24259

B. Tech. 5th Semester (ME) Examination – March, 2021

FLUID MACHINE

Paper : ME-305-F

Time : Three Hours]   [Maximum Marks : 100

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Section. Question No. 1 is *compulsory*.

1. (a) What is propeller turbine ? Write the condition for maximum efficiency for jet propulsion of a tank fitted with an orifice.

   (b) Explain Jet ratio and design aspects for a pelton wheel.

   (c) Explain pump losses.

   (d) What do you mean o Turbine ?

   (e) What is the main difference between Impulse and Reaction turbine ?   20

SECTION – A

2. Show that the force exerted by a jet of water impinges on an inclined plate fixed plate in the direction of jet is given by : $F_x = \rho A\, V^2 \sin^2\alpha$ where V is the velocity of jet, A is the area of jet and α is the inclination of plate to the direction of jet.   20

3. A Pelton wheel of 1.2 m mean bucket diameter works a head of 650 m. The jet deflection is 1650 and its relative velocity is reduced over the buckets by 15% due to friction. If the water is to leave without whirl, determine (a) rotational speed of wheel (b) ratio of bucket speed to jet velocity (c) impulsive force and power developed by wheel (d) available power and power input to buckets (e) efficiency of wheel with power input to buckets as reference input. Take $K_v = 0.97$.   20

SECTION – B

4. Explain the differences between the Francis and Kaplan turbines with the help of neat sketch. A Francis turbine developing 16120 kW under a head of 260 m

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runs at 600 rpm. The runner outside diameter is 1500 mm and the width is 135 mm. The flow rate is 7 m³/s. The exit velocity at the draft tube outlet is 16 m/s, assuming zero whirl velocity at exit and neglecting blade thickness determine the overall and hydraulic efficiency and rotor blade angle at inlet. Also find the guide vane outlet angle. **20**

5. (a) State Buckingham's π-theorem. Why this theorem is considered superior over the Rayleigh's method for dimensional analysis ? **10**

(b) What is meant by geometric, kinematic and dynamic similarities ? Are these similarities truly attainable ? If not why ? **10**

SECTION – C

6. (a) Explain what is meant by slip ? What are the effects of slip ? **08**

(b) Explain double suction impeller, shut off head, manometric efficiency and NPSH as applied to centrifugal pumps. **12**

7. (a) Explain why priming is necessary to start pumping by centrifugal pump ? **14**

(b) Explain the functions of a foot value. Indicate how it works ? **06**

SECTION – D

8. Explain function, construction and working of simple and differential hydraulic accumulator with a neat sketch. **20**

9. Explain with neat sketch the construction, operation and utility of hydraulic crane and lift. **20**

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