B.E. Mech. VII CBSGS   25.5.17   QP CODE : 793300   (15)

(3 Hours)   [Total Marks : 80]

Note:

  1. Question No.1 is compulsory.
  2. Attempt any three questions from remaining five questions.
  3. Assume suitable data if required.

Q.1   Solve any four   (20)

  a. Enumerate the various components of reciprocating air compressor.
  b. What is the function of air vessel in reciprocating pump?
  c. Distinguish clearly between NPSH available and NPSH required and discuss the factor that affect them.
  d. What are the methods of energy conservation in pumping system?
  e. Explain the working of centrifugal compressor.

Q.2 a) Why inter cooling is used in multistage compressor? Derive an expression for intermediate pressure in a two stage compressor when inter cooling is perfect.   (10)

     b) A rotary air compressor receives air at a pressure of 1 bar and 17^0 C and delivers it at a pressure of 6 bar. Determine, per kg of air delivered, work done by the compressor and heat exchanged with the jacket water when the compression is isothermal, isentropic and by the relation $pv^{1.6}$ = constant.   (10)

Q.3 a) The piston diameter and the stroke length of a single acting reciprocating pump are 150 mm and 300 mm respectively. The center of the pump is 5.0 m above the water level in the sump and 33 m below the delivery water level. Both the suction and delivery pipes have the same diameter of 75 mm and are 6.5 and 39 m long respectively. If the pump is working at 30 rpm, determine   (12)

  (i)   The pressure head on the piston at the beginning, middle and the end of both suction and delivery strokes, and
  (ii) The power required to drive the pump.

Take atmospheric pressure head = 10.3 m of water and friction co-efficient, f = 0.01 for both the pipes.

     b) Explain the methods to balance axial and radial trust in centrifugal pump.   (08)

Q.4 a) In a three-stage compressor, air is compressed from 98 kPa to 20 bar. Calculate for $1m^3$ of air per second   (10)
  1. Work under ideal condition for n = 1.3
  2. Isothermal work
  3. Saving in work due to multi staging.
  4. Isothermal efficiency.

     b) How does the acceleration head and pipe friction affect the indicator diagram and work done?   (10)

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Q.5 a) Draw a neat sketch of various components of the centrifugal compressor and show the variation of pressure and velocity of air being compressed. (10)

b) 3 m³ of water per second is lifted to a height of 30 m with an efficiency of 75% by single stage centrifugal pump. The impeller diameter is 300 mm and it is rotating at 2000 rpm. Find the number of stages and diameter of each impeller of a similar multi-stage pump to lift 5 m³ of water per second to a height of 200 m when rotating at 1500rpm. (10)

Q.6   Solve any four

    a. What do you mean by priming? Why is it necessary? (20)
    b. What is cavitation? How can we avoid it in reciprocating pump?
    c. What is closed loop network? And its advantages?
    d. What are the methods of energy conservation in compressed air system?
    e. Draw and comment on performance characteristics of pump.