

Roll No.

Total No. of Pages : 03

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B.Tech. (Mechanical Engg.) (Sem.-4)

FLUID MACHINES

Subject Code : BTME-402-18

M.Code : 77547

Date of Examination : 05-07-22

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

1. Write briefly :

- a) Write down the Bernoulli's equation.
- b) How do you understand by overall efficiency of a centrifugal pump?
- c) What do you understand by mass flow rate?
- d) What is propulsive efficiency? Give its expression.
- e) What is blade velocity coefficient?
- f) What is specific speed as referred to hydraulic turbine?
- g) What do you mean by speed ratio?
- h) What do you understand by plant efficiency? Give its relation.
- i) What is cavitation?
- j) What is NPSH?

SECTION-B

2. How are fluid (Hydrodynamic) machines classified? Explain briefly the difference between various types of hydrodynamic machines.
3. A jet of 4 cm in diameter having a velocity of 30 m/s strikes tangentially at one edge on a wheel which deflects the jet through an angle of 120° . Calculate the thrust on the vane when :
 - (a) The axis of symmetry of the vane is horizontal.
 - (b) The tangent at inlet tip is horizontal.
4. Derive an expression for force exerted by a fluid jet, work done by the fluid jet and vane efficiency when a jet impinges upon a moving vane with jet striking tangentially at one tip.
5. Establish the ratio of forces exerted by a water jet when it is made to strike:
 - (a) A stationary flat plate held normal to it,
 - (b) A flat plate moving in the direction of jet at one third the velocity of jet,
 - (c) A series of flat plates mounted on a wheel and moving at one third the velocity of jet.
6. Explain the characteristic features of the cup of a Pelton wheel. Draw a diagram for the same. What are the limitations in keeping the deflection angle of the cup as 180° ?

SECTION-C

7. A ship driven by reaction jets and discharging astern is found to have resistance to motion of 3.5 km/hr. The velocity of jet relative to ship is 18 m/s. Find the number of jets if each has an area of 100 cm^2 .

Also, calculate the propulsive efficiency and the power required to work the pump for the following cases:

 - (a) Inlet orifices at right angles to ship motion
 - (b) Inlet orifices face the direction of ship motion.

8. The axis of a Francis reaction turbine and its draft tube is vertical, the head in the spiral casing at inlet being 36 m and the speed of water 5 m/s. The flow through the turbine is $2 \text{ m}^3/\text{s}$, the hydraulic and overall efficiencies are 0.88 and 0.83, respectively. The top of the draft tube is 1 m below the centre line of the spiral casing while the tail race water level 3 m below the top of the draft tube. At inlet and outlet of draft tube, the velocities are 4 m and 1.5 m/s and there is no whirl at either position. Neglecting any leakage loss, work out
- the total head across the turbine,
 - the power output,
 - the head lost in friction in the turbine and draft tube, and
 - the power lost in mechanical friction.
9. A centrifugal pump impeller has diameter of 60 cm and width of 6 cm at the outlet. The pump runs at 1450 rpm and delivers $0.8 \text{ m}^3/\text{s}$ against a head of 80 m. The leakage loss after the impeller is 4 percent of discharge, the external mechanical loss is 10 kW and the hydraulic efficiency is 80 percent. Determine the blade angle at outlet, the power required and the overall efficiency of the pump.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.