(3 Hours) [Total Marks: 80

Note:
1. Question No.1 is compulsory.
2. Attempt any three questions from remaining.
3. Steam table is permitted.
4. Assume suitable data if required.

Q.1 Solve any five (20)

a. Differentiate Steam turbine and Hydraulic turbine.
b. What is Cavitation? How it can be avoided?
c. Differentiate between jet engine and rocket engine.
d. Describe working actual Brayton cycle? State the assumptions clearly.
e. State the role of Injector, Super heater, fusible plug and steam stop valve in Boiler.
f. What is degree of reaction? Prove that the degree of reaction for parson's reaction turbine is 50%.

Q.2 a) Explain the construction and working of Velox boiler. (10)

b) Calculate throat diameter and exit diameter of a converging-diverging nozzle for following data: (10)

Initial steam pressure = 13 bar
Final steam pressure = 4 bar
Quantity of steam = 1.2 kg/s
Steam temperature at inlet = 300^{o}C
nozzle efficiency = 0.86

Q.3 a) Calculate equivalent evaporation and efficiency of the boiler for the following data: Pressure of steam = 9 bar, Quality of steam = 0.97 dry, Quantity of steam = 5600 kg/hr, Temperature of feed water = 36°C, Coal consumption = 700 kg/hr, C.V. of coal = 31380 kJ/kg of fuel. What will be the saving in coal consumption per hour if by putting an economizer the temperature of feed water is raised to 100^{0}C and other data remains same except the increase in boiler efficiency by 5 %. (10)

b) A Pelton wheel is to be designed for the following specifications: (10)

Power (Brake or Shaft) = 9560 kW; Head = 350 m; Speed = 750 rpm; Overall efficiency = 85%; Jet diameter is limited to 1/6th of the wheel diameter. Determine the wheel diameter, diameter of jet and number of jet required. Take C_v = 0.985 and speed ratio =0.45.

Q.4 a) In a De-Laval turbine, steam issues from the nozzle with a velocity of 850m/s. The nozzle angle is 20^0. Mean blade velocity is 350 m/s and the blades are equiangular. The mass flow rate is 1000 kg/min. The friction factor is 0.8. Determine blade angles, axial trust on the bearings, power developed in kW, blade efficiency, stage efficiency if nozzle efficiency is 93%. (10)

b) Derive an expression for maximum hydraulic efficiency of a Pelton wheel with neat sketch. State assumptions clearly. (10)

Q.5 a) An inward flow reaction turbine is supplied 0.233 m^3/s of water under a head of 11 m. The wheel vanes are radial at inlet and the inlet diameter is twice the outlet diameter. The velocity of flow is constant and equal to 1.83 m/s. The wheel makes 370 r.p.m. Determine guide vane angle, inlet and outlet diameter of wheel and width of wheel at inlet and exit. Assume that the discharge is radial and there are no losses in wheel. Take speed ratio = 0.7. Neglect the thickness of the vane. (10)

b) A gas turbine installation works on Brayton cycle between the temperature limits of 35^0C and 715^0C. For the maximum work developed calculate temperature at the end of compression, pressure ratio and thermal efficiency. (10)

Q.6 Solve any four (20)

a. Differentiate Francis and Kaplan Turbine
b. Explain the working of Ramjet Engine?
c. Write the features of High Pressure boiler in comparison to low pressure boiler.
d. Describe working of reheating gas turbine plant with the help of a T-S diagram.
g. Why compounding is necessary? Explain working of pressure-velocity compounding with neat sketch.
