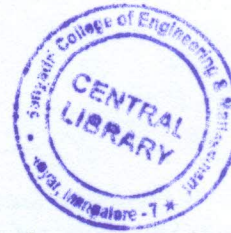


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10ME56

Fifth Semester B.E. Degree Examination, June/July 2017

Turbo Machines

Time: 3 hrs.

Max. Marks:100

**Note: 1. Answer FIVE full questions, selecting at least TWO questions from each part.
2. Missing data may be assumed suitably.**

PART – A

- 1
 - a. List the difference between positive displacement machines and turbo machines. (05 Marks)
 - b. Explain the significance of flow coefficient, head coefficient and power coefficient with equations. (05 Marks)
 - c. An output of 10 KW was recorded on a turbine of 0.5 m dia running at a speed of 800 rpm under a head of 20 m. What is the diameter and output of another turbine which works under a head of 180 m, at a speed of 200 rpm when their efficiencies are same? Find the specific speed and name the turbine which you preferred. (10 Marks)

- 2
 - a. Define static and stagnation states. (05 Marks)
 - b. Define total-to-total efficiency and static to static efficiency of compression process. (05 Marks)
 - c. Air enters a compressor at a static pressure of 1.5 bar, a static temperature of 15°C and a flow velocity of 50 m/s. At the exit the static pressure is 3 bar, the static temperature is 100°C and the flow velocity is 100 m/s. The outlet is 1 m above the inlet. Evaluate:
 - i) The isentropic change in enthalpy
 - ii) The actual change in enthalpy
 - iii) Efficiency of compressor. (10 Marks)

- 3
 - a. With a neat sketch derive an expression for Euler's turbine equation. (10 Marks)
 - b. An inward flow reaction turbine has outer and inner diameter of the wheel as 1 m and 0.5 m respectively. The vanes are radial at inlet, and the discharge is radial at outlet and water enters the blade at an angle of 10°. Assume the velocity of flow is constant and equal to 3 m/s, find:
 - i) Speed of the wheel
 - ii) Outlet blade angle
 - iii) Degree of reaction R. (10 Marks)

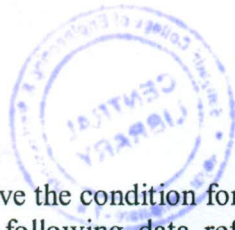
- 4
 - a. Derive an expression for degree of reaction for radial outward flow machine and explain briefly the effect of β_2 , blade discharge angle on degree of reaction 'R'. (10 Marks)
 - b. For a radial outward flow turbo machine has no inlet whirl. The blade speed at the exit is twice that of inlet. Assume radial velocity is constant, with inlet blade angle = 45°. Show that degree of reaction,

$$R = \frac{2 + \cot \beta_2}{4}$$

where β_2 , blade angle at exit with respect to tangential direction.

(10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.



10ME56

PART - B

- 5 a. Derive the condition for maximum utilization factor for impulse turbine. (10 Marks)
b. The following data refers to Delaval turbine. Velocity of steam at exit of the nozzle is 1000 m/s with a nozzle angle of 20° . The blade velocity is 400 m/s and the blades are equiangular. Assume a mass flow rate of 1000 kg/hr, friction coefficient 0.8 nozzle efficiency 0.95, calculate:
i) Blade angles
ii) Work done/kg of steam
iii) Power developed
iv) Blade efficiency
v) Stage efficiency. (10 Marks)
- 6 a. Define the draft tubes with a neat sketch. Explain different type of draft tubes. (05 Marks)
b. Define mechanism efficiency and overall efficiency of turbines. (05 Marks)
c. A propeller turbine has a outer diameter of 4.5 m and inner diameter 2m. It develops 20,605 KW under a head of 20 m at 137 rpm, the hydraulic efficiency is 0.94 overall efficiency is 0.88. Find the:
i) Runner blade angles
ii) Discharge through the runner. (10 Marks)
- 7 a. Explain with a neat sketch, multistage centrifugal pump arrangement. (05 Marks)
b. Explain with a neat sketch, different casings of pump. (05 Marks)
c. A three stage centrifugal pump has impeller 40 cm dia and 2 cm width at outlet. The vanes are curved back at an angle of 45° at the outlet and reduced the circumferential area by 10%. The manometric efficiency is 90% and overall efficiency is 0.8. Find the total head generated by the pump, when running at 1000 rpm, delivering 50 lit/sec. also calculate the power required to drive the pump. (10 Marks)
- 8 a. Explain slip and slip coefficient. (05 Marks)
b. Explain surging and choking of compressor. (05 Marks)
c. An axial flow compressor of 50% reaction design has blades with inlet and outlet angles with respect to axial directions of 45° and 10° respectively. The compressor is to produce a pressure ratio of 6:1 with a overall isentropic efficiency of 0.85. When the inlet static temperature is 37°C . The blade speed and axial velocity are constant throughout the compressor. Assuming a value of 200 m/s for blade speed. Find the number of stages required if the work done factor is (i) unity, (ii) 0.87 for all the stages. (10 Marks)

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