

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V (NEW) EXAMINATION – WINTER 2023****Subject Code:2151903****Date:13-12-2023****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.
4. Simple and non-programmable scientific calculators are allowed.

		MARK
Q.1	(a) Classify hydropower plant. Explain essential components of hydropower plant.	03
	(b) Explain Performance characteristics of Axial flow compressors	04
	(c) With neat sketch explain construction and working of Reciprocating pumps. Classify reciprocating pumps.	07
Q.2	(a) What are Air Vessels? State effect of air vessels on performance of reciprocating pumps.	03
	(b) Draw and explain the velocity diagrams at the inlet and outlet of the moving blade.	04
	(c) How ships are propelled? Derive an expression for propulsive work and propulsive efficiency if the water is drawn from an orifice at right angles to the motion of ship	07
	OR	
	(c) Derive an expression for the change in the angular momentum when the radial distance of the liquid particles change while passing over the vane mounted on a wheel. Hence obtain expression for work done and efficiency.	07
Q.3	(a) What is NPSH? State its importance.	03
	(b) With neat sketch explain Construction and working of Hydraulic accumulator.	04
	(c) Explain the following with neat sketches Volute Casing, Vortex casing, diffuser Casing.	07
	OR	
Q.3	(a) Explain in detail classification of centrifugal pumps.	03
	(b) With neat sketch explain Construction and working of hydraulic press.	04
	(c) With neat sketch explain construction and working of hydraulic lift.	07
Q.4	(a) Compare Pelton, Kaplan, and Francis turbines.	03
	(b) Define Volumetric efficiency, Mechanical efficiency, hydraulic efficiency, overall efficiency.	04
	(c) Derive an expression for the work done per Kg of water by a Pelton turbine in terms of bucket speed, jet velocity and blade angle at outlet. Clearly state the assumptions made.	07

OR

- Q.4** (a) Differentiate between Impulse and reaction turbines. **03**
(b) Explain governing of Hydraulic turbines **04**
(c) Explain main characteristics curves and operating characteristic curves for hydraulic turbines. **07**

- Q.5** (a) Define Pre-whirl. Explain its effect on the impeller of a centrifugal pump. **03**
(b) A rotary air compressor working between 1 bar and 2.5 bar has internal and external diameters of impeller as 300 mm and 600mm resp. The vane angle at inlet and outlet are 30° and 45° resp. If the air enters the impeller at 15 m/s calculate speed of impeller in rpm, work done by the compressor per kg of air. **04**
(c) In a two stage air compressor, in which intercooling is perfect, prove that the work done in compression is a minimum when the pressure in the intercooler is the geometric mean between the initial and final pressures. Draw the indicator diagram for the two stage compression. **07**

OR

- Q.5** (a) A Centrifugal compressor delivers 50 kg of air per minute at a pressure of 2 bar and 97°C . The intake pressure and temperature of air is 1 bar and 15°C . If no heat is lost to the surrounding calculate Index of compression, power required if compression is isothermal take $R=287\text{ J/Kg K}$ **03**
(b) Differentiate between Reciprocating air compressor and Rotary air compressor. **04**
(c) A two stage single acting reciprocating air compressor draws in air at a pressure of 1 bar and 17°C and compresses it to pressure of 60 bar. After compression in the L.P cylinder the air is cooled at constant pressure of 8 bar to a temperature of 37°C . The low pressure cylinder has a diameter of 150 mm and both the cylinders have 200mm stroke. If the law of compression is $p v^{1.5}=C$, Calculate the power of the compression, when it runs at 200 rpm. Take $R=287\text{ J/Kg K}$. **07**
