Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) - EXAMINATION – SUMMER 2016

Subject Code:2151903 **Date:09/05/2016**

Subject Name:Fluid Power Engineering

Time:02:30 PM to 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)**	List the factors affecting selection of site for hydro-electric power plant.	**07**
	(b)	A jet of water of diameter 7.5 cm strikes a curved plate at its center with a velocity of 20 m/s. The curved plate is moving with a velocity of 8 m/s in the direction of jet. The jet is deflected through an angle of 165°. Assuming the plate smooth, find: (i) Force exerted on the plate in the direction of jet, (ii) power developed, (iii) efficiency.	**07**
Q.2	**(a)**	The cylinder bore diameter of a single acting reciprocating pump is 150 mm and its stroke is 300 mm. The pump runs at 50 rpm and lifts water through a height of 25 m. The delivery pipe is 22 m long and 100 mm in diameter. Find: theoretical discharge and theoretical power required to run the pump. If the actual discharge is 4.2 lit/s, find the percentage of slip. Also determine the acceleration head at the beginning and middle of the delivery stroke.	**07**
	(b)	Water in a jet propels boat is drawn at the middle of the sea and discharge at the back with an absolute velocity of 20 m/s. The cross-section area of jet at the back is 0.02 m^2 and the boat is moving in sea water with a speed of 30 km/hr. Determine: (i) propelling force on the boat, (ii) power required to drive pump, (iii) efficiency of jet propulsion.	**07**
		OR	
	(b)	Derive an expression for force exerted by the jet striking tangentially at one of the tip of moving curved vane. Also derive an equation of work done.	**07**
Q.3	**(a)**	What is draft tube? Why is it used in a reaction turbine? What are various type of draft tube?	**07**
	(b)	A francis turbine with an overall efficiency 75% is required to produce 148.25 kW power. It is working under head of 7.62 m. The peripheral velocity is $0.26(2gh)^{1/2}$ and the radial velocity of flow at inlet is $0.96(2gh)^{1/2}$. The wheel runs at 150 rpm and the hydraulic loss is in the turbine are 22%. Assuming radial discharge, determine (i) guide blade angle, (ii) wheel vane angle at inlet, (iii) diameter of wheel at inlet, (iv) width of wheel at inlet.	**07**
		OR	
Q.3	**(a)**	Classify hydraulic turbines.	**07**
	(b)	A reaction turbine works at 450 RPM under a head of 120 meters. Its diameter at inlet is 120 cm and the flow area 0.4 m^2. The angle made by absolute and the relative velocity at inlet are 20° and 60° respectively with a tangential velocity. Determine; (i) volume flow rate, (ii) power developed, (iii) hydraulic efficiency.	**07**
Q.4	**(a)**	Derive an equation for minimum work done in case of two stage reciprocating air compressor with perfect intercooling.	**07**

	(b)	A centrifugal compressor running at 1440 rpm, handles air at 101 kPa and 20 °C and compress it to a pressure of 6 bar isentropically. The inner and outer diameters of the impeller are 14 cm and 25 cm, respectively, The width of the blade at the inlet is 2.5 cm. 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**
		OR	
Q.4	**(a)**	Draw stage velocity diagram for axial flow compressor and derive an equation for work input.	**07**
	(b)	A two stage single acting reciprocating air compressor takes in air at 1 bar and 300 K. The delivery pressure is 12 bar. The intermediate pressure is ideal for minimum work and the intercooling is perfect. The index of compression is 1.3. Flow rate of air through the compressor is 0.30 kg/s. Determine: (i) Power required to drive the compressor, (ii) Isothermal efficiency, (iii) Saving in power as compared to single stage.	**07**
Q.5	**(a)**	Derive an expression for minimum speed for starting a centrifugal pump.	**07**
	(b)	Explain fluid coupling with neat sketch.	**07**
		OR	
Q.5	**(a)**	Write a short-note on: Hydraulic ram.	**07**
	(b)	Explain roots blower with neat sketch.	**07**

****