Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE – SEMESTER V • EXAMINATION – WINTER - 2012

Subject code: 151903   **Date: 17-01-2013**
Subject Name: Fluid Power Engineering
Time: 02:30 pm to 05:00 pm   **Total Marks: 70**
Instructions:
   1. **Attempt all questions.**
   2. **Make suitable assumptions wherever necessary.**
   3. **Figures to the right indicate full marks.**

Q.1 **(a)** Explain the term 'Minor losses'. Obtain an equation to calculate head **07**
loss due to sudden expansion and from that equation derive equation of
exit loss.

(b) Water is flowing through a horizontal pipe of 30 cm diameter and 50 m **07**
length. One end of pipe is connected to a tank and the other end is
open to atmosphere. If the height of water in the tank is 6 m above the
centre of pipe, determine flowrate through the pipe. Take $4f = 0.02$ in
equation $h_f = (4flV^2)/ (2gD)$.

Q.2 **(a)** A tank, which is free to move, is provided with an orifice on side, **07**
through which jet of water is coming out. Obtain an equation for work
done per sec on tank and efficiency of propulsion.

(b) A water jet of 80 mm diameter impinges on a curved vane at its centre **07**
and is deflected through an angle of 140^0. The water flowrate is 80 lit/
s and vane moves with velocity of 5 m/s in direction of jet. Neglecting
friction, find (i) component of force in direction of motion and (ii) the
power developed by vane and its efficiency.

OR

(b) Explain function of draft tube. State types of draft tube and explain **07**
importance of cone angle (θ) in draft tube.

Q.3 **(a)** (i) Differentiate clearly between Impulse turbine and Reaction turbine. **03**
(ii) Explain function of components of Pelton turbine. **04**

(b) A Pelton wheel is required to develop 8000 kW while working under **07**
head of 380 m at a speed of 500 rpm. If overall efficiency is 88%, find
(i) flowrate through the turbine, (ii) runner diameter, (iii) no. of
nozzles and (iv) no. of buckets in runner. Assume jet ratio of 10,
coefficient of velocity as 0.97 and speed ratio of 0.46.

OR

Q.3 **(a)** Give detailed classification of Francis turbine and explain function of **07**
wicket gate. Compare Francis turbine with Kaplan turbine also.

(b) A Francis turbine develops 160 kW at 150 rpm under head of 10 m. **07**
The peripheral velocity at inlet and flow velocity at inlet of runner are
$0.3(2gH)^{0.5}$ and $0.9(2gH)^{0.5}$ respectively. The overall efficiency of
turbine is 78% and hydraulic efficiency is 82%. Assuming radial
discharge at outlet, find (i) guide blade angle and runner vane angle at
inlet and (ii) diameter and width of runner at inlet.

Q.4 **(a)** Explain (i) minimum starting speed of centrifugal pump and (ii) **07**
cavitation in centrifugal pump.

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(b) A centrifugal pump running at 900 rpm is working against head of 18   **07** m. The outlet diameter of impeller is 380 mm and outlet width is 40 mm. If outlet blade angle is 28^0 and manometric efficiency is 78 %, find discharge of the pump.

OR

Q.4 **(a)** Compare Reciprocating pump with Centrifugal pump.   **07** Draw theoretical indicator diagram of reciprocating pump and explain function of air vessel.

(b) A single stage, single acting reciprocating air compressor compresses   **07** 7×10^{-3} m^3 of air /s from pressure of 1.013 bar to 14 bar. The index of polytropic compression process is 1.3 and mechanical efficiency is 82%. Neglecting effect of clearance, determine power required to drive the compressor and show the process on P-V diagram.

Q.5 **(a)** Explain necessity of multistaging in reciprocating air compressor.   **07** A two stage air compressor has perfect intercooling in intercooler. Show this process on P – V diagram.

(b) Explain effect of pre- whirl in centrifugal compressor.   **07** State types of impeller used in centrifugal compressor and show their characteristics curves.

OR

Q.5 **(a)** (i)For a centrifugal compressor, draw impeller having radial blades   **04** with its outlet velocity triangle and state function of volute casing.
(ii) Draw stage velocity diagram of an axial flow compressor.   **03**

(b) Explain function of hydraulic press, hydraulic ram and fluid coupling.   **07**

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