{E_m}{2\omega L}[\cos(\alpha - 30) - \cos(\delta + 30)]$$

8. Show that for 3/4 valve conduction mode
9. Draw the converter chart taking V_d and I_d as axis for u>60.
10. A six-pulse bridge converter is used for HVDC inverter which is operating at a delay angle of 150^0. The overlap angle is 10^0. The gate pulses are given to the valves at 60^0 intervals in sequence. At the end of valve-1 and valve-2 conduction, valve-3 received the gate pulse but it misfired. Draw the dc output and valve-3 voltages for a complete cycle.
11. Draw the DC terminal output voltage waveform for a complete cycle where valve-5 fails to commutate valve-3 in inverter operation due to the delay in firing angle by 5^0. Take $\beta = 15^0$ $u = 10^0$ and for normal operation. It can be assumed that valves 3 and 5 are conducting even at the firing of valve 6. Also draw the valve-6 voltage for complete cycle.
12. Find the Jacobian and its elements for extended variable method of AC/DC load flow for a_R, γ_i, a_i, I_d a control mode where are specified.

13. Derived the variable elimination method for AC/DC load flow and find the elements of the Jacobian for a control mode where a_R, a_i, V_{di}, I_d are specified.
14. Derive the harmonic current (AC side) components of 12-pulse bridge converter without using the six-pulse harmonic results (u=0).
15. A HVDC bipolar link (six-pulse operation), having three bridges per pole, is rated at 1.8 kA, $\pm$ 400 kV, 1440 MW. The resistance of line is 18.95 ohm per pole. The sending end voltage is kept at rated voltage. The equivalent commutation resistance per bridge is 7.65 ohm. If the rectifier controller is operating at a delay angle of 15^0 and the inverter CEA of $\gamma = 16^0$. Find
    a. Sending end line voltage and overlap angle.
    b. Receiving end line voltage and overlap angle.
    c. If sending end line voltage is increased by 10%, what are the new values of overlap angle?
16. Find the minimum cost 5^{th} harmonic filter for a HVDC link. Assume the unit cost of capacitors to be Rs 17.50/kVAr and that of inductors Rs 40/kVAr. The harmonic current in the filter is 50A. The filters are to be connected to the 400 kV, 50Hz three-phase line.