Seat No.: _____ Enrolment No._____

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. Explain the function of each components. **07**

(b) Classify the Hydro-Electric power plants according to availability of head, quantity of water and nature of load. **07**

Q.2 **(a)** A Pelton wheel is to be designed for the following specifications: 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. **07**

(b) Explain necessity of governing of hydraulic turbine. Describe governing of Francis turbine with neat sketch. **07**

OR

(b) Explain the function of Draft tube. State and sketch types of Draft tube and explain the importance of cone angle in Draft tube. **07**

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 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 25^0. 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. **07**

OR

Q.3 **(a)** What is cavitation? What are its causes? How it can be prevented in centrifugal pump. **07**

(b) (1) Define and derive specific speed relation for pump. **03**

(2) Model power P = 30 kW, Head H = 8m and speed N = 1000 rpm. If the 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. **04**

Q.4 **(a)** Explain the effect of Pre-whirl in centrifugal compressor. State types of impeller vanes used in centrifugal compressor and show their characteristic curves. **07**

(b) A centrifugal compressor running at 12000 rpm delivers 1.3 m^3/s of free air. The pressure and temperature at inlet are 1 bar and 25^0C. 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. **07**

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 (i) Differential hydraulic accumulator and (ii) Fluid coupling. **07**

OR

Q.5 **(a)** A single acting single cylinder reciprocating air compressor is driven by 25 kW electric motor. It takes air at 1.013 bar and 18^0C 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 m^3/min, the volumetric efficiency and the bore and stroke of the compressor. **07**

(b) Explain with the help of a neat sketch the principle and operation of (i) Hydraulic ram and (ii) Hydraulic intensifier. **07**

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