## **GUJARAT TECHNOLOGICAL UNIVERSITY** PDDC - SEMESTER-IV • EXAMINATION – WINTER 2013

Subject Code: X41902

Subject Name: Fluid Power Engineering

Time: 02.30 pm - 05.00 pm

### **Instructions:**

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- Q.1 (a) Show that in case of jet striking the flat plates mounted on wheel, the 07efficiency will be maximum when the tangential velocity of wheel is half of the jet.
  - (b) A jet of water of diameter 80 mm strikes a curved plate at its centre with a 07 velocity of 20 m/s, the plate is moving with a velocity of 10 m/s in the direction of the jet. The jet is deflected through an angle of 160°, assuming the plate is smooth. Calculate :
    - 1. Force exerted in the direction of jet
    - 2. Work done by jet on the plate per sec
    - 3. Efficiency of the jet.

#### Q.2 (a) Explain the following terms :

- 1. Major losses
- 2. Minor losses
- 3. Equivalent pipe
- (b) An oil of specific gravity 0.78 is flowing through a pipe of diameter 300 07 mm at the rate of  $0.6m^3$ /sec. Find the head loss due to friction and power required to maintain the flow for a length of 500 meter. Take kinematic viscosity of an oil as 0.29 stokes.

#### OR

- (b) Prove that head loss due to friction is equal to one third of total head inlet 07 for maximum power transmission through nozzle.
- Q.3 (a) Explain the following terms with reference to water turbines. Give 07 expression of each efficiencies.
  - 1. Hydraulic efficiency
  - 2. Mechanical efficiency
  - 3. Overall efficiency
  - (b) A Pelton wheel has a mean bucket speed of 10 m/s with a jet of water 07 flowing at a rate of 1000 liter/sec under a head of 50 meters. The bucket deflect the jet through an angle of 160°. Assuming that co efficient of velocity as 0.97. Calculate
    - 1. Velocity of jet
    - 2. Work done per second on the runner
    - 3. Hydraulic efficiency of turbine

#### OR

- 0.3 (a) State the function of draft tube. Enlist the type of draft tube and explain 07 any one with a neat sketch.
  - **(b)** A Kaplan turbine runner is to be designed to develop 10,000 kW working 07 under a head 6 m. If the speed ratio=2.00, flow ratio=0.68, overall efficiency of turbine is 90% and diameter of the boss is  $\frac{1}{3}$  the diameter

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# **Total Marks: 70**

of runner. Calculate:

- 1. Discharge in  $m^3/sec$
- 2. Diameter of the runner and boss
- 3. Speed of the turbine
- Q.4 (a) Enlist the various types of impeller used in centrifugal pump and explain 07 any one from it with a neat sketch .
  - (b) Find the power required to drive a centrifugal pump which delivers 0.05 07  $m^3$ /sec of water to a height of 25 m through a 20 cm diameter pipe and 100 m long. The overall efficiency of the pump is 75% and co efficient of friction *f*=0.015 used in Darcy's equation.

#### OR

- Q.4 (a) Give classification of Reciprocating pump and explain any one with neat 07 sketch.
  - (b) Write a short note on Submersible pump.

07

- Q.5 (a) Give detail classification of rotary compressor and explain any one with 07 line sketch.
  - (b) Air at 1 bar and 27°C is compressed isentropically in two stage 07 reciprocating air compressor. In first stage air is compressed to 8 bar and then cooled at constant pressure to 40°C in an inter cooler. The air is again compressed in second stage to a pressure of 42 bar and is delivered at this pressure. The compressor has to delivered 0.5 m<sup>3</sup>/min of air measured at inlet condition. Calculate
    - 1. Temperature at the end of compression process at both stages
    - 2. Power required to run the compressor

#### OR

- Q.5 (a) With the help of velocity triangles and head capacity curves, discuss 07 salient features of backward, radial and forward curves vanes in centrifugal compressor.
  - (b) With a suitable sketch explain the working principle of an axial flow 07 compressor. Draw the stage velocity triangles.

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