Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–IV EXAMINATION – SUMMER 2016

Subject Code:X41902 **Date:30/05/2016**

Subject Name:Fluid Power Engineering

Time:10:30 AM TO 01:00 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 the force exerted by a jet of water on an inclined fixed blade in the direction of jet is given by $F_x = \rho a v^2 \sin^2\theta$ with usual notation **07**

(b) A jet of water of diameter 75 mm strikes a the flate plate with a velocity of 40 m/s, assuming the plate is smooth . Calculate force on the plate, work done and power developed when **07**

1. Plate is stationary
2. Plate is moving with a velocity of 20 m/s along the jet direction
3. Plate is moving with a velocity of 20 m/s towards the jet

Q.2 **(a)** What is the function of draft tube ? State the type of draft tube and explain with a neat sketch of any one . **07**

(b) Derive an expression of specific speed for Pelton wheel. **07**

OR

(b) Why governing of water turbine is required? Explain governing of any one hydraulic turbine with neat sketch **07**

Q.3 **(a)** Derive Darcy- Weisbach formula for calculating loss of head due to friction in a pipe. **07**

(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

Q.3 **(a)** A hydro electric power plant developed 100 MW under the head of 500 meter and 500 rpm. Assuming over all efficiency as 90%, co efficient of nozzle 0.92, jet ratio and speed ratio are 10 and 0.5 respectively. Calculate **07**

1. Total quantity of water required
2. Diameter of jet
3. Number of nozzle required.

(b) The external and internal diameters of an inward flow reaction turbines are 1.20 meter and 0.6 meter respectively. The head on the runner is 20 meter and velocity of flow through the runner is constant and equal to 3.0 m/sec. The guide blade angle is given as 12° and the runner vanes are radial at inlet and discharge at out let is radial, determine : **07**

1. The speed of the turbine
2. The vane angle at outlet of the turbine
3. Hydraulic efficiency

Q.4 **(a)** Give detail classification of rotary compressor and explain any one with line sketch. **07**

(b) Derive an expression for the optimum value of the intercooler pressure in a two stage reciprocating air compressor for perfect inter cooling condition. **07**

OR

Q.4 **(a)** With a suitable sketch explain the working principle of an axial flow compressor. Draw the stage velocity triangles. **07**

Q.4 **(b)** Define the following terms in case of centrifugal air compressor. **07**

1. Slip
2. Slip factor
3. Power in put factor

Derive an equation of Euler's work in case of centrifugal compressor with usual notation.

Q.5 **(a)** Sketch the different types of impellers used in centrifugal pump. State its application. **07**

(b) A centrifugal pump is running at 600 rpm and discharge 9 m^3/min against a head of 15 meter. It has an impeller of 60 cm outer diameter and 25 cm inner diameter. Vanes are set back at outlet at an angle of 45°. The constant velocity of flow is 3 m/s. Calculate : **07**

1. Manometric efficiency
2. Vane angle at inlet

OR

Q.5 **(a)** Derive an expression for the work done per second of single stage reciprocating pump. **07**

(b) Write a short note on Vane Pump. **07**

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