

GUJARAT TECHNOLOGICAL UNIVERSITY**B.E. Sem-Vth Examination December 2010****Subject code: 151903****Subject Name: Fluid Power Engineering****Date: 16 /12 /2010****Time: 03.00 pm - 05.30 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) Explain the phenomenon of water hammer. Obtain an expression for the rise of pressure when the flowing water in a pipe is brought to rest by closing the valve gradually. **07**
- (b) A pipe line 300 mm dia. and 3200 m long is used to pump up 50 kg/s of an oil whose density is 950 kg/m³ and whose kinematic viscosity is 2.1 stokes. The centre of the pipe line at the upper end is 40 m above than that at the lower end. The discharge at the upper end is atmospheric. Find the pressure at the lower end and draw the hydraulic gradient and total energy line. **07**
- Q.2** (a) Show that the efficiency of a free jet striking normally on a series of flat plates mounted on the periphery of a wheel can never exceed 50 %. **07**
- (b) Find an expression for the propelling force and the work done per sec. on a tank which is provided with an orifice through which jet of water is coming out and the tank is free to move. **07**
- OR**
- (b) A jet of water impinges on a symmetrically curved vane at its center. The velocity of the jet is 60 m/s and the diameter 120 mm. the jet is deflected through an angle of 120° Calculate the force on the vane if the vane is fixed. Also determine the force if the vane moves with a velocity of 25 m/s in the direction of the jet. What will be the power and efficiency? **07**
- Q.3** (a) What is a draft tube? Why is it used in a reaction turbine? What are the various types of it? **07**
- (b) The following data is related to a pelton wheel turbine. **07**
- (I) Head at the base of the nozzle = 80 m
 - (II) Diameter of the jet = 100 mm
 - (III) Discharge of the nozzle = 0.30 m³/s
 - (IV) Power at the shaft = 206 KW
 - (V) Power absorbed in mechanical resistance = 4.5 KW
- Determine power lost in nozzle and power lost due to hydraulic resistance in the runner.
- OR**
- Q.3** (a) Define specific speed of a turbine and derive an expression for the same. **07**
- (b) Define the term "Governing of a turbine". **07**
- Explain with neat sketch governing mechanism of Francis Turbine.
- Q.4** (a) How will you obtain an expression for the minimum speed for starting of a centrifugal pump? **07**

- (b) Find the power required to drive a centrifugal pump which delivers $0.04 \text{ m}^3/\text{s}$ of water to a height of 20 m through a 15 cm diameter pipe and 100 m long. The overall efficiency of the pump is 70 % and co-efficient of friction $f = 0.015$ in the formulae $h_f = 4fLv^2 / 2gd$ **07**

OR

- Q.4 (a)** Prove that the work done / kg of air in single stage reciprocating air compressor without clearance is given by **07**

$$W = \frac{n R T_1}{(n - 1)} \{ (P_2 / P_1)^{(n-1)/n} - 1 \}$$

Where notations have their usual meaning.

- (b) What is pre-whirl? Sketch the velocity diagrams with and without pre whirl for a centrifugal compressor. **07**

- Q.5 (a)** Explain the phenomenon of surging and stalling in an axial flow air compressor. **07**

- (b) An axial flow air compressor stage has a mean diameter of 60 cm. and runs at 15000 rpm if the actual temp. rise and pressure ratio developed are 30°C and 1.35 respectively. Determine : **07**

- (I) Power required to drive the compressor while delivering 57 kg/s of air, if the mechanical efficiency is 86 percent and inlet temp. rise is 35°C .
- (II) The stage loading coefficient.
- (III) The degree of reaction if the temp. at the rotor exit is 55°C

OR

- Q.5 (a)** Write short note on the following (Any two) **07**

- (I) Hydraulic ram
- (II) Screw compressor
- (III) Roots blower

- (b) Answer the following (Any two) **07**

- (I) Hydraulic accumulator
- (II) Hydroelectric power station
- (III) Define the lift and drag co-efficient and derive their expressions.
