

University of Technology-Electromechanical Engineering Dept.
Final Exam- - 2013-2014

Class : 3rd year - power
Subject: Fluid Machinery
Examiner : Dr. Hussein Majeed Salih



Time : 3 hours
Date: / / 2014
Note: Attempt five questions only
Each question has an equal mark

Name:

ID No.

Signature

Q1/

A. Prove that the rise in static enthalpy for a centrifugal compressor is equal to

$$\left(\frac{u_2^2 - u_1^2}{2} + \frac{w_1^2 - w_2^2}{2} \right).$$

B. Derive the mathematical expression for the head coefficient.

Q2/

A series of curved vanes (entrance angle 30° and exit angle 165°) deflect a jet of water 10 square cm in area, moving at 50 m/s and inclined at 15° to the line of motion of the vane, find: (i) The velocity of vane to avoid shock at entry. (ii) The magnitude and direction of the resultant force on the vane and the force in the direction of motion. (iii) The magnitude and direction of velocity of water at exit.

Q3/

A quarter scale turbine model is tested under a head of 10.8 m. The full-scale turbine is required to work under a head of 30 m and to run at 714 rev/s. At what speed must the model be run? If it develops 100 kW and uses 1.085 m³ of water per second at this speed, what power will be obtained from the full-scale turbine? Assume that the efficiencies for both turbines are the same. What is the specific speed of the full-scale turbine?

Q4/

In an impulse turbine of the Pelton type, the jet is turned by the bucket by 165°. The head available at the nozzle is 750 m and blade speed ratio is 0.46. $k_v = 0.98$. Relative velocity is reduced by 12% due to friction. Determine the hydraulic efficiency. If the flow available is 20 m³/s. What is the power potential. Assuming 5 units of equal power, **determine the jet diameter and wheel diameter** if $D/d = 12$.

Q5/

A Francis turbine developing 16120 kW under a head of 260 m runs at 600 rpm. The runner outside diameter is 1500 mm and the width is 135 mm. The flow rate is 7 m³/s.

Q6/

Good Luck

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