Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE- V$^{th}$ SEMESTER–EXAMINATION – MAY/JUNE - 2012**

**Subject code: 151903 Date: 04/06/2012**

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

**(b)** Explain the following terms : (1) Major losses (2) Minor losses and (3) Equivalent pipe **07**

**Q.2** **(a)** A jet delivers water at the rate of 60 liters per second with velocity 30 m/s. The jet strikes tangentially on the vane moving in the direction of the jet with the velocity of 15 m/s. The vane is so shaped that if stationary it would deflect the jet through an angle 50°. Calculate: (1) angle made by absolute velocity at outlet and (2) work done per sec. **07**

**(b)** 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**

**OR**

**(b)** A jet of water of 30 mm diameter, strikes on the hinged rectangular plate weight 100 N at the center of the plate. The velocity of the jet is 8 m/s. Calculate: (1) angle through which the plate will swing, and (2) force must be applied at the lower edge of the plate in order to keep the plate vertical. **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 and
(3) Overall efficiency

**(b)** The following data is related to Pelton wheel turbine **07**
(1) Heat at the base of the nozzle=80 m
(2) Diameter of the jet = 100 mm
(3) Discharge of the nozzle=0.30$m^3$/s
(4) Power at the shaft=206 kw and
(5) Power absorbed in mechanical resistance= 4.5 kw
Determine: (1) power lost in nozzle and (2) power lost due to hydraulic resistance in the runner.

**OR**

**Q.3** **(a)** Why governing of water turbine is required? Explain governing of any one hydraulic turbine with neat sketch. **07**

**(b)** Francis turbine designed to develop 160 kw working under a head 10 m and running at 200 rpm. The hydraulic losses in turbine are 15% of available energy. The overall efficiency of turbine is 80%. Assume flow ratio=0.94 and speed ratio=0.25. Calculate: (1) guide blade angle and runner vane angle at inlet and (2) diameter and width at inlet. **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 0.04 $m^3$/sec of water to a height of 20m through a 15 cm diameter pipe and 100 m long. The overall efficiency of the pump is 70% 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**

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

**Q.5** **(a)** Derive an expression for the optimum value of the intercooler pressure in a two stage reciprocating air compressor for perfect inter cooling condition. **07**

**(b)** A centrifugal air compressor has a pressure ratio of 4:1 with an isentropic efficiency 88% when running at 14000 rpm and including air at 25° C. Curved vanes at inlet give the air a pre-whirl of 18° to axial direction at all radii and the mean diameter of eye is 245 mm. The absolute air velocity at inlet is 120 m/s. Impeller tip diameter is 580 mm. Calculate slip factor. **07**

**OR**

**Q.5** **(a)** With a suitable sketch explain the working principle of an axial flow compressor. Draw the stage velocity triangles. **07**

**(b)** Explain working of Differential hydraulic accumulator with neat sketch. **07**

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