Seat No.: _____   Enrolment No._____

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 30^0 with the direction of motion of vanes when entering and leaves at an angle of 150^0 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=165^0
Discharge through the nozzle=110 litres/s
Co-efficient 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 30^0 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 workdone 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**

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(b) Air at 1 bar and 20^0 C is compressed to a pressure of 55 bar in a two stage reciprocating air compressor.Intercooler cools the air to a temperature of 40^0C 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 (η_c=0.85) runs at 14000 rpm inducting air at 20^0 C ,the work done by the impeller is 160 kJ/kgK.Guide vanes at inlet gives the air a prewhirl at 25^0 .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**

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