

GUJARAT TECHNOLOGICAL UNIVERSITY
BE – SEMESTER – V (NEW) EXAMINATION – WINTER 2015

Subject Code: 2151903

Date: 08/12/ 2015

Subject Name: Fluid Power Engineering

Time: 10:30am to 1:00pm

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)** Draw general layout mentioning essential components of hydro power plant. **07**
Explain the function of each components.
- (b)** Classify the Hydro-Electric power plants according to availability of head, **07**
quantity of water and nature of load.
- Q.2 (a)** A Pelton wheel is to be designed for the following specifications: **07**
Power = 9560 kW, Head = 350m, Speed = 750 rpm, Overall efficiency = 85 %
and Jet ratio = 6. Determine (i) The wheel diameter (ii) Diameter of Jet (iii) The
number of Jets required. Take $C_v = 0.985$ & speed ratio $K_u = 0.45$.
- (b)** Explain necessity of governing of hydraulic turbine. Describe governing of **07**
Francis turbine with neat sketch.

OR

- (b)** Explain the function of Draft tube. State and sketch types of Draft tube and **07**
explain the importance of cone angle in Draft tube.
- Q.3 (a)** Derive expression for minimum speed for starting a centrifugal pump. **07**
- (b)** The impeller of a centrifugal pump has an external diameter of 450 mm and **07**
internal diameter of 200 mm and it runs at 1440 rpm. Assuming a constant flow
velocity through the impeller at 2.5 m/s and that the vanes at the exit are set
back at angle of 25° . Determine (i) Inlet vane angle (ii) The angle, absolute
velocity of water makes with the tangent at the exit and (iii) The work done per
unit weight of water.

OR

- Q.3 (a)** What is cavitation? What are its causes? How it can be prevented in centrifugal **07**
pump.
- (b)** (1) Define and derive specific speed relation for pump. **03**
(2) Model power $P = 30$ kW, Head $H = 8$ m and speed $N = 1000$ rpm. If the **04**
prototype pump has to work against a head of 25 m, Calculate the speed, the
power required and ratio of flow rates handled by the two pumps. Model to
prototype scale ratio is $1/5$.
- Q.4 (a)** Explain the effect of Pre-whirl in centrifugal compressor. State types of **07**
impeller vanes used in centrifugal compressor and show their characteristic
curves.
- (b)** A centrifugal compressor running at 12000 rpm delivers $1.3 \text{ m}^3/\text{s}$ of free air. **07**
The pressure and temperature at inlet are 1 bar and 25°C . The compression ratio
is 5, blades are radial at outlet, the velocity of flow is 58 m/s and is constant
throughout. Assume slip factor is 0.9 and isentropic efficiency is 84 % .
Determine (i) temperature of air at outlet, (ii) impeller diameter and blade angle
at inlet and (iii) power required. Assume inlet diameter of impeller half of outlet
diameter of impeller.

OR

- Q.4 (a)** Explain phenomenon of surging and choking in centrifugal compressor with **07**

- neat sketch.
- (b) Explain in detail working of a Scroll compressor with neat sketch. 07
- Q.5** (a) (1) Draw stage velocity diagram of an axial flow compressor. 03
(2) Give comparison between axial flow and centrifugal compressor. 04
- (b) Explain with the help of a neat sketch the principle and operation of 07
(i) Differential hydraulic accumulator and (ii) Fluid coupling.
- OR**
- Q.5** (a) A single acting single cylinder reciprocating air compressor is driven by 25 kW 07
electric motor. It takes air at 1.013 bar and 18°C and delivers it at 8 bar.
Compressor runs at 300 rpm. The index of compression and expansion is 1.32
and the clearance volume is 6 % of the swept volume. Assuming the
mechanical efficiency as 85 % and bore is equal to stroke, calculate the free air
delivery in m³/min, the volumetric efficiency and the bore and stroke of the
compressor.
- (b) Explain with the help of a neat sketch the principle and operation of 07
(i) Hydraulic ram and (ii) Hydraulic intensifier.
