GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER– V (New) EXAMINATION – WINTER 2019

Subject Code: 2151903   **Date: 04/12/2019**

Subject Name: Fluid Power Engineering

Time: 10:30 AM TO 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.

			Marks
Q.1	**(a)**	Explain the principle of operation of hydro-electric power plant.	**03**
	(b)	Discuss the factors affecting the site selection of a hydro power plant.	**04**
	(c)	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**
Q.2	**(a)**	Classify hydraulic turbines.	**03**
	(b)	Derive an expression for work done per second by a jet of water striking a moving plate held inclined to the direction of the jet.	**04**
	(c)	A jet of water of diameter 45 mm having a velocity of 24 m/sec strikes a curved vane which is moving with a velocity of 12 m/sec in the direction of the jet. The jet leaves the vane at an angle of 60° to the direction of motion of vane at outlet. Determine : (i) The force exerted by the jet on the vane in the direction of motion. (ii) Work done per second by the jet.	**07**

OR

	(c)	Explain the phenomenon of surging and choking in centrifugal compressor.	**07**
Q.3	**(a)**	Discuss the operating characteristics curves for hydraulic turbines.	**03**
	(b)	A Pelton wheel has a mean bucket speed of 10 m/sec with a jet of water flowing at the rate of 800 litres/sec under a head of 32 metres. The bucket deflects the jet through an angle of 165°. Calculate the power given by water to the runner and hydraulic efficiency of the turbine. Assume co-efficient of velocity as 0.98.	**04**
	(c)	Define cavitation and cavitation factor. Discuss the effects and methods to prevent cavitation in hydraulic turbine.	**07**

OR

Q.3	**(a)**	Differentiate between Pelton and Francis turbine.	**03**
	(b)	Discuss the constant efficiency or Muschel curves for hydraulic turbine.	**04**
	(c)	240 litres of water per second are supplied to an inward flow reaction turbine. The head available is 12 m. The wheel vanes are radial at inlet and the inlet diameter is twice the outlet diameter. The velocity of flow is constant and equal to 1.85 m/sec. The wheel makes 380 rpm. Find (i) Guide vane angle (ii) Inlet and outlet diameter of the wheel (iii) The width of the wheel at inlet and exit.	**07**

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Assume that the discharge is radial and there are no losses in the wheel. Take speed ratio = 0.7. Neglect the thickness of the vanes.

Q.4 **(a)** Classify pumps. **03**

(b) Discuss the factors to be considered for selection of pumps. **04**

(c) The impeller of a centrifugal pump is of 320 mm diameter and 55 mm width at the periphery and has blades whose tip angle incline backwards 60° from the radius. The pump delivers 18 m^3/min of water and impeller rotates at 1000 rpm. Assuming that the pump is designed to admit radially, calculate : **07**

    (i)   Speed and direction of water as it leaves the impeller.

    (ii)   Torque exerted by the impeller on water.

    (iii)   Shaft power required and

    (iv)   Lift of the pump

          Take mechanical efficiency = 96 % and hydraulic efficiency = 74%.

OR

Q.4 **(a)** Define indicator diagram. Draw ideal indicator diagram and prove that work done by the reciprocating pump is proportional to the area of indicator diagram. **03**

(b) What do you mean by an air vessel ? Explain the function of an air vessel for reciprocating pump. **04**

(c) Explain construction and working of screw compressor. State its advantages, disadvantages and applications. **07**

Q.5 **(a)** Explain working of reciprocating compressor. **03**

(b) What is pre-whirl ? Explain the effect of pre-whirl in centrifugal compressor. **04**

(c) Explain lift and drag as related to axial flow compressor and with suitable diagram explain variation of lift and drag coefficient with angle of attack. **07**

OR

Q.5 **(a)** Explain working of direct acting lift. **03**

(b) Differentiate between reciprocating and centrifugal compressor. **04**

(c) Explain function, construction and working of air lift pump. State the advantages and disadvantages. **07**

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