Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V • EXAMINATION – SUMMER • 2014

Subject Code: 151903 **Date: 19-06-2014**

Subject Name: Fluid Power Engineering

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.**
4. **Assume suitable additional data if required.**

Q.1	**(a)**	Derive an expression for ratio of outlet area of nozzle to the area of pipe for maximum transmission of power	**07**
	(b)	Find the maximum power transmitted by a jet of water discharging freely out of nozzle fitted to a pipe 250m long and 120mm diameter with co-efficient of friction as 0.01 and the available head at nozzle is 110m.	**07**
Q.2	**(a)**	Prove that the velocity of the vanes should be half the velocity of jet for maximum efficiency for a series of flat vanes held normal to the axis of the jet	**07**
	(b)	A jet of water having a velocity of 20 m/s strikes a curved vane, which is moving with a velocity of 10m/s. The jet makes an angle of 30° with the direction of motion of vane at inlet and leaves at an angle of 130° to the direction of motion of vane at outlet. Calculate (i) Vane angles, so that the water enters and leaves the vane without shock. (ii) Work done per second per kg of water striking the vane	**07**
		OR	
	(b)	Draw a neat diagram of a hydraulic intensifier and Explain its working.	**07**
Q.3	**(a)**	Derive the expression for maximum hydraulic efficiency of a Pelton wheel turbine.	**07**
	(b)	A pelton wheel is required to develop 1500 kW under a net head of 150 m at a speed of 450 rpm. Assuming the following data: Coiefficient of velocity jet = 0.96, Speed ratio= 0.45, overall efficiency= 85 % , The jet diameter d to be 1/10 of the mean diameter of the wheel D, Calculate: (i) the mean diameter of the wheel. (ii) the diameter of the jet. (iii) the number of jets required.	**07**
		OR	
Q.3	**(a)**	State the functions of a draft tube and Explain with neat sketches different types of draft tubes	**07**
	(b)	Describe with a sketch the working of a governing system for Francis turbine	**07**
Q.4	**(a)**	Derive expression for the pressure rise in the impeller of the centrifugal pump by neglecting the frictional and other losses in the impeller.	**07**
	(b)	Find the rise in pressure in the impeller of a centrifugal pump through water is flowing at the rate of 15 liters per second.. The internal and the external diameters of the impeller are 0.20m and 0.40m respectively. The width of the impeller at inlet and outlet are 1.6cm and 0.6cm.The pump is running at 1200rpm. The water enters the impellers radially at inlet and impeller vane angle at outlet is 30°. Neglect losses through the impeller.	**07**
		OR	
Q.4	**(a)**	Discuss the various characteristic curves of a centrifugal pump.	**07**
	(b)	What is an air vessel? Explain with a neat sketch the working of air vessels in a reciprocating pump.	**07**

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

(b) A two stage air compressor takes in 3.0 m^3 of air per minute at a pressure of 1.0 bar and temperature of 25°C. It delivers the air at 9.0 bar. The compression is carried out in each cylinder according to law $PV^{1.25}$ = constant. The air is cooled to its initial temperature in intercooler. **07**

Find the minimum power required to drive the compressor neglecting the clearance volume.

OR

Q.5 **(a)** Explain with a suitable sketch construction and working of an axial flow compressor. **07**

(b) Explain the phenomenon of surging, stalling and choking in a centrifugal compressor. **07**

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