

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC SEM-IV Examination-Nov-2011

Subject code: X41902

Date: 23/11/2011

Subject Name: Fluid Power Engineering

Time: 2.30 pm -5.00 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 Pelton wheel with neat sketch and derive expression for it's work done and efficiency. **07**
- (b) A Francis turbine has external and internal diameter as 1.2m and 0.8m. Hydraulic efficiency is 90% and neat head is 40m. Velocity of flow at outlet is 2.5 m/s and discharge is radial at outlet. If guide vane angle at outlet is 15^0 and width of the wheel is 10cm at inlet and outlet, Find (1)Speed of turbine (2) Guide blade vane angle (3) Vane angle of runner at inlet (4) volume flow rate of turbine and (5) Power developed. **07**

- Q.2** (a) Define Centrifugal pump and Explain working of single stage Centrifugal pump with neat sketch. **07**
- (b) A single acting reciprocating pump runs at 30 rpm, delivers $0.012\text{m}^3/\text{s}$ of water. The diameter of the piston is 25cm and stroke length is 50cm. Find (i) The theoretical discharge of the pump (ii) Co-efficient of discharge and (iii) Slip and percentage slip of the pump. **07**

OR

- (b) A Centrifugal pump having outer diameter equal to two times the inner diameter and running at 1200 rpm works against a total head of 75m. The velocity of flow through the impeller is constant and equal to 3 m/s. The vanes are set back at an angle of 30^0 at outlet. If the outer diameter of the impeller is 600mm and width at outlet is 50mm, Find (a) Vane angle at inlet (b) work done per second by impeller (c) manometric efficiency **07**

- Q.3** (a) Define the term Hydraulic accumulator. Obtain the equation of capacity of Hydraulic accumulator and differentiate between Hydraulic accumulator and differential accumulator **07**
- (b) What do you understand by minor energy losses in pipe? Derive formula for loss of head due to sudden enlargement of a pipe. **07**

OR

- Q.3** (a) Find the head loss due to friction in a pipe of diameter 250 mm and length 60 m, through which water is flowing at a velocity of 3.0 m/s using (i) Darcy formula and (ii) Chezy's formula take $C=55$ and V for water = 0.01 stroke. **07**

- (b) Explain Hydraulic Ram with neat sketch derive expression for it's efficiency. 07

- Q.4 (a) Prove that the work done per second on series of moving curved vanes by jet of water striking on one of tip of vane is given by 07

$$\zeta A V_{T1} (V_{W1} \pm V_{W2}) \times u$$

- (b) A 4 cm diameter jet having velocity of 12 m/s strikes a fixed plate, the normal of which is inclined at 30° to the axis of the jet. Find the force exerted by jet normal to the plate and in the direction of jet. If now the plate moves in a direction of jet with a velocity of 4 m/s, find the force, work done/sec and efficiency. 07

OR

- Q.4 (a) What is function of the draft tube in reaction turbine explain different types of draft tube in short. 07
(b) Explain the root blower with two lobe rotor with figure and derive expression for it's efficiency. 07

- Q.5 (a) Derive expression for the polytropic work done of a Single stage reciprocating compressor by neglecting the clearance. 07
(b) From the following data calculate the impeller diameter of a centrifugal compressor. 07
Total pressure ratio=4, compressor isentropic efficiency=0.78, RPM=16000, static inlet temperature = 282 K, Axial velocity of air at inlet= 150 m/s. Assume suitable value of slip factor and power input factor.

OR

- Q.5 (a) What is slip in centrifugal compressor ? Define slip factor and derive expression for the same. 07
(b) What is Axial flow compressor? With a suitable sketch explain the working principle of axial flow compressor. And derive expression for work input to the compressor. 07
