



(Solve All Questions, Each question is of 14 M)

- 1- In a 1- Φ full wave controlled rectifier, The anode to cathode voltage consists of four portions, each one is of (90°) . Two of them are half of the supply voltage, while the third one is equal to the supply voltage and the last one is equal to zero.
 - a) Draw the circuit diagram
 - b) Define the load type and the value of the firing angle α .
 - c) Draw the load voltage, the load current, and the anode to cathode voltage of one thyristor.
 - d) Calculate the average voltage, and the peak inverse voltage.
 - e) If it is required to double the current suggest another circuit that has the same condition and verify this requirement, then repeat (a, b, c, d) for this circuit.

- 2- In (3- Φ) rectifier circuit with R-L load, the output voltage has 6- pulses. Three of them are of duration (30°) each, while the other three pulses are of duration (90°) each.
 - a) Draw the circuit diagram.
 - b) Calculate the average voltage, and the PIV.
 - c) Calculate RMS value of the supply current, and the RMS value of one thyristor current .
 - d) Draw the output voltage, the load current, the supply current, the anode to cathode voltage of one thyristor
 - e) Repeat (b,c,d) if α is shifted (30°) to the right of the first position, and comment on the results.

- 3- 1- Φ semi controlled rectifier bridge with highly inductive load, the firing angle is equal to (60°) . Discuss the operation of this circuit with the aid of the wave forms of the output voltage, and the anode to cathode voltage. Compare this circuit with that of the fully controlled rectifier bridge with the same load and at the same firing angle. Then discuss the main advantages of each circuit.

- 4- (3- Φ) half wave controlled rectifier with resistive load, draw the output voltage, the anode to cathode voltage and the supply current at $\alpha = 60, 90$. Calculate the average output voltage, PIV, and RMS value of the supply current at both cases. Then replace the load with a highly inductive load and obtain the previous requirements. Give some notes on the difference among the four cases.

- 5- Draw an electronic firing circuit which is used to control the firing angle of 1- Φ fully controlled rectifier bridge to produce an average output voltage at a resistive load terminals of $0.5V_{rms}$, $C = 1 \mu F$, $R = 10 K\Omega$, the input voltage to the integrator is equal to (-12 volt) .
 - a) Draw the waveforms at each point of the circuit and explain the function of each element.
 - b) Calculate the control voltage V_c .
 - c) Calculate the maximum firing angle and its corresponding control voltage.