Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**PDDC - SEMESTER–IV • EXAMINATION – WINTER • 2014**

**Subject Code: X41902** **Date: 29-12-2014**

**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 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 100 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 165°, 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)** Write a brief note on: Water Hammer **07**

**(b)** Explain the following terms : **07**

1. Pipes in series
2. Pipes in parallel
3. Equivalent pipe

**OR**

**(b)** Prove that total head loss due to friction is equal to $1/3^{rd}$ of the total head at inlet for maximum power transmission through pipes or nozzles. **07**

**Q.3** **(a)** Explain the following terms related to hydraulic turbine : **07**

1. Gross head
2. Net head
3. Hydraulic efficiency
4. 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 1.5 $m^3$/sec under a head of 60 meters. The bucket deflect the jet through an angle of 165°. Assuming that co efficient of velocity as 0.94 Calculate: **07**

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

**OR**

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

**(b)** Draw and explain Characteristic curves of hydraulic turbine **07**

**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 25m through a 20 cm diameter pipe and 75 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. Draw neat sketch of single acting reciprocating pump. | **07** |
| **Q.4** | **(b)** | Write a short note on Submersible pump. | **07** |
| **Q.5** | **(a)** | A centrifugal air compressor draws air at a temperature of 27°C running at 12000 rpm has the following data:<br>1. Outer diameter of blade tip= 550 mm<br>2. Slip factor=0.92<br>3. Isentropic total head efficiency= 90%<br>Assuming that the absolute velocities of air at inlet and outlet are same. Calculate :<br>1. Temperature rise of air passing through compressor<br>2. Static pressure ratio | **07** |
| | **(b)** | With a suitable sketch explain the working principle of an axial flow compressor. Draw the stage velocity triangles. | **07** |
| | | **OR** | |
| **Q.5** | **(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** |

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