

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. Sem. - V - Examination – June- 2011

Subject code: 151903

Subject Name: Fluid Power Engineering

Date: 24/06/2011

Time: 10:30 am – 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) With usual notations derive Darcy-Weisbach expression for calculating head loss due to friction in a pipe. **07**

(b) The diameter of a horizontal pipe which is 300mm is suddenly enlarged to 600mm. The rate of flow of water through this pipe is $0.4 \text{ m}^3/\text{sec}$. If the intensity of pressure in smaller pipe is 125 KN/m^2 , determine loss of head due to sudden enlargement, intensity of pressure in large pipe, power loss due to enlargement. **07**

Q.2 (a) With neat sketch explain construction and working of hydraulic crane. **07**

(b) Prove that for a curved radial vane the efficiency is given by **07**
$$\eta = \frac{2(V_{w1}u_1 + V_{w2}u_2)}{V_1^2}$$

OR

(b) A jet of water moving with a velocity of 27 m/s impinges tangentially to a single curved blade which is moving in the direction of jet with a speed of 12 m/s . Jet is deflected through 45° . If the friction reduces the relative velocity by 20% calculate the angle through which the jet will leave the blade, work done /kg of water and efficiency. **07**

Q.3 (a) Explain how hydraulic turbines are classified. **07**

(b) A Pelton turbine is to be designed for following specifications: **07**
shaft power = 11770 KW , Head = 380 m , speed = 750 rpm , overall efficiency = 86% , jet diameter not to exceed one sixth of wheel diameter, Determine the wheel diameter, number of jets required, diameter of jet. assume $C_v = 0.985$, $v = 0.45(2gH)^{0.5}$

OR

Q.3 (a) State function of draft tube and explain with neat sketch different types of draft tubes. **07**

(b) A turbine is to operate under a head of 25 m at 200 rpm . The discharge is $9 \text{ m}^3/\text{sec}$. If the efficiency is 90% determine, specific speed of machine, power generated, type of turbine and performance under head of 20 m . **07**

Q.4 (a) Explain following terms: Net positive suction head, Priming, Cavitation in pump **07**

(b) A centrifugal pump raises the head of water through 4 m and delivers $1.5 \text{ m}^3/\text{sec}$. The speed of the impeller is 180 rpm . The impeller diameter at the outlet is 1.3 m and area at the periphery is 0.3 m^2 . The **07**

ratio of the outlet at the inlet diameter is 2m and vane angle at the outlet is 30° . Determine the hydraulic efficiency, power required and minimum starting speed.

OR

Q. 4 (a) With neat sketch explain construction and working of submersible pump. **07**

(b) A triple cylinder reciprocating pump raises the water level by 100m and discharge is 100l/s. The diameter of piston is 250mm and stroke is 600mm. The velocity of water in the delivery pipe is 1.4m/s. The friction losses amount to 2m in the suction pipe and 18m in delivery pipe. Taking efficiency of pump as 90% and slip 2%, calculate speed and power input of the pump. **07**

Q.5 (a) Derive an expression for indicated work of reciprocating air compressor considering its clearance. **07**

(b) In a three stage compressor, air is compressed from 98KPa to 20 KPa. Calculate for 1m^3 of air per second, **07**

- (1) Work under ideal condition for $n=1.3$
- (2) Isothermal work.
- (3) Saving in work due to multi-staging.
- (4) Isothermal efficiency.

OR

Q.5 (a) Describe principle construction and working of centrifugal compressor. **07**

(b) A centrifugal compressor running at 1440rpm, handles air at 101KPa and 20°C and compress it to a pressure of 6 bar isentropically. The inner and outer diameters of the impeller are 14cm and 25cm, resply, The width of the blade at the inlet is 2.5cm. The blade angles are 16° and 40° at entry and exit. Calculate mass-flow rate of the air degree of reaction, power input and width of the blades at outlet **07**
