1. (a) What are the types of nozzles? Explain with neat diagrams?

(b) Dry saturated steam enters in to a steam nozzle at 10 bars, and discharges at 2 bars.

1. Velocity of steam without friction
2. Velocity of steam for 15 % friction loss and also calculate % reduction in final velocity

1. (a) Derive an expression for maximum discharge through a convergent – divergent nozzle?

(b) Dry saturated steam is passed at 7 bars through a convergent – divergent nozzle. The throat cross-sectional area is 4.5 cm 2. Find the mass of steam passing through the nozzle per minute?

1. (a) What do you know about critical pressure ratio? What is its significance? (b) The nozzles of a turbine are supplied with superheated steam at 10 bars, 2500C. The steam leaves the nozzles at a pressure of 1 bar. The steam consumption for the turbine is 16 kg/kWhr, when it develops 225 kW. If the throat diameter is 0.8 cm, determine no. of nozzles required and exit diameter of the nozzles, assuming that 10 % of the total heat drop is lost in overcoming the friction in the divergent portion only. Neglect the velocity of approach?
2. a) What is the effect of friction on the flow of steam through a nozzle? What is nozzle efficiency?

b) Super saturated expansion occurs in a nozzle supplied with steam at 2 MN/m2  and 325 oC. The law for the expansion may be taken as **pv** 1.3 = constant up to the exit pressure of 0.36 MN/m2 . For a flow rate of 450 kg/min determine throat and the exit areas of the nozzle and also calculate degree of under cooling.

1. a) Discuss the function of convergent portion, throat and divergent portion of a convergent divergent nozzle with reference to flow of steam with the help of neat sketch?

b) Dry saturated steam at a pressure of 12 bars expanded in a nozzle to 2.5 bars. If the steam flow is isentropic, find

1. velocity at throat
2. exit velocity
3. find the area of throat and exit, if the mass flow rate is 16 kg/s.
4. Also find the ratio of cross-sectional area of exit to throat.