Q.P. Code : 6381

(3 Hours)   [Total Marks : 80

Question no.1 is compulsory.

Attempt any **THREE** from question no. 2 to 6.

Use of steam table is permitted.

Q.1   Solve any **Five**   20

a)   Give differences between ram jet and pulse jet.

b)   Explain the function of draft tube with neat diagram.

c)   What are the limitations of pelton wheel turbine?

d)   Define the following terms for a turbine:
   (i) Stage efficiency
   (ii) Blade efficiency

e)   Differentiate between high pressure and low pressure boilers.

f)   Make a list of any five boiler mountings and write down their functions.

Q.2   a)   Derive the expression for the force exerted by a jet of water of velocity V and area A on a   08
       plate when:
       (i) Plate is vertical
       (ii) Plate is inclined at θ

b)   The following data was recorded during a test performed on a boiler, economizer and a   12
      superheater.
      Steam generated = 5000 kg/hr at 14 bar pressure ; Mass of coal burnt = 660 kg/hr ;
      Calorific value of coal = 29500 kJ/kg ; Temperature of feed water at entry and exit of
      economizer = 30^0C and 130^0C resp.; Temperature of steam leaving the superheater =
      320^0C ; Dryness fraction of steam leaving the boiler = 0.95 ; C_p (superheated steam) =
      2.3 kJ/kg K ; C_p (water) = 4.18 kJ/kg K. Calculate
      (i) Factor of evaporation
      (ii) Overall efficiency of the plant
      (iii) The percentage of available heat utilized in the boiler, economizer and
           superheater. Hence determine percentage of heat lost.

Q.3   a)   With neat sketch explain the working of closed cycle gas turbine plant and discuss the   08
       advantages of closed cycle over open cycle gas turbine plant.

b)   The following particulars refer to a single row impulse turbine: 08
      Mean diameter of blade ring = 2.5 m ; speed = 3000 rpm ; nozzle angel = 20^0 ; ratio of
      blade velocity to steam velocity = 0.4 ; blade friction factor = 0.8 ; blade angle at exit =
      3^0 less than that at inlet ; steam flow = 36,000 kg/hr.

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      Draw velocity diagram for moving blade and estimate (a) power developed ; (b)
      blade efficiency ; and (c) steam consumption in kg/kW hr.

c)   With neat sketch explain the principle of operation of Turbofan engine   04

Q4) a)   Derive the expression for Maximum discharge through steam nozzle.   06

b)   A gas turbine unit receives air at 100 kPa and 300 K and compresses it adiabatically to   10
      620 kPa with efficiency of the compressor 88 %. The fuel has heating value of 44180
      kJ/kg and the fuel/air ratio is 0.017 kg fuel/kg air. The turbine internal efficiency is 90 %.
      Calculate the compressor work, turbine work and thermal efficiency.

c)   Draw general layout of a reaction turbine plant and explain various heads on turbine.   04

Q5) a)   Explain the working of any one type of high pressure boiler with the help of neat sketch.   08

b)   A single jet pelton turbine operates a 10,000 kW generator. The generator efficiency is   12
      92%, turbine efficiency is 86%, turbine head is 350 m, coefficient of nozzle velocity is
      0.98, speed ratio is 0.46 and jet ratio is approximately 12. Find the size of jet, mean
      diameter of runner, synchronous speed, specific speed of turbine and bucket dimensions.

Q6) a)   Explain turbojet engine with neat diagram. What are the advantages and disadvantages of   10
       turbojet engine?

b)   The nozzles of an impulse turbine are supplied with superheated steam at 10 bar, 250^0C.   10
      The steam leaves the nozzles at a pressure of 1.0 bar. The steam consumption for the
      turbine is 16 kg/kW hr when it develops 225 kW. If the throat diameter is 0.8 cm,
      determine the number of nozzles required and exit diameter of the nozzle, assuming that
      the 10% of the total heat drop is lost in overcoming the friction in the divergent portion
      only. Neglect the velocity of approach.

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