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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FOURTH SEMESTER B.TECH DEGREE EXAMINATION, JULY 2017

Course Code: ME206
Course Name: FLUID MACHINERY (ME)

Max. Marks: 100   Duration: 3 Hours

PART A
Answer any three questions. Each question carries 10 marks.

1   Derive expression for the force exerted by the jet of water on a series moving flat   (10)
     plate placed on the periphery of a wheel. Also find the maximum efficiency?
2 a) Give the comparison between impulse and reaction turbines   (4)
   b) A Pelton wheel having a mean bucket diameter of 1.2m is running at 1000 r.p.m.   (6)
      The net head on the Pelton wheel is 840 m. If the side clearance angle is 15° and
      discharge through the nozzle is 0.12 m^3/s. Determine: -
          (i) Power available at the nozzle   (ii) Hydraulic efficiency of the turbine.
3   An inward flow reaction turbine has external and internal diameters as 0.9m and   (10)
     0.45 m respectively. The turbine is running at 200 r.p.m and the width of the turbine
     at the inlet is 0.2 m. The velocity of flow through the runner is constant and is equal
     to 1.8 m/s. The guide blades make an angle of 10° to the tangent of the wheel and
     discharge at the outlet of turbine is radial. Draw the inlet and outlet velocity
     triangles and determine:-
          (i) Relative velocity at inlet   (ii) The runner blade angles
          (iii) Width of the runner at outlet   (iv) Head at the inlet of the turbine
          (v) Power developed   (vi) Hydraulic efficiency of the turbine.
4 a) What is cavitation? On what factors does the cavitation in water turbines depend?   (4)
   b) A turbine is to operate under a head of 25 m at 200 r.p.m. The discharge is 9 m^3/s. (6)
      If the overall efficiency is 90 percent. Determine: -
       (i) Power generated   (ii) Specific speed of the turbine   (iii) Type of turbine.

PART B
Answer any three questions. Each question carries 10 marks

5 a) Define the following terms: -   (4)
          (i) Static head   (ii) Manometric head   (iii) Total Head
   b) A centrifugal pump is running at 1000 r.p.m and working against head of 20 m.   (6)
      The rate of flow through the pump is 0.2 m^3/s. The outlet vane angle of impeller is
      45° and velocity of flow at outlet is 2.5 m/s. If the Manometric efficiency of the
      pump is 80 percent, calculate the diameter and width of impeller at outlet.
6 a) Define specific speed of a centrifugal pump. Derive expression for the same.   (5)
   b) What is negative slip in a reciprocating pump? Explain with neat sketches the   (5)
      functions of air vessels in a reciprocating pump?

7   The diameter and stroke length of a single-acting reciprocating pump are 75 mm   (10)
     and 150 mm respectively. It takes its supply of water from a sump 3 m below the
     pump through a pipe 5 m long and 40 mm in diameter. It delivers water to a tank
     12 m above the pump through a pipe 30 mm in diameter and 15 m long. If
     separation occurs 75 kN/m^2 below the atmospheric pressure. Find the maximum
     speed at which pump may be operated without separation. Assume that the piston
     has a simple harmonic motion.

8 a) Describe with the aid of neat sketch the construction and working of a Hydraulic   (5)
       Ram.

   b) With the aid of a sketch explain the working of a Hydraulic Accumulator?   (5)

PART C
Answer any four questions. Each question carries 10 marks.

9   A double acting air compressor works with an indicated power of 37kW. Air is   (10)
     drawn at 1 bar and 300 K and compressed, according to the law $PV^{1.2}$ = Constant
     to 7 bar. The compressor runs at 200 r.p.m with average piston speed 2.5 m/s.
     Neglect clearance. Find the dimensions of the cylinder.

10   Derive an expression for indicated work of a reciprocating air compressor by   (10)
     neglecting clearance volume.

11   Describe the principle of operation, construction and working of centrifugal   (10)
     compressor.

12 a) Compare axial flow compressor with centrifugal compressor.   (5)

   b) Distinguish surging and stalling phenomenon happens at off design condition in   (5)
       axial flow compressor?

13 a) Derive expression of work done for axial flow compressor.   (6)

   b) Draw the performance characteristics, pressure coefficient and flow coefficient for   (4)
       backward curved, radial and forward curved vane impeller of a centrifugal
       compressor?

14 a) Draw the stage velocity triangles for an axial compressor with upstream guide   (5)
       vanes, rotor blades and diffuser blades.

   b) Explain the construction and working of a roots blower.   (5)

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