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Roll No .....

ME - 502

B.E. V Semester

Examination, December, 2012

TURBO MACHINERY

Time : Three Hours

Maximum Marks : 70/100

Note: (1) All questions are compulsory.
(2) Assume suitable data wherever necessary.

1. Derive the alternate form of Euler equation and explain each component in that equation.

OR

2. A centrifugal pump delivers water against a head of 25m. The radial velocity of flow is 3.5 m/s and is constant. The flow rate of water is 0.05 m^3/s. The blades are radial at the tip and pump runs at 1500 rpm. Calculate
   a) The diameter at the tip
   b) The width of the blade at the tip
   c) Inlet diffuser angle at the impeller exit.

3. Explain degree of reaction. Explain the working of single stage reaction turbine. Also explain pressure & velocity variations along the axis of the turbine.

OR

4. A single stage impulse turbine rotor has a diameter of 1.2m running at 3000 rpm. The nozzle angle is 18°. Blade speed ratio is 0.42. The ratio of the relative velocity at outlet to relative velocity at inlet in 0.9. The outlet angle of the blade is 3° smaller than the inlet angle. The steam flow rate is 5kg/sec. Draw the velocity diagram and find the following.
   (a) Velocity of whirl
   (b) Axial thrust on the bearing
   (c) Blade angles
   (d) Power developed.

5. A kaplan turbine runner is to be designed to develop 10,000 b.h.p. The net available bead is 5.5m. Assume that the speed ratio is 2.09 and the flow ratio is 0.68 and the overall efficiency is 60%. The diameter of the loss is $^1/_3^{rd}$ of the diameter of the runner. Find diameter of the runner, it's speed and it's specific speed.

OR

6. Derive an expression for specific speed of a reaction turbine & impulse turbine.

7. An axial flow compressor comprises a number of similar stages with equal work done/stagi and the velocity of flow is uniform throughout the compressor. The following are the data :
   Overall stagnation pressure ratio = 3.5
   Stagnation inlet temperature = 60°C

Relative air angle at rotor inlet = 130°C

Relative air angle at rotor outlet = 100°C

Blade velocity = 185 m/sec

Degree of reaction = 0.5

Overall stagnation adiabatic efficiency = 0.87. The data refer to mean blade height and the measurement of angle is done in the same sense from the blade velocity diagram. Calculate

(a) Stagnation outlet temperature

(b) Number of stages

OR

8. Plot and discuss the characteristics of centrifugal and axial flow compressor.

9. Derive an expression for the work done and the power in respect of the centrifugal compressor.

OR

10. Derive an expression for the overall pressure ratio developed in the centrifugal compressor.

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