Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–IV • EXAMINATION – WINTER 2013

Subject Code: X41902 Date: 05-12-2013

Subject Name: Fluid Power Engineering

Time: 02.30 pm - 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)** Show that in case of jet striking the flat plates mounted on wheel, the efficiency will be maximum when the tangential velocity of wheel is half of the jet. **07**

(b) A jet of water of diameter 80 mm strikes a curved plate at its centre with a 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 : **07**

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 : **07**

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 mm at the rate of $0.6 m^3$/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. **07**

OR

(b) Prove that head loss due to friction is equal to one third of total head inlet for maximum power transmission through nozzle. **07**

Q.3 **(a)** Explain the following terms with reference to water turbines. Give expression of each efficiencies. **07**

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 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 **07**

1. Velocity of jet
2. Work done per second on the runner
3. Hydraulic efficiency of turbine

OR

Q.3 **(a)** State the function of draft tube. Enlist the type of draft tube and explain any one with a neat sketch. **07**

(b) A Kaplan turbine runner is to be designed to develop 10,000 kW working 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 $^1/_3$ the diameter **07**

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 any one from it with a neat sketch . **07**

(b) Find the power required to drive a centrifugal pump which delivers 0.05 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. **07**

OR

Q.4 **(a)** Give classification of Reciprocating pump and explain any one with neat sketch. **07**

(b) Write a short note on Submersible pump. **07**

Q.5 **(a)** Give detail classification of rotary compressor and explain any one with line sketch. **07**

(b) Air at 1 bar and 27°C is compressed isentropically in two stage 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^3/min of air measured at inlet condition. Calculate **07**

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 salient features of backward, radial and forward curves vanes in centrifugal compressor. **07**

(b) With a suitable sketch explain the working principle of an axial flow compressor. Draw the stage velocity triangles. **07**

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