Section - 1

Q1. Ans Intercooling additionally includes the utilization of a heat exchanger. The intercooler is a type of heat exchanger where it is used to cool the compressor gas amid the compression process.

Reheating in thermodynamic process refers to an approach to build turbine work without variation in the compressor work from which the turbine is developed.

Regeneration in thermodynamic process refers to a method where the certain quantity of heat abstracted from the steam is utilized to heat the water. The regeneration process occurs between the stages of turbine and pump respectively. Using regeneration, the efficiencies of thermodynamic cycle can be improved.

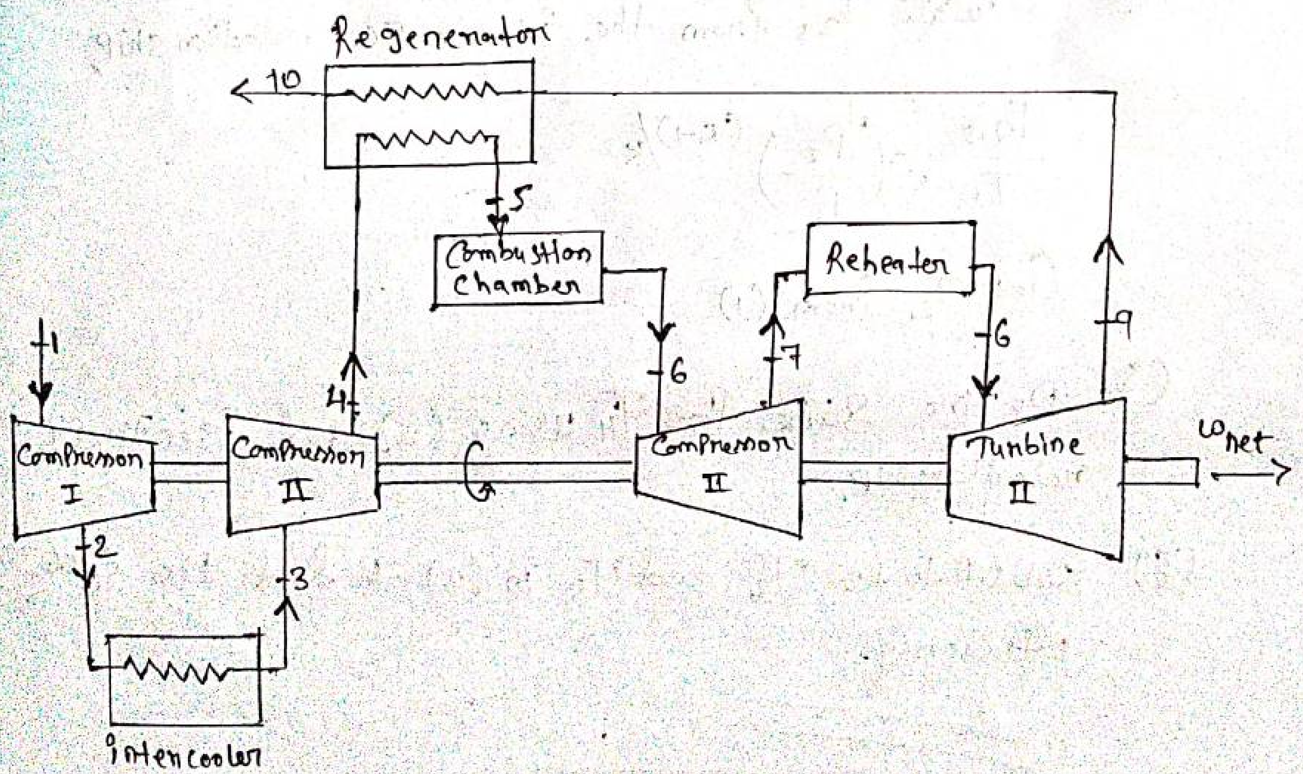

fig: Schematic Diagram of Gas turbine with intercooling, reheating and regeneration.

* Brayton cycle derivation:-

* Compressor and turbine efficiencies:

Isentropic Efficiencies

(1) $$\eta_{comp} = \frac{h_{2,s} - h_1}{h_2 - h_1} = \frac{C_p(T_{2,s} - T_1)}{C_p(T_2 - T_1)}$$

(2). $$\eta_{turb} = \frac{h_3 - h_4}{h_3 - h_{4,s}} = \frac{C_p(T_3 - T_4)}{C_p(T_3 - T_{4,s})}$$

(3)

$$\eta_{cycle} = \frac{W_{net}}{Q_H} = \frac{Q_H - Q_L}{Q_H} = 1 - \frac{Q_L}{Q_H} = 1 - \frac{C_p(T_4 - T_1)}{C_p(T_3 - T_2)}$$

(4) Calculate T_{2s} from the isentropic relationship,

$$\frac{T_{2,s}}{T_1} = \left(\frac{P_2}{P_1}\right)^{(k-1)/k}$$

Get T_2 from (1)

(5) Do the same for T_4 using (2) and isentropic relationship.

(6) Substitute T_2 and T_4 in (3) to find the cycle efficiency.