

GUJARAT TECHNOLOGICAL UNIVERSITY**BE SEM-V Examination-Nov/Dec.-2011****Subject code: 151903****Date: 26/11/2011****Subject Name: Fluid Power Engineering****Time: 2.30 pm -5.00 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) Show that when a jet of water impinges on a series of curved vanes, maximum efficiency is obtained when the vane is semi-circular and the velocity of jet is double the velocity of vane. **07**

(b) A jet of water having a velocity 25 m/s strikes on a series of vanes moving with a velocity 10 m/s. The jet makes an angle of 30° with the direction of motion of vanes when entering and leaves at an angle of 150° with the direction of motion. Sketch the velocity triangles and calculate,
(i) Vane angles at inlet and outlet
(ii) Work done when the vane discharging 325 litres/s
Take loss due to friction over the vane as 10 % of relative velocity. **07**

Q.2 (a) Sketch a hydro-power plant and explain its different elements. **07**

(b) Derive Darcy-Weisbach formula for calculating loss of head due to friction in a pipe. **07**

OR

(b) Explain the governing of Francis turbine with neat sketch. **07**

Q.3 (a) What are the ill effects of cavitation in turbine? Give causes and remedies to avoid cavitation in a hydraulic turbine. **07**

(b) The following data relate to a Pelton wheel. **07**
Tangential velocity of bucket = 25 m/s
Head of water = 65 m
Deflection of jet on bucket = 165°
Discharge through the nozzle = 110 litres/s
Coefficient of nozzle = 0.95
Determine the power developed by the runner and the efficiency

OR

Q.3 (a) Discuss the various characteristic curves of a centrifugal pump. **07**

(b) A centrifugal pump has impeller of 25 cm diameter at inlet and 50 cm diameter at outlet and runs at 1600 rpm. The vanes are set back at an angle of 30° to the outer rim if velocity of flow through impeller is constant at 3 m/s and entry to the impeller is radial. Calculate the vane angle at inlet and work done on the wheel per kg of water. **07**

Q.4 (a) Show that for a two stage reciprocating air compressor with complete intercooling the total work of compression becomes minimum when the pressure ratio in each stage is equal. **07**

- (b) Air at 1 bar and 20°C is compressed to a pressure of 55 bar in a two stage reciprocating air compressor. Intercooler cools the air to a temperature of 40°C at 10 bar. The diameter of low pressure cylinder is 175 mm and both the cylinders have 225 mm stroke. If the compression follows the law $pV^{1.2}=C$, find the indicated power of compressor if it runs at 150 rpm. **07**

OR

- Q.4** (a) With the help of velocity triangles and head-capacity curves, discuss salient features of radial, backward and forward curved vanes in a centrifugal compressor. **07**
- (b) A centrifugal compressor ($\eta_c=0.85$) runs at 14000 rpm inducting air at 20°C , the work done by the impeller is 160 kJ/kgK. Guide vanes at inlet gives the air a prewhirl at 25° . Mean eye diameter is 225 mm, the absolute air velocity at inlet is 130 m/s. At the exit, the blades are radial and the slip factor is 0.75. Calculate (i) the pressure ratio and (ii) impeller tip diameter **07**

- Q.5** (a) Justify the need for multistaging in a reciprocating air compressor. List any two advantages of multistage compression. **07**
- (b) Explain the phenomenon of surging and stalling in an axial flow compressor. **07**

OR

- Q.5** (a) Describe the working of a screw compressor and list its applications. **07**
- (b) Write a short note on hydraulic ram. **07**
